CRITICAL APPRAISAL OF REMOTE VITAL-SIGN TELEMONITORING

Julie-Ann Walkden

Faculty of Life and Health Sciences

Ulster University

This dissertation is submitted for the degree of Doctor of Philosophy

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Dedicated to those who encourage and support women and children to rebuild their lives after trauma

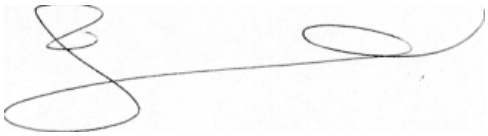
SPERO MELIORA

(I HOPE FOR BETTER THINGS)

DECLARATION

This dissertation is the result of my own work and includes nothing, which is the outcome of work done in collaboration except where specifically indicated in the text. It has not been previously submitted, in part or whole, to any university of institution for any degree, diploma, or other qualification.

In accordance with the Faculty of Health and Life Sciences guidelines, this thesis does not exceed 100,000 words, and it contains less than 150 figures.

Signed: 

Date: 13th July 2020

Julie-Ann Walkden

Diploma Podiatric Medicine – Huddersfield Polytechnic

BSc Podiatric Medicine – Westminster University

Advanced Diploma in Health Service Management – Leeds University

Masters Business Administration – Ulster University

ABSTRACT

Background: Patient self-monitoring with telehealth technologies has not demonstrated savings to secondary care budgets but there remains optimism regarding potential benefit for people with long-term conditions.

Aim: To critically assess whether remote vital-sign telemonitoring is perceived to have derived benefits for patients.

Design: Mixed methods research was adopted with questionnaire distribution to service users and their informal carers and with semi-structured one-to-one interviews conducted with clinical practitioners and senior managers.

Sample: Questionnaires were distributed to 274 patients living with long-term conditions who were using telemonitoring provided by one integrated health and social care organisation in Northern Ireland. Data from 97 patients and 49 carers were analysed. A total of 16 clinical practitioners experienced with the use of remote vital-sign telemonitoring in their therapeutic regimens, across a range of professions, were interviewed along with eight senior managers or commissioners.

Results: The great majority of patients (90.7%) were supportive of technology and agreed that *the remote monitoring system assisted me in managing my health on a day-to-day basis*. They reported that telehealth technology gave them control for self-management, better understanding, timely access to support, peace of mind and empowerment. These observations were echoed by clinicians who were equally supportive and saw greater future use of innovative technologies in the delivery of health and care. They did not view remote monitoring as any diminution of care.

Conclusion: Whilst not necessarily saving money, remote vital-sign telemonitoring enabled collaboration between patients, carers and the clinicians where patients were empowered to actively self-manage their long-term conditions. Patients accepted technology and support increased use as part of their care regime in the future. Healthcare systems should become open to the exploitation of new technologies in order to realise the real patient benefit.

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LIST OF ABBREVIATIONS AND ACRONYMS

Acronym or Term	Meaning
BDO	BDO Stoy Hayward is an accountancy and business advisory firm.
Carers	Family and/ or friends who assist the patient in the use of RVT.
CHF	Congestive Heart Failure (also sometimes referred to as Chronic Heart Failure).
COPD	Chronic Obstructive Pulmonary Disorder.
ECCH	European Centre for Connected Health [later renamed Centre for Connected Health (CCH)] a department within the Public Health Agency (PHA).
EU	European Union.
DAWN	4S DAWN Clinical Software for the warfarin dosing of patients from their INR result.
DM	Diabetes Mellitus.
DoH	Department of Health.
HPSS	Health and Personal Social Services.
HSCB	Health and Social Care Board.
Hub	Means the item of patient equipment or client equipment (as relevant) to which monitoring data is sent by peripherals and which transmits the monitoring data to the central solution.
INR	International Normalised Ratio – for reporting blood coagulation results.

Monitored Patient Day (MPD)	Means a day during which the patient Equipment, installed/delivered at the request of the practitioner.
NICE	National Institute for Health & Care Excellence.
Patient and Client Council (PCC)	Is a Northern Ireland Health and Social Care organisation, publicly funded to assist the public to make a complaint, take the public's views and communicate/ act upon them, promote advice and information and help the public get involved.
Patients and service users	People who are prescribed and utilise the RVT services and generally have long term conditions.
Peripheral device	Means an item of patient equipment or client equipment (as relevant) other than the hub.
Practitioner	Healthcare/ clinical professional, doctor, nurse, allied health professional or pharmacist, of a senior grade, Band 6 or above, with experience of utilising RVT.
QALY	Quality-adjusted life year: a measure of disease burden.
RATS	RATS INR Monitoring Software for the warfarin dosing of patients from their INR result. RAT-i Regulating Anticoagulation Treatment.
Researcher	Julie-Ann Walkden.
RTM	Remote Telemonitoring.
RTNI	Remote Telemonitoring Northern Ireland. A region wide project to commission RVT

	which was awarded to a consortium known as TF3.
RVT	Remote vital-sign telemonitoring.
Self-Management	Means a person-centred approach in which the individual is empowered and has ownership over the management of their life and conditions. The role of health and social care professionals, services and treatment are to support the person journey towards living well in the presence of absence of symptoms.
Senior Manager	Northern Ireland Health and Social Care system Senior Officer/ Manager/ Leader/ Executive with responsibility for commissioning, policy or delivery of RVT type services. (Normally Band 8A and above).
Telehealth or Telehealth monitoring	Means the remote telemonitoring and delivery of support services through information and communication technology, using vital signs monitoring and /or interpreting changes to a patient's health.
TF3	A region wide RVT service for multiple long-term conditions offering a track and trend or nurse triage service with peripheral devices connecting to a 'home-hub' which in turn transfers readings to a central control service. The acronym combined the names of the three commercial partner who formed a consortium to bid for and deliver the regional service; Tunstall, Fold Telecare and S3.

The study or the research or thesis	Patient empowerment through use of remote vital sign telemonitoring.
Track and trend	Means a tabular and graphical report of individual patient monitoring data against monitoring parameters which is accessed by the practitioner without the patient receiving a triage nurse intervention or service.
Triage or nurse triage service	Means the service that assesses the patients' alert, validates the vital signs when an alert has been raised, reviews monitoring data, obtains more information from the patient by asking questions designed to clarify or elicit more detail on clinical issues and deciding the action to be taken as a consequence including escalation to the local response team.
Trust or Trusts or SET	Health and Social Care Trusts are providers of clinical services both within the community and hospital environments. In this study the Trust being examined is South Eastern Health and Social Care Trust and is referred to as (SET).
Unacceptable reading	Where an RVT reading is either outside of the parameters set by the practitioner or where there is a fault with equipment and reading is spurious.
U-Tell	A Trust based RVT service for patients who receive oral anticoagulation through the administration of warfarin and who report, via the internet, their INR result to a central

	database accessed directly by Trust nurses in the outpatients department.
Vital Signs	Means physical signs such as heartbeat, breathing rate, temperature and near patient test results that assess a Patient's condition.
Virtual Ward	Means a domiciliary based community nursing service that delivers high intensity nursing care as an alternative to acute based in-patient care. The treatments given are more intense and complex than standard community or district nursing services.
Warfarinised	A patient who is taking Warfarin as an anticoagulation therapy. (Trade names for Warfarin in USA are Coumadin and Jantoven, in Australia Marevan and in Canada Apro-warfarin).
WHO	World Health Organisation.
WSD	Whole System Demonstrator – a programme within the UK to test remote monitoring at scale.

1 INTRODUCTION

1.1 Background of the problem

Chronic illness costs up to 7% of gross domestic product (Nolte and McKee, 2008) and, chronic illnesses contribute to 63% of deaths worldwide according to the World Health Organisation (WHO) (2013), with 15 million people aged between 30 and 70 years dying each year due to non-communicable disease (WHO, 2017). In 2008, there was optimism that telehealth care could economically help address the care needs of people with chronic diseases and the local Health and Social Care Board Northern Ireland (HSCB) commissioned remote vital sign telemonitoring (RVT) technology through 16 pilot projects aiming to reduce risk of hospital admission for patients with chronic diseases, as reported by BDO Stoy Hayward, (BDO, 2009).

This optimism currently prevails for conditions such as paediatric asthma (Zimlich, 2019) where patient, carer and nurse connectivity promoted medicines adherence. This was dispelled as not having an economic benefit by Henderson et al. (2013) with a review of the UK's Whole System Demonstrator telehealth project. Within the Northern Ireland context, the development of remote vital-sign telemonitoring enabled patients to digitally report their own vital sign readings to their health care practitioners. In the host service provider, South Eastern Health and Social Care Trust (SET), an initial project was developed specifically for patients taking warfarin for anticoagulation. Before the project these patients were normally monitored by

specialist anticoagulation nurses at the local Haematology Outpatient Department, where a venous sample of blood would be taken for laboratory-based testing. Instead, the new system (known as U-Tell) enabled self-testing of capillary blood and the transmission of the International Normalised Ratio (INR) reading to the healthcare system. Patients connected via computer, or later using a smartphone, to an internet site, uploaded their readings and responses to questions (vital signs) and in so doing sent their critical information to the haematology nurses (El-Agnaf et al. 2014).

Also, between April 2011 and March 2018, a region wide Remote Telemonitoring Service was made available to clinical practitioners and patients within SET (PHA, 2011). This service was mainly utilised by specialist nurses and allied health professionals (AHP) for the management of patients with Chronic Diseases such as diabetes, Chronic Obstructive Pulmonary Disorder (COPD), post-stroke hypertension and chronic heart failure. This service (known as TF3) was a remote monitoring system where peripheral devices were used by patients to capture relevant vital signs including blood pressure, three-lead electrocardiogram (ECG), estimate of arterial oxygen saturation (SPO2), temperature, weight and near patient testing readings, typically for blood glucose levels. A home hub would transfer the data, from the peripheral devices, to a central Triage Nursing service for monitoring. These types of systems are referred to in the literature by many terms including telemonitoring, telemedicine, connected health and within the UK's health service as telehealth care (NHS choices. 2013). Within this thesis these systems will be referred to as Remote Vital-Sign Telemonitoring (RVT) as it is descriptive of the service offered. The strategic context, (detailed in this chapter and Appendix 1), will detail the service history, contract and operational factors and procedures in more detail.

A public funded independent review of the TF3 service did not determine that there was an economic benefit for the region when key performance indicators such as reduced length of stay or reduced admissions were tested, (McElnay et al. 2016). Consequently, the Centre for Connected Health (CCH), embedded within the Public Health Agency, extended the supplier's contract for 12 months from 1 April 2017 to consider options. Then the CCH did not procure a new RVT service at the close of the TF3 contract on 31 March 2018.

1.2 Statement of Problem

In 2016, Bengoa emphasised outcome of care as being a purposeful central and recurrent theme. He stated,

> "Making better use of technology and data are essential if we are to move to a model focussed on service users, on improving the health and wellbeing of the population". (DOHNI. 2016, p23)

The difficulty lies in the identification of appropriate indicators of success.

Pinnock et al. (2013) conducted a large-scale study in Scotland and failed to demonstrate a discernible difference between hospital admissions rates for patients with Chronic Obstructive Pulmonary Disorder (COPD) who utilised RVT compared with a control group. This Randomised Control Trial (RCT) had three distinct service issues within the context of possible use of technologies, no design of RVT service to gather the appropriate vital signs, delays in installation of service for patients and technology overlaid onto existing practice. Although an RCT is highly regarded as a design research methodology, Wyatt (2012) argued there are too many variables within the context of health and technologies for an RCT to be conclusive.

By contrast, in England, a review of a trial involving 6,191 patients 'suggested some benefits' (DoH. 2011). Bower et al. (2011) described benefits within five categories: use (applicability to condition and ease of operation), clinical effectiveness, cost effectiveness, user-experience and organisational. These benefits were later challenged by Steventon and Bardsley (2012) who suggested variable technology and variable mode of deployment could affect outcome. It has also been argued that the large trials failed to recognise any health system benefits, and some studies fail to consider the time required to enable embedded change (Vinegar, 2013). Henderson et al. (2013) evaluated the English RVT Whole System Demonstrator Sites using a questionnaire. Whilst this questionnaire was tested to scale (6191 patients and 238 GP practices it focused upon service user acceptability and concluded that the *Whole System Demonstrator* did "…not seem to be a cost-effective addition to standard support and treatment." (Ibid.)

Therefore, evidence to date does not suggest how to utilise such technologies or demonstrate meaningful patient centric benefit. Rather it suggests that the technology was found to be acceptable by users but that it was not considered of benefit as hard economic metrics, such as outcome key performance indicators (hospital admission rates) were not altered. Thus, there is a need to further explore the practice of RVT, in order to consider optimal utility, taking account of key influences upon outcome and patient benefit. Current local regional health care strategies do not necessarily drive the technology agenda but do emphasise the potential impact of outcome-based care and self-care and so indirectly may afford an opportunity for RVT to contribute an alternative benefit to the health care system (DOHNI. 2016). This thesis will argue that the focus of RVT should be outcome focused but that original planned metrics for the service failed to recognise the real patient value. Therefore, it is important to consider and examine the disease drivers for change, environmental factors, the context and technologies in order to derive meaning and value for society as well as identifying if there is tangible benefit for the patient.

1.3 Chronic Disease, Long-Term Conditions and a Brief Demographic Overview

Within this thesis, as within several Northern Ireland based policy documents the term Chronic Diseases (CD), Non-Communicable Diseases (NCD) and Long-Term Conditions (LTC) are utilised inter-changeably and are synonymous. The ageing population has a large and increasing burden of chronic illness and demographics are such that there will be a proportionately smaller group of clinical practitioners of working age to care for all needs.

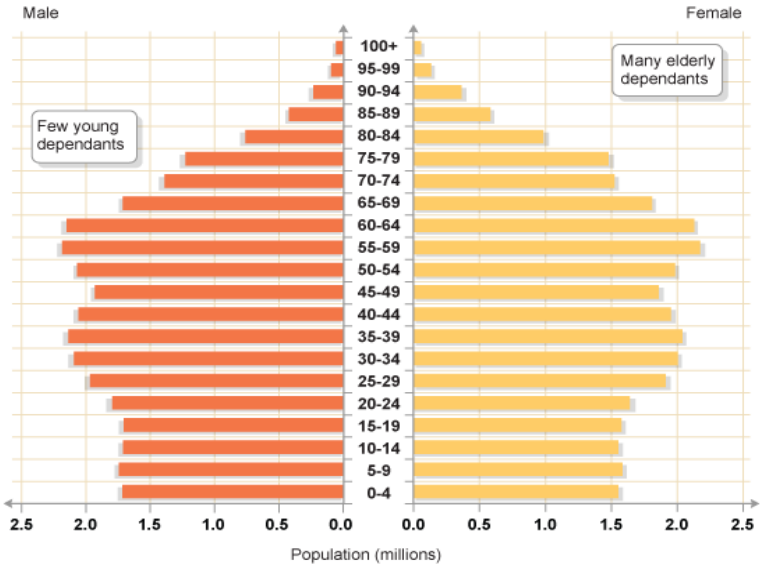


Figure 1.1: Population structure by age group forecast for 2025

(Source Projected population pyramid for the UK 2025 http://www.bbc.co.uk/schools/gcsebitesize/geography/population/population_change_structure_rev5.shtml)

The Demographics demonstrate the likely retracted working age population and burgeoning older population by 2025 (Figure 1.1). Indeed, in December 2012 it was estimated that approximately half a million people in Northern Ireland were living with a LTC (LTCANI, 2012).

From these early developments of RVT there was emergent evidence that RVT within NI may well improve health care service delivery and efficiency, being able to deliver more care with fewer practitioners, particularly in relation to chronic diseases where demand was growing. *Living with Long Term Conditions* – A Policy Framework (DHSSPS, 2012) indicated that by 2032 the number of people aged over 85-years will have increased two-fold with increasing numbers of people living with one or more LTC. In 2015 population estimates, published within the Policy Framework (Ibid.), indicated 30.3% of the population with hypertension (high blood pressure), 5.9% with chronic heart disease, 2.6% stroke and 6.0% with diabetes (type 1 and 2). Chronic Disease has been defined as a disease with a slow progression over a long period of time (WHO, 2013.) and will probably require a concomitantly long period of clinical management. Disease profiles have changed over the years with the health service originally established to focus care upon those with an

acute problem accommodated within a hospital. Whereas, today the demand for care, for those with chronic disease, is high and the model of centralised, hospital-based care, outdated. Indeed, local strategy dictates patient empowerment and care as close to home as possible (DHSSPS, 2011).

It has been estimated that chronic diseases (LTC) may cost 7% of a nation's gross domestic product (Nolte and McKee, 2008, p8). The World Health Organisation (WHO) recognition of the issues for health care systems with the maintenance of health for an ageing population particularly in relation to chronic diseases and suggest that chronic diseases are the main cause of total deaths worldwide at 63% (WHO, 2013). By 2008 in Northern Ireland it was agreed to invest in a new model of care for the most prevalent chronic disease groups; chronic obstructive pulmonary disorder (COPD), chronic heart failure (CHF) and diabetes mellitus (DM). The demographics and morbidity rates suggested that these would be a significant local issue. In particular, with an estimated increase of 30% of patients with hypertension, CHF, stroke and DM between 2007 and 2020 (DHSS&PS, 2012) the health and personal social care system was beginning to experience the burden.

In Northern Ireland, it was agreed in 2008 to invest in a new RVT model of care for three diseases: COPD, CHF and DM and so funders were made available to permit pilot projects to be developed.

1.4 General Remote Vital-Sign Telemonitoring

The context for the thesis is a changing demography, burgeoning demand for health and social care services, limited resources both financial and human and the emergence of new technologies. Whilst Telemonitoring is generally a recognised term, as this study specifically focused upon service models and technology to transmit patient vital signs and near patient test results, the term Remote Vital Sign Telemonitoring (RVT) has been applied; thus, excluding the transmission of non-patient health status metrics such as location

coordinates or fall sensor data. RVT is defined within the Regional Remote Telemonitoring Northern Ireland (RTNI) contract as…

> "the remote tele monitoring and delivery of support services through information and communication technology, using vital signs monitoring and /or interpreting changes to a Patient's health" (Refer to Appendix 2 glossary reference p142).

From a practical perspective it is where the patient-recorded readings are electronically reported to a health care practitioner through the utilisation of digital technology. RVT is a home-based service whereby a "hub" provides a series of functions: reminders, data collection, storage, processing and transfer. The patient is reminded to undertake daily monitoring using recording peripheral devices provided. Then compiled data are transmitted via phone-line to a central data centre. If there is an unacceptable reading, the system generates an appropriate alert. Web based technologies enable the review of readings by patient, triage nurse and Trust practitioner. Some RVT provision does not include the hub or blue tooth enabled peripheral devices; rather it is a light-touch service where a patient simply uploads their result into a portal or application (app). Therefore, RVT is used to describe a more focused subset of telemedicine or telehealth.

The environment for RVT is constantly changing as new technologies, sensors and applications are developed (Vogt et al. 2012). However, within Northern Ireland the European Centre for Connected Health (ECCH) undertook procurement for the region between 2008 and 2011 and then managed contract performance until 2018. Unfortunately, local innovation and development has faded as the focus of the commissioning authorities was upon implementation and deployment of the Remote Telemonitoring Northern Ireland (RTNI) service. An award-winning service, (PHA.2012) the RTNI service could arguably be described as such a traditional service and yet it was only activated in December 2011 with the recruitment of the first patients. Indeed, in an InnovateUK call for research published in October 2014, bidders were expressly instructed not to offer what was described as 'traditional' telemonitoring (SBRI Glasgow, 2018). However, for services within Northern Ireland, RTNI still 'feels' like a new service, not a traditional technology as

InnovateUK describe, as the technology was still being inculcated into practice.

Although service detail and standards were specified, wide practice variation led to variability in uptake rates, clinical opinion, variance in care standards and unclear expectation of outcomes. Observations by practitioners within SET suggest there are some critical success factors which enable the implementation of emerging remote monitoring technologies to be more or less effective. In doing so the concept of optimisation is considered, with a goal of optimisation being a theme. For the purpose of the thesis the term optimisation is defined as ‘safe and effective use of RVT to enable the best possible outcome’. This has been adapted from a utilised by National Institute for Health and Clinical Excellence (NICE) when describing Medicines Optimisation (NICE, 2015).

RVT has been implemented across the five Health and Social Care Trusts and has had variability in success of uptake and attainment of the ECCH’s performance targets, with variance in numbers of patients, conditions and leadership context. It has been observed that deployment from a leadership perspective has varied in approach with one Trust mandating practitioners to utilise technology focusing efforts on attainment of performance targets. SET took a more laissez faire approach to deployment. It is within this Trust, where ECCH performance target achievement was below expected. The thesis will examine patient, carer, practitioner and manager experience and opinion. This will determine if critical success factors emerge based upon patient need, disease group or clinical practice.

Two-years after the RTNI contract was signed there was an official launch of the service, entitled ‘A Celebration of Telemonitoring NI’. On the 8th April 2013 the Minister for Health, Social Care and Public Safety in Northern Ireland, addressed a delegation at Stormont, stating “... that practitioners in Northern Ireland are at the vanguard”, suggesting that the application of Remote Vital-sign Telemonitoring was being led, from a practice development perspective,

by the Region. In addition, SET RTNI patients also publicly shared their experiences. On 19 March 2013 two carers described how their mother had fewer hospital admissions despite her chronic ill health and how the family could manage her care. On 28 March 2013, Mr W indicated that the service saved his life, how reassuring it was to have access to a specialist practitioner and that he was, "...much more confident with regard to his condition." However, running counter to the very public praise for the service the 2012/13 SET utilisation of RTNI remained significantly below expected contract levels, being half of expected. Contract currency was not outcome based, did not consider patient experience or quality of life, rather counted days a patient was in receipt of a service, designated a monitored patient day (MDT). When a patient was enrolled onto the service the length of time, in days, they were registered and in receipt of RVT, was recorded by the provider and statistics reported back to referring Trust on a monthly basis. However, during 2012/13 it was evident that there were pockets of success within SET but equally there were areas where practice development, by practitioners, had not enabled the effective application of RVT per se.

1.5 South Eastern Health and Social Care Trust

The SET was established on 1st April 2007 as one of five acute and community health and social care Trusts commissioning RVT. The Trust is an integrated organisation, incorporating acute hospital services and community health and social services and serves a population of approximately 345,000 people. The Trust encompasses the local government districts of Ards, North Down, Lisburn, Down and part of Castlereagh. The clinical facilities include Ards Community Hospital, Bangor Community Hospital, Downe Hospital, Downshire Hospital, Lagan Valley Hospital and the Ulster Hospital. Community bases are located in many local towns and villages from Moira in the west to Portaferry in the east and from Bangor in the north to Newcastle in the south. The Trust is committed to providing health and social care to the local population it serves, from conception to death, and strives to meet the needs of the community within a budget of approximately £500,000,000 per

annum. The population is located in both rural and urban communities and affords residents care within the domiciliary environment, primary care health centres, community hospitals and acute General Hospitals. Refer to Appendix 1 for further Trust context details and a history of clinical interest in the deployment of evolving e-Health technologies. Within the Trust there were teams of staff focused upon the care of chronic diseases some of which utilised RVT. These included specialist services for diabetes, respiratory and cardiology but also a community team that cared for patients who, without their service, would have traditionally been in hospital and this service and practitioners were referred to as the Virtual Ward. Co-morbidity is significant within the older segment of the population only the Virtual Ward practitioners cared for patients using the TF3 service for multiple conditions, typically a combination of CHF, respiratory, hypertension and diabetes.

1.6 Policy and operational Context for RVT in Northern Ireland

The DHSSPS (2009) Health and Care (Reform) Act (Northern Ireland) created an environment to enable innovative care solutions to flourish and find novel approaches to deliver care in new and effective ways. The most senior managers and civil servants drove an agenda of reform and transformation with the goals of enabling health and social care to be delivered effectively, efficiently, as close to home as possible and to harness the energy of the new five Trusts following whole system restructuring that occurred in 2007. Then followed the work-streams as articulated within *Transforming Your Care*, (HSCB, 2011), a consultative document (DHSSPS, 2012a) and, most recently, a post consultation report 'Vision into Action' (HSCB, 2013) which proposed services as close to home as possible, patient centred care and emphasised the genuine need to empower the patient to self-care. Particular emphasis was placed upon alternatives to hospital care for those with LTC. It was within this progressive environment that there emerged an eagerness for technology reform, particularly gaining political support. The e-Health Strategy for Northern Ireland was published, which included the overarching strategic vision of eHealth to,

> "…empower people to be more active in their own care and support health and social care to achieve real change that delivers the best possible health and wellbeing for everyone" (HSCB, 2016).

Prior to this review of eHealth strategy there were drivers from within industry as well as practitioners envisaging change through technological advancement. Political lobbying from the Private Sector, with the support of Department of Enterprise, Trade and Investment (DETI), meant that funding from both the DHSS&PS and DETI would be pooled and directed centrally. The aim was that local industry and the reputation of Northern Ireland as a region within the World Market Place would be enhanced in the field of Health and Life Sciences. (MATRIX, 2008)

1.7 Creation of European Centre for Connected Health and Authority Commissioning of RVT

In order to enable change of emphasis within the wider health and social care environment and the adoption of innovative technologies the Department of Health established new structures dedicated to innovation and technology adoption. In 2007, the organisational structures within the re-organised Health and Social Care Services were enshrined in statute and stability returned. In 2008, the DHSS&PS issued a mandate formally establishing the European Centre for Connected Health (ECCH). This was important within the RVT thesis as it was both an enabler for change and also established the funding mechanisms by which early RVT could be commissioned and implemented. A Senior Civil Servant headed the venture and two directors, three project managers and part-time consultancy (provided by medical and nursing staff) were deployed to create an environment enabling innovation through technology within health care. The Remote Vital-sign Telemonitoring or Connected Health as it became known locally was the main focal point. There were three workstreams undertaken by the ECCH, (i) to commission an end-to-end Remote Vital-sign Telemonitoring System for Northern Ireland (RTNI), (ii), to fund and evaluate a multiple of small-scale pilots across each of the five Health and Social Care Trusts and (iii) to create strategic linkages with the European Union (EU), industry and academia. Lessons learned from work

stream two informed the development of a service specification designed to procure the end-to-end service for the region. For a detailed history of this period refer to Appendix 1, 10.3. A summary timeline demonstrates the life of the RTNI activity from constitution of ECCH on 1 April 2008 to the termination of the TF3 RTNI contract on 31 March 2018. (Figure 1.2)

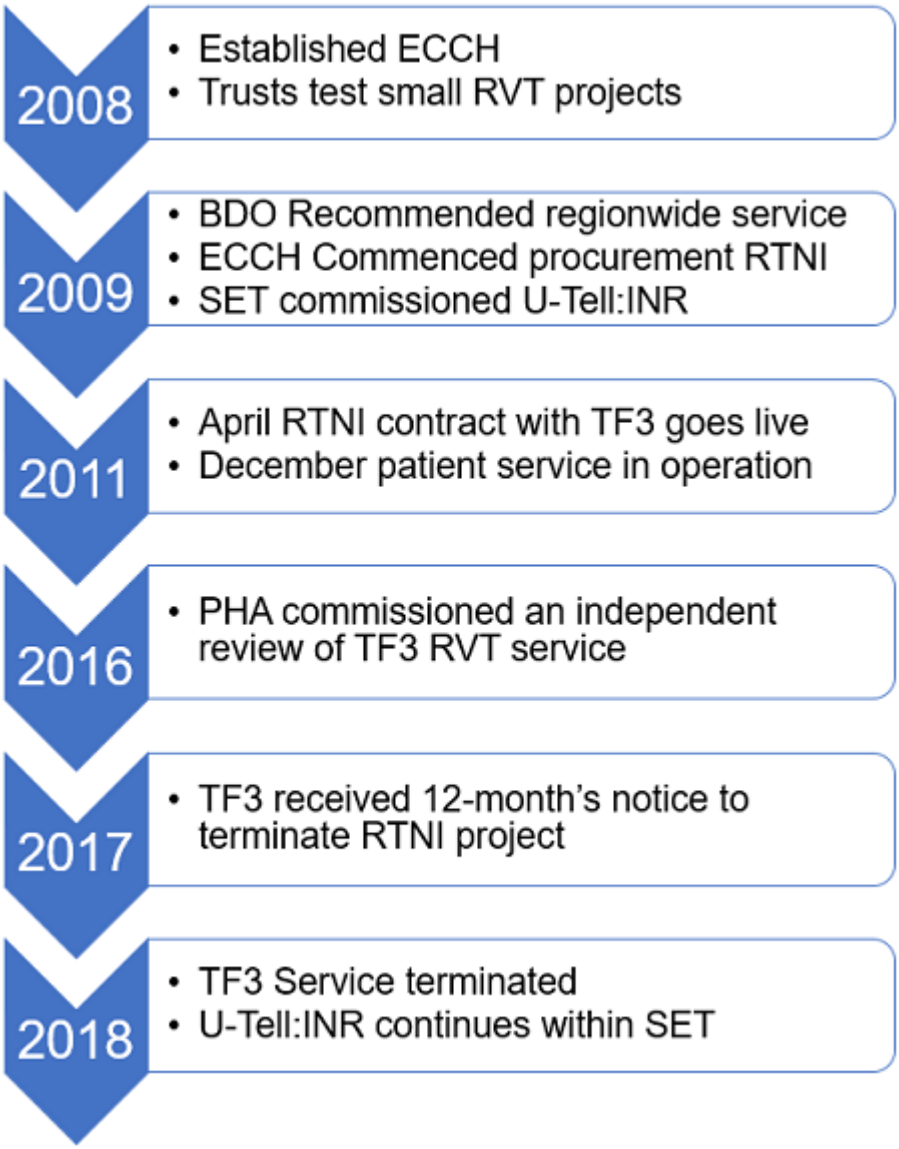


Figure 1.2: RVT Service Timeline

The contract was awarded for a 6-year term from 1st April 2011 to 31st March 2017 with £3 million available for each service year. Within this envelope £60,000per annum was available to each of the five Trusts to enable infrastructure supports with the residue available to fund both a standing charge and a variable element based upon actual utilisation. Between 1 April 2011 and 4 December 2011, the service was built, and staff trained. Moreover,

the contract currency of Monitored Patient Day (MPD) was established along with the Regional monitoring target for each Trust.

The MPD allocation was calculated based upon each Trust's financial equity share with the divisor being the unit cost of a day of monitoring (excluding the standing overhead charge). The contractor had devised a charging formula based upon packages given. This single action may have been a key deciding factor as to whether RVT could be optimised within the new regional contract with TF3 as an alternative solution would have permitted clinicians to select from a catalogue the peripheral devices, they required on a patient by patient basis. At this juncture of contract development, perverse incentives were created, and health outcomes were not considered rather the political impact of an apparent low unit price and high-volume currency. Therefore, with success being measured as more people in receipt of service for longer period of time; it could be argued that a Trust management structure focused upon achieving performance targets rather than efficacy and utility. The performance management system may drive behaviours whereby, many patients would be put onto the system for long periods of time without regard for outcome or benefit or even review of ongoing need. Whilst, this practice may have occurred in some areas within SET the Trust service's focus was to remain upon patient benefit and outcome rather than a dogged determination to attain performance targets regardless of clinical governance or patient outcome. However, the corollary to that was that if a practitioner could not be motivated to test technology then there were no real sanctions or management actions undertaken. Overall, regional commissioning enabled RVT to be implemented within a robust contract framework to ensure equality of access, service standards and consistency of practice. However, there were negative aspects that affected clinical adoption and application, most notably the focus upon the contract currency and lack of patient benefit or outcome measures.

1.8 The RTNI Contract and Agreement with the TF3 Consortium

Following a prolonged commissioning process, described above and in Appendix 1, 10.3, a regional contract for the provision of RVT was agreed. The contract was written by the Legal Advisor, DLA Piper, and amounted to four files, which described the specified service in very great detail; signed by the five Trust Chief Executives, the TF3 Consortium led by Tunstall and was dated 16 March 2011. Of particular interest was the first file intentionally did not define RVT, instead referring to the service as the "Managed Service" which was articulated, within the Schedule 1 Definitions of Terms, to mean, as "any and all elements of the service to be provided by the Contractor under this Agreement including as set out in schedule 2.1 (Service Description) including the Pre-Operational Services, Operational Services, Additional Services and/or Future Services" (Reference Appendix 2).

During the almost 3-year period between August 2008 and the best and final offer in December 2010 and final contract agreement in March 2011, the Authority Group has defined every element of service to be commissioned within the service specification. Not only did tenderers have to explain how each element would be attained within their service offering but both service specification and best and final offer narrative were combined by DLA Piper into the RTNI Project Agreement/ RTNI Managed Service Agreement.

1.9 RTNI Managed Service Agreement

It was important to understand and explore the development of RVT in the region. The two systems being studied enabled patient level data relating to their well-being to be transferred to the clinician for action, the history and design of both are significantly different. One, the RTNI, developed through a complex detailed and disciplined approach across organisations, and the other a local collaboration between Trust Practitioners and a University where collegiality and iterative planning through development and testing. The RTNI managed service was specified and described within a 'Managed Service Agreement'.

A law firm, (DLA Piper) wrote and managed the production of the agreement between the five Health and Social Care Trusts within Northern Ireland and Tunstall Healthcare (UK) Limited, (lead contractor in the TF3 consortium) relating to the provision of managed Remote Tele Monitoring Services in Northern Ireland (RTNI).

The agreement extended to four lever arch volumes along with a supplementary binder containing the six relevant signatories. The contents of each of the four master folders have been summarised and are documented within Appendix 2 and the key feature to note is the list of definitions of terms which gives insight to the understanding of the commissioners between 2008 and 2011 when the contract was being developed. File 1 of 4 contained the overarching definitions of services and established the implementation of the programme. The folder described the standards by which the service was to be delivered. Within the definitions section of the RTNI Project Agreement there were key definitions to be noted and a glossary of terms aiming to ensure any risk of ambiguity was minimised. (The glossary can be referenced in Appendix 2).

These terms are important to note within the context of this thesis as the researcher has assigned the same meaning to the terms when utilised within the research findings and report. The sample of pertinent terms selected and captured within this section are illustrative of the level of forethought that was employed by the Public Health Authority and Trusts prior to the deployment of RVT; it was not the testing of equipment on offer by suppliers, rather a genuine attempt to rethink models of care and pathways to positive effect. The definition of the RTNI per se, does not appear within the definitions and is rather within file 2 of 4, schedule 2.1.

> "A1 overview of Manged Service, The contracts shall ensure the provision of an end-to-end Managed Service to facilitate the following:
>
> - The processing of patient referrals;
> - The delivery and/or installation of appropriate patient equipment to/in a patient's home and/or the provision of a mobile solution as determined by the HSC staff and be responsible for any remedial repair work as a consequence of installation;
> - The provision of training to the HSC staff and patients/carers;
> - The collection of accurate and reliable monitoring data;

- A triage service which validates monitoring data and provides patient advice where appropriate and/or the escalation of their care to the local response team as appropriate;
- The provision of relevant monitoring data to HSC staff in an appropriate manner and;
- The removal and/or de-installation and decontamination of patient equipment".

The Managed Service Agreement file 1 of 4 sets out the detail of service to be provided in terms of service development, implementation and testing and also which patient groups. These included CHF, COPD and DM and also for the secondary prevention within stroke care. The progress was to be measured against pre-agreed targets and the issuing of a 'milestone Achievement Certificate' was documented. Any delays and concomitant correction plans and remedial actions were discussed along with the actions of the Liaison Committee. These elements were specifically designed to enable the development of an entirely new end-to-end service recognising that technological developments in the real-world may need more time to adapt than in theory or a laboratory. Indeed, the risk of delay was well accounted for with reasonable actions for both parties exclusively documented. The contract was novel and designed to realise the translation of in-theory laboratory technology proposition into the real-world application.

At section 9 the document began to address directly the matters relating to the Managed Service with the onus placed upon the contractor to fulfil obligations with regard to service standards as detailed within the schedule 2-1 (Service Description).

At clause 9.8 reference is made to an 'Additional Service Implementation Timetable' however, this in itself could be viewed as either an afterthought or to reflect that the commissioning team (referred to within the contract as the 'Authority') recognised that the pace of service change and equipment development was out pacing the drafting of the service standards. However, later in the contract execution, many of the service additional desirable services were just out of the price range of the commissioners. An example of this was the development by SET of the standalone technology INR – U-Tell module which will be considered within this research project as it operated in parallel with the TF3 Service. Similarly, at clause 9.17 1 the 'future service implementation plan' referenced enabled the provider to protract potential

charges to point of non-progress. For example, following two years of development a revised on-line methodology of service referral had still not been completed. A process failure first attributed to service implementation planning and later precluded due to extraordinarily high costings.

Of note, is clause 9.22

> "At the same time as provision of additional and/ or future service is commenced, the contract shall at no additional cost to the Authority, implement and commence provisions of any other services, functions and responsibilities which are both necessary for and incidental to the paper performance by the contractor of their additional and/ or future services."

This is a particularly interesting clause as the research progresses the researcher learns from practitioners that the complexity of referring a patient to the service acted as a significant barrier to utilisation and uptake. However, the Authority reported fees in excess of £70,000 to remedy the track and trend referral system; arguably clause 9.22 may have been interpreted and invoked to enforce service improvement by the contractor.

Section 10 considers the service levels and quality failures.

1.10 Description of the RVT TF3 Service

The interpretation of the service offering is as follows:

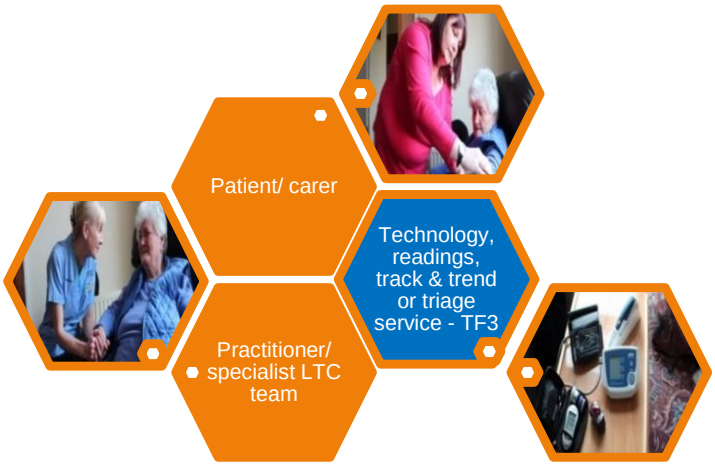


Figure 1.3: Relationship between practitioner, patient, carer and technology

The patient with a Long-Term Condition (LTC), defined by the RTNI Agreement as, "…health problems that require ongoing management over a period of years or decades" will be in receipt of care by SET practitioners,

typically led by Specialist Nursing. The practitioner will assess the patient as suitable for RVT and duly make a referral to TF3. The triumvirate, that is the power relationship shared between patient/ carer, practitioner and Managed Service Provider TF3 (Figure 1.3). The TF3 technology and service enabling data transfer between patient and practitioner to enable proactive intervention. The technology and service, a new interface, created a new digital relationship between the participants. The referral was by means of a fourteen-page electronic referral form and included all demographic information and pertinent clinical information along with a request for service.

Upon later software releases the referral process improved as there should have been a reduction in manual completion of mandatory fields as automatic data population, for example, General Practitioner (GP) auto population and patient demographics with the utilisation of the Health and Care Number; which is a unique 16-digit number allocated to each patient within Northern Ireland to enable sharing of information, clinical record access, service scheduling, prescription management and care tracing without the risk of name confusion and misidentification. Of note, at this juncture, the 14-page referral form, with data fields specified by the Authority through the dialogue phase was set within a context pre-NI Electronic Patient Record (ECR) so de facto the GP and nurse advisor to the project were almost specifying an ECR within the RTNI without regard to the demands placed upon the practitioner.

During the referral to the TF3 service the practitioner would define the level of service and package required in three decisions. The first decision was to have a service which included a triage nurse or not. The triage or triage service is defined within the RTNI managed service agreement as…

> “the service that assesses the patient’s alert, validates the vital signs when an alert has been raised, reviews monitoring data, obtains more information from the patient by asking questions designed to clarify or elicit more detail on clinical issues and deciding the action to be taken as a consequence including escalation to local response team;” (DLA Piper, 2011, Refer to Appendix 2).

In short, a practitioner may want to be assured that another nurse, a triage nurse, is able to filter alerts so that only clinically significant issues are brought to the attention of the practitioner for action.

> ***An example*** *may be that a patient with (COPD) may have been 'red-flagged' by the system having breached parameters set by the practitioner at point of referral. The patient may have reported that they are more breathless, higher temperature with a more productive cough and a reduced SPO2 level than normal and so the system would highlight the patient and their concomitant alert to the triage nurse. In turn, the triage nurse would enter into the patient's TF3 electronic patient record, review the case history and advice recorded by the patient's practitioner and telephone the patient. The triage nurse would then follow an agreed algorithm/ pathway of telephone triage as well as utilise their own professional nursing skills to assess the patient's condition. The triage nurse may ask the patient to retake their readings, ask questions, discuss symptoms and rescue medication and decide to escalate the case, as appropriate, back to the practitioner/ specialist team for action.*

Equally, the referring practitioner may decide not to avail of the triage service so that the patient simply takes their own readings when prompted to do so by the system and the practitioner concomitantly takes all responsibility for managing the data. Typically, patients with diabetes mellitus would be placed onto the TF3 service without triage so that the practitioners can more readily track and monitor blood glucose levels over time. This facilitates telephone consultations between practitioner and patient so that the need for a practitioner to physically review a patient's handwritten logbook of blood glucose readings is reduced or negated. The triage nurses only intervene with the monitoring of these patients where the patient is failing to upload readings into the system. In both the triage and non-triage service, known as track and trend, the patient records and results are available on-line to the practitioner through safe-guarded log-in credentials and also to patients who opt to gain access through a web-portal service. The RTNI project agreement defines track and trend as "a tabular and graphic report of individual patient monitoring data against monitoring parameters"; with monitoring parameters defined as "the tolerance levels that are set for the identification of which monitoring data are referred to the triage service." Monitoring data are defined as "the data items that are collected and reported to the managed service" (Refer to Appendix 2).

The practitioner secondly decides upon the clinical data requirements for a patient and concomitantly the devices a patient may be required to capture the data. Within the TF3 service these devices are referred to as peripheral devices, meaning "an item of patient equipment or client equipment (as

relevant) other than the hub;" with the hub defined as "the item of patient equipment or client equipment (as relevant) to which monitoring ata are sent by peripherals and which transmits the monitoring data to central solution." (Refer to Appendix 2).

The practitioner's third decision when referring a patient onto the system relates to the frequency of monitoring and the monitoring parameters. To simplify matters for practitioners the system had default settings for both and prompted a patient to take readings each morning. However, the practitioner can adjust parameters as required, and may choose to do so to change the tolerances at any stage in the TF3 service provision. The patient at their 'norm' may trigger excessive alerts which may lead to unwanted habitual behaviour with a disregard of alert or experience nuisance or raised anxiety or create unnecessary work for the triage service. Indeed, monitoring parameters may be disregarded entirely for track and trend patients as the key requirement is to observe clinical data trends.

The RVT systems underpin new data flows between patients, their clinicians and the system. The TF3 system was designed to connect patients with their clinicians who would enhance knowledge both of the health status of the clinician's patients and also at a patient level to take responsibility for measuring and uploading onto the system their vital sign readings. TF3 supplied the technology and training for all participants and users which supported data exchange and the clinical undertaken by practitioners. However, as patient readings were transmitted there were two modes of review either direct practitioner review, track and trend, or a first level non-specialist nurse screening, triage. The output of both modes of data availability meant the clinical practitioner was able to target care as appropriate. The information flow to influence activity of service participants is illustrated Figure 1.4.

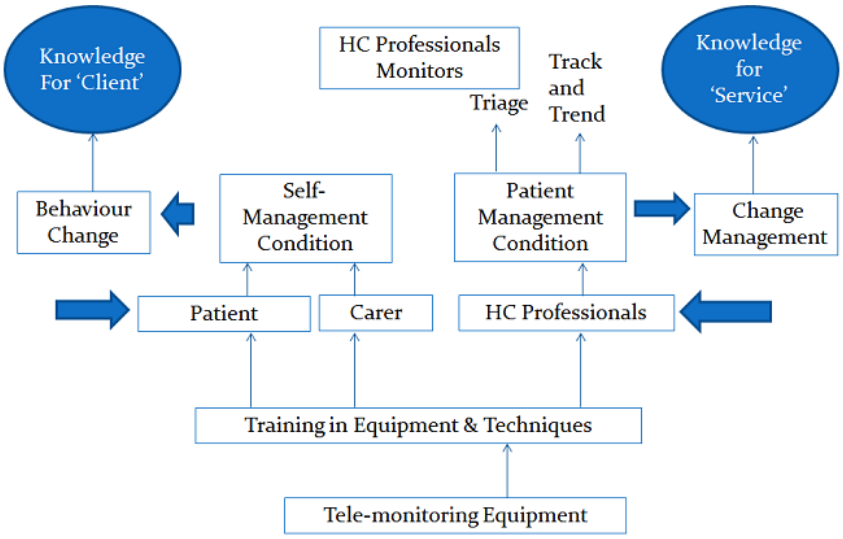


Figure 1.4: Showing the flow of information through an RVT service structure

The RVT system designed and delivered through the regional RTNI contract by TF3 was hardware reliant with little use of internet and no use of smart phone technology. The patient possessed a home hub which collected data from the prescribed peripheral devices and transferred via a 'plain old telephone' system (POTs) to the central server. The RTNI contract specified restrictive security safeguards and strict governance to protect patient data, identity and integrity. Whilst the hub scheduled reminders and transmitted data it collected data from Bluetooth enabled technology (peripheral devices such as scales) and also the responses to psycho-social questions relating to well-being and symptoms. The data would either be made available directly to the patient's clinical practitioner (track and trend service) or first be screened by a triage nurse. This nurse would contact a patient if a problem was suspected, take appropriate action and an intervention might be simple advice, reassurance, through to an immediate contact with the SET practitioner or in emergency situations an emergency response. The data flow, management, security and schematic architecture were designed by TF3 in responses to the regional RTNI tender (Figure 1.5).

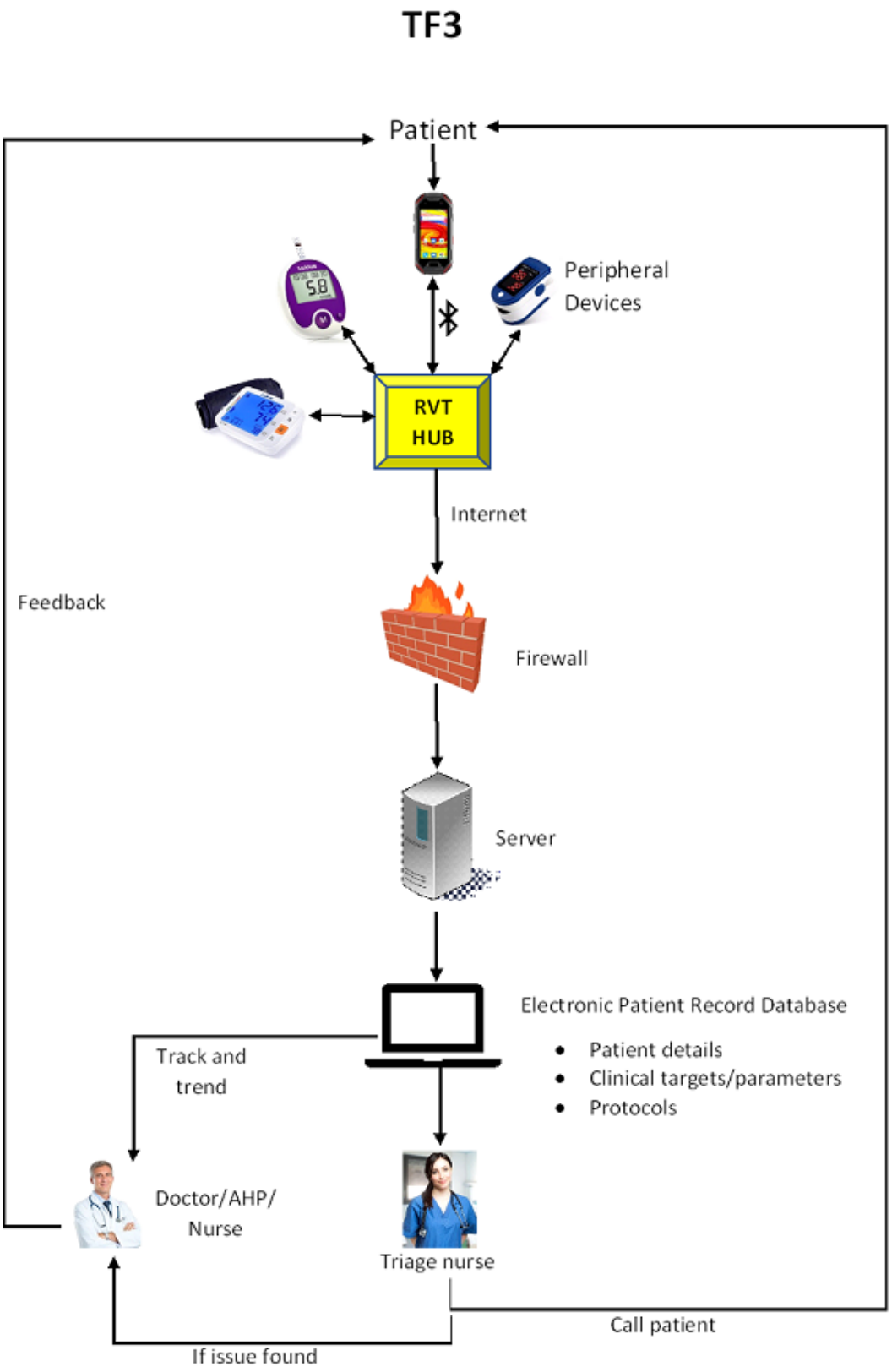


Figure 1.5: Schematic Architecture of TF3 System

Following the referral to the TF3 service a new relationship between patient, practitioner and managed service provider is created and has previously been described as being a triumvirate. The triage nurse will initially undertake a

‘welcome’ telephone call and ensure that the patient is competent and confident in the utilisation of their equipment, including the hub and tailored peripheral devices. The purpose was to put into place a community service to cost-effectively manage patients by reducing acute admissions and enabling an earlier discharge. The patient changed behaviour, which enabled urgent clinical intervention to take place following an alert and the practitioner to utilise their time more effectively in caring for an ever-growing cohort of patients with LTC. Within the RTNI Project Agreement, ‘Alert’ was defined as “an electronic message from an item of Patient Equipment that a Monitoring Parameter has been breached” (Refer to Appendix 2). Once referred, TF3 ensure the patient receives a service within a defined contracted period.

At the stage of Best and Final Offer (BAFO) within the procurement of the RVT system the two service offerings varied in several respects. Firstly, the BT offering had a simple and intuitive electronic referral system when compared to a series of 14 screens presented to practitioners through the TF3 service and secondly the equipment on offer for the patient. The BT offering included a catalogue style whereby a practitioner could tailor actual requirements for peripheral devices to meet a patient’s need versus the TF3 offering which had fixed equipment prescription packages for simplified standard packages of care and invoicing. There were 16 different packages proposed within the TF3 BAFO albeit that by contract year 2014/5 only 13 were utilised and priced.

The packages of care, tailored to particular LTCs, included peripheral devices that would capture only the required vital signs. Therefore, if a patient, post stroke, required their blood pressure to be monitored then they would be given a home hub and a blood pressure cuff whereas if a patient with diabetes required both blood pressure and blood glucose monitoring then they would receive a home hub, blood pressure cuff and a glucose meter.

Table 1.1 To demonstrate the equipment utilised in the TF3 including hub and peripherals, model, connectivity and expected lifespan.

Item Description	Model	Manufacturer	Connectivity	Replacement period	Current market position of technology
Hub	MyMedic	Tunstall	POTS	6 years	Advanced
Mobile Hub	MyMedic+	Tunstall	GSM/GPRS	6 years	Advanced
Scales	UC-321	A&D	Bluetooth	6 years	High Mid Range
Glucometer	OneTouch UltraSmart	Lifescan	Cable	2 years	Low Mid Range
BP cuffs	UA-767	A&D	Bluetooth	6 years	High Mid Range
Pulse Oxymeter	Onyx 9560	Nonin	Bluetooth	10 years	High Mid Range
BP cuff with Pulse meter	UA-767	A&D	Bluetooth	6 years	High Mid Range
Thermometer	TD-1261E	Taidoc	Bluetooth	2 years	Low Mid Range
Single lead ECG	100BT	Vitaphone	Bluetooth	6 years	High Mid Range
Contractor software	n/a	Tunstall and S3	n/a	periodic upgrades	Advanced

(Refer to Appendix 2, derived from RTNI contract: The equipment as listed within BAFO Contract excel spread sheet ‘35107840_1_UKMATTERS)

Although during the term of the contract there were modifications made to certain products, mainly the glucose meters, the basic equipment remained the same and the initial products are recorded in Table 1.1.

Table 1.2 Peripheral devices within each package type.

		Package	Hub	Scales	Glucose Meter	Blood Pressure Cuff	Pulse Oxymeter	Blood Pressure and Pulse meter	Thermo meter	Mobile Diabetic equipment incl Glucometer	Mobile Hub	Single - line ECG
(1)	Diabetes Home Based	A	y	y	y	n	n	y	n	n	n	n
	Diabetes Mobile	B	n	n	n	n	n	n	n	y	n	n
	COPD	C	y	n	n	n	y	n	y	n	n	n
	Heart Failure	D	y	y	n	y	y	n	n	n	n	n
	Heart Failure ECG	E	y	y	n	y	y	n	n	n	n	y
	Stroke	F	y	n	n	y	n	n	n	n	n	n
Co-morbidities:	Diabetes/Heart Failure	G	y	y	y	y	y	n	n	n	n	n
	Diabetes/COPD	H	y	n	y	y	y	n	y	n	n	n
	COPD/Heart Failure	I	y	y	n	y	y	n	y	n	n	n
	Stroke /Diabetes	J	y	y	y	n	n	y	n	n	n	n
	ECG only	K	y	n	n	n	n	n	n	n	n	y
	Mobile Stroke	L	n	n	n	y	n	n	n	n	y	n
(1)	Diabetic patients do not need their oxygen saturation measured, so may use a blood pressure cuff with pulse measurement rather than a pulse oxymeter and a blood pressure cuff.											

(Refer to Appendix 2, derived from RTNI contract: The equipment grouped into the 13 Packages of care as listed within BAFO Contract excel spread sheet '35107840_1_UKMATTERS)

Therefore, if a practitioner is caring for a COPD patient with a co-morbidity of CHF the practitioner would routinely order a 'Package I' which consists of a Hub and four peripheral devices, including scales, blood pressure cuff, pulse oxymeter and thermometer. Table 1.2 was issued to practitioners so that they were clear regarding the available packages. Moreover, the practitioners were at liberty to order the individual packages for as long or as short as required but typically the routine operational time was blocks of 13-weeks so that if a patient remained on the system for 52-weeks, they would receive four sequential blocks of service provision and the Trust achieved 365 MPD against their performance target.

The charging mechanism for Remote Vital-sign Telemonitoring Northern Ireland (RTNI) consisted of two elements, a standing charge to cover service overheads, for example staff costs of Fold (the TF3 consortium member operating the call-centre) and decontamination services and a variable charged for installation, de-installation, consumables (for example, batteries and test strips) and MPD. Information relating to initial contract costs and charges can be observed in Appendix 2 Tables 12.2, 12.3, 12.4 and 12.5.

From a practice perspective, within the service across Northern Ireland in general and in particular within SET there was little or no agreement with regard to which subset of patients should avail of the service. For example, the Respiratory Service within the Ulster Hospital developed a Care Bundle to ensure that practitioners consider RVT as an option for each patient; this is illustrated in Figure 1.6. Care Bundles were not universally accepted by all practitioners, some of whom prefer to use other approaches. Within the context of RVT the Institute of Health Improvement (IHI) (2015) Care Bundle definition was accepted…

> "An evidence-based Care Bundle is a structured way of improving the processes of care and patient outcomes: a small, straightforward set of evidence-based practices… (generally three to five)…that, when performed collectively and reliably, have been proven to improve patient outcomes."

All other services utilising RVT took a less formal approach to application permitting practitioner preference and freedom.

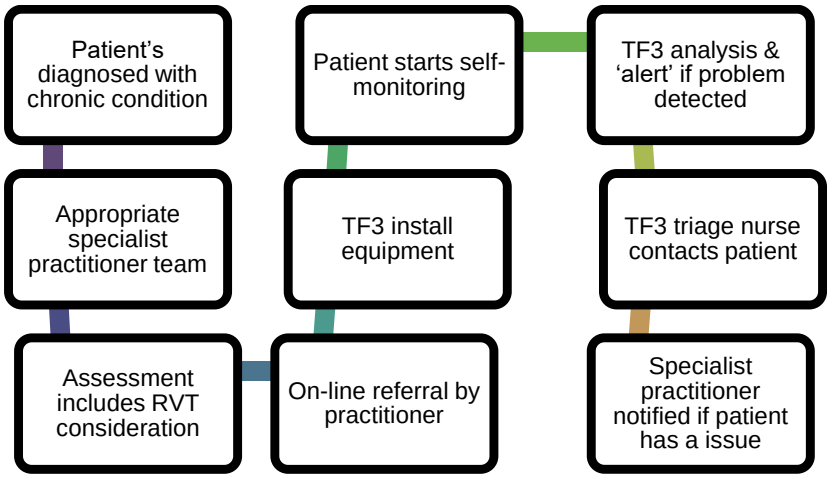


Figure 1.6: Flowchart to illustrate RVT 'care bundle' as a process for a patient with a chronic disease as used within the Ulster Hospital by the Respiratory Specialist Team

1.11 RVT/ TF3 Performance Monitoring for South Eastern Trust and Northern Ireland

With the introduction of the regional service came a degree of monitoring to ensure compliance with the contract. This is included to show how the monitoring influenced the subsequent developments. Management data

obtained from SET via the research protocol. Accountability and performance monitoring were reported by SET to the Public Health Agency (PHA) with primary performance data being derived from activity reports accompanying the variable contracts issued by TF3. The European Centre for Connected Health (ECCH) was moved from being based within the Department of Health and Personal Social Services and Public Safety (DHSSPS) to being within the PHA; at the same time there was a name change to the Centre for Connected Health (CCH).

Due to differing perspectives on performance, early on the service performance within SET failed to attain the targets established by the CCH. The CCH set MPD targets based upon annualised MPD potential associated with the maximum number of patients cared for within budget. Failure to attain the expected outturn was due, in part, because practitioners tended to utilise the service purposefully with short term intervention and that the baseline patient cohort was smaller than three of the other Trusts.

As explained in Appendix 1, the SET RVT 2008 pilot had been undertaken by Home Telehealth Ltd, (later became Alere). This was a triage service and at the close of the service in November 2011 there were very few patients who practitioners considered suitable for transfer to the TF3 service. Indeed, it was the COPD patients from the community service in Lisburn who were amongst the few to receive the new service. Many of the original triage nursing staff transferred to TF3 under Transfer of Undertakings (Protection of Employment) TUPE; under UK law protection was afforded to the previous subcontractor's staff. This afforded staff protection but importantly the TF3 service commenced with experienced RVT triage nurses. Three of the other NI Trusts, the Northern, Western and Southern had all undertaken RVT pilots (with Fold Telecare), albeit not a triage service, rather track and trend. Fold, being part of the TF3 consortium, was able to facilitate a transfer of long-standing routine monitored patients, most of whom were track and trend service users that were mainly diabetic patients monitoring blood glucose. Therefore, at performance reviews SET fared poorly against target particularly at the initial stages. The three Trusts which were previously served by Fold performed well and the fifth Trust, Belfast, had limited engagement. The failure to engage was caused by tension between staff who expected Trust specialist nursing

services to be augmented to enable proper deployment of RVT without negative impact upon service provision.

During the first four months of the service the Regional Target for SET was to refer up to 41-patients per month with the actual number of patients enlisted on the service during that time representing 47% of target. In total 85-patients were referred to the service with 75 installations being made before 31 March 2012, which was the close of a Trust's financial year. There were no migrating patients from pilot Fold projects and the initial use of the service is illustrated in Table 1.3.

Table 1.3 The SET referrals to TF3 during the first 4 months of the TF3 service showing uptake by disease.

	Referrals	Proportion
COPD	31	36%
Heart Failure (CHF)	5	6%
CHF	1	1%
COPD with BP	9	11%
COPD/ CHF	6	7%
Diabetes	33	39%
Total	85	100%

(TF3 Service Management Report December 11 - March 12 v0.2)

By 2015 the annual target had increased, and the outturn for contract year 2014/5 is demonstrated in Table 1.4.

Table 1.4 The actual MPD against target 2014/15.

Month 2014/15	Target MPD	Actual MPD	Variance against Target	Triage MPD	Track & Trend MPD
April	6500	6048	-7%	4274	1774
May	6500	6131	-6%	4465	1666
June	6500	5965	-8%	4284	1681
July	6500	6103	-6%	4418	1685
August	6500	5821	-10%	4243	1578
September	6500	5410	-17%	4010	1400
October	6500	6111	-6%	4406	1705
November	6500	6410	-1%	4642	1768
December	6500	6835	+5%	5009	1826
January	6500	6948	+6%	5095	1853
February	6500	6304	-3%	4519	1785
March	6500	7174	+10%	4981	2193
Total	78,000	75,260	-3.5%	54,346	20,914

(TF3 Service Management Report March 15 v0.1)

By contract year 2014/15, service in 3rd year of operation, that the lag created by a zero baseline of SET patients within the TF3 service system should have been eliminated so that attainment of the MPD target was more likely than in the first four or twelve months of operation. However, the Trust still failed to attain the regional target by 4% of the expected MPD, which equated to 8 patients on the system for 12 months or rather 33 patients each receiving RVT for a single package period of 13-weeks. By considering the metric of MPD, SET failed to attain regional targets and, by inference, failed to maximise the use of available, commissioned RVT service capacity.

In the same year the performance against the metric of MPD of other four Trusts was benchmarked against SET. The Trust did not compare favourably when compared to the other Trusts.

Table 1.5 The 2014/15 TF3/ Trust performance metrics.

Month 2014/15	Target MPD	Actual MPD	Variance against Target	Triage MPD	Track & trend MPD
Belfast	50004	64376	+29%	23785	40591
SET	78333	75260	-4%	54346	20914
Northern	122518	122271	0%	57575	64696
Southern	105000	112181	+7%	77773	34408
Western	106056	115236	+9%	43831	71405

(Data compiled from TF3 Service Management Report March 15 v0.1)

Table 1.5 is interesting in that at a stage that behaviour should have become embedded and reflected in practice it appeared that Belfast Trust was over performing by almost a third. However, at the time when Belfast Trust clinicians were refusing to engage, and the CCH reallocated funds from Belfast Trust to the Northern, Southern and Western Trusts along with a concomitant share of MPD. The Belfast Trust's reduced funding share meant it was over-performing against an artificially deflated target. The original target distribution was based upon the population sizes within each of the five Trusts. The key point here to note is that it was clearly behaviour and stance, within one cohort of staff that drove application of RVT or not. It illustrates the 'Gate-Keeper' role of the practitioners.

It also raises questions as to why the Northern, Southern and Western Trusts attained or exceeded their MPD Performance target, particularly as the service targets were raised to mitigate against overall regional failure of contracted targets or to artificially create a situation whereby some Trusts required additional revenue resources to fund overuse whilst Belfast Trust remained significantly underspent and in credit. The CCH agreed in 2013/14 with SET not to adjust baseline funding, instead SET committed to endeavour to attain MPD Targets.

Examination behind the target figures illustrated a complex pattern of utilisation behaviour across the Trusts. With data compiled from TF3 Service Management Report March 15 v0.1, was created which illustrates some key service pattern differences.

The Trusts are represented by their initials, BT is Belfast Trust, SET is South Eastern Trust, NT is Northern Trust, ST is Southern Trust and WT is Western Trust. The disease groups are an aggregation of services with the lead condition where co-morbidity exists accounted for in main overall reason for being in receipt of the RVT service. The LTC groupings are COPD, albeit in SET patients with Bronchiectasis are part of the respiratory patient cohort utilising RVT, diabetes mellitus (Types 1, 2 and in the Western Trust Gestational Diabetes), stroke and CHF. SET had a 70/30 split between the TF3 triage and the track and trend provision higher than the other Trusts along with the highest proportion of patients utilising the system for COPD. Moreover, unlike the other Trusts, at that time there were no CHF or Stroke patients on the system in SET (see Table 1.6).

Table 1.6 The service utilisation by Trust.

	% Triage	%Track & Trend	%COPD	%DM	%Stroke	%CHF	Installs	Discharges	Total Month End
BT	38	62	37	49	13	0	9	10	166
SET	70	30	67	30	0	0	23	14	233
NT	51	49	40	44	5	10	24	20	330
ST	69	31	52	30	1	17	18	14	270
WT	38	62	36	51	12	1	0	20	277

(Data compiled from TF3 Service Management Report March 15 v0.1)

The Western Trust, a high user of RVT, did not have any new referral patients enrolled onto the service in March 2015 because there was a 9% over performance of the MPD metric and therefore spend on the variable element of the contract had to be controlled. With reference to the Western Trust's target having previously been inflated due to Belfast Trust's underperformance indicates that Western Trust Management may, at this time, have attempted to contain costs by not permitting referrals to be made or for the equipment to be installed into patient's homes during the last month

of the financial year to ensure affordability and cost containment. Budgetary pressures within CCH prevented a further easement or bailout due to cost pressure. This retraction of service also illustrated the power of management control to the extent that services can, in effect, be turned on and off at will in a Trust rather than necessarily reflecting clinical practice or patient need.

The dominance of provision of service for diabetic patients in the Belfast, Northern and Western Trusts may also reflect both the commissioning of track and trend and a lack of alternative technologies to monitor glucose control or better engagement of diabetes practitioners than within SET.

Therefore, the 2014/15 TF3 performance data for the region appears to indicate a variance between Trusts relating to patterns of service type uptake, patient access and attainment to the MPD metric. However, the reporting of this metric is binary, with either a succeed or a fail result without the acquisition of understanding of actual benefit, disbenefit, utility or meaningful outcome. However, the regional TF3 report, had been positively skewed by SET reporting RVT MPD that were derived from another system, a Trust based system U-Tell. (Table 1.5)

1.12 TF3 and U-Tell:INR Combined Monitored Patient Day Activity for South Eastern Trust Demonstrates a Different View of Target Attainment

Of note, for the overall assessment of SET's relative RVT performance success in relation to MPD is the effect of adding the U-Tell:INR MPD to the TF3 MPD; CCH permitted the variation. This could be marked as a turning point in outlook of the CCH as they were accepting data from a service that was not end-to-end as had been specified in the RVT documentation; the medical and nursing advisors to CCH who had insisted upon electronic data transfer had both retired from service. A mind-set of change as well as increase in performance had occurred with the CCH acceptance of the U-Tell RVT MPD data in addition to the TF3 MPD performance data.

Table 1.7 The MPD 2014/15 as at 31 March 2015 for SET splitting standard TF3 and U-Tell data.

Month	Target	Actual	Variance against Target	Triage	Track & Trend
SET TF3	78333	75260	-4%	54346	20914
SET U-Tell:INR	0	14600	0%	0	16600
SET Total	78333	89860	15%	54346	37514

(Data compiled from TF3 Service Management Report March 15 v0.1 and U-Tell:INR activity)

Table 1.7 demonstrates the effect of including a stratified approach to RVT for appropriate patients and both modes of RVT, TF3 and U-Tell, will be considered in the thesis. The 15% over-performance of SET when compared to the other Trusts may demonstrate more effective utilisation of RVT as the cost of service did not over run requiring a cessation of service in the final month of contract year 2014/15. Equally, it may demonstrate a lack of adoption of the TF3 or a targeted approach to care regimen for patients. It does indicate a mixed use of different RVT solutions within SET.

1.13 Stratified Provision of RVT and First Consideration of Model in Thesis

Access to alternative forms of RVT must not be ignored particularly as the Regional RVT service, RTNI, provided by TF3 was to be the only service provided and indeed to be end-to-end. During the specification design stage, the two clinical advisors were concerned by risk of variation in service provision; in particular risks posed by patient self-reporting as errors, deliberate or accidental, were possible. At the time of specification design Trust representatives argued that patients with diabetes already had an ability to inappropriately record their readings in their logbook for practitioners. It was further argued that experienced practitioners could discern when

inappropriate recording was occurring most particularly with the utilisation of the HbA1c blood test which demonstrates control over time. SET argued that patients should be trusted, and self-reporting permitted but this view did not prevail, and the regional service specification only reflected end-to-end and automated data reporting. Moreover, during the design of the specification SET argued for the development of portals and apps for data capture, particularly for simple single data capture, for example, blood glucose readings. During negotiations one potential provider's Chief Executive explained that income for them was derived from the sale of hardware and so would not compromise high volume sales for low cost alternatives. Therefore, from the outset of the RTNI contract, SET did not share the strategic view as to how RVT should be developed as the opinion maintained by CCH and TF3.

If the attainment of Trust's MPD target within the TF3 contract alone was the measure of relative success or failure of RVT within SET, then as shown SET, may be considered as failing or not optimising RVT. However, SET RVT management and some clinicians took a different approach to RVT than the other Trusts and the construction of a pyramid of cost versus volume was proposed by the researcher. (Figure 1.7)

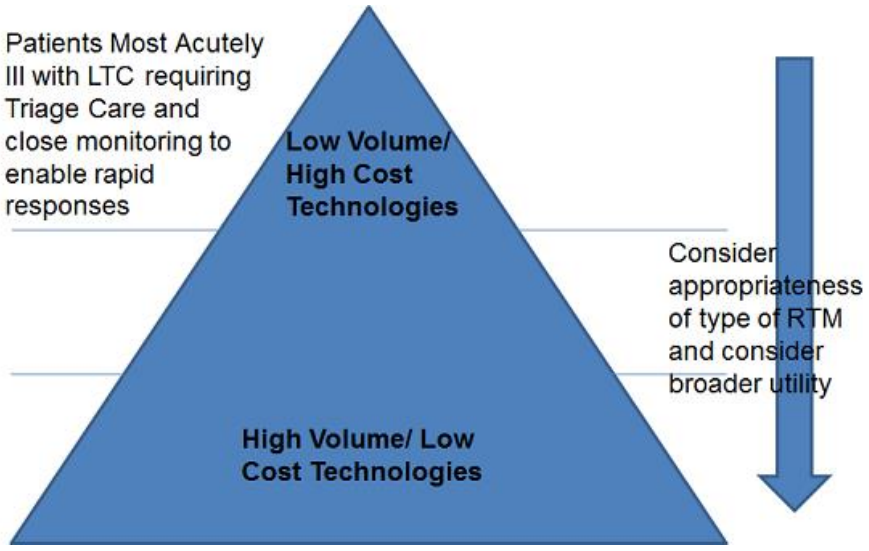


Figure 1.7: Stratified provision of RVT

In order to expand this, SET decided to seek alternative provision and go beyond the RTNI TF3 service. One service in particular is U-Tell and this RVT tool was included when the research question of optimisation of RVT was explored.

1.14 South Eastern Trust Creation of an Alternative Low Value/ High Volume RVT

In 1998 during the time of the Path.Finder Medical committee early work commenced between the Ulster University Computer Science Department and a Consultant Endocrinologist, based within the Ulster Hospital. The practitioner had wanted to be able to review his diabetic patients blood pressures without the need for clinic visits and so a PhD Student, Ulster University, created and tested a new technology utilising Voice Recognition Technology (VRT) called 'Di@l-log'. At that time most patients were not comfortable nor had access to the internet and so VRT offered a simple alternative.

Essentially, the practitioner gave to the patient a blood pressure (BP) cuff to take home along with a unique patient identifier and pass code. With a small amount of training the patients were able to record their own BP and upload data to be viewed by the practitioner via an internet portal. The patient would dial the Freephone number, identify themselves utilising a four-digit pin, confirm identity and record their blood pressure via VRT or the use of a Touch Tone keypad. The practitioner could then contact the patient via the phone to adjust medication.

In 2009, during the RVT pilot phase, SET agreed a grant contract with Ulster University Computer Science Department (UU) to develop the next generation; U-Tell for diabetes was created. Here the system could record the patient's reading via VRT or via a web portal and patients could both record BP and Blood Glucose readings. A problem was soon encountered as the time of Blood Glucose reading and in relation to time of day was not available and practitioners would have preferred the functionality to exist so they could track blood glucose against a meal schedule. However, U-Tell was unique in that patients would receive instant feedback and advice. This was achieved by having pre-set/ algorithm-based responses programmed into the system. Functionality was dependent upon practitioners recording into U-Tell, when patients were being registered, the clinical parameters tailored to the individual. Responses therefore ranged from a 'well done, keep up the hard work' to pointing out the parameter breach and asking patient to make urgent

contact with their practitioners or clinic. The rudimentary decision making innate within the system gave U-Tell new utility.

1.15 Description of the RVT U-Tell:INR Service

The Trust in partnership with Ulster University developed a RVT solution which operated in parallel with the TF3 service. Whilst the original iteration was designed for patients with diabetes, the system was proactively utilised for patients who took the anticoagulant and who had poor control, often failing to stay in therapeutic range. The RVT system in use was known as U-Tell.

The overarching utility of U-Tell was considered within other clinical areas, most notably for patients prescribed warfarin. Warfarin is a commonly utilised anticoagulation therapy but unlike many medications it is metabolised differently by different individuals. Some patients are able to break down warfarin more quickly in the liver and clear the medication from the system, variance between individuals is known as pharmogenomics; how genes affect medicines. Moreover, particular food substances affect the action of warfarin, for example alcohol will increase the anticoagulation or blood ‘thinning’ effect of warfarin whereas foods high in vitamin K, (e.g. spinach), will counteract its action. Therefore, unlike many drugs, most notably modern alternative anticoagulation medications (known as direct oral anticoagulants DOACs), for example dabigatran, apixaban, dabigatran and rivaroxaban, a standard daily dose of warfarin is not given. Indeed, warfarin dosage may vary not only across patient groups but also over short periods of time for individual patients. This means that a system of measurement and dose adjustment has been developed. The International Normalised Ratio (INR) is an assay which is used to determine anticoagulation; a measure of extrinsic pathway of coagulation.

Most patients within the SET geography who receive warfarin therapy had their INR measured and warfarin dose adjusted within the GP Primary Care environment whilst a number of high risk or difficult to control patients were monitored and cared for by hospital based out-patient services. It is crucial for the dosages to be correct as an INR reading that is too high may lead to internal life-threatening bleeding, for example causing a haemorrhagic stroke

and equally an INR that is too low will demonstrate reduced efficacy and the patient may form a blood clot or thrombus causing a blockage which equally may be fatal through an ischaemic stroke or pulmonary embolism. Most patients are required to maintain an INR range within 2.0-3.0; this is higher than a normal person who may have an INR range between 0.8-2.1 and indeed, some patients at very high risk of clots, for example those with Thrombophilia Factor V Leiden may be required to maintain an INR range between 2.5 and 3.5.

The blood sample is most commonly collected by a venous sample at a frequency dependent upon results but may typically range between weekly up to 6-weekly for patients who maintain control well. However, there are some near patient testing devices that would enable the assay to be undertaken utilising capillary blood from a ‘finger prick’. The blood is absorbed into a test strip and inserted into a device for the data to be readable by the patient and or practitioner. These near patient testing devices first started to become available in the mid to late 1990’s but there was reluctance to use them due to the catastrophic consequences for patients if they were not appropriately quality assured or calibrated. Despite the Path.Finder Medical Committee wanting to trial near patient testing the significant lack of assurance of device calibration meant that inherent risks could not be balanced by potential benefits. In 2009, SET commissioned U-Tell:INR and by 2011 a consultant haematologist within SET’s Ulster Hospital, was convinced of efficacy from a clinical governance perspective and was trialling a multi user INR meter device, [Roche CoaguChek XS], within the Outpatients Department to cross-check venous sampling results from the Laboratory with capillary samples.

Within the control process, once the INR result was known the result was transcribed by the haematology nurse into a computerised dosing system, called DAWN (within Primary Care RATS). Both systems guide the practitioner to advise vis-à-vis the next dose of warfarin and when the next INR test is required to be undertaken.

Therefore, an opportunity was recognised to utilise the single patient use INR monitor with a U-Tell:INR system. In 2011, collaborative work between the SET, UU and the technology supplier Roche, commenced to design a version of U-Tell specifically for INR. The patient received a unique identifier and

passcode, dialled into U-Tell:INR to utilise VRN technology, a touch tone phone or entered an on-line portal to upload their readings. The patient's expected INR range was set by the practitioner if it was outside the default parameter of normal therapeutic range. The patients were also asked two simple yes/ no questions to indicate if there was an increased risk of bleeding. As soon as the patient confirmed and sent their data instant feedback and advice was given. The data were then available on a clinic-based computer for the practitioners to review, put the data into DAWN dosing system and message the patient back. The U-Tell:INR system was designed to be a low cost/ high volume service where the only cost was the original grant investment by SET with UU, circa £20,000, along with the purchase of the INR meter and the test strips; this was funded through year end RVT slippage funds in 2011.

The U-Tell system connected the clinician to the patient and enabled direct intervention by the clinician in response to a reading the patient has taken responsibility to upload themselves. U-Tell facilitated multiple metrics to be reported such as blood pressure or blood glucose but from 2011 there was a reduction of diabetic patients utilising the system and the focus shifted towards the interchange of INR data between patients warfarinised and their haematology nurses.

The data flow between patient and clinician was managed through the U-Tell system via the internet with clear data flow as illustrated within the architectural schematic (Figure 1.8). As with TF3 data governance and system security is an essential feature.

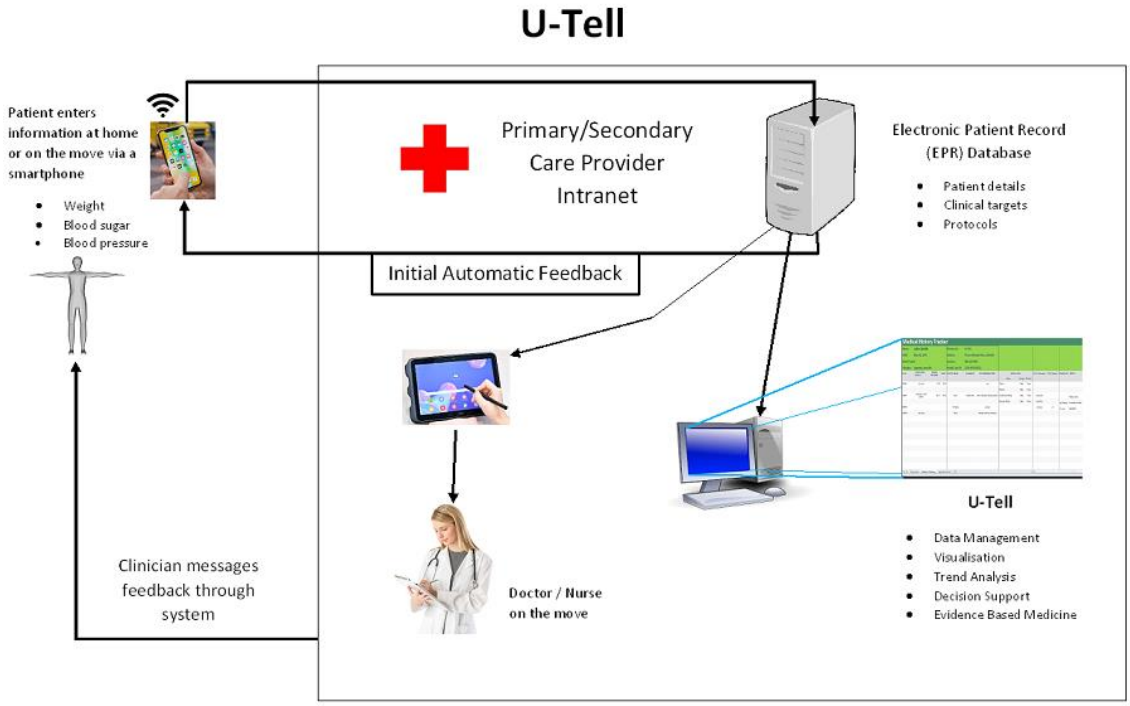


Figure 1.8: Schematic Architecture of U-Tell System

The INR Meter and U-Tell:INR system were designed to be simple for a patient to use as the following sequence of figures demonstrate:

a. Patient's U-Tell:INR website login screen
b. Patient's home-based equipment for monitoring INR and near-patient testing device showing an INR reading of 3.7 (above patient's safe level)
c. Patient uploads reading into the website
d. Patient confirms that their responses are correct and can be sent to practitioner
e. System responds automatically to patient to inform them that the reading is outside their parameter and causing concern
f. Later in the day the patient logs back into the U-Tell system to read a response from their clinical practitioner. In this example reducing dose and instructing a retest.

Steps 'a' to 'f' are illustrated in Figures 1.9 to 1.14.

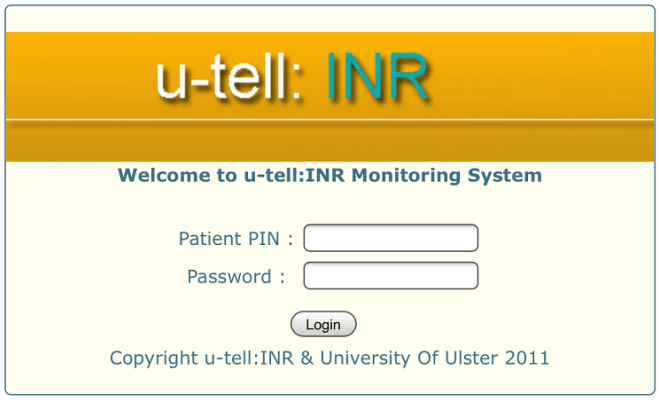


Figure 1.9: a) Screenshot to illustrate patient login for U-Tell

Figure 1.10: b) Photograph to demonstrate INR Meter with INR reading to be recorded in patient log book and U-Tell

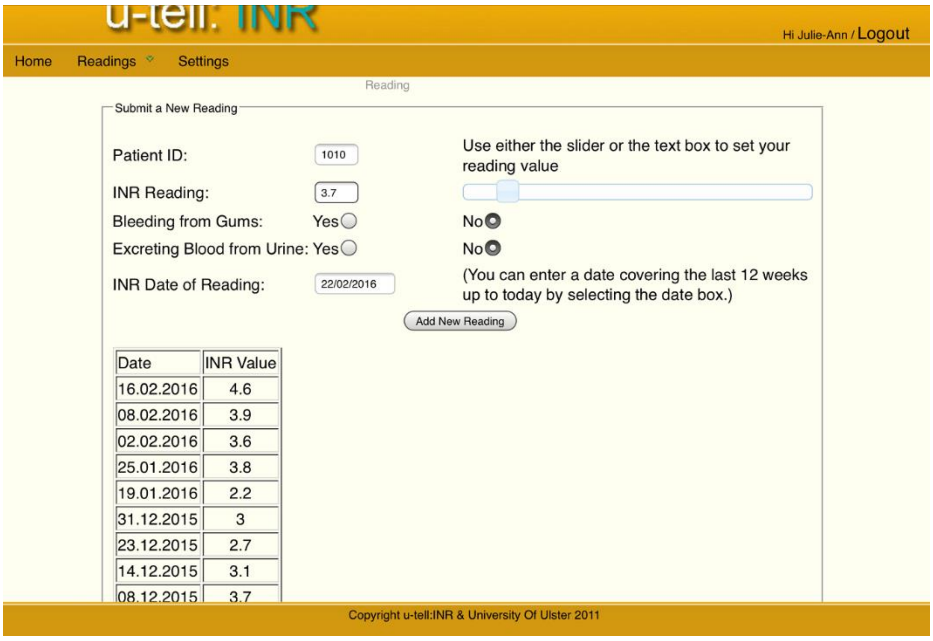


Figure 1.11: c) Screenshot to demonstrate patient recording INR reading in U-Tell

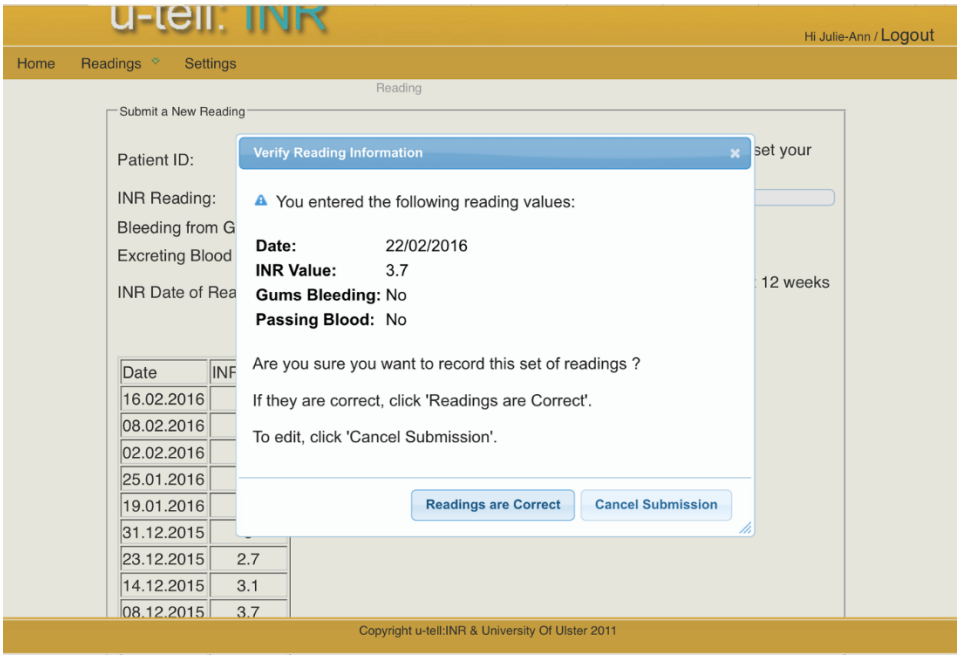


Figure 1.12: d) Screenshot to demonstrate U-Tell verification

Figure 1.13: e) Screenshot to demonstrate U-Tell feedback; programme recognised INR was out of range and alerted patient

Patient is then given instant feedback. In this illustration the INR has breached expected parameter for patient. (Normal range for this patient 2.5 – 3.5 and reading being too high at 3.7)

Figure 1.14: f) Screenshot to show Haematology Nurse's dosing instruction to patient on U-Tell

The SET then established a clinical trial, a Randomised Controlled Trial (RCT) involving 80 participants, 40 randomised to test the U-Tell:INR intervention

and 40 traditional care within the SET Ulster Hospital's Outpatient Department. The results indicated that patients utilising U-Tell:INR maintained better control of their INR and were more satisfied with the care they received with RVT than traditional services. (El-Agnaf, 2014). (Refer to Appendix 1 for brief overview of RCT findings). The view of participants is important in the consideration of optimisation of RVT and will be revisited later in this thesis (Chapters 4 and 5).

1.16 Description of the RVT Design for Mainstream Service

The design of both the TF3 system and U-Tell:INR took much effort to ensure that by 2011, with known available state of the art RVT technologies, the two systems could be rolled out to scale within SET with the basic understanding of efficacy. The basic roll out and how the systems were to be utilised was well developed on paper, building upon the learning acquired by practitioners during the pilot project phases. Collaborative working across professions, commissioners and providers to understand and agree service specification had been undertaken. The pre-deployment collaborative design and specification was important to set the context for this thesis. In some studies, the stance taken by researchers has been to demonstrate clinical utility and relative value or effectiveness of RVT and yet the specification and deployment was often ill-conceived. Pinnock et al. (2013) intended to demonstrate clinical effectiveness of RVT, through RCT methodology, for patients with COPD living within Edinburgh; clinical efficacy was not demonstrated. Unlike the ECCH's RTNI, where every element of service was planned, the Edinburgh project utilised donated equipment and did not demonstrate consideration as to which vital signs should be monitored, so that the basic peripheral device, the thermometer, to indicate infection in respiratory patients was not utilised. Furthermore, a plan for uniformity of service was not considered so that delays of many weeks for deployment of RVT equipment post hospital discharged was a frequent occurrence. Therefore, the context for RVT in SET was to deploy a well thought through service to augment usual care regimes. The effect of which, beyond the MPD

metric was unknown and the case to determine if there was benefit was made within this thesis.

1.17 Purpose of study

A new political focus upon healthcare reform illustrates the timeliness of the study (Bengoa, 2016). Patient-centric care derived from self-management could be of potential benefit for the wider system of management for those with chronic conditions (Grady and Gough, 2014). Previous studies have signalled an early indication that technology may enable self-management (Calvillo et al. 2013) but little evidence that RVT could deliver a patient-centric ethos. Indeed, the context of the TF3 service evaluation hinted of a possibility of patient personal utility but the research methodology was not constructed to explore or test the hypothesis (McElnay et al. 2016); a conclusion echoed in the findings by McDowell et al. (2015).

The working title for this research study was the ‘Optimisation of Vital Sign Remote Telemonitoring’. The Participant Information Sheet interpreted this for patients and carers to mean that the purpose of the research was to examine the ‘best way we can use Remote Telemonitoring equipment and services to help our patients’, and for clinicians and managers ‘we can try to improve the care and support offered to patients in the future’. The Participant Information Sheet described how the researcher was interested to learn about the participant’s experience to improve the care. This purposeful approach was adopted as the researcher did not want to influence opinion of participants by suggesting any particular utility or benefit. Therefore, the purpose of the study was to examine the experiences of service users to determine if a consensus emerges indicating the real benefit of RVT. Thus, it revolved around a patient-centric ethos. Additionally, the study aimed to understand how to maximise the effect of RVT, contribute to knowledge, and influence how future technology can be purposefully designed and deployed.

1.18 Aims and Objectives

The Aim of the thesis was to critically assess whether RVT is perceived to have derived benefits for patients.

This will be achieved through four objectives, to understand the context, to gain RVT knowledge, to understand benefit and to evaluate and engage.

The Objectives are:-

1. To describe, summarise, critically evaluate and clarify the current state of knowledge on implementation of RVT.
2. To identify and describe service data trends from service user and practitioner perspectives.
3. To determine the factors of patient benefit which are enabled using Remote Vital Sign Telemonitoring (RVT), taking the views of practitioners and senior managers into account and identify service benefits and risks.
4. To devise recommendations to enable future deployments for optimal patient care.

1.19 Hypothesis

The identified gap in knowledge revolves around the understanding of a possible linkage between RVT and patient outcomes; thus, this research is designed to examine and test the hypothesis that:

If the healthcare system successfully integrates remote vital sign telemonitoring into the treatment regimens for patients with chronic disease, then the effect will be that patients will feel better supported, in ways yet to be determined.

1.20 Research Design

Owing to the complexity of RVT implementation it was necessary to adopt a mixed methods research design in a post-positivist stance using a broad methodology of programme evaluation.

1. Review of available literature focused search criteria
2. Use of baseline service data
3. One-to-one interviews with health service practitioners, managers and commissioners.
4. Application of a service user and carer questionnaire.

Prior to engagement with research participants the prerequisite research governance and ethics approval was obtained:

1. Ulster University Research Ethics Committee (Project No: 15/0065).
2. The Proportionate Review Sub-Committee of the Health Research Authority, NRES Committee South Central – Oxford C (July 2015) gave permission for the research to be undertaken. IRAS project ID 155990
3. SET Research Governance approval was attained on 11-Aug-15 REC 15/SC/0424 Trust reference SET/15/17

There were four main stakeholder groups identified who interacted with the RVT services; engagement with all groups was determined appropriate in order to examine data from all perspectives, to balance bias and interpret convergence and/ or divergence of opinion. However, engagement and data collection could not be designed to be conducted utilising a single methodological paradigm; instead, both qualitative and quantitative data collection methods were designed. Tables 3.1 and 3.3 in Chapter 3 illustrate the framework of data collection. It was estimated that at time of survey there would be circa N=280 service users/ patients and an unknown number, estimated as up to N=90, carers would receive questionnaires by post. The approach with health and social care staff, both clinical practitioners and operational or commissioning senior managers is qualitative. It was estimated that N=12 practitioners and N=8 managers would attend one-to-one semi-structured interviews which would be scheduled to last up to 60 minutes. Then after high-level analysis of the qualitative data the practitioners would be invited to attend a validatory workshop.

1.21 Risks and Inconveniences

There were no serious risks associated with participation or data collection. Any potential for harm, such as through data breaches, were

mitigated through planning but it will be seen that none occurred during the data collection phase.

1.22 Data Analysis and Interpretation Framework

A quantitative analysis, of data held within the (IBM-SPSS version 25) data base has been undertaken and concomitantly the analysis of the qualitative data held within the (NVivo 12) database, for overall analysis. The data, regardless of type, was considered of equal value and was further analysed, blended, compared and considered complementary when reviewing RVT in SET from multiple perspectives. The process, known as triangulation can be undertaken from different stances but within the RVT Research, the equal weighting, the parallel data collection and handling enables the approach of Concurrent Triangulation (Creswell, 2003). (Refer to Chapter 3, Figure 3.17)

However, before data can be triangulated each paradigm requires data collection, handling and analysis in parallel and two independent data analytics software were utilised to manage large volumes of data within independent databases and assist with the quantitative calculations and with the order, classification, interpretation and as appropriate the ‘quantitizing’ of qualitative data (Creswell and Plano Clark, 2007, P138).

The Primary data analysis, prior to triangulation of findings, is summarised:

1. Quantitative (statistical) analysis of numerical data from the patient and carer questionnaires were undertaken: - descriptive, exploratory and explanatory; (IBM-SPSS version 25 to be utilised).
2. Qualitative analysis of narrative data obtained through semi-structured interviews on the topic of RVT with health professionals at all levels;
    a. One-to-one semi-structured interviews with practitioners with experience of utilising RVT and senior health and social care managers.
    b. Validation workshop with practitioners following high-level completion of quantitative analysis of the interview transcripts.
    c. Qualitative analysis of interview transcripts following a descriptive thematic approach. The stages and process involved within (NVivo) 12 will be based upon Krippendorff (2004).

1.23 Assumptions, Limitations and Scope

1.23.1 Sample Size

It was decided that the entire RVT active user patient population would be invited to voluntarily participate in the study and be sent a questionnaire pack. Sampling was not employed as a data collection strategy was to maximise the power and meaning of the data from one service setting; given the maximum number of participants was less than 300 and contained at least seven disease sub-groups and two RVT technologies with three service deployment models, sampling was considered counterproductive. This approach was accepted by the three-research governance and ethics committees as no statistical rationale or ethical benefit would be gained by sampling the patient population. Equally, all clinical practitioners trained in the use of RVT would be invited to voluntarily participate in the study.

1.23.2 Participant Bias

It was accepted that those who choose to participate are more likely to view RVT from an individual perspective whether positive or negative. However, statistical analysis of the quantitative data should determine if there was validity and an expected distribution of responses. To balance this, the mixed methods approach should enable the issue to be viewed from four different positions with the participant groups interacting with RVT. That is to understand the perspectives of patients, their carers, clinical practitioners and the managers.

1.23.3 Researcher Bias

The adoption of a post-positivist stance ensures and accepts that the researcher utilises the underlying knowledge in a balanced way ensuring that the interpretation of findings will encompass the researcher’s own values and background when describing observations and analysed data. Equally, there is a potential for bias as there was a single reader during the literature review

process. Of note midway through the research the researcher moved employment from SET to the Health and Social Care's central administration provider, the Business Services Organisation. It is likely that this move helped to achieve neutrality in later stages of the work.

1.23.4 Scope

Strict project management techniques, Prince II (Office of Government Commerce, 2009), were utilised to ensure that the research remained within parameters and executed data collection and analysis as planned and an approach duly approved by the research governance and ethics committees. Moreover, constraining the project to SET practitioners, despite approaches from practitioners from other Trusts, reduced scope-creep.

1.24 Definition of Terms

Within the strategic context, a detailed definition of terms is referred to Appendix 2, which was derived from the regional TF3 contract. However, for ease of referencing the most common terms utilised within the thesis are documented in 'List of Abbreviations and Acronyms' section, prior to Chapter 1.

1.25 Statement of Purpose

Currently there is a gap in knowledge where the benefits of digitally transferring vital sign readings from patients at home to their practitioners are not well understood. There have been pilot projects but changes in professional practice are unclear and this contribution will attempt to address the knowledge gap. The aim and objectives have been defined and the research designed to test the hypothesis, resolve the questions and address the gaps. It is anticipated that the findings of the research will contribute to the knowledge, understanding, application and potential future application of RVT.

1.26 Summary

The context for the research thesis was within a health and social care climate of a rapidly increasing elderly population with associated healthcare demands, increase prevalence of chronic diseases and a limited health resource. The sample population was that within the SET's boundary and the technology being studied was a subset of telehealth, known in this research as Remote Vital-Sign Telemonitoring (RVT). There are two distinct services, one commissioned regionally from TF3, which was a higher value technology permitting both triage and track and trend models of care and the second, U-Tell, was an in-house low value solution for warfarinised patients whose control was complex and so were managed through secondary rather than primary care. The regional strategic direction for eHealth was to harness possibilities afforded by telehealth whilst a service review commissioned by the Public Health Agency concluded that, set against the health economics metrics associated with reduced secondary care utilisation, the TF3 service had largely failed to show those benefits so was decommissioned (2018). There were management instruments such as service performance currency monitored patient days (MPD). This metric encouraged Trusts to put patients onto a monitoring system and to keep them on the service rather than genuinely enable technology to change healthcare delivery models and enable real patient benefit and improved outcomes to be discovered. However, clinical practitioners were, for the first time, given continuous access to patient level data to suggest healthcare status. This information that had not been made available before, had not been taught in educational institutions and where the meaning, benefit and practical use was yet to be understood.

The value of this research is centred upon patient benefit derived from the RVT technology; it is to observe and determine if RVT adds value to and facilitates care or not beyond the simple performance management metrics associated with reduced utilisation of secondary care services. The research methodology is a mixed methods research design in a post-positivist stance.

The data are derived from multiple sources including strategic context, literature, qualitative data from patient and carer participant questionnaires and qualitative data from practitioner and manager participant one-to-one semi-structured interviews. Data are handled and analysed using standard methods packages (IBM-SPSS version 25 and NVivo 12). Equal value is placed upon data captured within a quantitative paradigm with that captured within a qualitative paradigm; triangulated using a concurrent strategy. The thesis articulates synthesised data, interpretation and created meaning; demonstrated perceived benefit for patients and made recommendations for the future use of technology in healthcare for those patients with LTC.

2 LITERATURE REVIEW

2.1 Introduction

A plan to undertake the review of literature pertaining to Remote Vital Sign Telemonitoring (RVT) was created to address the aim to critically assess whether RVT is perceived to have derived benefits for patients. The review of literature enabled horizon scanning, policy framework and synthesis of papers which tested a relevant hypothesis. It was believed that there was a broad base of material that could be reviewed and synthesised in order to contribute to the knowledge and understanding of effective technology deployment. In addition, it was recognised that not only should published academic papers be considered but also a scanning of local public media sources for anecdotal media reports of relevant subject matter. Whilst rigour was built into review system, topical horizon scanning was also undertaken with some non-peer review reports considered so as to track commercial innovative technology developments which may give an early indicator of the future of RVT.

2.2 Review Methods

A framework for a review was developed (Table 2.1). Literature Search terms included telemedicine/ telehealth, remote vital sign monitoring, implementation and success factors. When reviewing abstracts for relevance the degree of relevance was considered by reviewing the study's context including the type of technology/ telemedicine/ telehealth, the environment, practitioners, practice development, service users/ clients/ carers/ patients within the aspect of chronic disease management. Given the novelty of concept and technology the rationale for the search period was restricted to the most recent period back to 2000 as prior to this date telemedicine was limited by the state of the art and was not akin to RVT.

2.2.1 Literature Search Plan included the following themes:

Rationale for Literature Search Plan and Paper Selection

Table 2.1 The rationale for literature search plan and paper selection.

DATABASE (available at Ulster University)	PROVIDED BY
Medline Ovid	Wolters Kluwer Health Ovid Technologies
CINAHL Plus	EBSCO Host
Cochrane Library	Wiley Online Library
PubMed	PMC-US National Library of Medicine
Scopus	Elsevier BV

Search Criteria

STRUCTURE	APPLICATION TO STUDY
Publications	English Language, Peer Reviewed Journals, 2000-2014 inclusive and research based
Type of Service	Telemedicine/ Telehealth
Aspect Specific to Service	Chronic Disease
Client Groups	All
Decisional Factors (refined)	Implementation, critical success factors, service measures/ outcomes, practice development and practitioner involvement

Inclusion and Exclusion Criteria

INCLUSION
Publications in English between 2004-2014 inclusive in Peer-reviewed Journals
Empirical Research Design
Studies primarily relating to Remote Vital Sign Telemonitoring/ Telehealth/ Telemedicine
Studies primarily relating to Chronic Disease Management
Patients living in their own home/ tenancy within the community
Practice/ Clinical Development demonstrated
Implementation or deployment factors/ conditions/ issues described
Health/ Medical Based Publications – Health Sector Rigour
EXCLUSION (Review of abstract)
Public opinion or views of non-health care professions/ groups
Patients living in nursing homes or hospitals
Where devices utilised are implanted into patients
Where devices do not require patients to upload or send data
Non-health Publications

The initial search results, based upon the above Rationale, are tabulated in the Table 2.2. It can be seen that the key search topic areas were refined in a phased approach so that an initial review of the topic of telemedicine/ telehealth suggested that there were 38,546 papers that matched the search criteria; chronic disease 762,160 and health plan implementation 184,662. These raw figures do not consider duplicated documents. The next cycle of searches reviewed success factors/ further development, then practice development, practitioner involvement, patient involvement and finally outcome measures. This led to a more manageable number of potentially pertinent papers (662).

Table 2.2 Illustrates the numbers of research papers identified showing the reduction of available papers as exclusion review was undertaken.

DATA BASE	tele-medicine/ telehealth	Chronic Disease	health plan implementation	first 3 combined	Success factors/ programme Development	first 4 combined	Practice Development	Practitioner Involvement	Patient Involvement	Tele-medicine and Practice Development	Practice Development with Chronic Disease & Telemedicine	Outcome Measures	tele-medicine outcome measures chronic diseases	Papers of value with further manual exclusions
Medline Ovid	10802	216280	14481	322	22040	9	598				0	47282	16	6
CINAHL Plus	8051	28145	10958	3	817948		59377			54	8051	18155	8	5
Cochrane Library	8350	8413	4										4	
PubMed	4946	509322	159219	899		408	303698	5919	44			276869	532	17
PubMed repeated				81										9
Scopus (Health)	6397	1287		372			49	0					102	13
Total not de-duped	38546	763447	184662	1677	839988	417	363722	5919	44	54	8051	342306	662	50

The 662 possible research papers matching the search criteria where then electronically de-duplicated and a manual review of abstracts concluded that there were 50 relevant research papers to analyse. The 50 papers were obtained in full and a first read then eliminated 7 as not relevant to the study and were disregarded. There was then a review of the search process and the analysis, and the initial search findings confirmed. However, prior to analysis of individual research papers the criteria for future searches was further refined, as illustrated in Table 2.3, in order to extend and update the review.

The final Literature Search terms included: telemedicine/ telehealth, remote vital sign monitoring, implementation and success factors. decisional factors considered type of service: - technology/ telemedicine/ telehealth, the environment, practitioners, practice development, service users/ clients/ carers/ patients within the aspect of chronic disease management.

2.2.2 Updated Literature Search Plan included the following themes:

Updated Rationale for Literature Search Plan and Paper Selection

Table 2.3 The updated rationale for literature search plan and paper selection.

DATABASE (available at Ulster University)	PROVIDED BY
Medline Ovid (all 3 data bases)	Wolters Kluwer Health Ovid Technologies
CINAHL Plus	EBSCO Host
Cochrane Library	Wiley Online Library
PubMed	PMC-US National Library of Medicine
Scopus	Elsevier BV
Embase	Elsevier

Updated Search Criteria

STRUCTURE	APPLICATION TO STUDY
Publications	English Language, Peer Reviewed Journals, 2014-date of search inclusive and research based
Type of Service	Telemedicine/ Telehealth
Aspect Specific to Service	Chronic Disease (Stroke, Diabetes, Hypertension, COPD, Chronic Obstructive Pulmonary Disease, Bronchiectasis)
Client Groups	All
Decisional Factors (refined)	Implementation, critical success factors, service measures/ outcomes, patient centred (cent*) care/ practice development and practitioner involvement

Updated Inclusion and Exclusion Criteria

INCLUSION
Publications in English between 2011-date of search inclusive in Peer-reviewed Journals
Empirical Research Design
Studies primarily relating to Remote Vital Sign Telemonitoring/ Telehealth/ Telemedicine
Studies primarily relating to Chronic Disease Management
Patients living in their own home/ tenancy within the community
Practice/ Clinical Development demonstrated
Implementation or deployment factors/ conditions/ issues described
Health/ Medical Based Publications – Health Sector Rigour
EXCLUSION
Public opinion or views of non-health care professions/ groups

Patients living in nursing homes or hospitals
Where devices utilised are implanted into patients
Where devices do not require patients to upload or send data
Non-health Publications

In addition, local Northern Ireland Policy documents, European Union Policy Documents and service user engagement documents were obtained from the Health and Social Care Trust, Health and Social Care Board, Public Health Authority, Patient Client Council and the European Commission's website. Some consideration was also given to an on-going scanning of on-line news feeds such as for innovative commercially available technologies being deployed and where anecdotal findings may be indicative of a trend or opinion; such sources included the BBC, InnovateUK, GovTech and Knowledge Transfer Network. It was recognised that there was a distinct value difference between papers obtained following a formal literature review methodology and those that are newsworthy anecdotes so the researcher developed a framework within which each publication could be consistently classified. Moreover, email alerts from Elsevier.com were received and reviewed within the broad topic of telemedicine fields, chronic disease and published in English only. The PRISMA flow diagram (Moher et al. 2009), Figure 2.1 summarises the literature review.

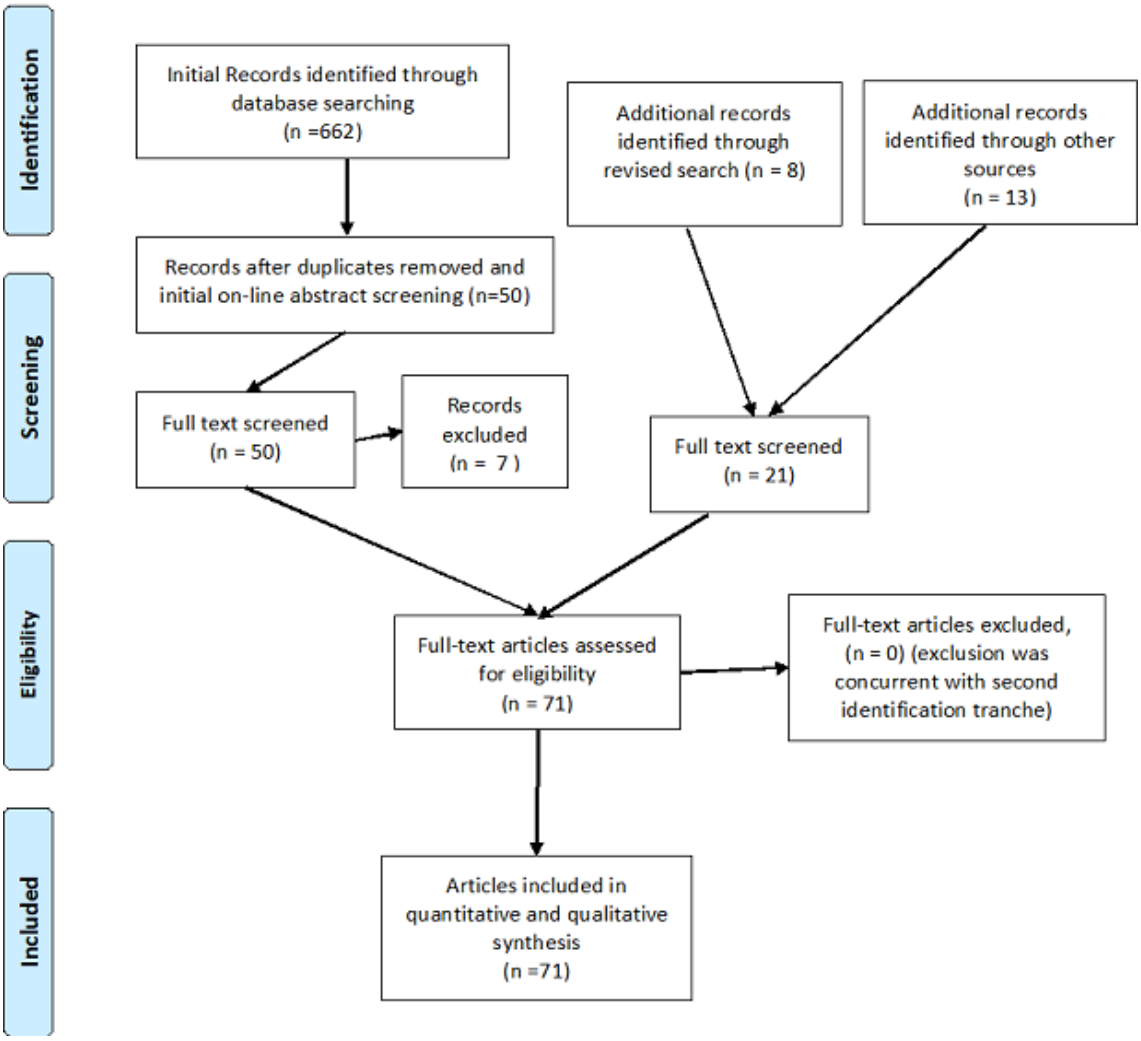


Figure 2.1: PRISMA Flow Diagram to show literature review search

The framework was developed, synthesising the work of Pope et al. (2007), Spencer et al. (2003) and Aveyard (2010) (Table 2.4).

2.2.3 Publication Review Framework:

Table 2.4 The publication review framework.

Author		
Year		
Title		
Publisher		
Reference		
EVIDENCE TYPE		EVIDENCE CONSIDERED AS:
a. Systematic reviews and meta-analysis b. RCTs c. Quasi experimental designs – cohort studies, case control studies d. Surveys e. Case Reports f. Qualitative methods g. Anecdote/ expert or user opinion h. Public policy/ Public Consultation/ Statement		
	APPRAISAL QUESTIONS	FINDINGS
1	Who is the Author?	
2	What was the purpose of writing the report?	
3	How credible are the findings?	
4	How well is scope for wider inference explained?	
5	How well was data collection carried out?	
6	How well are the links between data, interpretation and conclusion?	
7	How clear is the reporting?	
8	What evidence is there to attention to ethical issues?	
9	How adequately has research process been documented?	
10	Is the report relevant to the research topic?	
Issues of note:		
Quotation:		

2.3 Literature Review Findings

Following the extended review of literature there were a total of N=71 papers formally reviewed against the Publication Review Framework. Of note, papers classified as Public Policy/ Public Consultation/ Statement – evidence

classification ‘h’ were identified from public sector/ National Health Service (NHS) or European Commission (EC) sources rather than through the application of the Tabulated Rationale for Literature Search Plan and Paper Selection (Table 2.1). It was found that the numbers of types of publication were classified as tabulated (Table 2.5).

Table 2.5 The summary of total number of literature review search results and additional general scanning of broader sources.

Letter Classification	Evidence Type	2000 - 2004	2005 - 2014	2015 +	TOTAL	Letter %	Group %
a	Systematic reviews & meta-analysis	0	7	4	11	15.5	
b	Randomised Controlled Trials (RCTs)	0	5	4	9	12.7	33.8
c	Quasi experimental designs – cohort studies, case control studies	1	3	0	4	5.6	
d	Surveys	0	4	1	5	7	
e	Case Reports	1	6	3	10	14.1	26.8
f	Qualitative methods	0	4	0	4	5.6	
g	Anecdote/ expert or user opinion	0	14	3	17	23.9	23.9
h	Public policy/ Public Consultation/ Statement	0	6	5	11	15.5	15.5
	TOTAL	2	49	20	71	100	100

The extended literature review, as tabulated (Table 2.5) and further groupings recognised for relative importance or power. Letter classifications were assigned to types of evidence and the relative weighting given to the power

of the author's message. Such that types of research studies and concomitant findings were classified by letters 'a', 'b' and 'c' were considered, by the researcher, to be credible and most trusted. It can be seen that a third of research studies analysed were in the top weighted findings. In general policy statements and regional strategy, classification 'h' which were produced by the Departments of Health for Northern Ireland, UK Government and the European Union's Commission were based upon expert knowledge and local research and so contributed to overall understanding and knowledge. Published public policy, or consultation or statements gave a strategic context for the application of technology within the public health and social care sector. Without the support of state funders and affirmation of support for healthcare technologies the context for the research would be abject. Classification 'h', public policy, in itself added a further 15.5% to trusted evidence. In summary of all documents included within the literature review were considered as meaningful; contributing to the development of the research study.

The researcher placed greatest value upon findings articulated within classification types 'a' 'b', 'c' and 'h'. However, it will be demonstrated that each study needed to be considered on its merits. Of the 71 papers reviewed the greatest value grouping with 15.5% being systematic reviews and meta-analysis, classification 'a'. The researcher placed lowest value upon findings articulated within classification type 'g' but it was recognised that the anecdotal evidence, expert opinion or user opinion could act as an early barometer for the future of technology in a rapidly changing environment and as such were included for analysis if relevant. Equally, 26.8% of papers were evidence type classifications 'd' to 'f', including surveys, case reports and qualitative methods.

Of all non-policy papers (all literature excluding classification 'h') reviewed, the three highest value classifications ('a', 'b' and 'c') accounted for a total of 40%, and the lowest value classification ('g') accounted for 28.3% of the non-policy papers reviewed.

2.3.1 What the literature suggested regarding the use of RVT.

Each type of evidence is reviewed separately and documented by classification to consider the relevance to the purpose of the literature review.

2.3.1.1 Classification ‘a’ – Systematic reviews and met-analysis

Within the framework of critical appraisal of literature reviewed (Table 2.4) the most significant studies were classified as ‘a’, systematic reviews and meta-analysis. The eleven studies considered were published between 2008 and 2017 and synthesised the findings of previous studies within the fields of telemedicine for the support of self-management, professional practice and support of family caregivers. 70% of the studies considered the telemedicine support for general chronic disease management, 20% the respiratory condition, COPD, and 10% heart failure. All the disease topics were relevant to the application of RVT service for those with LTC. The systematic review of literature undertaken by the World Health Organisation (2013) was focused upon the reduction of the overall burden of non-communicable disease (NCD). Whilst least relevant to the research question it was retained as it set the strategic context for the overarching topic. However, Hanlon et al. (2017), cautions that findings could be outdated due to technology advances and nature of meta-analysis.

The eleven studies were published by authoritative academics, with seven teams based within the UK, two from international groups, one from USA and one European. All documented systematic review methodologies in detail and two studies were produced specifically for the Cochrane Collaboration. All reports were well explained, clearly structured with links between findings and source reports, well-articulated but only one of the ten expressly discussed ethical and research governance considerations.

The importance of addressing the global impact of chronic disease was a theme connecting all research in the field acknowledging the overall pressures within the healthcare systems. In essence, the concept of telemedicine was articulated to assist in addressing the care for those with chronic, or rather, NCD. It was reported that circa 38 million deaths per year were due to NCD, albeit cancer accounted for 8.2 million; the Global Action

Plan for the prevention and control of NCDs 2013-2020 aimed to “reduce the number of premature deaths from NCDs by 25% by 2025” (WHO, 2015). Moreover, the global organisation focusing research upon COPD equally did not solely focus their systematic review upon the utilisation of RVT but did conclude that

> “Accumulating data from a variety of studies indicate that telehealth in any of its current forms has not shown benefits for patients with COPD; thus, telehealth is not recommended for use with COPD patients” (Gold, 2014, pxi).

The lack of strong evidence, further reflected by Currell et al. Cochrane Review (2010), “Establishing systems for patient care using telecommunications technology is feasible but there is little evidence of clinical benefit.” A view echoed by McClean et al. (2011), observing that “Telemedicine is a complex intervention as defined by the MRC and …difficult to pin down exactly what is the "active ingredient" of the intervention.” Their meta-analysis suggested further studies be undertaken to understand how “effect is delivered”. The analysis did describe opportunity within the field of telemedicine to provide patient education, connect remotely and improve medicines adherence and did positively indicate that

> “research suggests that telehealth care has the capacity to reduce exacerbations and may improve the quality of life of the people using it in comparison to usual care.” (Ibid.)

Whilst indirectly this is suggestive of benefit it must be recognised that the meta-analysis was based upon experience of technology that is now in excess of 10 years old.

An analysis of studies reviewing the UK’s multiple RVT Dallas Projects highlighted many and several issues relating to varied RVT services (Wylie, 2015). The review applied the theory of Normalisation Process Theory (NPL) to the meta-analysis and Devlin et al. (2015) articulated the implementation issues and highlighted resistance to change.

> “Flexibility, adaptability and resilience are key implementation facilitators when shifting to new digitally enabled modes of care ...complex nature of implementing digital health and well-being in practice” recognising the “…tension between embracing innovative co-

> design and achieving delivery at pace and at scale" (Devlin et al., 2015).

In summary, RVT is a complex intervention which is difficult to successfully implement and requires agility to change practice and enable co-creation.

Taylor et al. (2014) further supported McClean's (2011) assertion regarding patient education and self-management suggesting that:

> "Supporting self-management is inseparable from the high-quality care for LTCs… promote a culture of actively supporting self-management as a normal, expected, monitored and rewarded aspect of care"

Again, echoing a call for additional research in this area. The definition of self-management was offered by Wylie (2015):

> "the tasks that individuals must undertake to live with one or more chronic conditions. These tasks include having the confidence to deal with medical management, role management and emotional management of their conditions"

…positively upholding RVT as an intervention. Moreover, beyond self-management the need for RVT to be integrated within the healthcare system rather than as an adjunct to care was thematic. The self-care collaboration between practitioner and patient was also considered by Nolte and McKee (2008) within the context of RVT and offered the suggestion that self-management was patient-centred and promoted "patient activation, education and empowerment." The theme of lack of evidence, in relation to patient involvement and satisfaction was extended by Kraai et al. (2011) calling for better questionnaire construction as it is "underexposed in telemedicine research and the measurement of patient satisfaction with telemedicine underappreciated". Of note, the analysis of Nui-Ching Chi and Demiris (2015) observed an additional beneficial dimension; the idea of a benefit of RVT going beyond the purely therapeutic gains of the patient stating that,

> "Technology can support caregivers and facilitate better coping. Caregivers believe that technology can help them to make caregiving more efficient, effective, safer and less stressful when delivering care to the patients."

In summary, whilst the need for more research in the field was articulated there was early evidence that RVT was capable of affording some benefit for patients and carers.

2.3.1.2 Classification ‘b’ – Randomised Controlled Trials (RCT)

Wyatt (2012) suggested that Randomised Controlled Trials (RCTs) are not necessarily the optimal methodology to utilise when reviewing the use of new complex telehealth technologies as there may be multiple variables and “… risks of interpreting study results ignoring the context.” However, to utilise a control group, within the context of healthcare is frequently viewed as a ‘gold standard’ by clinicians with the determination of effectiveness being important. Within the parameters of the literature search there were ten papers. However, the findings of a promising crossover RCT study, Lewis (2011), were not published (reason unknown); so only nine papers were considered.

In England and Wales, the Department of Health operated a programme called the ‘Whole System Demonstrator’ which was designed to implement to scale a range of remote telemonitoring services for service users in their own homes. The programme consisted of a cluster of individual projects which attempted to integrate telecare and telehealth into practice. As part of the post project evaluation several academic teams were commissioned to review the outputs. Stevenson and Bardsley (2012) examined hospital utilisation via emergency admissions and mortality. The study concluded that the introduction of telehealth should be considered as there

> “were statistically significant differences in rates of emergency admission and mortality during the twelve months of the trial between control and intervention groups”;

the findings suggested a 20% reduction of emergency admissions and there was a statistically significant difference with deaths with 4.6% of participants in the intervention arm versus 8.3% of control participants.

Henderson et al. (2013) undertook a study to examine the cost effectiveness of the same Whole System Demonstrator programme. The review considered the economic differences between usual care and participants who received the intervention. The conclusion did not favourably make the case for telehealth albeit it did report that the ‘back office’ costs were high which may indicate that there was a diseconomy of scale i.e. (disproportionate cost burden for a lower volume service) as clearly provision was over laid rather

than built to the same scale as usual care. Interestingly the study suggested that cost was borne by community services whereas cost benefit was realised by secondary care. The study findings concluded that

> "QALY gain by patients using telehealth in addition to usual care was similar to that by patients receiving usual care only, and total costs associated with the telehealth intervention were higher. Telehealth does not seem to be a cost-effective addition to standard support and treatment." (Ibid.)

An influential study, arguably slowing progress of telehealth, examined the effectiveness of telemonitoring as defined by the admission rates when compared to usual care for COPD patients in Edinburgh, (Pinnock et al., 2013). The report, did not give a direct indication of patient benefit through quantifiable data but nested qualitative analysis demonstrated participants had understanding of condition and appreciation of the intervention, ergo arguably demonstrated patient benefit (Ibid.p6). The study methodology itself was robust and was focused upon the reduction of hospital admissions as the key metric of success. The study did not show effectiveness against the key metric and hypothesised that earlier studies finding an opposite result could have been due to enhancement of underpinning care provision rather than telehealth. There were difficulties associated with poor telehealth solution design which were not considered, and recruitment was a challenge as so many people were ineligible. Recruited patients may have experienced long delays between discharge and equipment installation which may have affected patient outcome or benefit. The lack of relevant vital sign peripheral devices in the study would be a significant difference from other RVT service for respiratory patients (Pinnock et al. 2013 and McDowell et al., 2015). However, it was found that the service had been valued by both service users and carers alike.

One Northern Ireland trial of RVT services reported performance of warfarin management service (El-Agnaf et al., 2014). Forty patients were randomised to usual care and forty to the intervention which included self-testing and reporting to the anticoagulation nurse's office via a web portal. The metrics utilised to review the intervention included health related quality of life, cost-effectiveness, satisfaction and therapeutic benefit. The cost of the intervention

was high as all initial hardware commissioning and software design had been included. Participants were satisfied with the RVT but most interesting was that the Therapeutic Time in Range (TTR) was significantly better than usual care;

> "mean difference (SE) in time in therapeutic range (%) was -13.1 (3.5) using traditional method and -13.7 (3.5) using Rosendaal method. These results suggest that those in the intervention arm had a substantial improvement in TTR" (Ibid.).

Equally, another RVT service was a triage service for COPD which was subject to an RCT (McDowell et al., 2015). The study was designed to assess if care was improved through the use of RVT to determine if there was a benefit provided. The scope for wider inference was not widely elaborated but the economic review in itself informs the debate. Whilst the technology was found to be effective and the study contributes to the context.

> "In selected patients with COPD, telemonitoring was effective in improving health-related quality of life and anxiety but was not a cost-effective intervention," *and it was* "…possible that the reassurance provided through these regular contacts reduced anxiety and increased confidence, enabling patients to feel more in control of their symptoms and more able to carry out activities of daily living. This is reflected in the enhanced quality of life and suggested by the satisfaction questionnaire, with 84% of patients feeling more in control of their health with telemonitoring" (McDowell et al. 2015)

Moreover, 84% of participants utilising RVT agreed that it enabled them to feel more in control of their health, (Ibid.) an important indicator of potential value.

Greenwood et al. (2015) considered telemonitoring and triage nursing care for patients with diabetes mellitus; this is interesting as the RVT service offered in SET for those with diabetes mellitus included the technology in a 'track and trend' provision and did not offer the nurse triage component to care. In particular, the study maintained an emphasis upon self-care and behaviour change. The findings of the RCT was meaningful indicating the usefulness of the intervention as in particular,

> "complete feedback loop in the primary care setting, supported by telehealth remote monitoring and paired glucose testing, improves HbA1c and self-management behaviours in adults with type 2 diabetes." (Ibid.)

Another Northern Ireland based study, RVT for those with Gestational Diabetes Mellitus (GDM) (conducted as part of a PhD study) and given the technology tested was supplied by the same TF3 service utilised by SET, it was considered relevant (Given et al. 2015). Of note, in the GDM study there was a suggestion that RVT should integrate into existing care whereas within SET there was more of an emphasis upon service redesign which may in turn enable practitioners to have dedicated RVT analysis sessions and therefore dedicated time. The GDM study reported,

> "there was also a suggestion that telemedicine assisted the women to take more control of their own health such as ensuring that the blood glucose tests were actually performed "instead of just skipping them" (participant B20)" (Given et al. 2015).

The study also found a high proportion of participants were satisfied and staff participants recognised the reduced burden of travel for participants was an important dimension of quality. Again, this GDM study echoed findings from the COPD study (McDowell et al. 2015) with clinical staff recognising that protected time for RVT was required and that RVT has a complementarity with standard care.

Fitzsimmons et al. (2016) reported upon a qualitative study examining COPD patient perceptions of telehealth (and the findings were very relevant). The findings were published five years after the data were collected but the conclusions remain consistent with qualitative findings in the RVT review. The COPD study articulates statements from participants who expressed personal views including feelings of being less confident since the technology was subsequently removed and that they felt they were being kept safe when on the system; it was reported that

> "Our study shows that this benefit is derived even when patients were initially resistant to the concept of technology-enabled care for their condition… Beneficial feelings of comfort and safety from the Telehealth service" (Ibid.)

Therefore, most of the RCT papers, relating to telehealth, supported the initial proposition that there may be benefits to patients.

2.3.1.3 Classification ‘c’ – Quasi experimental design – cohort studies, case control studies

Some of the papers described projects undertaken in the ‘real-world’, and followed the ‘nature of quasi’ experiments, although lack control, they were more akin to actual service delivery. Within the literature review methodology, four papers classified as quasi experimental designs, cohort studies or case control studies, one of which was published in 2004 [some four years before early experimentation with RVT commenced in the South Eastern Trust]. The study methodology was not well explained, technology basic, primarily being a Plain Old Telephone System (POTS) and the cohort of participants were younger children who received a psychiatric report. However, it was thought provoking as Young and Ireson (2004) intimated that the remote care delivered through technology was particularly beneficial for families suggesting financial incentives.

Ure et al. (2011) reported a mixed methods exploration within a COPD pilot study that was well designed and executed. The subject matter was articulated and considered pertinent except the technology used was limited to pulse oximetry, spirometry and questionnaires. Patients were asked about self-care; they reported abrogation of responsibility for self-care and looked to practitioners for support. The findings indicated that both service users and practitioners were positive about the technology in particular addressing a common problem of early identification of exacerbations to enable early intervention with the provision of “… a tangible symptom score, both validated the decision to seek help and ensured a prompt appointment.” (Ibid.) Moreover, Ure et al. reported, “…access to readings and emergency supplies of antibiotics at home gave them confidence to respond to deteriorating symptoms themselves.”

The study by Bower et al. (2011) was the only study found that articulated a difficulty with randomisation and so methodology was changed mid study and compared telehealth and telecare across two nested groups to test five themes. There were two lines of enquiry that were considered pertinent,

> “*Theme 2: Clinical effectiveness*. Does the introduction of telehealth or telecare result in improvements in quality of life, well-being, self-

> care and carer burden? …*and*…*Theme 4: Patient and professional experience*. What is the experience of service users, carers and health and social care professionals during the introduction of telehealth and telecare?" (Ibid.)

Whilst the study was clearly reported, the findings were inconclusive.

The fourth research paper within classification 'c' demonstrated more promise and studied a group of patients with hypertension; being relevant to RVT and was compelling although suggested patient compliance was emphasised highlighting the need for nurse support. Indeed, the Italian telemonitoring efficacy study stated that

> "When the patients realize that their adherence is constantly and carefully checked, they acquire a feeling of greater control and consequently higher compliance which contributes to positive effects" (Bernocchi et al. 2014).

These in-service studies indicated that there was patient level benefit and encouraged utilisation and further research. The suggestion that the act of being monitored, drove patient behaviour to be compliant or adherent with therapy was a new benefit.

2.3.1.4 Classification 'd' – Surveys

The value of the reports formulated around surveys had utility as they gave to patients a voice and enable reflection on user experience. Five reports published between 2013 and 2016 which were classified as providing the evidence type of 'surveys', classification letter 'd'; equating to 7% of documents considered. Two reports were results of remote vital sign telemonitoring (RVT) user satisfaction surveys over two consecutive years (SET, 2013 and 2014).

Kennedy et al. (2014) for Long Term Conditions, the integration of self-management in primary nursing care was considered but the details of study methodology and results were not reported in detail so that inference could not be determined. However, a reported finding was that unless staff are committed there would not be effective implementation and benefit would not be demonstrated.

An interesting approach to surveying General Practitioners (GPs) in England was reported by Chambers (2014) in an examination of how GP Commissioning Groups viewed Telehealth. There were 176 questionnaires issued and 108 returned. The Freedom of Information legislation was used to seek a response to survey questions. Of note, Chambers identified,

> "'Telehealth' as if the technology is a clinical intervention in itself, when in fact it is no more than a means of conveying healthcare-related messages and information" (Ibid.)

This was the only report to suggest such a finding. It was also noted that GPs were offered an enhanced service rate for telecare in April 2013 whereas such encouragement was not documented within 2014/15 contracts. Chambers made some specific recommendations that, if followed, would lead to greater use by GPs and Trusts of telehealth. These included telephone or video consultation, highlighting convenience for patients and that workforce competence was required at three levels which were basic understanding, higher knowledge including 'digital health assessment' and expertise in 'digital health modalities' (Ibid.).

These specific findings did not resonate with the findings and recommendations of a review undertaken in Belfast as a general review of the Northern Ireland Remote Telemonitoring Service.

In 2016 McElnay et al. returned a report to the Centre for Connected Health (CCH), the Commissioners in Northern Ireland responsible for Remote Vital Sign Telemonitoring, the RTNI service. The report was aimed to address effectiveness of the RTNI and be a formal post project evaluation. From the report there was a focus upon the articulation of success in relation to economics and effect upon secondary care. Service uptake data available and a limited number of surveys directly with service users and practitioners formed the data. The clinical participants were mainly GPs and community pharmacists, neither profession groups had experienced the regional RVT service with less than a third of interviewees having used RVT. When examining the regional RTNI Service review 15 patients and 8 carers were surveyed through a total of 5 focus groups including 2 patients and 1 carer from within South Eastern Trust (SET) Area.

The report gave an interesting service account of activity by long term condition and district over time but with a low response rate from service users. It could be argued that there were insufficient participants to provide a conclusion but the observation that patients felt reassured was a patient-centric benefit. This suggestion was consistent with the findings across a range of studies as articulated which suggests RVT technology acceptance and receptivity is important and yet such a benefit is frequently not interpreted as a benefit of RVT rather as a secondary observation.

2.3.1.5 Classification ‘e’ – Case reports

The case study is a fundamental approach to basic evidence gathering and is useful at early stages giving potential value to this category and are of benefit when preparing for further trials or research (Bowling, 2002). Within the second tier of evidence type there were 9 publications categorised as ‘e’, case reports. At the turn of the century there was an optimism suggesting that healthcare could be enhanced by new technologies. Lorenzi and Ripley (2000) do not directly relate to RVT but do raise the issue of change management when IT is introduced into the healthcare environment and that it would be the people who enable effective use of technology - they need themselves to be empowered. This publication clearly articulates that technology adoption and behaviour change with practitioners “…starts with creating a vision for change and then empowering individuals to act as change agents to attain that vision” and in turn the leadership of change to inculcate new information technologies into healthcare is essential (Ibid.).

At these early stages, practitioners were enabled to experiment with small scales tests or RVT. For example, the respiratory team (within the locality of Lisburn) commenced a trial of RVT with a cohort of COPD patients. The service was evaluated against metrics which were measured through detailed analysis of GP records of patients who participated in the pilot and also gained direct feedback. Not only did the respiratory team establish their own pilot and determine mode of utilisation of technology, but their findings concluded that

"…patients felt empowered and there was an overall improvement in their quality of life" (Hanna. 2008)

The COPD RVT pilot in Lisburn (SET) was also a case study evaluated by BDO Stoy Hayward (2008) in order to determine if remote telemonitoring showed promise and should move from pilot phase into a regionally commissioned service. The auditors won a contract to evaluate all telehealth projects across the five Health and Social Care Trusts in Northern Ireland. These reports were not made public, were marked 'Commercial in Confidence' and the European Centre for Connected Health (the Department of Health body which was the predecessor to Centre for Connected Health and Care). The report was relevant given it was the antecedence to the RTNI regional programme but could only be classified as a case study. This report reviewed several early SET RVT projects during 2007/ 2008. Arguably the most interesting observation highlighted was that

> "… there are differences in perception between clinicians and patients in respect of the use of clinical triage – over 80 % of clinicians are not confident that clinical triage is suitable for monitoring patients from a distance where the nurse has not met the patient in person. This compares to 90% of patients who are satisfied with clinical triage" (BDO, 2008).

The reported apparent disagreement about the advantages of triage service between patient and practitioner was reported. Several studies have muted the receptivity of service users and the reticence of practitioners when others note the need for practitioners to be enabled to inculcate technology into practice (rather than to have it mandated by management). In the early studies the theme of implementation appeared to preoccupy researchers and the e-Health Research Unit, Kings College, London undertook to evaluate the e-Health Implementation Toolkit (e-Hit). Whilst, no impact of RVT upon service users was documented the impact for practitioners was explored with themes documented. It was highlighted that the

> "narrow focus on organisational issues related to implementation, with little attention paid to the impact of new technologies on workload, inter-professional relationships, and communication between health professionals and patients." (Murray et al. 2010).

A case study undertaken by the Kings Fund (Sonola et al., 2013) considered telehealth in a virtual ward environment in Devon for patients with long term conditions. The report focused upon the need to have a community integrated, Virtual Ward, approach to improving care for those with chronic diseases. By adopting the Virtual Ward approach with a lead nurse, community matron, to engage patients; a change in care with technology alone did yield benefit. The researchers suggested that

> "Perhaps not so evident from the impact data is the extent to which patients themselves are empowered to manage their own care and the degree to which they, or their carers, are expected or able to play a full part in the care planning." (Sonola et al., 2013).

In a single site extended case study, Llewellyn et al. (2014) investigated how the gap in organisational factors that did not enable technology uptake and was contextualised as a search for benefit from an organisational stance, not from the perspective of patients. The role of a practitioner to integrate technology into pathways of care and adapt care regimes is not defined in job descriptions but it was reported that there had been a bottom-up approach to technology adoption. Evidence showed enthusiasm for adoption was juxtaposed with their finding that there was "no evidence of benefit over existing technologies" (Ibid.)

Conversely in 2014, a review of the RTNI focused upon patient and service user experience, with crucial conversations with 9 patients. The Patient and Client Council (2014) recorded the findings of their anonymous face-to-face interviews. A number of participants reported feeling better connected with practitioners, better informed and had better understanding of their condition. Indeed, the Patient and Client Council's reported six benefits (Table 2.6).

Table 2.6 The patient reported benefits of telemonitoring service.

Benefits of the telemonitoring service that patients reported
1. Less travel/ visits to clinics or the hospital for routine appointments 2. Patients feeling that healthcare professionals would be kept well informed about their condition over the monitoring period 3. Reassurance, feeling of being well supported 4. Better channel of communication with healthcare professionals 5. Greater understanding of their condition and how it affects them 6. Improved self-management of their condition

(Patient Client Council, 2014)

However, not all case studies reviewed focused upon direct benefit for service users, rather focused upon technology itself. Vladzymyrskyy et al. (2016) charted the history of telemedicine over a century. A series of case reports within their textbook tracked the evolution of telecommunications and adaption and deployment into health care up to and including polar and space exploration. From a reflexive stance RVT, as an extension of telecommunications, is a means by which clinical practice can evolve to both empower practitioner to care and patient to participate. The narrative also reminded and demonstrated the accelerating pace of change.

2.3.1.6 Classification ‘f’ – Qualitative methods

The benefit of qualitative methods is the contribution to understanding of those involved in service delivery as providers, patients or carers. The final classification of the 2nd Tier is described as qualitative methods, classification ‘f’, which equated to 5.6% of the papers considered in the review of literature with 4 papers published between 2009 and 2014. Sandberg et al. (2009) utilised telephone interviews with practitioners, referred to in the study as ‘telemedicine providers’ when interviewing healthcare providers about their experience of utilising telehealth.

Sanders et al. (2012) undertook a qualitative analysis of the English telehealth, Whole System Demonstrator (WSD) examining the barriers to adoption and participation. The findings were credible with comprehensive one-to-one interviews highlighting resistance to the intervention; relevance demonstrates an emerging picture of the requirement to enable practitioners to be part of solution development with co-creation rather than a management instruction; “…the need for closer proximity between innovation design and

evaluation, so that critical insights might usefully feed back into design and implementation." (Ibid.)

A European Commission evaluation also examined barriers and enablers in acceptance of new technology. However, the technology blended ambient technologies, guidance systems and limited vital sign monitoring. With the

> "Difference between experiencing and understanding the benefits of technology and acknowledging a need and wishing to adopt the service"

being highlighted for consideration when planning ICT for Older People at home. (Georgantzi et al. 2014).

The theme of requiring an enabling environment for technology implementation whereby the new ideas, services, products, practice, policies and processes, skills, competency and the translation from theory in academia into practice was discussed by Silva et al. 2014. The Brazilian study was not particularly easy to decipher nor was it entirely related to telehealth, rather the wider family of technology into healthcare but the key concepts resonated with the interpretation of feedback.

2.3.1.7 Classification 'g' – Anecdote/ expert or user opinion

The third tier of reports considered, included both expert opinion and anecdote and was given the classification of 'g' with 17 papers reviewed contributing to 23.9% of the literature review content. The decision to include the third tier was made on the basis that much of technology in RVT is fast moving, quick paced in development, agile in design and today it appears that no sooner has a technology been tested it is superseded. Therefore, although lacking academic rigour in study design, data collection and execution, classification 'g' was considered to be a barometer of opinion to include. This classification is considered to contribute the lowest value findings to the overall review.

The emergent theme of environmental factors influencing technology development and integration was articulated by Gardener et al. (2007) "leaders in the global health community… articulate a broader and more inclusive vision for health innovation" and makes the case for a link between the variety of view of the manager and the practitioner and highlights authority to influence tech innovation. The paper is relevant in so far as it shows the

link between policy and social environment and the power of leaders and practitioners to influence adoption. May and Finch (2009) reaffirmed utility and relationship between the study of normalisation and the implementation of RVT; the theory of normalisation processes can explain why putting into practices new ways of working and embedding the change can be complex and time consuming. Murray et al. (2010) discussed the issues relating to adoption of technology and normalisation in practice; use of complex intervention and ensuring relevance for practitioners to ensure widest adoption into practice, in particular they highlight the

> "…substantive problem is the gap between research evidence and practice…Translational gap is also evident: that of using the results of such health services research to inform wider health-related policy and practice. Such implementation failures are often attributed to slow behaviour change by professionals" (Ibid.).

Deloitte (2012) detailed staff engagement being crucial to success, highlighting lack of expertise, lack of evidence and perceptions about high cost.

The need for a strengthened base of evidence upon which future development can be anchored and that telehealth in general lacked underpinning theory. With "…theories that are well validated with empirical work and scholarly review hold the greatest value," (Brennan.2008). However, the complexity of gathering such empirical evidence in complex interventions, multiple variables and new telehealth technologies is in itself complex "…and the risks of interpreting study results ignoring the context" (Wyatt. 2012) is recognised. The willingness to test new technology by practitioners can be linked to evidence to support practice and in turn the level to which clinicians become involved. (McKinstry et al. 2013)

The concept of patient involvement, self-care, empowerment and benefit emerge within papers allotted the classification 'g'. In 2011, Wyatt believed that "Technology can empower…. We need to shift towards a new model in which the patient is treated as a partner in medical care" and by 2013 Wismar and Greer extended the concept further suggesting patients should be participants in co-creation and involvement in decision making. The support of people with complex health care needs through telehealth was recognised by Ham and Walsh (2013) and its ability to change behaviour and benefit

service users suggested by Scott (2013). Compliance with treatment regimen is well understood in healthcare as a critical success factor; Bruzek (2014) suggested that (anecdotally) the use of RVT in self-management could provide better outcomes by encouraging patients to participate in care and be compliant. Farr and Nayak (2014) demonstrated a growing interest by public, media and industrial funders of healthcare in technology for self-care and management suggesting there is a future space for self-management in cost reduction and compliance. The journalist Wall (2016) suggested that a general trend of self-monitoring of a greater range of conditions will be supported by NHS senior staff with the advancement of sensor technology. Fellow journalist Smyth (2017) highlighted the need for both tailored health care and that patients and carers consider information as a key dimension in health care delivery with information as a power component for the patient or carer.

Within the classification ‘g’ there were two dissenting writers. Scullion (2014), a leading respiratory specialist nurse in the UK expressed a view that did not support the utilisation of RVT albeit there was a suggestion the system may work well where deployment is thought through and integrated. However, contrary to benefit the risk of abrogation of responsibility by patient remained too high a risk; the stance was maintained based upon personal clinical experience. In 2017 the BBC reported the emergence of ‘Cyber-Chondria’ following research undertaken by Imperial College, London, where patient use new technologies created anxiety which led to "over-investigation by clinicians".

In summary, most papers suggested that when integrated into practice RVT had the potential to be beneficial whilst two warned of risks.

2.3.1.8 Classification ‘h’ – Public policy/ public consultations/ statements

The eighth and final classification within the literature review included material which could be described as public policy, public consultation or published by the public authorities at regional, national or European level; classification ‘h’. Such documents could have had a political bias but in general were based

upon best practice and translation of academic research or local experience into guiding principles rather than based upon direct findings of research undertaken by civil or public servants. However, these documents should set the context for the services being delivered and in turn direct impact upon the delivery of RVT. Arguably, low value when the metric of academic rigour is applied but were considered of high value given the impact upon health and social care services. The 11 papers equated to 15.5% of the papers reviewed, (equal to that of classification 'a'), all published between 2011 and 2017, set the strategic direction for healthcare delivery which included the integration of novel technologies to engage the service users.

One of the most significant commissioning documents to trigger systemic change in and to set the strategic direction for the Health and Social Care system in Northern Ireland was the 2011 publication 'Transforming Your Care a Review of Health and Social Care in Northern Ireland' (HSCB). It demonstrated a strategic willingness to enable technology development within service. However, whilst the use of technology is listed as number 11 of 12 major principles (HSCB, 2011) it was not illustrated in a diagrammatic representation of the future of integrated health and care. Moreover, the model could be construed as paternalistic with patient perspectives being conspicuous in their absence.

A year later the Department of Health in Northern Ireland produced a comprehensive policy framework for Long Term Conditions. The policy demonstrated referencing to best practice, National Institute for Health and Care Excellence (NICE) guidance. Indeed, the policy discussed the potential role for RVT in self-care. It is highly relevant and described the involvement of people with chronic conditions in self-care. Most particularly, it referenced technology, stating that

> "People with long term conditions should have a personalised care plan which recognises the expertise, experience and knowledge of all parties, but particularly the individual themselves." (DHSS&PS, 2012).

The policy context, which enables the strategic engagement of those with a long-term condition in their own self-management and care, was established.

The following year the World Health Organisation (2015) updated the Global Action Plan for Prevention and Control of Noncommunicable Disease, (also

known as Long Term Conditions or Chronic Conditions) in order to contribute to management of preventable deaths. The Action Plan referenced data as a global aggregation. The Action Plan is fundamental to the research topic as the primary use for RVT is with patients with long-term conditions. Emphasis was placed upon chronic disease as an international issue, prevention is the focus; “People and communities should be empowered and involved in activities…including… monitoring.” (WHO.2013)

The National Health Service (NHS) for England and Wales documented the use of data and technology to improve the outcome of care for service users. Whilst, the basis of the strategy was the adoption of technology and setting strategic direction the consideration of vital sign data was omitted. The strategic drivers were essentially the transformation of care and reduction of variation through technology enabled care (NHS, 2014, p7). The policy was framed within the context of knowledge cascading from higher tiers of healthcare professions down through to lower skilled staff and service users.

> “The skilling and empowerment of the service user are the result of a skill transfer process, which moves skills from the highly skilled to the less skilled and ultimately to the consumer” (NHS, 2014, p11).

The European Commission’s Green Paper documented the emergence of mobile health (mHealth) technologies; mHealth, was defined as encompassing,

> "medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants (PDAs), and other wireless devices" (EC, 2014).

The underpinning research was articulated and the broad and meaningful purposes to which mHealth could be applied were articulated. Crucially, these included a change in the role of a service user from passive recipient of care to proactive participant and encouraging service users to improve their own health.

The importance of the concept of patient utility and benefit was further documented by the European Commission encouraging services to develop whereby service users should be enabled to be active participants in care and decision making suggesting that an enhanced understanding of condition

would encourage compliance with therapeutic interventions. (EC, 2015) The strategy for active and healthy ageing is relevant to the research study and highlights personal information, self-care, empowerment, technology and sets a context.

The use of innovative technology to promote self-care was promoted in the NHS (2015), encouraging healthcare commissioners to consider a range of technologies at different stages of a patient's care journey and for a broad range of conditions including maternity and child health, mental health, long-term conditions, urgent and emergency care, post-operative care and post-discharge. The use of Apps was encouraged for self-care (NHS, 2015) to "… promote understanding of the condition and better self-management" (NHS, 2015).

In Northern Ireland the Health and Social Care Board published a commissioning plan focusing upon eHealth and Care in order to improve health. The base data to create the document was derived from stakeholder engagement rather than a detailed review of contemporary research. Importantly the policy set the direction for the development of health and care improvement supported by integrated technology for the region against which all technology enabled innovation should be benchmarked. The commissioning priority recognised the contribution and participation of service users in their own care;

> "Through eHealth, we will empower people to be more active in their own care and support health and social care staff to achieve real change that delivers the best possible health and wellbeing for everyone" (HSCB, 2016, p5).

The Commissioning Plan was congruent with the regional policy 'Health and Wellbeing 2026 Delivering Together' which highlighted the requirement to change models of care to meet growing demands upon service given demographic and morbidity trends; it predicted that by 2039 25% of people will be aged 65+. Person-centred approach to supported modes of service delivery was an imperative factor with home-based services and service user engagement essential. Whilst the narrative of 'empowerment' was utilised in relation to staff, the strategy extended to technology with "…information technology to improve outcomes for service users and free up time for front line staff" (DOH, 2016).

Northern Ireland's Assembly ceased operation in January 2017 which impacted upon the role and ability to execute functions of Civil Servants. The last regional document within the Department of Health to be published under the leadership of a Minister was in October 2016 and sent out a 10-year plan. The policy 'Systems, Not Structures: Changing Health and Social Care', colloquially referred to as the 'Bengoa Report' highlighted four main themes: 'better healthcare experience, better population health, lower cost per capita and better staff experience'. The report expressly recommends that investment in e-health technology should continue in order to improve "self management, care at home" (Bengoa et al. 2016. p79). The report repeated the EC's narrative (EC, 2015) calling for patients to be active not passive in their care and that they should be "…empowered to stay healthy and care for themselves" (Bengoa et al. 2016, p84).

Policy at the European, National and Regional levels indicated a future model of care which integrated novel technologies into direct patient care. Most suggested that through technology, patients would be able to be active in their care and derived benefits were suggested.

2.4 Literature Review Summary

The rationale for the search of literature including search terms, inclusion and exclusion criteria were developed (Table 2.3) and the literature search was undertaken. N=71 papers were collected and were reviewed against a Publication Review Framework (Table 2.4). The Framework was created by synthesising the work of Pope et al. (2007), Spencer et al. (2003) and Aveyard (2010). In particular, the framework enabled the publication/ literature to be classified as a type of evidence whereby, the concept of weighting of opinion was constructed based upon research methodology employed by the author. So that the more rigorous a research methodology utilised and described, the more important and likely to be valid their findings and recommendations were considered.

Evidence types 'a' systematic reviews and meta-analysis, 'b' randomised controlled trials, 'c' quasi experimental design – cohort studies, case control studies and 'h' public policy/ consultation and statement were considered of

most intrinsic value as rigour was applied within the methodology and contributed 49.3% of the literature reviewed. However, all literature within this section could be viewed through a prism of a historic journey of technology adoption, trial and development. Technology reported in a meta-analysis or RCT in 2010 would, from a technology evolutionary perspective, be outdated in comparison to the technology utilised in the SET RVT service (2011 to 2018). Therefore, balance vis-à-vis currency and contemporaneous experience is required when considering the overall review. The second tier of literature reviewed, ‘d’ surveys, ‘e’ case reports and f ‘qualitative methods was recognised as important and indeed acted as a barometer for user perception; accounted for 26.8% of the literature reviewed. The third tier of literature, ‘g’ anecdote/ expert user or user opinion, 23.9% of the literature reviewed, was considered of lowest value and also included public interest journalist reports which indicated trends in technology adoption or user experience. This classification was only included as it was an early indicator of changes in the technology environment, several of which may well be too new to have been reviewed by academics.

It can be seen that there was much early optimism reported regarding an opportunity remote telemonitoring may afford the healthcare system whereby it could reduce pressure on acute services. There was a general consensus that the reality of service delivery was such that there was little or no evidence, from a health economics perspective, that such a system-based benefit or outcome was realised. There were also indicators that the integration of technology into healthcare, to the point where the application of telemonitoring was normalised and routine, was a hurdle to overcome. Several implementation issues were highlighted including lack of practitioner involvement or knowledge and the lack of an enabling environment created by the healthcare system. Indeed, commentators suggested implementation consideration including co-creation and design of new pathways of care with technology. There was a theme which expressed a degree of reluctance to adopt remote telemonitoring by practitioners with suggestions that it may enable service users to abrogate responsibility for self-care. This finding within the literature was tested through the analysis of the SET practitioner’s qualitative data. However, where users of remote telemonitoring services

were considered as participants and reported upon in the literature there was a sense that remote telemonitoring was almost universally well-received.

Literature indicated that whilst practitioners are trained to apply evidence-based practice there were issues as the new technologies did not have a beneficial clinical track record; there was little or no evidence to support application and this may create a sense of clinical anxiety or reticence. There was evidence to suggest that benefits realised, when set against the principles of health economics, were insufficient to justify system and care regime change to enable large scale technology adoption.

A common theme, particularly in policy documents, is the requirement to care differently, recognising the demographic shift that is occurring with an ageing population, increasing numbers of people with chronic diseases/ noncommunicable diseases along with the concomitant health burden; with local policies advocating disruption to the conventional care system. Transformation of care using health technologies emerged as a strategic direction. Equally, the need to engage service users with long-term conditions to participate in self-care, adherence to therapeutic interventions, modify behaviours and to become informed, experts in their own condition was evident with a drive to relieve burden from the state. It was muted that eHealth technology per se, and remote vital sign monitoring in particular, could enable service users and patients to be educated, compliant and engaged participants. The policy-based literature indicated a need to embolden service users and there were suggestions that remote monitoring may yield this benefit.

The potential benefit or utility for the service users through remote vital sign telemonitoring appears to have been overlooked as a metric of success in the literature classified in the first tier, classifications ‘a’, ‘b’ and ‘c’ and so the extent to which the patient, carer, practitioner and manager perceived benefit or utility as a critical success factor, emerges in the data within the South Eastern Trust’s Remote Vital Sign Telemonitoring services was explored.

3 METHODOLOGY

3.1 Restate Aim and Objectives

To critically assess whether RVT is perceived to have derived benefits for patients.

This will be achieved through four objectives, to understand the context, to gain RVT knowledge, to understand benefit and to evaluate and engage.

Objectives:

1. To describe, summarise, critically evaluate and clarify the current state of knowledge on implementation of RVT. (*Understand Context*)
2. To identify and describe service data trends from service user and practitioner perspectives. (*RVT Knowledge*)
3. To determine the factors of patient benefit which are enabled using Remote Vital Sign Telemonitoring (RVT), taking the views of practitioners and senior managers into account and identify service benefits and risks. (*Experience and Benefit/ Outcome Determination*)
4. To devise recommendations to enable future deployments for optimal patient care. (*Evaluate and Engage*)

3.2 Exploration of Potential Research Methodologies

Initially the exploration of potential research methodologies to study the subject was problematic in nature given the complex nature of the intervention, new digital medium, multiple contextual variables, patient participants with varied medical conditions and time constrained clinical participants. The determination of the methodology to explore the subject was a challenge in the context of fluidity in the development of technologies to capture data, report findings, highlight difficulties and enable effective care. The context is complex as practitioners frequently experience pressure from

an ever-growing presenting need, complexity of care demands and mixed opinion vis-à-vis the efficacy of RVT per se.

The research methodology decision making process, to enable the research question to be answered, was extensive in order to test for efficacy within the research field and context. The topic was initially broken down into sectors and constituent parts to understand possibilities and limitations of data collection techniques. Several key observations were made which included, inconsistent technological ‘prescriptions’ deployed to a range of patients by a range of different professions specialising in different LTC clinical areas. As already described within the research context, clinicians included doctors, nurses, physiotherapists, a pharmacist and a dietitian; there were two RVT systems the U-Tell: INR and the TF3 service. The TF3 service was further divided into a service with or without nurse triage; the package of peripheral devices was issued to patients based upon the referral request of lead practitioner. The referring practitioner also typically worked within a specialist field and cared for patients with at least one LTC which included diseases such as diabetes, heart failure, COPD, bronchiectasis, hypertension, post-stroke stroke hypertension and anticoagulated haematology (patients prescribed warfarin). There were many interested stakeholders who may have insight into various dimensions of relative success of RVT and these include patients, their carers, practitioners and also decision makers within the Northern Ireland health care system. It was important to adopt a definition of a carer within the study; it has been selected from National Institute of Health and Care Excellence (NICE) definition,

> “A person who provides unpaid support to a partner, family member, friend or neighbour who is ill, struggling or disabled and could not manage without help. This is distinct from a care worker, who is paid to support people.” (NICE, 2018, p26).

The inclusion of the lay recipients and supporters of service within the research was considered an important aspect of the research as the encouragement of patients to self-care and carers to support is recognised to enable health care systems to manage a growing demographic burden (European Commission, 2015). The contribution of lay people to build understanding was argued by Popay and Williams (1996).

3.3 Five Potential Research Methodology Options Considered

3.3.1 Option 1 – Randomised Controlled Trial and Obtain Evidence of Effectiveness

The local practitioners considered Randomized Controlled Trial (RCT) as the 'gold' standard but as an approach to conduct the study it was problematic. The first observation described a research field with many and diverse variables which could not easily be controlled. Moreover, Wyatt (2012) suggested that RCT was not the methodology of choice within the field of new RVT technologies. During the planning phase of the research methodology the researcher was frequently told by medical staff that there was '…no research to support the use of telemonitoring' however, the researcher interpreted that to mean that there was little empirical RCT findings to support the use of technology in general. Within SET there were two previous service based RCTs executed to test RVT, one to examine the use of the TF3 triage service for COPD patients (McDowell, 2015) and the other a test of U-Tell:INR (El-Agnaf, 2014). These trials were not without difficulty, not least objection by practitioners when potential RVT beneficiaries were enrolled as research participants and were randomised to the control groups, which is to receive usual care without RVT intervention. Furthermore, the research could only provide insight as to whether it was better to augment care with RVT or to treat patients utilising established standard care packages without RVT. RCT design could not then determine if there was an optimum deployment technique to maximise care benefit or to understand the benefit derived by patients and carers. Of note, the two studies endeavoured to answer health economics questions, so that economic efficiency was a key factor of examination. Whereas, the economic benefit or disbenefit of RVT within this research was not of primary interest. Therefore, giving consideration to six dimensions, (i) there had been two previous RVT RCTs conducted within SET, (ii) there was no need to consider effectiveness or economic value and efficacy, (iii) the RVT service deployment was beyond feasibility study of translation from laboratory technology into the field, (iv) lack of support from local practitioners, (v) inability to control variables and (vi) deeper meaning and experience required examination. The need to secure a broad

engagement from participants was driven by an objective to discover experience-based opinion which may influence or optimise future deployment. In order to implement RVT into routine practice the need to discover if there is a potential for disbenefit/ harm or adverse incidents, perceived and observed benefit and patient's motivation to utilise RVT, impact and experience. Such less tangible and patient-centred metrics may be invisible to a researcher if RCT was to be utilised as a research methodology. Therefore, RCT was excluded as a methodology to be considered.

3.3.2 Option 2 – MRC Framework for the Evaluation of Complex Interventions

Extending beyond RCT was the opportunity afforded by the Medical Research Council framework for the evaluation of complex interventions (MRC). RVT systems have multiple inputs, actions, outputs and outcomes. Therefore, consideration was given to a logical systems approach considering the MRC (2008) framework for the evaluation of complex interventions (Craig et al. 2008). Variability and inability to fix key dimensions of the service hindered research design and the replication of study environments where smaller scale comparative studies were to be undertaken. The Edinburgh based split site comparative study was well designed and executed (McKinstry, 2013) but again whilst findings could be construed as robust, the research design could not be replicated to consider RVT in SET as clinicians were reluctant to participate in such research and there was an uneven distribution of specialist services. This study was designed to ascertain if there was benefit, from a health economics stance, with the use of telemonitoring when compared to usual care and did not determine if there were patient-centred metrics of success to be described. The MRC framework could not satisfactorily address the research topic and the methodology could not robustly suggest optimal deployment of RVT, consider patient-centric metrics or suggest relatively better deployment techniques for consideration. The methodology, as applied in the Edinburgh study was influential in suggesting RVT lacked utility. Equally, the lack of homogeneity across SET, with broad range of conditions, different

models of deployment and broad spectrum of clinical practitioners meant that trial design and deployment could not be sufficiently anchored and could be hinder the MRC. However, Gosling (2014) suggested the MRC principles had utility in eliciting expert opinion and articulated methods for engaging with experts. Therefore, elements of the MRC Framework were considered when constructing the overarching research design, but the methodology was not selected.

3.3.3 Option 3 – PARiHS Framework for Successful Implementation

In seeking a methodology there was an examination of data collection techniques that were more focused upon qualitative data collection and analysis rather than quantitative data and an emphasis upon finding a more engaging approach. In order to describe and understand enabling factors it was useful to review practice development approaches such as the Alberta Context Tool (Estabrooks et al. 2009) and PARiHS framework (Kitson et al. 2008). These offered a structure to help identify success factors but had not been tailored to the deployment of RVT. The Alberta Context Tool described structural elements, resourcing, and interactions between staff, while the PARiHS framework identified clear evidence, strong facilitation and positive context as critical success factors. An underlying theme in practice development, within the concept of PARiHS is the need to make change based upon the principles of ‘evidence-based practice’ (Kent and McCormack, 2010) which can be problematic within RVT given the novel nature of the technologies being deployed. Both tools suggest elements to consider when changing practice and there was a tentative alignment to the BDO Stoy Hayward (2009) recommendation relating to ‘support’ change in practice. When observing ‘success’ from a perspective of a health environment where care work is more open-ended with longer timeframes where the notion of an enabling or supportive style of environmental leadership could be viewed as a critical success factor (Handy, 1985, p212) and merited further investigation. However, owing to the lack of RVT service evidence, efficacy testing and applying PARiHS within the SET context of RVT was eliminated.

3.3.4 Option 4 – Cycles of Action Research

It was proposed that action research would be utilised given that the thoughts, feelings and behaviours of research participants were of interest within a context of patient centred care. Action research, and most particularly transformational action research, was initially selected as the methodology to be applied. It was assessed that through action research, the specific framework for success in RVT deployment could be synthesised to demonstrate alternative value and the expressed opinions of research participants. Early indications suggested a degree of correlation between a model for optimisation of RVT with the Alberta Context Tool but recognising the need to extend beyond to encompass purposeful application, multi-professional learning, support with specific training, enabling environment and supportive leadership. Transformational action research recognised the softer more creative metrics and allowed the clinical practitioners to analyse, interpret and personally develop themselves.

The transformational action research could add creative ecological and spiritual dimension to practice development, essentially permitting practitioners to develop their service and modality of care. As a methodology it was considered useful in the context of RVT as there were many variables, fluidity within a developing arena and the need for on-going iterative improvement and experimentation. It was believed that for this to happen the current context must be evaluated to inform programme development. Essentially when transformation action research commences practitioners would be proactively encouraged and enabled to make iterative improvements, but the context should be known to promote innovation and freedom to practice. A significant feature of the action research was the development of practitioners, within the context of adoption of technology, and the improvement of patient care.

Whilst the methodology of transformational action research was initially favoured to determine the answer to the overarching research question, a decision was taken to terminate the plan and change methodology. There were two key drivers, the first was that the methodology was far too complex and although compelling was not well proven. The second driver for change of research methodology was a serious lack of willingness to participate if action research was utilised. Given

that action research as a methodology is structured to embolden the practitioner to direct the research the methodology and data collection tools, methods and activities were shared with potential research participants. The response was such that the researcher decided that pursuing the approach would be unproductive; 80% of the practitioners confirming that they would feel uncomfortable, were sceptical, decided it was too demanding of their time and resources and so could not consider consenting to participate. Therefore, whilst the researcher believed there were significant merits to the methodology the research design process would have to be reconsidered as without willing voluntary participation the outcome of research would be weak and findings inconclusive. Despite the methodology being planned to an advanced stage there were too many barriers to proceed. (Refer to Appendix 5 for greater detail describing the initial Action Research Plan.)

3.3.5 Option 5 – Mixed Methods

Option 5, Mixed Methods, was considered as an option owing to the complexity of RVT implementation. The methodology of mixed methods in a post-positivist stance using a broad methodology of programme evaluation was proposed (Creswell, 2003). The sources of data which were accessible were:

1. Use of literature
2. Use of baseline service data
3. One-to-one interviews with participants who would be health and personal social services staff; practitioners, managers and commissioners.
4. Application of a service user and carer questionnaire.

An illustration of which data collection methods to contribute to specific research objectives has been included in the Table 3.1:

Table 3.1 To illustrate which data collection methods contributed to addressing specific research objectives.

	OBJECTIVES				
	To Understand Context	To gain RVT Knowledge	Experience	Benefit, outcome determ-ination	To Evaluate & Engage
METHODS					
1. Literature	x	x			
2. Baseline Data	x	x			
3.1-to-1 Interviews	x	x	x	x	x
4. SU & Carer Questionnaires		x	x	x	x

Therefore, with such available material it was believed that a triangulation of findings could be effectively studied, and resultant findings interpreted. Moreover, to validate findings and enable a cross practitioner learning opportunity a final half-day group discussion/ workshop with participants was offered to practitioners who shared anonymous case studies and personal experiences at one-to-one semi-structured interviews. The data analysis required the combination of the findings of both data of a quantitative and qualitative nature to reach a conclusion.

The researcher challenged the metrics of success for RVT; some modes of evaluation fail to recognise the benefit of patient self-management and the ability of practitioners to successfully manage greater caseload numbers targeting their care in a timely manner. However, such assumptions could only be tested and examined with data analysis, digital analytical databases and tools (QSR International's NVivo Version 12 and IBM-SPSS Version 25) to determine outcome or benefit which may enable the optimisation of future deployments to be created upon a foundation of new knowledge, learning and direct participant experience.

The researcher examined beyond a concept of RVT as a 'bolt-on' service option and acknowledged more complex factors to achieve service integration; the examination of critical success factors allowed the experience-based benefits and issues to emerge. This recognised the opportunity for

reform and practice development as integral to effective deployment of RVT. Through a process of both qualitative and quantitative data analysis, synthesis, refinement and development the researcher defines the new knowledge. For example, the findings may address a range of issues, as yet unknown, which may include factors such as barriers to access; enhanced communication and training. The utilisation and interpretation of existing qualitative and quantitative data were proposed as a method of enquiry to augment practitioner case study analysis.

In addition, by involving service users and carers, through the application of a questionnaire it was determined as likely to maintain the patient centric focus, as previously suggested within Transformational Action Research; service user perception utilised to encourage and harness practitioners to change practice thus permitting patients to contribute to the findings. Indeed, it was determined that by comparing the responses of service users collected within a research framework with the opinion of HSC staff there may be variance of opinion found. The questionnaires were sent to SET RVT service users, N=240, with responses sent via freepost to SET's Safe and Effective Care team to compile the returned documents. The team undertook an initial collation of results with the application of SPSS software with the early high-level findings being given to the questionnaires author, the researcher, in order to publish a brief report which was shared with participating carers and patients via the Trust's website, as per the research protocol. It was recognised that it may not be possible or even necessary to eliminate all researcher-bias but this process with the questionnaire was designed to reduce the risk of bias or influence by the researcher. Moreover, it was recognised that there was a possibility that perhaps only those potential participants who had a positive opinion of RVT may be inclined to respond so a risk of bias is also acknowledged.

The modes of enquiry included the utilisation of a questionnaire and direct engagement of practitioners and commissioning managers through one-to-one semi-structured interviews with practitioners being given the time and space to share their personal case studies and experiences. Whilst the research was conducted from an evaluative stance there were aspects from the transformational action research methodology that may have enabled the

personal development of those clinical practitioners who volunteered as research participants which were adopted within the study design. Practitioners, regardless of discipline or disease area, were enabled to participate in a safe environment, where they were given the opportunity to expressively share, learn, flourish and create with the semi-structured interviews being conducted purposefully and it was anticipated that it enabled practitioners to innovate, change, reform, develop and enable time for reflective practice in a similar mode as they may have experienced were they to have engaged with action research (Titchen, McCormack and Manley. 2013). However, the focus of the research, whilst dependent upon personal experience, was focused upon lessons learned from the perspective of evaluation.

Therefore, balancing the strengths and weaknesses of the methodologies considered, it was decided that the mixed methods would be most effective and was chosen.

3.4 Selection of Research Methodology Summarised

The five recognised methodologies considered for use in the research were evaluated (Table 3.2). In summary, option 5, was selected as the most appropriate strategy to answer the research question.

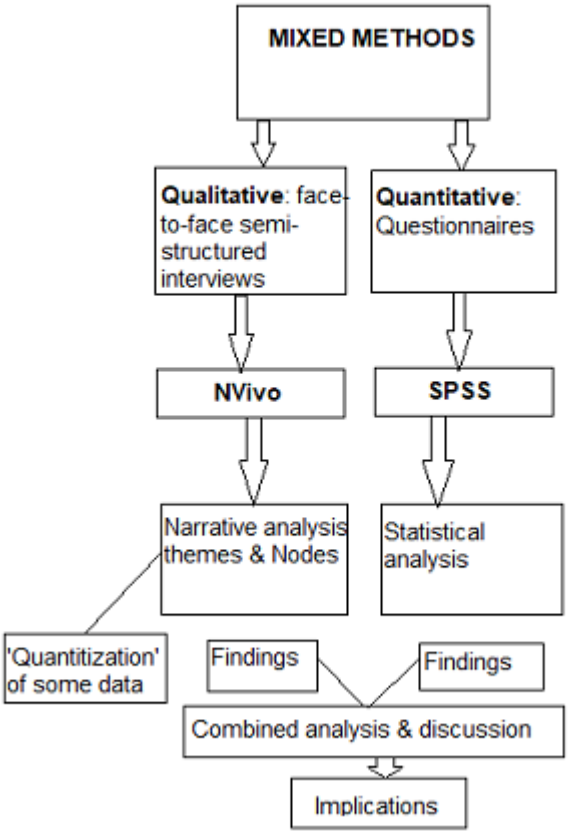
Table 3.2 To illustrate summary assessment undertaken to select the appropriate research methodology.

OPTIONS	NEGATIVE ISSUES	POSSITIVE ISSUES	REJECT/ ACCEPT
Option 1 – RCT	a/ Too many variables to be controlled b/ Practitioner objection to limiting access where patients could benefit c/ Economic analysis not of interest d/ Would not determine a broad base of experience or opinion	a/ Considered the 'gold' standard	Rejected
Option 2 – MRC	a/ Inability to fix variables	a/ Reviews complex interventions	Rejected

	b/ Economic benefit not of interest c/ Softer metrics may not be explored	b/ Recognised standard	
Option 3 - PARiHS	a/ Requires evidence-based practice to be evaluated and RVT was not an evidence-based modality of care	a/ Structure to identify success factors b/ Facilitates qualitative data collection through engagement	Rejected
Option 4 – Action Research	a/ Researcher bias may be exaggerated b/ Cycles of research too time demanding of clinical practitioners c/ Potential clinical practitioner participants refused to participate as they did not feel it was a methodology, they could comfortably engage with	a/ Engage to seek opinion of research participants b/ Purposeful application of multidisciplinary learning c/ Can accommodate variability, broad functionality and differing ecology	Rejected
Option 5 – Mixed Methods	a/ A study in two paradigms, i.e. collecting and analysing qualitative and quantitative data can be complex and difficult for the researcher to manage.	a/ Broad base of data and evidence can be managed b/ Triangulation of data from multiple sources c/ Robust supportive technology to enable data analysis (SPSS & NVivo) c/ Permits data, regardless of paradigm, to be collected and analysed simultaneously and in parallel	Accepted

3.5 Research Design – Mixed Methods

The simultaneous planning of data collection, parallel design of both quantitative and qualitative data analysis and the equal status of data collected in either paradigm, were mapped. Figure 3.1 illustrates the collection, handling and interpretation of data to find meaning has been adapted from Creswell (2003).



Adapted from (Creswell. 2003. Pp 212-214).

Figure 3.1: Illustrates the design structure and flow of mixed methods; the parallel nature, the digital tools and equal value of qualitative and quantitative data captured

3.5.1 Mixed Methods Theoretical Underpinning

Parahoo (2014) suggested that there may be six reasons why a researcher may choose to utilise mixed methods with the one that applies in this study being a study that evaluates “different aspects of the same topic”. The underpinning philosophy for the mixed methods study was founded within the stance of postpositivism with a pragmatic world view adopted by the researcher. Whereby, the researcher attempted to collect data in as unbiassed approach as possible, utilising instruments designed to capture data from several perspectives, and independent participant groups, to answer the research question and to fail to reject or reject the hypothesis. (Creswell and Plano Clark. 2007). A definition adopted by Greene, Caracelli and Graham 1989 included the core tenant that the research must include at least one set of data collected in each paradigm, that is both qualitative and quantitative data. Creswell and Tashakkori (2007) suggested mixed methods research could be conducted from four different perspectives, or even blended to address the research topic; within the research the fourth perspective, that of ‘the practice perspective’ was selected. This allowed a pragmatic bottom up approach to building the evidence. The dynamic approach to mixed methodology research afforded the opportunity to remodel understanding within RVT (Guba. 1990).

The researcher, in triangulating data from various sources, undertook enquiry utilising mixed methods, to determine validated findings from multiple perspectives (Robinson, 2002, p370). The triangulation of data was then further discussed following the explanation of data collection and the management of quantitative data through the utilisation of standards methods packages (IBM SPSS version 25) and qualitative data through (NVivo 12).

3.5.2 Approach with Clinical Practitioners

A descriptive approach was taken, in the form of semi-structured one-to-one interviews with staff. It was agreed that the researcher would also ensure that participants did not feel obliged to participate in the research and through the

Participant Information Sheet and Consent Forms ensured that only practitioners open and willing to confidentially share their experiences were enabled to participate. (Albeit the request for participation may have introduce some bias, as there is a risk that only those with positive opinions may be motivated to engage.)

The participants were self-selecting, and it was assumed likely that those who were enthusiastic about utilisation of RVT were more likely to join the research. Whilst, this may have risked the introduction of bias, the nurses, allied health professions and medical personnel, Band 6 and above (senior experienced practitioners) were enabled to contribute to the study and possibly influence future application of RVT. Whereas, those with a less favourable disposition, may have excluded themselves from reflective practice focusing upon RVT. Whilst, early voluntary self-nomination to participate had N=12 potential participants from across a range of practitioners and clinical fields it was determined to be necessary to trawl further until the one-to-one interviews had reached data saturation of topic and no new material is forthcoming. However, if it had been found that there were widely divergent views, the interpretation of the data would express the views of practitioners from across the spectrum. Only once the practitioners were able to articulate their patient's outcomes and their experiences could a determination be made about the nature of success factors or potential for patient benefit which may optimise the RVT intervention.

All relevant practitioners were initially invited to participate in the research but only self-selecting, consenting respondent practitioners were invited to participate in one-to-one semi-structured interviews in a safe environment. They were given the opportunity to express their views from the stance of developing future practice based upon their personal direct experience of RVT.

The mixed-methods methodology enabled the researcher to seek from the practitioners their qualitative data. The one-to-one interviews were piloted with two senior nurses in May 2014 and the outcome of the meeting used to create

the semi-structured interview plan for the research. Practitioners, each a self-selecting participant, were given the opportunity to share with the researcher their experiences of learning to use RVT, within the semi-structured interviews structure. The practitioner participant became a specific case study within the overall data collection phase and contributed qualitative data. The observation of the phenomenon from the stance of the practitioner participant was undertaken through listening and prompting discussion which was recorded as a case study (Saks and Allsop, 2008). It was planned that they would be given the opportunity to describe their view of how to enable effective future deployment and consider all elements of experience to date. The semi-structured interviews were conducted purposefully to enable the practitioners to describe their personal experience of changing and developing care through RVT (Titchen, McCormack and Manley, 2013). From the perspective of evaluation of experience, this research was dependent upon personal practitioner experience and enabled practitioners to reflect upon the lessons they have learned from using RVT in the natural clinical environment and also allows new knowledge to emerge.

The semi-structured interviews (case studies) permitted the practitioners to reflect and share their views and experience. This approach was selected because it permits a degree of freedom of expression for practitioners and for the researcher to encourage the participant to share knowledge; to express real experience of new way of care delivery. It was planned that the researcher would share the written-up findings to the practitioner participants if requested to enable them further opportunity to comment and sense check. In order to minimise the risk of interviewer bias the broad themes emerging from the data were presented to the practitioner participants to discuss in a half-day group workshop. This activity further enabled reflection upon clinical practice, analysis and validation of theory being built and if RVT could be appropriately embedded into clinical practice. The results of quantitative analysis and findings from qualitative analysis were synthesised to determine the emerging factors required to perhaps achieve effective future deployment or reveal benefit or disbenefit. This was undertaken by coding qualitative data to enable

tabulation and comparison (Oppenheim, 2003). Themes in comments were reflected and articulated within the narrative of analysis.

3.5.3 Approach with Commissioning and Operational Managers

To explore in detail environmental issues, the most senior executives, N=8, within the Health and Personal Social Services (HPSS) with an influencing position in RVT were interviewed to reflect on their RVT experience of the service, system, environment and management factors. These semi-structured one-to-one interviews were intended to contribute to reflection upon and interpretation of prior findings. The short working title of, 'Optimisation of Vital Sign Remote Telemonitoring' was used within the participant information sheet with the purpose describing how the ambition is to improve care and support in the future.

It was planned that the data would be sorted into common themes in order of magnitude and consistency of opinion, with findings compared with the directly reported experiences of practitioners. It was recognised that within the study the complex intervention, RVT, would be examined from several perspectives. Simply taking a quantitative approach to data collection would have been likely to omit the psychosocial dimensions associated with the application of innovative technologies from the perspectives of patient, carer, practitioner and manager. Equally, only examining the issues from a purely qualitative perspective, the study may not have been as inclusive and lacked objectivity. Within the context of ensuring a comprehensive review, mixed methods, was selected and aimed to ensure "…complementarity, completeness, confirmation" (Parahoo, 2014, p88).

3.5.4 Approach with Patients/ Service Users and Carers

Henderson et al. (2013) evaluated the English RVT Whole System Demonstrator (WSD) Sites using a questionnaire. Whilst, this questionnaire was tested to scale it focused upon service user acceptability and did not allow the patient to share opinion of experience and personal benefit, so it was not

chosen for use but the principle of using questionnaires as an instrument with patients was applied. Indeed, the WSD research utilised the questionnaire-based study to determine economic benefit with three main dimensions being examined, acceptability, effectiveness and cost effectiveness. This SET based RVT research was concerned within the context of determining effective use of the system and if perceived benefit could be derived. The method of data collection from the service user was undertaken using a tailored questionnaire which offered the ability to engage with many individuals and assess relevant elements of accessibility, benefit, experience and effectiveness. In the design of research methods and instruments to be applied included an examination of other studies considering the optimisation of healthcare systems.

3.5.4.1 Development of Patient and Carer Questionnaires

Initial service user satisfaction questionnaires were undertaken by SET in 2013 and 2014 and a pilot service evaluation in 2009 by BDO Stoy Hayward. These contain a rich narrative, particularly in the form of open responses. The 2013 and 2014 questionnaire had been developed by the researcher to assess service user RVT service satisfaction for the Trusts was agreed for use across the Region by the five Trusts, Public Health Agency and the service provider. Distribution of the survey tool across all service users within Northern Ireland was, periodically, undertaken by the service provider, TF3, but SET directly issued the questionnaire to all its service users on the annual basis; N=204 in 2014. The 2014 service evaluation questionnaires were analysed and from 184 anonymous questionnaires 127 service users contributed and further survey responses were received from 47 carers and nine practitioners. This experience demonstrated that a questionnaire was a practical instrument to engage service users and obtain data effectively.

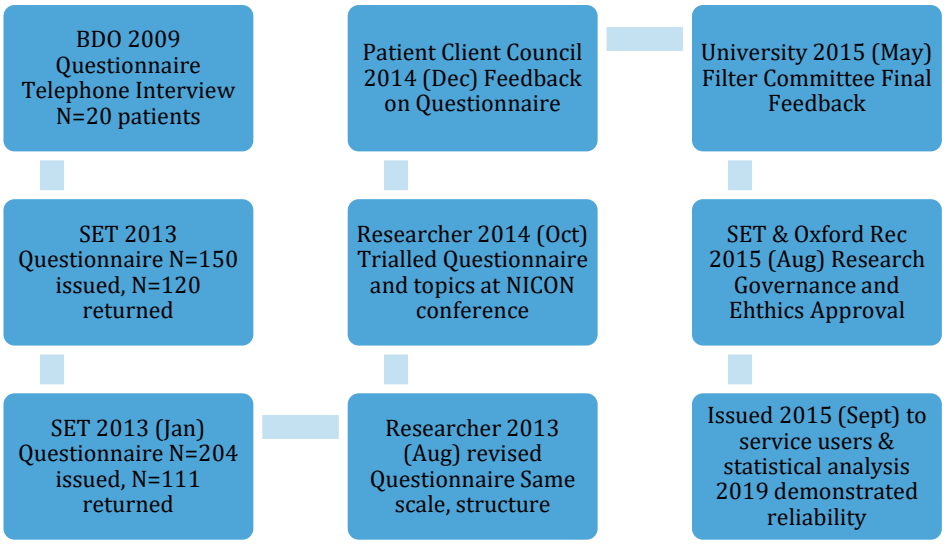


Figure 3.2: Flow diagram to demonstrate the development of the questionnaires, starting from an original source used by BDO to inform commissioning of RVT.

The researcher duly designed the survey instrument and the series of improvements to the questionnaire were made following an iterative process of refinement and peer review, refer to Figure 3.2, which illustrates the stages of questionnaire development.

The survey was designed to have both quantitative closed questions where the respondent had choices to indicate and open questions where the respondent could respond using free text with the narrative forming qualitative data (Saks and Allsop. 2008). However, whilst the patient and carer questionnaires were designed for self-completion the open questions were utilised conservatively so that analysis and interpretation could be undertaken efficiently. The design of the self-completion survey instrument was such that complexity was avoided and that there was a clear flow of questions being asked with the questionnaire broken down into subject area (Robson. 2005). As an understanding of attitude toward and perceived benefit of RVT was required a unidimensional survey was constructed which permitted comparison of and association with particular variables. Whilst there were some binary questions to identify attributes of the respondents, a Likert scale was consistently applied to the remaining closed questions. The scale consistently applied was four to one, with strongly agree rated four, agree three, disagree two and strongly disagree one which enabled the respondents

to be grouped broadly around attitudes (Oppenheim. 2003). Planning and texting of the instrument was a vital component of instrument design (Bowling. 2006) and was undertaken in an iterative process as illustrated in Figure 3.2. Indeed, pilot testing and the modification through experience refined the survey tool increasing the likelihood of reliability (Creswell. 2003).

Whilst initially based upon the BDO Stoy Hayward questionnaire, the second trial questionnaire underwent a process of content challenge by the five Trust telehealth managers from across the region, the Patient Client Council and Ulster University academic staff (not related to the research project) and through the Research Ethics and Governance Filter Committee.

The service user and carer questionnaires were modified to enable further enquiry and enable tracking of service perception, both current experience and reflecting a patient's view of potential future application. The researcher garnered support from stakeholders and incorporated advice and feedback received following independent review from the Patient Client Council. The data from the earlier service evaluation questionnaires was reviewed for commonality in theme, analysed and examined for development of experience and was only used to shape the tool for the research. The research questionnaires retained key questions from earlier iterations but were enhanced to elicit deeper opinion regarding the effect of RVT upon self-care and utilisation of technology. The plan was for the questionnaire to be issued within the context of voluntary participation in evaluation and seeking more in-depth opinion rather than service satisfaction. The questionnaire was designed to enable Personal and Public Involvement (PPI) activity so that patients, as well as practitioners, could be enabled to inform development and deployment. The questions, for use with service users, in the prospective questionnaires were designed to direct them to respond to themes focused upon benefits and harm. It was anticipated that there may be an opportunity for service user recommendations to influence practitioner behaviour and there was freedom through free text for feelings and opinions to be recorded thus creating an open journey of discovery to enable emphasis upon the transformation of practice, care and application of technology; albeit elements of satisfaction were retained to determine if RVT adds value and generally met with approval. The plan for the data collection instrument was to permit

patients to be able to influence practitioner behaviour, responses or actions and RVT Programme design, embracing the regional strategy of user engagement, PPI and enabling Transforming Your Care, (HSCB, 2010). The focus of the study remained the future deployment of service through the effective optimisation of care, the deployment of technology and enabled the emergence of discovery of the real effect of RVT beyond original contract intentions of keeping people out of hospital.

3.5.4.2 Distribution of the Questionnaires

Engagement was fundamental to elicit the service user's voice of experience of RVT. It was planned that all service users within the SET, at a point in time which was determined to be mid-August 2015, would be given the opportunity to complete the pseudonymised questionnaire. The entire patient base was surveyed as pilot questionnaires applied to the whole group have been successful and also the N=280 patients were known to be a heterogeneous group living with co-morbidity or one of several LTC. SET had many service users experiencing several combinations of RVT. Some service users had a track and trend service, whilst others self-entered data on PC and others were in receipt of a full triage service. Also, there was a broad range of medical conditions that meant they may have been offered different peripheral devices so that the vital signs reported were relevant to their personal treatment plans. The differing conditions meant that practitioners selected different RVT peripheral devices to meet clinical observation needs. Therefore, with so many variables, the entire patient population actively who interacted with RVT was included. This contained seven disease sub-groups and two RVT technologies with three service deployment models. By the inclusion of the entire SET RVT caseload, it was assumed that the findings would be less likely to be skewed or inadvertently unrepresentative of participants' views; whereas, sampling may have introduced such difficulties. The short working title of, 'Optimisation of Vital Sign Remote Telemonitoring' was used within the participant information sheet with the purpose describing how the ambition is to improve care and support in the future.

All completed patient and carer questionnaires were returned to the Trust's Safe and Effective Care Team via free-post envelopes, were basically compiled and results entered into a database (IBM-SPSS) to profile high-level summary data to enable the researcher to conduct a rapid superficial analysis to report back to the participants via the Trust's website. The questionnaire material was then returned to the researcher, was coded and compiled in a new (IBM-SPSS Version 25) data base for analysis; the resultant report contained both narrative and numeric articulation of findings. Coded questionnaire templates were used to collect data (Appendix 3). Commonality in theme of service user's free text was collated and reviewed to assess relative benefit or perceived risk of harm, both through statistical analysis of coded text (Oppenheim, 2003) and researcher interpretation of narrative.

3.6 Development of Questions

The clinical practitioner, manager/ commissioner, patient and carer perceived benefit questions were developed to specifically answer the research question, which was to 'critically assess whether RVT is perceived to have derived benefits for patients' (Robson.2005). They were designed to offer subtle insights rating attitude through the consistent application of the Likert scale (Oppenheim. 2003). The questions were all piloted prior to final data collection instrument production through small scale tests with practitioners or service user engagement and underwent peer review and iterative modification. The service user questions were closed and asked through a self-completed questionnaire whereas, the HSC staff questions were all open and administered utilising a semi-structured one-to-one interview technique. Refer to Table 3.3 to review the questions designed to answer the research question.

Table 3.3 Questions designed to enable reflection of perceived RVT benefit.

	QUESTIONS
	SOURCE CLINICIAN & MANAGER SEMI-STRUCTURED INTERVIEW
1	Describe your experience with RTM and feel free to illustrate your experiences with reference to anonymous case studies – please remember not to disclose patient or carer details…
2	What are our lessons learned from your perspective?
3	What are your thoughts on this service?
4	Is there anything else you would like to tell me about RTM or technology in healthcare in general?
	SOURCE PATIENT QUESTIONNARE
5	The telemonitoring system assisted me in managing my health on a day to day basis.
6	I believe the telemonitoring system has reduced the number of my GP visits.
7	I believe my own monitoring of my condition has reduced the number of nurse/community team/health professional visits.
8	I believe that during the telemonitoring period, the system has prevented the need to attend Accident & Emergency Department and /or GP Out of Hours services.
9	I believe that during the telemonitoring period, the system has prevented or reduced the need to attend outpatient appointments.
10	I believe that during the telemonitoring period, the system has prevented my admission to hospital.
11	The telemonitoring system has enabled me to better manage my own condition and become more involved in my health care.
12	I believe telemonitoring has given me peace of mind.
	SOURCE CARER QUESTIONNARE
14	I believe telemonitoring has improved the overall level of health and social care given to the person I care for.
15	I believe telemonitoring has helped prevent the person I care for being admitted to hospital.
16	When assisting the person to operate the telemonitoring equipment, I found it easy to use.
17	I think the use of telemonitoring as part of a care package is generally helpful.
18	I believe telemonitoring has given me peace of mind.

3.7 Ethical and Research Governance Approval

Prior to engagement with participants there were three steps that were considered and undertaken, (i) identification of actual ethical issues, (ii) ethical approval and (iii) research governance.

Prior to the consideration of the methods of data collection or obtaining of any patient level information the researcher had to satisfy the Ulster University's Research Governance and Ethics Committee that all relevant 'Good Research Governance' and research ethics training had been successfully completed.

SET Research and Development Team advised that if the study was to engage SET practitioners then full ethical approval was not required simply a basic Trust approval to conduct the interviews mandated through the local Research Governance Policy. It was not believed the line of enquiry to be undertaken by the researcher would be contentious or personal and was unlikely to cause Trust staff distress. Moreover, there was a requirement for the researcher to gain access and review RTNI TF3 Service Agreements/ Contract material, have access to performance management material and also to review and utilise the findings of historic RVT questionnaires completed by patients over time in order to inform the research, shape the design of the research methodology and future data capture methods. On 11 October 2013 the Trust formally approved the release of data for 'service evaluation' and research protocol design.

The requested material assisted with the refinement of both the research focus and the methodology by which the data would be collected to determine new findings. One-to-one recorded interviews were required with practitioner participants and also the opinions of patient participants so that a comparison could be made. As a 360-degree review of perspectives was required from a variety of stakeholder participants mixed methods was deemed to be the most appropriate methodology. Given the required participation of service users full ethical approval was then required for the data collection to proceed, albeit that a proportionate review was determined to be an appropriate route of approval.

The researcher then registered the project with the Integrated Research Application System (IRAS). With revisions made to the research protocol and support material with appropriate University approvals and certifications in place, the research proposal was submitted to the Trust's Research Ethics and Governance committee where consent was given. (Refer to Appendix 6 for protocol materials).

The formal approval to proceed enabled a series of two data capture methods to proceed to collect both qualitative and quantitative data. The first method approved, gave permission to issue a questionnaire to all current SET RVT patients, with the only exclusion criterion being that no service user under the age of 18-years would be sent a questionnaire. The second data capture method approved was to interview a cohort of practitioner and manager participants and to deliver a validation workshop for practitioners to review findings.

Research participation, was explicit and understood by participants that at all points along the research journey for the service user, carer, practitioner and senior managerial officer would be voluntary with the participants being free to withdraw at any stage up to data entry; withdrawal after data collection meant that they would not take any further part in data collection or review of findings. It was planned that material submitted to the date of withdrawal would be analysed and form part of the research findings albeit no participant withdrew from the research and data collection phase. The questionnaires posted to service users and carers were accompanied by a stamped addressed return envelope along with a cover letter to explain, study purpose, ethical consideration, confidentiality and consent. The questionnaires were sent to approximately N=280 service users with the option of them being able to pass a supplementary questionnaire on to further potential participants; that is the service user's carer, if available; their responses were also be returned in a separate sealed envelope. The management of sensitive issues was considered so that the safeguards were in place to protect vulnerable adults if issues were identified through a 'red flag' system which ensured such matters were addressed through the Trust governance administration; there were no issues identified. (Refer to Appendix 4). Patients were not identified in the research findings and their contribution retained securely and

confidentially for 10 years in line with the Ulster University standards, the Code of Practice for Research Integrity and the Data Handling procedures and the Data Archiving procedures. However, not knowing patient identity also meant that patients who had not responded could not be targeted and encouraged to participate. Pseudo-anonymity was achieved through the coding of the questionnaires so that, should the need arise to identify a particular service user, appropriate action could be taken. The file containing participant study identification codes and personal details were kept under secure conditions by the chief investigator, in a password-controlled computer system with access for the researcher. Any hard copies of data were kept under locked conditions, designed for the purpose. The chief investigator was the custodian and had control of the data generated from the study. Confidentiality was respected but not guaranteed. Any disclosure of poor practice would have followed normal management protocols; there were no issues identified. (Refer to protocol instrument documents Appendix 4 and research governance and ethics approval in Appendix 6)

In summary, the research governance and ethics approval was a stepped process whereby three committees sanctioned progression:

1. Ulster University (Project No: 15/0065).
2. Proportionate Review Sub-Committee of the Health Research Authority, The National Research and Ethics Service (NRES) Committee South Central – Oxford C (July 2015). The Integrated Research Application System (IRAS) project ID 155990
3. SET Research Governance was attained on 11 August 2015 REC 15/SC/0424 Trust reference SET/15/17

Table 3.4 documents the list of version control documents that constituted the suite of research protocol documents as submitted to and approved by the Research Governance and Ethics Committee. These covered all dimensions of the data collection (see Appendix 6).

Table 3.4 To summarise the suite of documents approved by the research governance and ethics committees.

Protocol v6 040615
a ox optimising remote TM Response to Filter Committee v5 140715
b ox Subject Information Sheet patient v5 140715
c ox Letter User Questionnaire TF3 v7 140715
d ox Letter User Questionnaire UTEL v6 140715
f ox Service User Questionnaire TF3 v4 140715
g ox Service User Questionnaire UTELL v3 140715
h ox Carer Questionnaire TF3 v4 140715
i ox Carer Questionnaire UTELL v3 140715
ia ox Staff member consent form v4 140715 mckinstry walkden
ia ox Staff member consent form v4 140715
j ox Subject Information Sheet staff v4 140715
k ox Invitation letter practitioners v2 140715
l ox Invitation letter Managers v2 140715 McKinstry 071015
l ox Invitation letter Managers v2 140715
m ox semi-structured interviews with healthcare professionals v2 140715
n ox semi-structured interviews with healthcare managers v2 140715
15 SC 0424_(PRS)_Favourable_opinion_on_further_information_20.07.15
15SC0424 - Favourable Opinion
Final Permissions Letter from SET
ox a 15 SC 0424_(PRS)_Provisional_opinion_09 07 15
ox b response to NRES Committee South Central
Re Outcome from Research Committee Meeting - SET.15.17
SET.15.17 Notification of Valid Application
SL-AR2 Non-CTIMP Standard Conditions v5.2

(Relevant documents are available in Appendices 3 and 4)

Following the systematic review of literature and with reference to the Ethical Approval given by Ulster University, the Proportionate Review Sub-Committee of the Health Research Authority, NRES Committee South Central – Oxford C and SET, it was proposed that the relevant data were obtained and managed utilising Mixed Methods within a broad-based programme evaluation.

1. Analyse existing service contract material and data at Trust and Regional level;

- This includes service statistics and reports relating to previous service evaluations and customer surveys
- Evaluation of existing Regional service use data.

2. Confirming this prospectively through service user and carer surveys;
    - Questionnaires were sent to all current South Eastern Trust RVT service users, N= 280 patients were on the system at any given time), with responses returned for collation and analysis.
    - Where an informal carer plays a role in RVT, they were invited to provide data from their perspective (From experience of pilot studies it was anticipated there are approximately 30% of RVT Patients who are assisted by carers); N=90.
3. Interviews on RVT with Health professionals at all levels;
    - One-to-one semi-structured interviews with practitioners with experience of utilising RVT and Senior Health and Social Care Leaders; N=20
    - Workshop for Trust practitioners; N=12
    - Quantitative (statistical) analysis of numerical data (from 1 and 2, above): descriptive, exploratory and explanatory;
4. Qualitative analysis of transcripts (from 3) following a descriptive thematic approach.

3.7.1 Framework of Data Collection:

To summarise the expected data collection methods linked to participants and the associated outputs for data analysis a table was produced (Table 3.5)

Table 3.5 To illustrate the framework of data.

Data Collection		Data Analysis	
Designed four tailored questionnaires: - a service user and a carer questionnaire for each of the two services (TF3 & U-Tell) – These were based upon BDO Stoy Hayward 2009 RVT questionnaire, then piloted and reviewed by Patient Client Council	To Patients (Pa) N= 280 & Carers (C) N=90	Quantitative Data Questionnaires [Pa,C] analysed using SPSS (final version utilised by researcher was 25)	Quantitative Information
One-to-one Semi-structured Interviews	Senior Management Executives (E) N=8 Practitioners (Pr) N=12	Case Study narrative [E,Pr] analysed using NVivo (final version utilised by researcher was 12)	Qualitative Information
Workshop: Bryson Technique for Cognitive Mapping used to help Practitioners review initial findings, group issues and find common meaning and critical success factors	Practitioners [Pr, N=12]	Validation of NVivo Nodes	Qualitative Information

3.8 Scope

Consideration was given to the comparison between disease specific groups versus a single disease area. The enquiry comprised of groups of practitioners who were of varied professional backgrounds and specialising in the care of patients with various chronic illnesses whilst having commonality in possessing the ability to access the TF3 RVT service. This approach enabled greater opportunity of a transferable framework of success factors, enabled cross-fertilisation between professional areas and maximised the number of eligible practitioners. Criteria for selection was defined as participants must be of HPSS Band 6 or above with a professional clinical background (defined as someone with a medical, nursing, pharmacy or allied health professional registration).

3.9 Autonomy

Consideration was also given to the parameters within which the researcher was permitted to operate. The research governance and ethics approval process safeguarded the participants and through a process of audit and supervision the correct execution of the protocol was assured whilst the activity of the researcher occurred independently. The Trust enabled access to data and participants without hindrance.

3.10 Benefit

There was no direct benefit for the participants. Potentially future patients may benefit from appropriately designed and targeted RVT and improved care for those with LTC. Being able to engage with service users and give early feedback, via the Trust's website, contributed to Public and Patient Involvement and an engagement agenda for the region. However, if benefit is found or if a mode of effective deployment is identified to optimise RVT then the potential benefit is to improve the care for those with LTC and manage resources more effectively.

3.11 Risk

No serious risk attached to participation nor to data collection. There were five systemic risks identified with the research project and these include: (1) service capability of provider restricting operation of remote monitoring, (2) technology advancement providing new alternatives to service under review, confounding findings, (3) engagement with clinical participants being limited by other service requirements, (4) high risk of inconvenience for the participants associated with data capture and (5) separate, Public Health Authority commissioned service evaluation to judge if the service should be re-commissioned (in 2017). Each risk was reviewed with regard to possible impact and affect upon both research progress and the participants. None of the identified risks were anticipated to be likely to seriously conflict with the

research project or negatively affect research participants; burden was kept to a minimum as far as practicable.

3.12 Project Planning

A project flow chart, (Figure 3.3), illustrates the steps of the research programme associated with data collection. Permissions were granted to access relevant Trust data. The researcher commenced the personal development training programmes and undertook training specifically related to Human Subjects, Ethics and Research Governance. Application for ethical approval was received for survey work and interviews. In line with the original project plan the service user evaluation questionnaires were issued in the third quarter 2015 and one-to-one interviews undertaken at the end of the second quarter 2016 as illustrated by the Gantt Chart, Figure 3.4. From start to finish this process took 5.5 years.

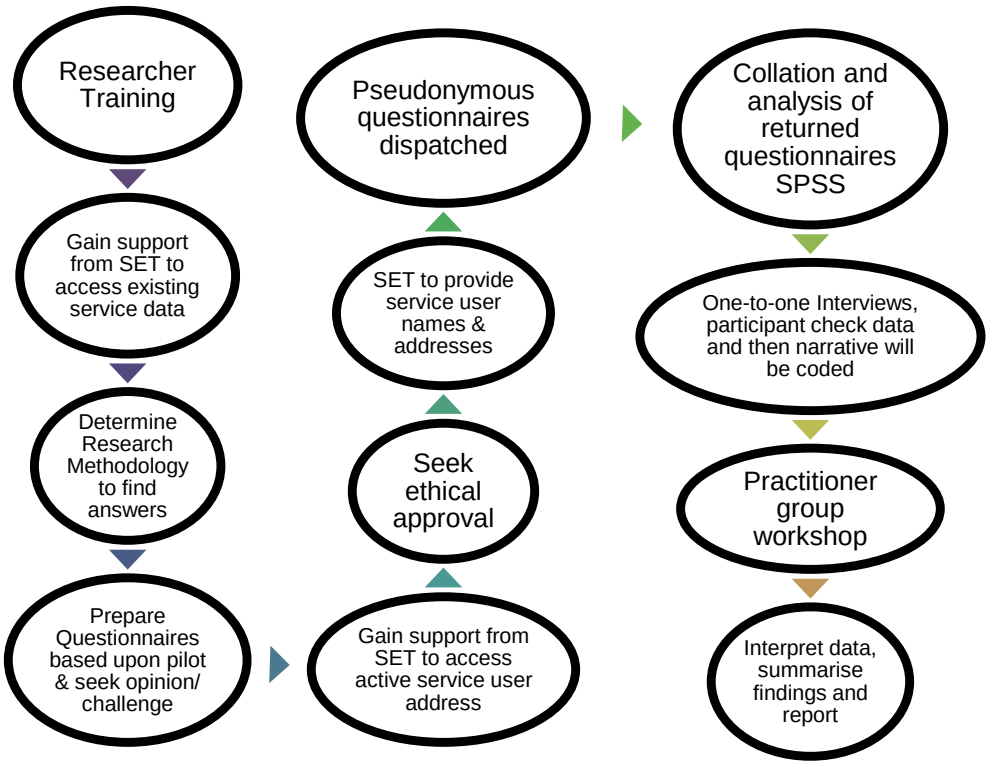
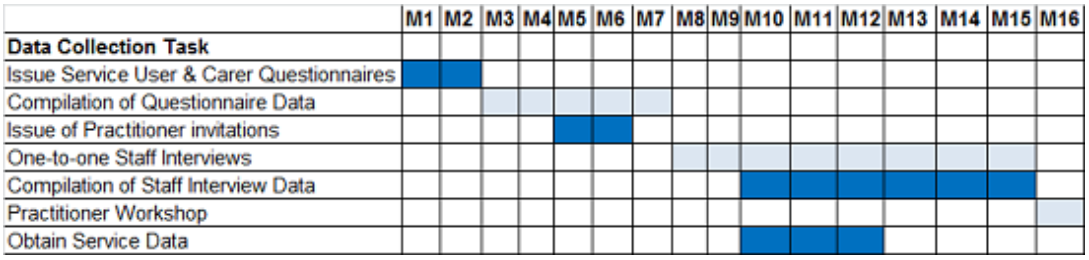


Figure 3.3: Flow chart to illustrate the steps within the data collection and analysis process



(M1 = Month 1, etc.)

Figure 3.4: Gantt chart to demonstrate the data collection and analysis phases timeline of study

3.13 Methods of Data Capture

There were two methods for data capture. As there were two distinct types of research participants, (1) those who were practitioners or who have a strategic influence over the development or deployment of RVT in Northern Ireland and (2) those who were in active receipt of the RVT service.

3.13.1 Practitioner and Manager Participants

Staff were given an opportunity to opt into the research in two-stages. (1) a recorded and transcribed interview with the researcher and (2) a workshop to consider overall findings and challenge common themes relating to optimisation of RVT. The experience of RVT for each of the practitioners was articulated in a case study for each participant and data from all participants combined utilising a descriptive thematic approach. Practitioners discussed the synthesised findings.

A descriptive approach was taken, in the form of questionnaires and interviews with staff. It was recognised that a manager within SET conducting interviews of staff may have introduced bias into the process and skew findings. Therefore, the researcher proactively moved out of the SET to join the BSO and no longer was in a position to influence operational service outcomes for staff. The researcher ensured that potential participants did not feel obliged to participate in the research and through the participant

information sheet and consent forms ensured that only practitioners open and willing to confidentially share their experiences were enabled to participate. Practitioners were given the opportunity to express their views from the stance of developing future practice based upon direct experience of RVT.

Each potential participant practitioner was sent, by post, a cover letter, the Participant Information Sheet for staff, a consent form, a sample of possible discussion topics and a stamped addressed envelope to return the consent form should they wish to participate. A month later, the Safe and Effective Care Team, SET, forwarded completed consent forms to the researcher. The participants were given clear guidance about the intention, method of participation and personal time commitment along with the understanding as to why they had been asked to consider participation. Included within the Participant Information Sheet the Trust practitioners received the researcher's contact details and general details (Appendix 4).

Practitioners were also given information regarding likely, guiding, questions to be utilised during the one-to-one interviews. However, there was some modification between those discussion-guided questions for Clinical participants and those who undertake a management role (Appendix 4).

3.13.2 Patient and Carer Participants

Patient and carer participants were given an opportunity to participate in the research via questionnaires. By returning the completed questionnaire, in the pre-paid and addressed envelope to the SET Safe and Effective Care team, they were assumed to have consented to participate.

Each potential patient participant was sent, by post, a cover letter, the Participant Information Sheet for patients and carers, two questionnaires and a stamped addressed envelope to return the completed questionnaires form should they wish to consent and participate. The patient was also sent a shorter questionnaire to give to their carer, as appropriate, and a second envelope for it to be sealed into and returned within the main stamped

addressed envelope. Of note, whilst there are similarities between the two RVT systems being utilised they are not the same and so the questionnaires were appropriately tailored to the recipients. Questionnaire design was discussed but for ease of review they are available within Appendix 4. Of note, the questionnaires were colour coded; The TF3 Patient Questionnaire being printed on white paper, the TF3 carer questionnaire printed on yellow paper, the U-Tell patient questionnaire printed on blue paper and the U-Tell carer questionnaire printed on pink paper.

After a month the Safe and Effective Care Team, SET, transcribed the completed questionnaires onto IBM-SPSS, a software package utilised for statistical analysis, transcribed into typed Microsoft word document the responses to more narrative focused comments boxes. The Safe and Effective Care Team did not interpret the data; the electronic and paper documents were forwarded to the researcher for management as per the research protocol and data governance. The first step and high-level review was only to enable early feedback to patient and carer participants via the SET website by 31 March 2016 (Appendix 8).

The patient participants were given clear guidance about the purpose of the research and the understanding as to why they had been asked to consider participation. Included within the Participant Information Sheet the RVT patients received the researcher's contact details and general details (Appendix 4).

3.14 Patient Confidentiality and Duty of Care

As part of this study the management of patient level information was strictly governed; the patient participants in receipt of the questionnaires were all 'live' on either the TF3 or U-Tell RVT systems at the time of recruitment (August 2015). Not only would the researcher be privy to the patient's demographic details but also the reason for the RVT service they receive. For example, all but one of the recipients of the U-Tell patient questionnaire would have been

medicated with warfarin and would already have been participants in an earlier Trust RCT. Moreover, not only would the careful management of patient information and their concomitant responses be conducted in accordance with both Trust and University Data Governance policies, but the principles of Adult Safeguarding were adopted. This recognised the duty of care at all levels within the study to address issues of safety, handle data confidentially and protect the identity of the patients and carers. If a respondent to a questionnaire alerted the researcher to an adult safeguarding issue or poor clinical practice issue it was possible to act to safeguard a potentially vulnerable adult or address a matter of clinical governance. Therefore, the questionnaires were pseudonymised, and a confidential record kept of which patient was allocated which alphanumeric code. A protocol was specifically created for the research and was as shown (Table 3.6):

Table 3.6 Study Protocol for dealing with clinical and social care issues.

Study Protocol for dealing with Clinical and Social Care Governance Issues that might arise during the study

It is recognised that during the course of the investigation research participants may disclose material of a concerning nature. For example, these may include topics such as: -

- Adult Safeguarding
- Unprofessional conduct of staff
- Failure to act upon data provided by Remote Telemonitoring Service – act or omission of Trust or Service Provider's practitioners
- Discovery of Complaints against the Trust or Trust Staff or Service Provider

If the disclosure has been made through the questionnaires the following steps will be taken, in line with Trust escalation policy-

- The incident as documented will be transcribed
- The coding on the questionnaire will be accessed to note the demographic details of the participant.
- The details will be passed to the Trust's Research Governance Manager who in turn will follow the Trust's Clinical and Social Care Governance Policy to ensure matters are addressed by Trust managers.

If the disclosure has been made through the staff one-to-one interview process the following steps will be taken: -

- The incident as disclosed will be transcribed
- The details of the participant, patient and staff member involved will be recorded as disclosed.
- Participant who made the disclosure will be reminded of the duty of care held by the researcher to uphold Clinical and Social Care Governance standards as previously explained and documented within the Participants Consent form informed of the expected steps to be taken by the researcher.
- The details will be passed to the South Eastern Trust's Research Governance Manager who in turn will follow the Trust's Clinical and Social Care Governance Policy to ensure matters are addressed by Trust managers.

The researcher will also brief the Supervisor/ Chief Investigator of the actions taken.
Julie-Ann Augusto (20:02:15)

3.15 Quality Assurance and Compliance with Research Governance and Ethics

Quality Assurance and Compliance with Research Governance and Ethics was assured by the chief investigator, principal investigator and researcher. The study was randomly selected for audit by the Ulster University's Research Office Team. At short notice the research governance controls file was called into the University for a Compliance Audit. In November 2017 the research project was found to be compliant and with the researcher having followed all the research governance and ethics instruction and protocols.

In addition to the random audit of compliance, quality was considered separately in quantitative and qualitative approaches to ensure accuracy of data capture, transcription, handling and analysis.

3.16 Methodology: Building the Quantitative Database

The process of data analysis, when utilising the software IBM-SPSS Version 25, was recognised as reliable software for quantitative data analysis. From the decision to collect data to undertake quantitative analysis to enable an answer to the research question to be analysed there were seven overarching Steps.

3.16.1 The Seven Steps within the Data Analysis

Step 1 – To plan the structure and content of a new database.

Step 2 – Assigning of codes and consistent values.

Step 3 – The auto-coding of the database.

Step 4 – Numbering of the pieces of data and governance check.

Step 5 – Construction of the two Databases.

Step 6 – Quality Assurance of Database entries to validate accuracy.

Step 7 – Finalise the report of findings of qualitative data.

3.16.1.1 Step 1

The first step was to plan the structure and content of a new SPSS database based upon the data contained within completed service user and carer questionnaires. There were four different questionnaires which had received Research Governance and Ethics approval (July 2015). In accordance with the Protocol, the version-controlled questionnaires were issued to all recipients of the RTNI service and their carers and to recipients of the u-Tell service and their carers.

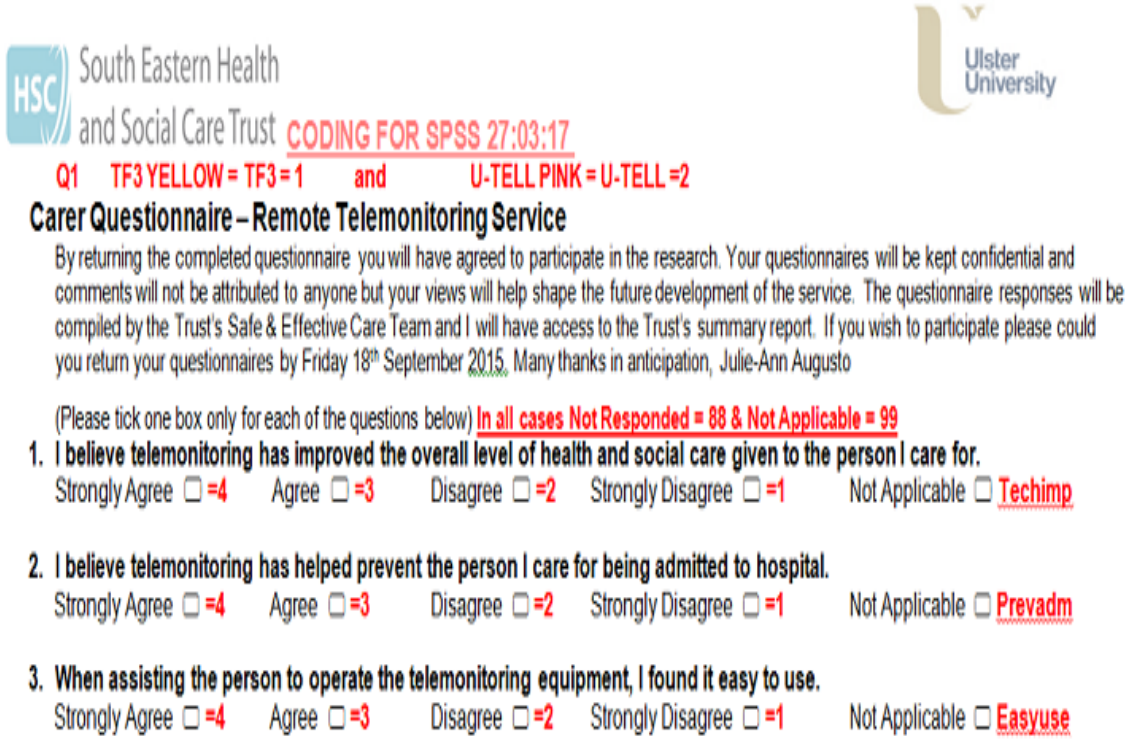
Next the RVT service users were sent the appropriate questionnaires, Participant Information Sheet (PIS) and freepost return envelope through the post if they had been a recipient of a SET's RVT service the previous month. The returned questionnaires were managed by SET's Safe and Effective Care Team. Trust Officers safeguarded the material and compiled the response data into an initial database. These databases were reviewed and disposed of and not utilised for the research as the structure and format was insufficient to interrogate data and some responses had not been appropriately coded. It was useful to review an early iteration of 4 separate databases, one for each type of questionnaire. Early review demonstrated weaknesses in the structure and inaccuracies in data input, but it was a useful exercise to review; from an informed position, and so two new data sets were planned and concomitantly two databases compiled. It was decided that the carer questionnaires were to be combined regardless of RVT service experienced and that data contained within all service user responses similarly be grouped.

It was determined that the service level nuances in data could be disaggregated from the overall data set if appropriate coding was developed and refined.

Equally there had been limited quantity of free text and a determination was made to retain the more qualitative data separately so that only the quantitative data was recorded in two data bases (patients and carers).

3.16.1.2 Step 2

The step of assigning of codes and consistent values to each possible response, to each question, across the four questionnaires. A ‘nickname’ or abbreviation was decided upon for each question asked of a respondent. For example, the question under the ‘Patient Benefit’ topic, question 1, “The telemonitoring system assisted me in managing my health on a day-to-day basis” was given the abbreviated code, “b1helpmeman” so that there would be a logic to follow for the researcher whilst analysing the data. Moreover, numbers to represent non-response or not applicable were allocated. For some yes or no, or rather binary on or off type of questions the numbers 1 and 2 were used and where there were agree or disagree responses a scale of 4 to 1 was applied with 4 representing a response of ‘strongly agree’ and 1 representing a response of ‘strongly disagree.’ The Figure 3.5 demonstrates assignment of codes and values to a questionnaire template whilst Appendix 3 contains coding details.


South Eastern Health and Social Care Trust

Ulster University

CODING FOR SPSS 27:03:17

Q1 TF3 YELLOW = TF3 = 1 and U-TELL PINK = U-TELL =2

Carer Questionnaire – Remote Telemonitoring Service

By returning the completed questionnaire you will have agreed to participate in the research. Your questionnaires will be kept confidential and comments will not be attributed to anyone but your views will help shape the future development of the service. The questionnaire responses will be compiled by the Trust's Safe & Effective Care Team and I will have access to the Trust's summary report. If you wish to participate please could you return your questionnaires by Friday 18th September 2015. Many thanks in anticipation, Julie-Ann Augusto

(Please tick one box only for each of the questions below) In all cases Not Responded = 88 & Not Applicable = 99

1. **I believe telemonitoring has improved the overall level of health and social care given to the person I care for.**
   Strongly Agree ☐ =4 Agree ☐ =3 Disagree ☐ =2 Strongly Disagree ☐ =1 Not Applicable ☐ Techimp

2. **I believe telemonitoring has helped prevent the person I care for being admitted to hospital.**
   Strongly Agree ☐ =4 Agree ☐ =3 Disagree ☐ =2 Strongly Disagree ☐ =1 Not Applicable ☐ Prevadm

3. **When assisting the person to operate the telemonitoring equipment, I found it easy to use.**
   Strongly Agree ☐ =4 Agree ☐ =3 Disagree ☐ =2 Strongly Disagree ☐ =1 Not Applicable ☐ Easyuse

Figure 3.5: Demonstration of assignment of codes and values to questionnaire template

3.16.1.3 Step 3

The auto-coding of the database; the data were then merged where miscoding had occurred which had been caused through software header variation. This process was designed to format and structure consistently.

3.16.1.4 Step 4

Numbering of the pieces of data and Governance Check.

Each of the completed and returned questionnaires were sequentially numbered and ordered so that one set of responses in a questionnaire could be cross-checked or referred to when quality assuring data entry in the database or when adding qualitative narrative to a particular finding or anomaly.

During this process the researcher visually examined the returned questionnaire in order to determine if any respondents had raised a clinical governance or safety issue. [*There were no comments to cause concern and so there was no need to follow the Research Project's Clinical Governance Policy and no questionnaire required to have the respondent identified*].

3.16.1.5 Step 5

Construction of the two SPSS Databases.

Following the structural plan decided upon in Step 1, in turn, each of the two SPSS data bases were constructed. Then each set of responses to an individual questionnaire were entered into the database in ascending numerical order. The responses were grouped by RVT service; all the RTNI responses were entered in numerical order before the group of u-Tell questionnaires.

3.16.1.6 Step 6

Quality Assurance of Database entries to validate accuracy.

Once the preliminary data base was constructed every cell rule and construction was cross-checked to ensure accuracy and all individual data entries, i.e. the transcription of questionnaire-based data into an electronic database, cross checked twice for validity. Therefore, a detailed quality assurance process was undertaken thus validating and ensuring data accuracy. This then meant that the databases were ready for data analysis to be undertaken, confident quantitative findings would accurately represent the views as expressed by RVT service users and carers.

3.16.1.6.1 Data Cleansing:

Preparation of the Patient Questionnaire responses recorded in the quantitative database included the transformation of the condition data so that it could be manipulated and counted more easily. The coding was scored ‘one’ for ‘yes’ to a condition, (14 possible condition options), and ‘two’ for ‘no’. The transformation was to change all score ‘two’ to score ‘zero’. There were two steps in the process first to transform all scores of ‘two’ in the Data View against the conditions and then to change the meaning within the Variable View so that N/S equals zero instead of N/S equals two and that ‘yes’ equals one remains.

In examining the data there were nine respondents who recorded a condition in the cell ‘other’; eight of those participants recorded a secondary condition that would be classified as the main condition that they recorded in their response to the questionnaire, i.e. recorded emphysema ‘other’ and also recorded that they were being monitored for COPD as both would be classified as ‘respiratory’. One participant recorded ‘other’ as pregnancy and had equally responded to maternity and weight management both of which would be classified as maternity as the primary reason for use of the RVT. One participant recorded that they had Parkinson’s and one participant recorded arthritis; neither of these conditions were managed through RVT and both participants recorded primary conditions managed through RVT, so the

entries recorded under ‘other’ were not considered. Only one participant recorded ‘other’ without any primary diagnosis for the purpose of RVT. Therefore, there were two options to pursue, the first being that no assumption could be made about condition so it would be accepted that their opinion would only be considered where specific conditions were specified as a required variable. The second option was to go back to the original narrative submitted by questionnaire of respondent number 47 to seek further indicators of condition. Upon examination there was evidence, on the completed questionnaire, that the respondent had chronic asthma, used a triage service and of note asked never to be taken off the system in a comments box. Therefore, the decision was taken to record the respondent as a respiratory patient with a most likely condition as COPD, concomitantly the response for the variable COPD was manually changed from 0 to 1 to show that they were using the system for a respiratory condition.

In the process of analysis of conditions, the analysis variable ‘data reliability’ relating to conditions excluded the ‘other’ variable and only reviewed the core conditions. Equally, one respondent, number 51, received the TF3 service and recorded that they were receiving RVT for dementia care but equally recorded RVT COPD, COPD and GDM. This could not have been the case as the respondent was a 78-year-old male. Gestational Diabetes Mellitus (GDM) is a condition only found in pregnant females and so the participant’s data was amended to reflect that they did not have GDM rather had DM; this recognised that having dementia, the questionnaire may have caused confusion and that he may have intended to indicate ‘diabetes’. Similarly, a 74-year-old lady with Parkinson’s recorded her purpose for management within the TF3 service as GDM and so again her response was changed to diabetes mellitus. The change of these two respondents’ health conditions meant that no respondents were recorded in the results as having just GDM which is entirely consistent with how the service TF3 RVT was being operationalised within SET. In turn, the responses recorded by the participants indicating that they received TF3 RVT for maternity care were three. Within SET RVT, policy indicated that the only patients who were prescribed the service and were pregnant, would be referred by the Dietitian and so received RVT to assist with weight management throughout their

pregnancy. One recorded maternity as a reason to use RVT but it is difficult to determine if this is genuine as the participant recorded their age as 61-years. Given the absence of other indicators of ill-health, an assumption was made that their age was incorrect, and the participant's responses was analysed as if they were receiving the TF3 RVT service during the pregnancy. Their responses were excluded from analysis where the opinions of those with chronic diseases or rather long-term conditions were considered and there is a note that this respondent may skew the related means.

One respondent, number 81 failed to identify the service being utilised and so a review of their overall questionnaire demonstrated it was the U-Tell service, so the data was changed from 'zero' to 'two' for the response; this removed one for missing data for the 'which service?' variable.

The questionnaire did not seek to clarify if patients suffered from a condition but were not monitored for it and so an assumption was made that when a participant responded positively to the presence of a condition by ticking a box associated with the question… 'What is your health condition being monitored through TF3 (or U-Tell)? Please tick all that apply', that they reported that multiple conditions were being monitored. It is accepted that there is a margin of error as some respondents may choose to report all their conditions and not only those which are being monitored through an RVT service, e.g. an INR patient not on U-Tell could not be monitored through TF3 for INR; N=18 participants reported INR/ warfarin but only N=16 received the U-Tell service. However, it is known that some participants, N=unknown, were genuinely monitored on TF3 by several Trust practitioners given the presence of co-morbidity; COPD patients with diabetes would be managed by both the respiratory team and the separate diabetes team; patients with COPD, diabetes and CHF would be cared for by the Virtual Ward community nurses. Therefore, an assumption was made that the co-morbidities reported are valid and being monitored and reported through the TF3 RVT service.

3.16.1.7 Step 7

Finalise the report of findings of qualitative data.

The summary of results, the application of statistical analysis tools and the description of findings is undertaken in step 7 and the report of the findings of

the quantitative data held within SPSS and is documented in later chapters. This step included an initial review of the data held within SPSS and decision making with regard to the focus of the data analysis. The overarching principles of the data analysis were then designed (described 3.15.2).

3.16.2 Overarching Principles of Quantitative Data Analysis

Once the two quantitative databases (patient and carer) had been constructed the process of analysis began.

A. The "conditions of interest" for the primary analyses was conditions combined but without weight management, paediatrics, maternity, gestational diabetes, dementia and renal.
B. Primary analysis for an indicator of self-care and was for analysis of question 32
C. Important secondary analyses were for questions within the topic range sections for patient benefit, telemonitoring equipment and technology and nurse triage (TF3 Service).
D. Answers to questions that could be strongly agree, agree, disagree, strongly disagree were analysed as the proportion who gave an answer and were strongly agree plus agree versus disagree plus strongly disagree, if found to be the case.
E. Subgroup analyses was undertaken for:
    a. Men versus women
    b. Service use with or without nurse triage so that a comparison between service users who have respiratory (bronchiectasis plus COPD) and cardiovascular (stroke plus CHF plus hypertension) versus those diabetes mellitus
    c. Different age groups
F. To determine if service users felt more or less able to self-care if they received the TF3 service or the U-Tell service.
    a. Variation of opinion of service users, e.g. if there was a difference in opinion between patients with different conditions in relation to question 32

G. To contrast responses of various groups to determine if RVT gave service users peace of mind (question 34).
    a. Contrast TF3 and U-Tell
    b. Contrast Gender

3.16.3 Statistical Analysis to be Undertaken

A plan to methodically analyse the data to determine if there was variation between patients with different conditions, gender or technology was created. Equally, the opinions expressed by responders relating to patient benefit such as self-care were planned.

1. Tables showing the number of each response to each question for all respondents in order to confirm response rate per item.

2. Tables for the conditions of interest combined for the questions noted in B and C, showing the proportions noted in D in order to determine the variation in respondents (from section 3.13.2).

3. Tables for men and women separately for the conditions of interest combined for the questions noted in B and C, showing the proportions noted in D to determine if gender affected opinion and if sample represented population. (from section 3.13.2).

4. Tables for INR, respiratory, diabetes and cardiovascular separately for the questions noted in B and C, showing the proportions noted in D to determine if there was variance in opinion based upon RVT technology used (from section 3.13.2).

5. Tables for self-care and triage (F from section 3.13.2) to determine opinion and if patient level benefit emerges.

6. Validity and reliability. The statistical analysis software (IBM-SPSS) can be utilised to test the internal reliability and consistency within the data. The statistic of Cronbach's coefficient alpha will be calculated to test the average correlation between the elements constituting the scale. Higher values, within a range between 0 and 1, will indicate stronger reliability. (Pallant, 2016).

Equally, if the measure, actually measures what it was intended to measure this is described as validity and indicates research quality.

Following interrogation and analysis of data, where data were found to be of interest it was recorded within Chapter 4.

3.17 Methodology: Building the Qualitative Database

The process of data analysis, when utilising the QSR International software NVivo Version 12 is both methodical and disciplined. The activities were broken down into eight steps. The eight-step framework was developed, Meehan (2016) and Krippendorff (2004).

3.17.1 The Eight Steps within the Data analysis

Step 1 - Transcription of digitally recorded semi-structured interviews with participants. The structure was laid out in a word processor and uploaded NVivo.

Step 2 – Assigning of characteristics and attributes to the participants i.e. profession, background and decade of qualification.

Step 3 – The auto-coding of the transcripts, using the formatting provided by a framework of semi-structured questions. The data were then merged where miscoding had occurred.

Step 4 – Break down further the narrative into themes, sub-themes and develop code to enable interpretation and understanding.

Step 5 – Further refinement and consideration of codes to create a structure of codes.

Step 6 – Documentation of findings.

Step 7 – Validate the interpretation and findings with a group of clinical participants.

Step 8 – Finalise the report of findings.

3.17.1.1 Step 1

First step was to create a new database named ‘RVT Interviews’ and established rules for data back-up and file recovery. All data were formatted and prepared within a word processor and spreadsheet to simplify data comparison, review and enable auto-coding. The data were then uploaded to create the ‘Sources’ of data. Initially the RVT Interview database was populated with source data creating three main folders, ‘Interview Participants’, ‘Interviews’, and ‘Questionnaire Free Text’. Then import the relevant documents into the appropriate source folders.

The creation of cases within the nodes was then required of which there were two sets of survey respondents within the semi-structured interviews, practitioners and managers. Identity was given to a case through the use of case nodes. The case node then contained all of the qualitative data relating to the cases.

3.17.1.2 Step 2

The classifications were then created for the data and were labelled as ‘Case Profiles’ and expanded adding further detail by creating attributes and values. The attributes assigned to the cases were Gender, Profession, Decade Qualification, Disease Group and RVT Service being utilised by practitioners as appropriate (Table 3.7). The next step was to link classifications to each case, each of which contains the qualitative data. On a case by case basis all of the 24 semi-structured interview participants’ data were created.

The Attributes and Values were added to each Case as shown (Table 3.7):

Table 3.7 To illustrate the attributes assigned within NVivo to the participant demographic data.

No#	ATTRIBUTE	VALUES
1	Gender	Male or Female
2	Professions	Nurse, Allied Health Professional (AHP), Doctor, Pharmacist, Manager
3	Decade of Qualification	1970, 1980, 1990, 2000, 2010
4	Disease Group	Diabetes, COPD, INR, Stroke, Weight, All, Indirectly Overview All
5	RVT Service	TF3, U-Tell, TF3 & U-Tell
6	Background	Medical, Nursing, Dietetics, Physiotherapy, Pharmacy, Business Studies, Law, Information Technology, Hotel Management & A Levels

Accuracy of assignment of Attributes and Values was cross-checked, further refined and cross-checked again ensuring accuracy.

Moreover, all values for the 24 cases were assigned. Ensuring the accuracy of data to protect the integrity of the research, as errors in assigning attributes and values undermines assertions (Meehan, 2016, p25.).

3.17.1.3 Step 3

Having built the framework of the database for the qualitative data a degree of auto-coding was planned. In order to plan, in advance, for auto-coding the typed transcripts of the digital voice recorded interviews had been formatted, prior to upload, so that topics, guide questions and narrative were formatted using different styles of header types. 'Auto-coding' was the pre-ordering of data prior to manual interpretation and coding.

Auto-coding of each group of interviews was initiated by header and paragraph style and then each section saved to a new folder within nodes under 'Clinicians by Topic' or 'Managers by Topic'. At this stage under nodes, within the database, were two node folders 'Clinicians by Topic' and 'Manager by Topic' and case folder 'Qualitative Data Individuals'. Table 3.8 profiles the type of participant by professional grouping, year of primary qualification, designation, which RVT service they were most familiar with and the patient group who were given RVT.

Table 3.8 To illustrate the attributes of the research participants.

#	P or M	Nick-name	Professional Group	Year Qualified	Designation	Service	Paient Group
1	p	KM	AHP	2002	Dietition	TF3	Weight
2	p	JM	AHP	2000	Physiotherapist - COPD	TF3	COPD
3	p	RD	Pharmacist	1983	Pharmacist	u-tell	Diabetes
4	p	DW	Dr	2000	Consultant Physician - Medicine Elderly	TF3	Stroke
5	p	RH	Dr	1987	Consultant Physician	TF3/ u-Tell	Diabetes
6	m	SM	AHP	2011	Physiotherapist	TF3	COPD
7	p	BH	Nurse	1986	Respiratory Specialist Nurse	TF3	COPD
8	p	JL	Nurse	1982	Anti-Coagulant Nurse	u-tell	INR
9	p	KH	Nurse	1981	DVT nurse/Staff Nurse	u-tell	INR
10	p	KO	Nurse	1998	Respiratory Nurse	TF3	COPD
11	p	MC	Nurse	1980	Diabetes Specialist Nurse	TF3	Diabetes
12	p	MM	Nurse	1981	Stroke Co-Ordinator Elderly Services	TF3	Stroke
13	p	NB	Nurse	1988	Specialist Nurse Virtual Ward	TF3	Diabetes
14	p	PC	Nurse	1988	Diabetes Specialist Nurse	TF3	Diabetes
15	p	RI	Nurse	1984	Anti-Coagulant Nurse	u-tell	INR
16	p	TH	Nurse	1991	Specialist Nurse Virtual Ward	TF3	All
17	m	ER	Hotel Management	1983	Programme Director	TF3	All
18	m	PH	Business Law & Tax	1986	Programme Manager	TF3	All
19	m	SD	Business Studies	1982	Director of eHealth	ehealth strategy	All
20	m	SH	Business & IT	1989	Programme Manager	TF3	All
21	m	JF	A'Levels into Civil Service	1976	Assistant Director DoH	TF3/ u-Tell	All
22	m	PM	Dietitian	1986	Dietetics Service Manager	TF3	All
23	m	NP	Nursing	1987	Director of Nursing	TF3/ u-Tell	All
24	m	PCN	Nursing	1997	R&D Manager	u-tell	All
Key P= Practitioner and M= Manager							

Following the creation of high-level auto-coding, further quality assurance was undertaken within each of the 'Manager by Topic' and 'Clinician by Topic' nodes so duplication caused by word document variation in formatting was eliminated through the merging of nodes. The auto-coding enabled the collecting of qualitative narrative around the topics for discussion as set out, to guide discussion, originally within the semi-structured interviews. It creates a framework for detailed analysis within a methodical and well organised format. However, data within the RVT (NVivo) databases that revolved around service user comments did not readily lend itself to auto-coding but then the low volume of qualitative narrative volumes was manageable for a pen-and-paper or word processor-based analysis. The free text submitted by patient and carer participants was narrative in response to open questions within a questionnaire for example 'Is there anything else you would like to tell us?' was not analysed using a database.

3.17.1.4 Step 4

Step 4 is a process of analysis and was explained through the coding and analytical strategy. The methodology described within this section has been interpreted from both approaches to Meehan (2016) and Krippendorff (2004).

Whilst the initial structure of the database was formulated based upon the structure and content of the guiding questions within the interview framework there was no auto-coding that could be applied to the participants' responses. Their responses were captured as open-ended free text statements and so within the coding of this narrative, meaning and relationships had to be utilised to determine the categories. The approach to the creation of categories was based upon the topic of research enquiry, i.e. to assist with answering the research topic, "Patient Empowerment through the use of Remote Vital Sign Telemonitoring". The (NVivo) software holds the data categories and codes created by the researcher and does not undertake any of the cognitive activities of considering, understanding and interpreting data. NVivo adds rigour and order to the process and at any stage permits an audit of activity and steps undertaken.

3.17.1.4.1 Coding and Analytical Strategy included the Auto-coding Structure:

Auto-coding Structure for the semi-structured interviews created a framework which enabled detailed analysis. The software auto-coding function reordered the semi-structured interview questions, and associated responses, into sections, albeit not following the original question order, Table 3.9).

Table 3.9 To illustrate the NVivo auto-coding process and how subject question order had been re-expressed by the programme.

NVIVO Number	Original Question Number	Interview Question used in auto coding
1	9	Are your thoughts and feelings generally positive, neutral or negative about RTM?...
2	1	Describe your experience with RTM and feel free to illustrate your experiences with reference to anonymous case studies – please remember not to disclose patient or carer details…
3	10	Do you choose to use RTM or are you given a quota by management to use the service?
4	5	Do you tend to use track and trend or triage?
5	11	Do you think RTM is value for money?...
6	2	Have you received training in RTM?
7	3	If so please could you describe it and your views relating to RTM training…
8	12	If we now think just about the HPSS commissioned end-to-end service provided by the supplying consortium TF3 or U-TELL *(Depends on practitioner's experience – will be one or the other*)
9	14	If you think the service could have been delivered more effectively please describe this?
10	19	Is there anything else you would like to tell me about RTM or technology in healthcare in general?....
11	4	Please tell me about how you use RTM
12	8	Please tell me what you have found works best for your patients and in what circumstances
13	16	What are our lessons learned from your perspective?
14	17	What are the barriers to RTM from your perspective?...
15	13	What are your thoughts on this service?
16	15	What do you believe are or would be the key factors to make deployment of this type of service most effective?
17	18	What is the future for RTM from your perspective?...
18	7	Which peripheral devices do you tend to choose and why?
19	6	Why do you make this choice?

3.17.1.5 Step 5

Following the refinement and deduplication of the auto-coded data a process of manual interpretive coding of data was adopted; the auto-coding had essentially sorted the data by semi-structured interview question and had grouped all responses to the discussion topic under a node. Auto-coding

made available compiled sources highlighting the relevant paragraph or section by nickname of respondent. This initial sift of data, through auto-coding, enabled a high-level review but a significant issue with the participant's response data was that, whilst themes were emerging, they were not consistently emerging within a single auto-coded node which detracted from interpretation and determination of meaning. Therefore, overlaying the folder within nodes under 'Clinicians by Topic' or 'Managers by Topic' with a new refined structure was devised. In creating refined topic nodes, at point of data saturation, after the detailed review of four manager/ commissioner participants and so whilst no new nodes were created for the remaining data coding greater detail and sub-nodes were articulated. Similarly, for the practitioners, topic or node saturation was achieved after five practitioner participants.

Following the creation of a new range of nodes or topics within the responses, a new structure for the nodes within each folder was created. In order to compare the views of the two main groups of participants the high-level nodes were duplicated across the two 'Clinicians by Topic' or 'Managers by Topic' folders. There was variance in the child node topics and a divergence of opinion began to emerge. The articulation of findings did not occur in Step 5.

With the manual coding of data, it was determined that there would be eleven main nodes within each folder and the child nodes from the initial manual coding of data was sorted again into the new nodes. Whilst these were decided upon through initial data analysis, the nodes themselves, at this step, were not findings rather a structure to enable data sorting, coding and analysis. However, it must be noted that in any further analysis the M or P 'z Original auto-coding' was not undertaken as it would be a duplication of data. In effect, this became a storage node of all the original data, as originally auto coded by the (NVivo) programme, and to be kept as both a step in the data base audit trail and for future reference should a query arise.

There were ten additional manual nodes created each with a unique name, definition, nickname and colour; with ‘M’ representing a manager/ commissioner node whereas ‘P’ representing a clinical practitioner. These were not findings, rather a structure to enable detailed analysis. The second letter was to give a reasoned structure to the list of nodes as the software displays nodes in alphabetical order and the last part of the title was to explain overarching node or topic content.

The details of the eleven-node structure, including node title, definition, and ‘nickname’ was documented as follows:

- MP a Experience as a manager or commissioner practitioner.
    - Background of or experience with RVT from the perspective of being a manager or commissioner practitioner. Comments may be about experience, qualification or advice gained from observation that does not fit within another Superior Hierarchical Node.
    - MP a Experience (no text highlight colour or coding stripe)
- MP b Feelings towards RVT
    - Where the participant expressed their feelings towards any aspect of RVT.
    - MP b Feelings (red text highlight colour or coding stripe)
- MP c Opinion expressed RTNI
    - Opinion expressed by manager or commissioner practitioner about the Regionally Procured Service and the comments could include reflections regarding any area from commissioning process to RTNI; from process of service design and procurement to end service.
    - MP c Opinion RTNI (blue text highlight colour or coding stripe)
- MP d Opinion of models of RVT
    - Opinion expressed by manager or commissioner practitioner about the models of RVT, that is the two main types of provision triage or track and trend. Both TF3 and U-Tell include track and trend.
    - MP d Opinion RVT (green text highlight colour or coding stripe).

- MP e Training
    - This describes the RVT training received, any deficits or recommendations.
    - MP e Train (purple text highlight colour or coding stripe)
- MP f Staff Engagement target
    - This considers staff engagement from the perspectives of clinical freedom versus performance targets and mandates
    - MP f Staff Eng (no text highlight colour or coding stripe)
- MP g Value for Money
    - This considers aspects of value for money and the perceptions and knowledge expressed by manager or commissioner practitioner
    - MP g VfM (orange text highlight colour or coding stripe)
- MP h Outcome and Benefit
    - This considers the aspect of outcome or benefits of the service expressed by manager or commissioner practitioner, whether actual, demonstrable, hypothetical or imagined.
    - MP h Outcome (yellow text highlight colour or coding stripe)
- MP i Clinical Service Issues
    - This considers any Clinical service issues beyond those documented within the node MP c Opinion expressed RTNI. It is more focused upon views, or perceived views (if made by a manager) of practitioners, service users, the change of practice and research evidence.
    - MP i Clinical (pink text highlight colour or coding stripe)
- MP j Future of RVT the next generation
    - Considers all aspects for the future of RVT, looks forward to the future or articulates what next for RVT in Northern Ireland, including policy, equipment, models and engagement regardless of a pessimistic or optimistic stance taken by participant.
    - MP j Future (no text highlight colour or coding stripe)
- MP z Original auto-coding (These initial data sorting nodes are to be ignored and not analysed to avoid duplication)

- Contains all the original (NVivo) Nodes that were generated through the auto-coding of discussion guide questions. The N=16 for practitioners and N=8 for managers/ commissioners
- MP z Auto (no text highlight colour or coding stripe)

The Figures 3.6 to 3.13 illustrate the screen shots of the node topics being rebuilt within (NVivo) to their final structure. Screen to demonstrate the formulation of new nodes.

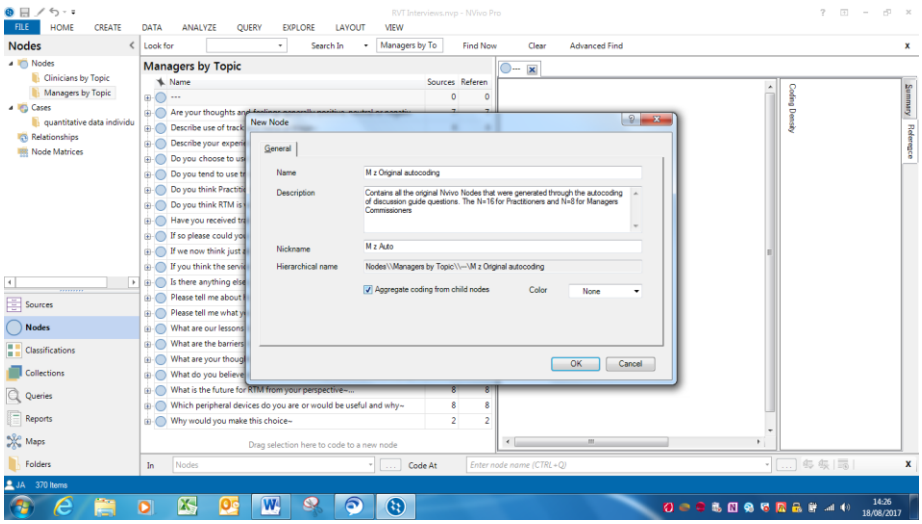


Figure 3.6: Illustration of practical formulation of new nodes in 5 manager screen shots of nodes

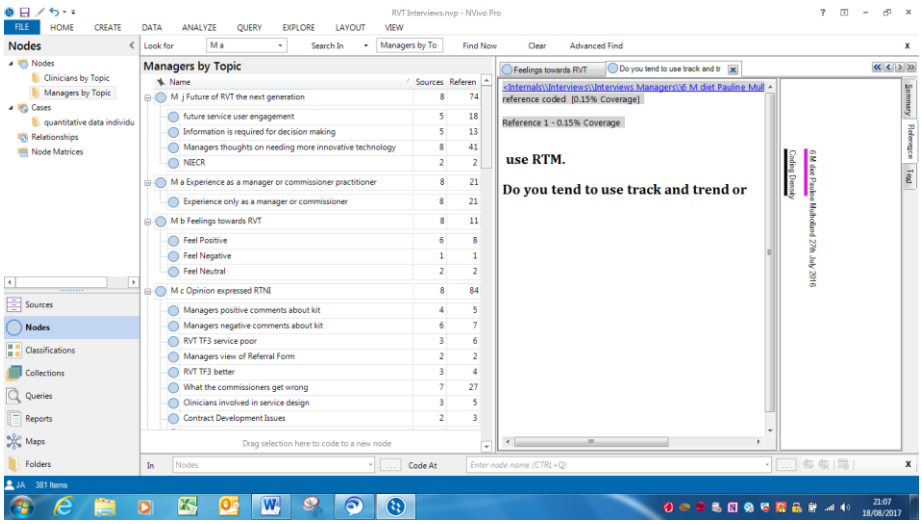


Figure 3.7: Manager node topics j, a, b and c

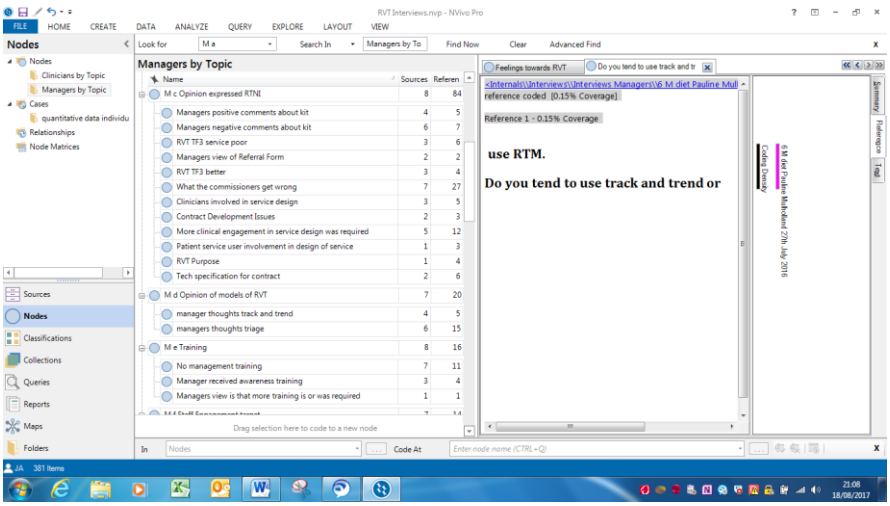


Figure 3.8: Manager node topics c, d and e

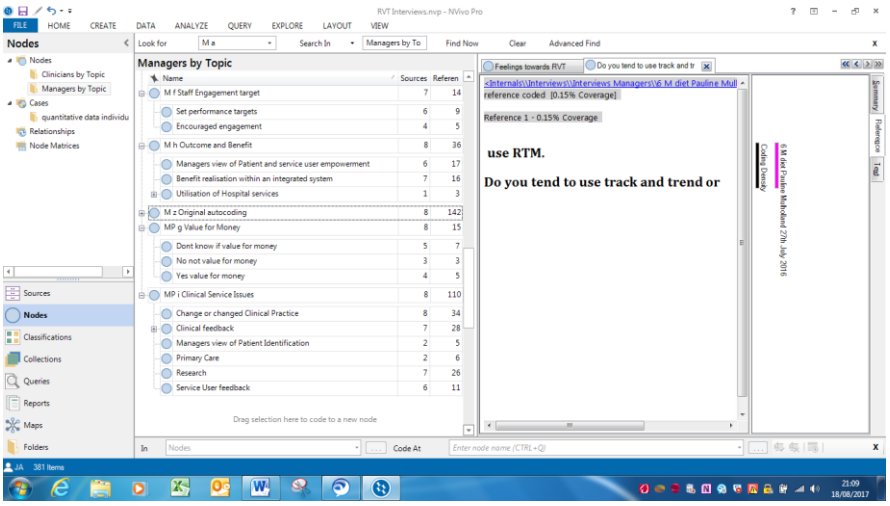


Figure 3.9: Manager node topics f, h, z, g and i

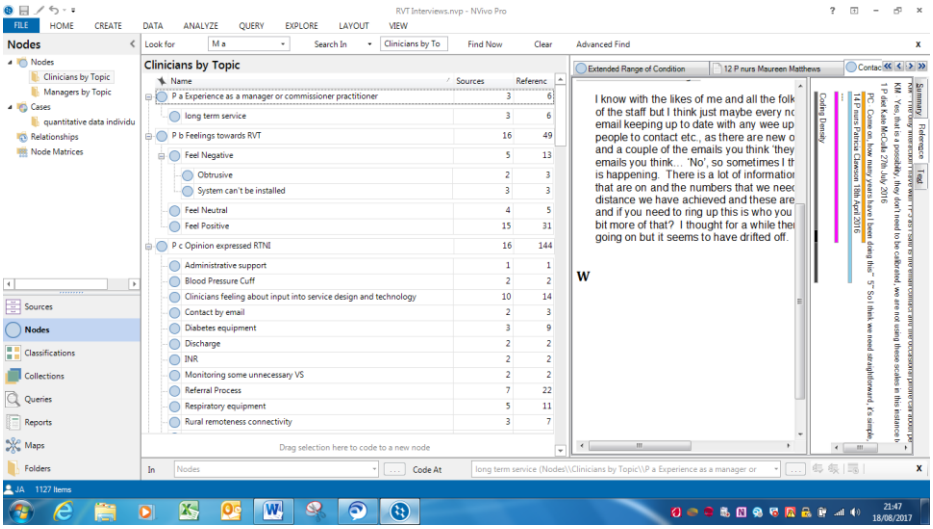


Figure 3.10: Practitioner screenshot of nodes topics a, b and c

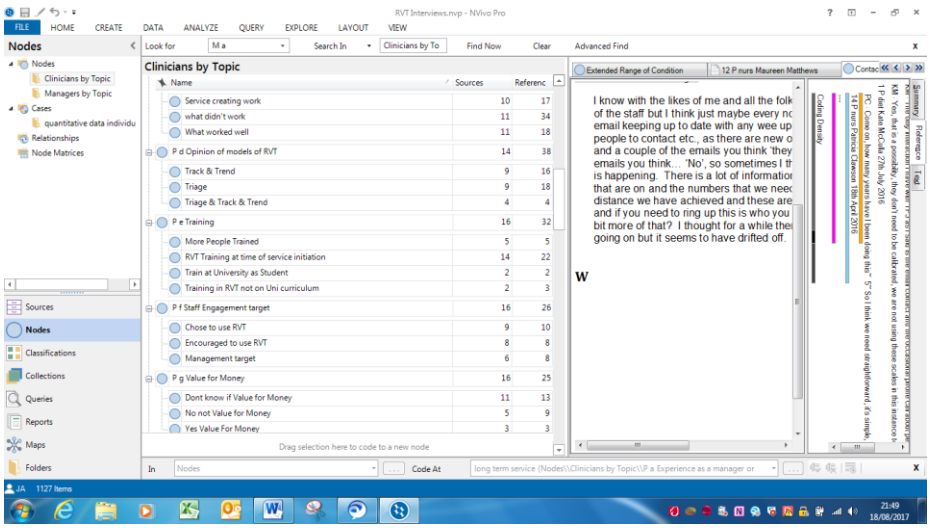


Figure 3.11: Practitioner node topics of d, e, f and g

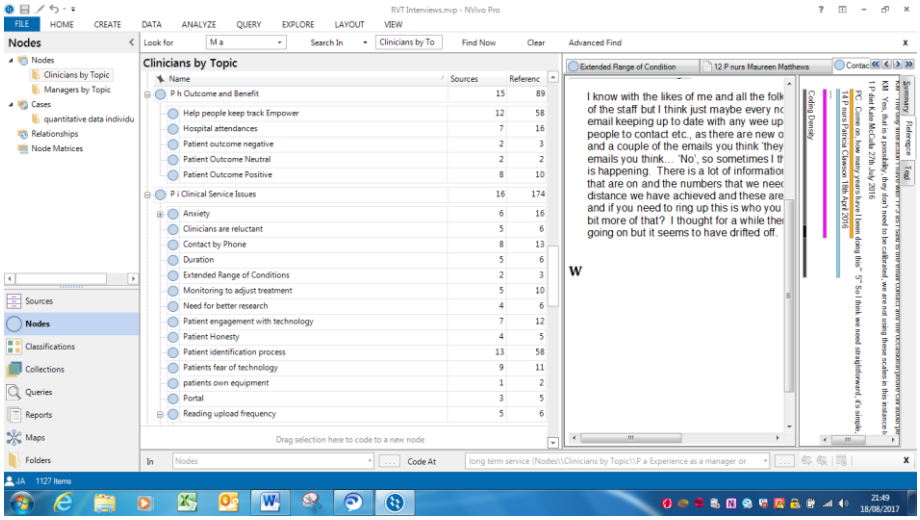


Figure 3.12: Practitioner node topics h and i

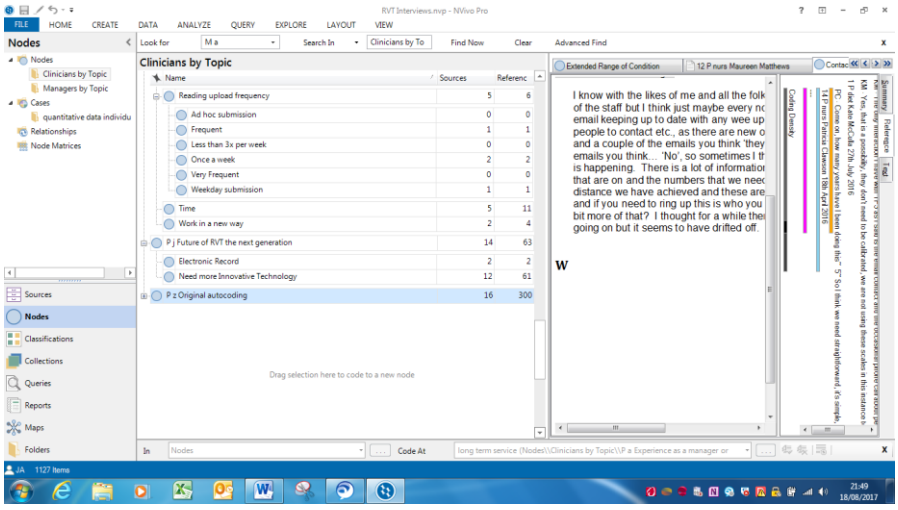


Figure 3.13: Practitioner node topics j and z

3.17.1.6 Step 6

Step 6 is where the researcher documented high level findings. In Step 5 the nodes were described in order for both the practitioner participants and the manager participants to enable both a high-level review and a comparison between two groups. The Step 5 node topic areas were alphabetically recorded so that the thoughts and comments across the two participant groups could be compared and contrasted, thus creating Step 6. The information was transferred into a spreadsheet with clear illustration of expanded high-level subjects further dividing nodes/ topics into sub nodes and sub-sub nodes (parent, grandchild and great grandchild nodes). Although still high level the node/ topics were captured indicating the number of sources where a node/ topic was referred to (with a maximum number of sources for practitioner participants as N=16 and for manager participants N=8). Then the final column demonstrated the frequency a participant made reference to the particular topic and gave a notional indication of the power or strength of feeling towards a particular node/ topic area. In the first column the letter M denoted manager and P the practitioner. The topics were sorted into alphabetical order whereas they are not necessarily displayed in order to illustrate the process steps and activities undertaken in step 6. (Tables 3.10 and 3.11 illustrate the summaries).

Table 3.10 To illustrate manager participants sample summary reports which were produced

Nvivo Step 6 Researcher Summary - Manager & Commissioner

Practitioner or Manager	Topic	Description	Sub Description	Sub Sub Description	Sources (Participants)	References (Frequency)
M	**a**	**Experience as a manager commissioner or Practitioner**			**8**	**21**
M	a		Experience only as a manager or commissioner		8	21
M	**b**	**Feelings towards RVT**			**8**	**11**
M	b		Feel negative		1	1
M	b		Feel neutral		2	2
M	b		Feel Positive		6	8
M	**c**	**Opinion expressed RTNI**			**8**	**84**
M	c		Managers positive comments about kit		4	5
M	c		Managers negative comments about kit		6	7
M	c		RVT TF3 service poor		3	6
M	c		Managers view of Referral Form		2	2
M	c		RVT TF3 better		3	4
M	c		What the commissioners get wrong		7	27
M	c		Clinicians involved in service design		3	5
M	c		Contract Development Issues		2	3
M	c		More clinical engagement in service design was required		5	12
M	c		Patient service user involvement in design of service		1	3
M	c		RVT purpose		1	4
M	c		Tech specification for contract		2	6
M	**d**	**opinion of models of RVT**			**7**	**20**
M	d		Manager thoughts of Track & Trend		4	5
M	d		Managers thoughts triage		6	15
M	**e**	**Training**			**8**	**16**
M	e		No management training		7	11
M	e		Managers received awareness training		3	4
M	e		Managers view is that more training is or was required		1	1
M	**f**	**Staff Engagement Target**			**7**	**14**
M	f		set performance targets		6	9
M	f		encourage engagement		4	5
M	**g**	**Value for money**			**8**	**15**
M	g		Don't know if Value for Money		5	7
M	g		not value for money		3	3
M	g		Yes value for money		4	5
M	**h**	**Outcome and Benefit**			**8**	**36**
M	h		Managers view of Patient and service user empowerment		6	17
M	h		Benefit realisation within an integrated system		7	16
M	h		Utilisation Hospital Services		1	3
M	h			RVT appropriate effect	0	0
M	h			RVT no effect	0	0
M	h			RVT reduced effect	0	0
M	**i**	**Clinical Issues**			**8**	**110**
M	i		Change or changed Clinical Practice		8	34
M	i		Clinical feedback		7	28
M	i			Clinical staff resistent to R	5	16
M	i		Managers view of Patient Identification		2	5
M	i		Primary Care		2	6
M	i		Research		7	26
M	i		Service User feedback		6	11
M	**j**	**Future of RVT the next generation**			**8**	**74**
M	j		Future service user engagement		5	18
M	j		Information is required for decision making		5	13
M	j		Managers thoughts on needing more innovative technolo		8	41
M	j		NIECR		2	2
M	**z**	***Original autocoding to ignore in analysis***			**8**	**142**

Table 3.11 To illustrate practitioner participants sample summary reports which were produced

Nvivo Step 6 Researcher Summary - Practitioner

Practitioner or Manager	Topic	Description	Sub Description	Sub Sub Description	Sources (Participants)	References (Frequency)
P	**a**	**Experience as a manager commissioner or Practitioner**			**3**	**6**
P	a		Long term service		3	6
P	**b**	**Feelings towards RVT**			**16**	**49**
P	b		Feel negative		5	13
P	b			obtrusive	2	3
P	b			System can't be installed	3	3
P	b		Feel neutral		4	5
P	b		Feel Positive		15	31
P	**c**	**Opinion expressed RTNI**			**16**	**144**
P	c		Administrative support		1	1
P	c		Blood Pressure Cuff		2	2
P	c		Clinicians feeling about input into service design and tech		10	14
P	c		Contact by email		2	3
P	c		Diabetes equipment		3	9
P	c		Discharge		2	2
P	c		INR		2	2
P	c		Monitoring some unnecessary VS		2	2
P	c		Referral Process		7	22
P	c		Respiratory Equipment		5	11
P	c		Rural remoteness connectivity		3	7
P	c		Service creating work		10	17
P	c		What didn't work		11	34
P	c		What worked well		11	18
P	**d**	**opinion of models of RVT**			**14**	**38**
P	d		Track & Trend		9	16
P	d		Triage		9	18
P	d		Triage & Track & Trend		4	4
P	**e**	**Training**			**16**	**32**
P	e		More People Trained		5	5
P	e		RVT Training at time of service initiation		14	22
P	e		Train at University as Student		2	2
P	e		Training in RVT not on Uni curriculum		2	3
P	**f**	**Staff Engagement Target**			**16**	**26**
P	f		chose to use RVT		9	10
P	f		Encouraged to use RVT		8	8
P	f		Management target		6	8
P	**g**	**Value for money**			**16**	**25**
P	g		Don't know if Value for Money		11	13
P	g		No not Value for Money		5	9
P	g		Yes Value for Money		3	3
P	**h**	**Outcome and Benefit**			**15**	**89**
P	h		Help people keep track Empower		12	58
P	h		Hospital attendances		7	16
P	h		Patient outcome negative		2	3
P	h		Patient outcome neutral		2	2
P	h		Patient outcome positive		8	10
P	**i**	**Clinical Issues**			**16**	**174**
P	i		Anxiety		6	16
P	i			Increase Anxiety	4	7
P	i			Decrease Anxiety	3	5
P	i		Clinicians are Reluctant		5	6
P	i		Contact by Phone		8	13
P	i		Duration		5	6
P	i		Extended Range of Conditions		2	3
P	i		Monitoring to adjust treatment		5	10
P	i		Need for better research		4	6
P	i		Patient engagement with technology		7	12
P	i		Patient Honesty		4	5
P	i		Patient identification process		13	58
P	i		Patient fear of technology		9	11
P	i		Patients own equipment		1	2
P	i		Portal		3	5
P	i		Reading upload Frequency		5	6
P	i			Ad hoc submission	0	0
P	i			Frequent	1	1
P	i			Less than 3x per week	0	0
P	i			Once a week	2	2
P	i			Very Frequent	0	0
P	i			Weekday submission	1	1
P	i		Time		5	11
P	i		Work in a new way		2	4
P	**j**	**Future of RVT the next generation**			**14**	**63**
P	j		Electronic record		2	2
P	j		Need more Innovative Technology		12	61
P	**z**	***Original autocoding to ignore in analysis***			**16**	**300**

3.17.1.7 Step 7

Validation of the interpretation and findings with a group of clinician/ practitioner participants. The practitioner participants were offered the opportunity to validate the findings but equally the participants were under no obligation to undertake this activity and were free to withdraw from the study at any stage. There were N=16 practitioner participants who had been consented into the research, had taken part in the one-to-one interviews and so were eligible to participate in validation. The original plan had been to use the Bryson Technique of Cognitive Mapping in a workshop environment, but concerns were raised vis-à-vis the length of time required to undertake the activity and the activity demanded a single question be considered by a large group (Bryson et al., 1995). The researcher decided that an activity which relied upon a single question was not appropriate as there were at least eight descriptive topics/ nodes and associate sub and sub-sub nodes for the practitioners to consider and validate. Moreover, as the practitioners all had on-going direct patient care responsibilities and clinical commitments to undertake, a protracted event was unduly onerous and not appropriate.

Therefore, printed high-level descriptive findings in summary form were given to the practitioner participants in a validation meeting that was scheduled to last a maximum of an hour. The date and venue for the validation meeting was set two months prior to the event to enable scheduling of practitioner's time given the frequent practice of rebooking patients into appointments 6-weeks ahead. The meeting was arranged for the convenience of most practitioners with the proximity to the main hospital campus. The practitioner participants were sent an email inviting them to participate, enclosing a further copy of the Participant's Information Sheet (PIS); simultaneously a Microsoft Office Outlook appointment invitation was issued. A month later, a letter was posted to the practitioner participants who had not responded to the initial invitation to stimulate a response. Then finally, five days before the meeting an electronic meeting reminder was issued to those practitioners who had responded with either 'yes' or 'tentative' N=7. Packs were then prepared for the participants including the agenda, original PIS, original consent form, the

Interview Guide from their original one-to-one interview, and one single-sided and compiled copy of each of the two Microsoft Excel NVivo Summary Tables to describe the responses of the participants, both managers and practitioners. The profile of the practitioner participants, refer to Table 3.12.

Table 3.12 To illustrate practitioner participants' attendance 26 January 2018 validation meeting.

		Professional Group	Year Qualified	Designation	Service	Patient Group	Validation meeting 26:01:18
1	p	AHP	2002	Dietition	TF3	Weight	yes
2	p	AHP	2000	Physiotherapist - COPD	TF3	COPD	yes
3	p	Pharmacist	1983	Pharmacist	u-tell	Diabetes	yes
4	p	Dr	2000	Consultant Physician - Medicine Elderly	TF3	Stroke	tentative
5	p	Dr	1987	Consultant Physician	TF3/ u-Tell	Diabetes	tentative
6	m	AHP	2011	Physiotherapist	TF3	COPD	no clinic duties
7	p	Nurse	1986	Respiratory Specialist Nurse	TF3	COPD	no unavailable
8	p	Nurse	1982	Anti-Coagulant Nurse	u-tell	INR	no
9	p	Nurse	1981	DVT nurse/Staff Nurse	u-tell	INR	no annual leave
10	p	Nurse	1998	Respiratory Nurse	TF3	COPD	yes
11	p	Nurse	1980	Diabetes Specialist Nurse	TF3	Diabetes	(no reply)
12	p	Nurse	1981	Stroke Co-Ordinator Elderly Services	TF3	Stroke	no retired
13	p	Nurse	1988	Specialist Nurse Virtual Ward	TF3	Diabetes	no training
14	p	Nurse	1988	Diabetes Specialist Nurse	TF3	Diabetes	no annual leave
15	p	Nurse	1984	Anti-Coagulant Nurse	u-tell	INR	(no reply)
16	p	Nurse	1991	Specialist Nurse Virtual Ward	TF3	All	yes - changed to no due to training
							KEY = YELLOW MEANS PARTICIPATED
							Also Present Professor Kernohan
17	m	Hotel Management	1983	Programme Director	TF3	All	
18	m	Business Law & Tax	1986	Programme Manager	TF3	All	
19	m	Business Studies	1982	Director of eHealth	ehealth strategy	All	
20	m	Business & IT	1989	Programme Manager	TF3	All	
21	m	A'Levels into Civil Service	1976	Assistant Director DoH	TF3/ u-Tell	All	
22	m	Dietitian	1986	Dietetics Service Manager	TF3	All	
23	m	Nursing	1987	Director of Nursing	TF3/ u-Tell	All	
24	m	Nursing	1997	R&D Manager	u-tell	All	

Upon arrival the practitioners, (N=4) were offered refreshments, signed an attendance form and given a pack. After introductions the researcher reminded the Participants of the purpose of the study, data collection activity, definitions of acronyms used and requested consent for digital voice recording. Four Participants gave verbal consent in support of their original written consent permitting the activity to be recorded by audio digital means. The Participants understood that the researcher and supervisor would record brief notes as the meeting progressed and that the meeting would be digitally recorded but not transcribed. The recording was to assist the researcher to review discussion in Step 8, as required.

The Steps of data analysis using NVivo were explained as was the format of the data presented in the Microsoft Excel NVivo Summary Tables. The information header columns and first two topics, 'a' manager or practitioner

and ‘b’ Feelings towards RVT were explained by way of a working example and all practitioner participants confirmed understanding and meaning of headers and information given and equally how the information had been derived from the original interviews. The practitioner participants confirmed understanding of the Header ‘Sources (Participants)’ to mean that the topic was mentioned by N=’x’ practitioners throughout the entire one-to-one interview process. Also, the practitioner participants confirmed understanding of the Header ‘References (Frequency)’ to mean that the topic was mentioned by N=’y’ number of times throughout the entire one-to-one interview process regardless of under which original guide question a response was given to (understanding the ‘Quantitization’ of qualitative data). It was assumed that the higher the frequency of referral to a topic the greater power or weight of importance the topic held for the participant respondents.

Having affirmed understanding of the format and contact of information presented, the group of practitioner participants were then taken through each of the eight topics labelled as topics ‘c’ to ‘j’. The role of the practitioner participants was to discuss, challenge or affirm and validate the high-level findings. One typographical error was found and subsequently corrected and following a robust discussion N=4 practitioners explained and confirmed agreement with the findings and verified the outcome of the data collection, compilation and then Step 1 through to Step 6 of data management using NVivo. With final validation in place the researcher was permitted to proceed to the Step 8.

3.17.1.8 Step 8

Finalise the report of findings of qualitative data.

The final step is to report the findings of the qualitative data and in order to achieve this objective; query tools were applied to generate reports. During the process of creating the database and the subsequent activity of coding the text there was the construction of abbreviated definitions for each node and sub-node etc. as described in Step 5. At the analysis stage, Step 8, the formal generation of the definitions book, an important action to ensure the

description of narrative was anchored to the nodal framework. Figure 3.14 illustrates a screen shot of the first page of the node code book. The Code book for the practitioner participant and manager participant RVT interviews were produced separately. Whilst, the highest-level codes broadly read between both sets of interviews there were subtle sub-node and sub-sub-node attributes by dint of the fact the groups viewed and spoke about RVT from very different perspectives, so emphasis and issues varied.

Then each of the Coding reports was generated. The coding report for the manager interviews was 97 pages long and for the practitioners were 122. Each of the coding reports grouped, in alphabetical order, the nodal topics and each sorted narrative coded to each node. The participant's code, name and date were included to the left of each statement which enabled attribution and an understanding of the context for the perspective offered by the participant. Figures 3.15 and 3.16 illustrate example text and formatting to demonstrate the structure and presentation the software, (NVivo), is capable of presenting (respondent's names are obscured). This then in turn enabled analysis within a structured framework of the outputs of the interviews, i.e. the qualitative data. It can be seen that the names of participants have been masked in Figures 3.15 and 3.16 in order to maintain anonymity.

RVT Interviews

Nodes\\Clinicians by Topic

Name	Description	Files	References
Pa Experience as a manager or commissioner practitioner	Background of or experience with RVT from the perspective of being a manager or commissioner practitioner. Comments may be about experience, qualification or advice gained from observation that does not fit within other Superior Hierarchical Node	3	6
long term service	Before the current RVT service there was a previous pilot service and patients from 2007/08 are still in receipt of RVT	3	6
P b Feelings towards RVT	Where the participant expressed their feelings towards any aspect of RVT	16	49
Feel Negative	Where a participant feels positive about their experience of using RVT	5	13
Obtrusive	Staff are concerned about obtrusive nature of RVT	2	3
System can't be installed	Patients cant access the system due to lack of phone lines or internet	3	3
Feel Neutral	Where a participant feels neither positive nor negative about their experience of using RVT	4	5
Feel Positive	Where a participant feels positive about their experience of using RVT	15	31
Pc Opinion expressed RTNI	Opinion expressed by manager or commissioner practitioner about the Regionally Procured Service and the comments could include reflections regarding any area from commissioning process to RTNI; from process of service design and procurement to end service	16	144

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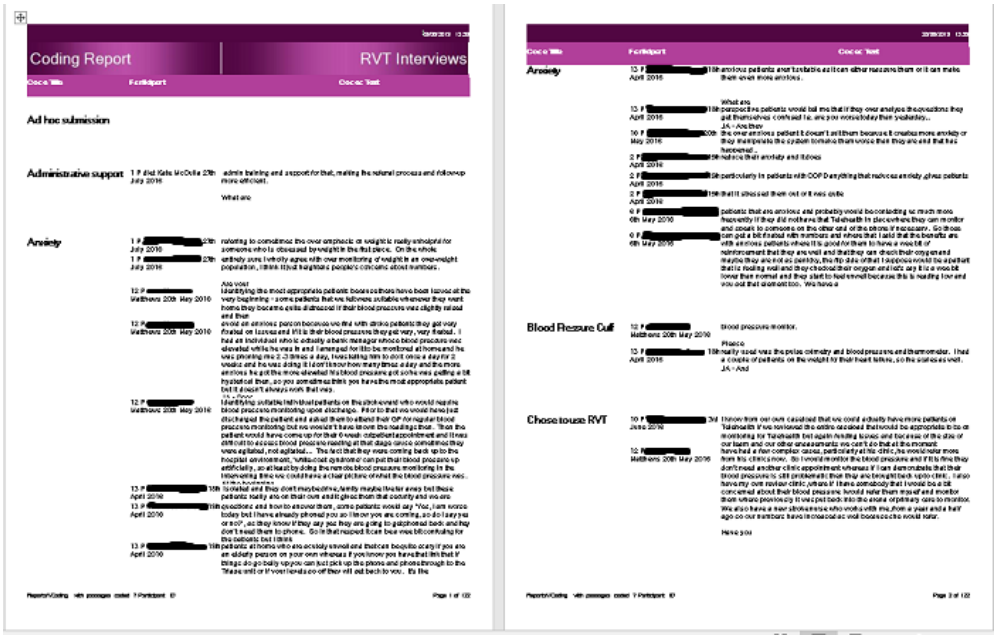
Figure 3.14: Screenshot of the first page of the node book to illustrate an output for the researcher to refer to the node definition book created during the manual coding process



Coding Report RVT Interviews

Ad hoc submission

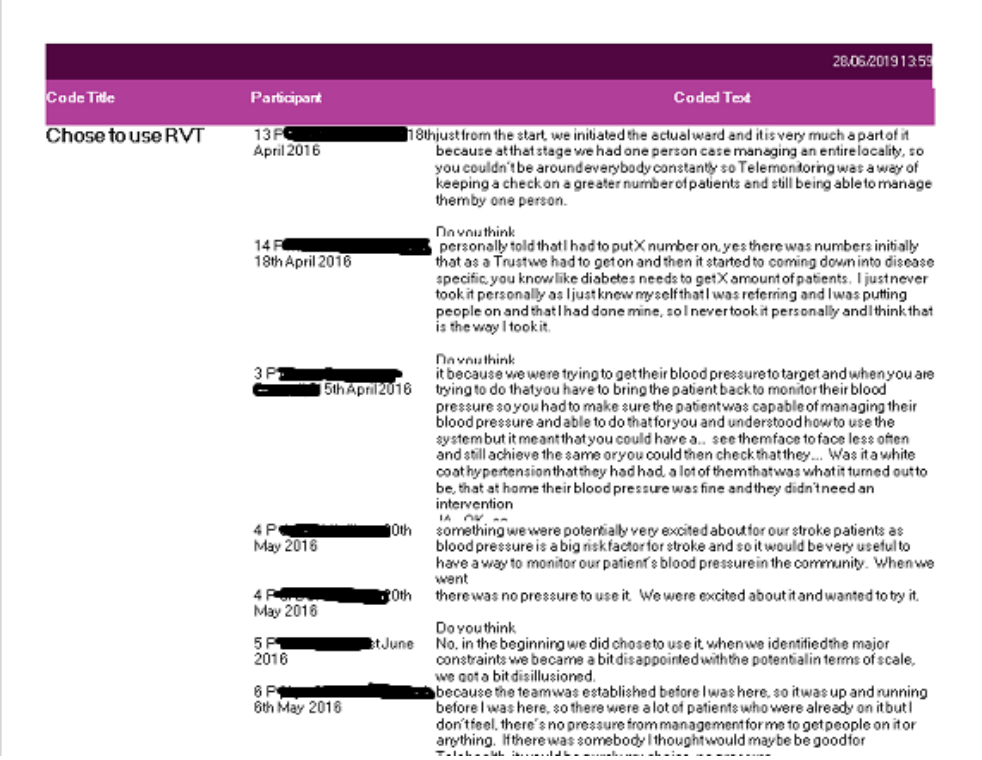
Administrative support

Anxiety

Blood Pressure Cuff

Chose to use RVT

Figure 3.15: Screenshot of coding report pages 1 and 2 with practitioner participant's names obscured



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Code Title	Participant	Coded Text
Chose to use RVT	13 P [redacted] 18th April 2016	just from the start, we initiated the actual ward and it is very much a part of it because at that stage we had one person case managing an entire locality, so you couldn't be around everybody constantly so Telemonitoring was a way of keeping a check on a greater number of patients and still being able to manage them by one person.
	14 P [redacted] 18th April 2016	Do you think personally told that I had to put X number on, yes there was numbers initially that as a Trust we had to get on and then it started to coming down into disease specific, you know like diabetes needs to get X amount of patients. I just never took it personally as I just knew myself that I was referring and I was putting people on and that I had done mine, so I never took it personally and I think that is the way I took it.
	3 P [redacted] 5th April 2016	Do you think it because we were trying to get their blood pressure to target and when you are trying to do that you have to bring the patient back to monitor their blood pressure so you had to make sure the patient was capable of managing their blood pressure and able to do that for you and understood how to use the system but it meant that you could have a... see them face to face less often and still achieve the same or you could then check that they.... Was it a white coat hypertension that they had had, a lot of them that was what it turned out to be, that at home their blood pressure was fine and they didn't need an intervention
	4 P [redacted] 10th May 2016	something we were potentially very excited about for our stroke patients as blood pressure is a big risk factor for stroke and so it would be very useful to have a way to monitor our patient's blood pressure in the community. When we went
	4 P [redacted] 10th May 2016	there was no pressure to use it. We were excited about it and wanted to try it.
	5 P [redacted] t June 2016	Do you think No, in the beginning we did chose to use it, when we identified the major constraints we became a bit disappointed with the potential in terms of scale, we got a bit disillusioned.
	6 P [redacted] 6th May 2016	because the team was established before I was here, so it was up and running before I was here, so there were a lot of patients who were already on it but I don't feel, there's no pressure from management for me to get people on it or anything. If there was somebody I thought would maybe be good for

Figure 3.16: Screenshot of a page of coding report at greater magnification with practitioner participant's names obscured

In writing the report, when the verbatim words of respondents were quoted, the names of the respondents were not disclosed. The individual coded narrative quoted was expressed inside speech marks and a pseudonymised alpha-numeric reference is used so that, if required, attribution can be checked. The number represents the date order the participant interview occurred and the letter either 'P' for practitioner participant or 'M' for manager participant. Following the production of the node code books and the coding report, analysis was undertaken with interpretation and meaning being documented and later discussed. The 8 Steps, and tool of (NVivo) as an approach, enabled rigorous analysis of larger volumes of text; there were 93,051 typed words following the 24 face-to-face interviews and so (NVivo) enabled a structure to handle large volumes of data and facilitate the researcher to give meaning through analysis. The number of participants within the qualitative data collection was within the normal range of between 1 and 30 (Bengtsson, 2016).

3.18 Approach to qualitative analysis – for NVivo

Hsieh and Shannon (2005) identify three approaches to the qualitative analysis of content within narrative, conventional, direct and summative with the first approach being adopted in this study. The tool used provided the framework and backdrop for the researcher's analysis of narrative. The software displayed the narrative and recorded the data coded by the researcher, but the approach taken to analysis was the,

> "subjective interpretation of the context of text data through the systematic classification process of coding and identifying themes and patterns". (Hsieh and Shannon, 2005)

Indeed, conventional content analysis was selected as there was little existing theory or literature available for RVT regarding experience of clinical users. NVivo facilitated the researcher to build a framework of themes, categories, attributes and nodes; building knowledge and context directly from the expressed experiences of the participants. The framework afforded the creation of a sustainable and robust structure to enable realistic content analysis.

3.18.1 Utilising numerical counts when analysing text

> "Numeric counts of instances of a theme within unstructured text are sometimes used as a proxy indicator of the importance of that theme for qualitative analysis" (Bazeley, 2010).

Albeit, it can be argued that a relationship between importance and frequency may be tenuous and that meaning derived from content and context has to be understood. Therefore, care was taken when counting was applied to the narrative data as indeed the researcher's coding may introduce influence on the number of comments, phrases, references, codes and nodes to be included in a tally. The counts were used as a basic proxy for relative importance and were utilised with caution. However, the table and matrix of relationship between theme, node, sub-

nodes and corresponded with associated tallies, was a very useful proxy indicator of emphasis, broadness of viewpoint experienced and to give structure to narrative analysis. These models enabled connections and relationships to be articulated experience and form a key element of analysis (Gibbs, 2002, p218). Indeed, in this study the linking of qualitative data, attributes, ideas and nodes was undertaken through the 'code it' approach, whereby,

> "save concept to data links require fathering of all material about a topic… reflect on it or explore in relation with other topics. Use visual coding for rapid identification of topic, service etc. or to introduce another 'layer' of interpretation that crosscuts coding at nodes" (Richards, 1999, p190).

3.19 Rigour

3.19.1 Trustworthiness

Rigor was applied to both the research methodology, the data collection instrument design and to the execution of the research to ensure trustworthiness. There were four tenant characteristics within the domain of trustworthiness that were incorporated: -

i) Credibility. The credibility of the research was founded upon validity and replicability of the research methodology; in ensuring the process was followed. The measures applied within both qualitative and quantitative paradigms of the research were stable and enabled consistent data to be collected. The mixed methods approach balanced the flexible and fixed data collection instruments and enabled the findings from both paradigms to be assimilated through triangulation. This ensured findings which related to the lived experience of RVT from multiple perspectives.

ii) Transferability. The methodological approach ensured that the findings of the RVT research were generalizable across the deployment of the technology within the health and social care environment to enable a patient centred approach not, simply rigid within the RVT system, structure and environment within SET. Transferability is the ability to transfer findings to another environment. The research methodology should be replicable, with

the findings being more broadly relevant rather than simply within the study's situation.

iii) Dependability. This was achieved by developing a systematic approach to the analysis of the data and interpretation of the findings and is achieved by ensuring an explicit audit trail.

iv) Confirmability. The confirmation of findings was built into the research methodology by observing, exploring and explaining the findings from four different perspectives (patient, carer, practitioner and manager) and within two paradigms (quantitative and qualitative analysis). It was based upon how the findings were checked before the triangulation of data. Within the qualitative analysis, the approach of quantitization of data and subsequent triangulation of all data, meant findings could be corroborated from different perspective. This allowed the research question of to be answered from all data sources and confirm that all the data was 'saying the same thing'. (Robson, 2002)

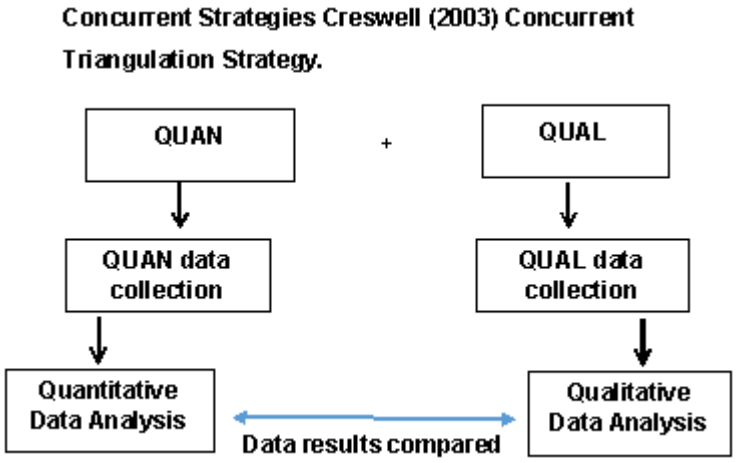
3.20 Methodology: Mixed Methods Data Integration

The mixed methods design is a scientific aspect of drawing findings together which was described by Creswell (2003) "integration means that the researcher "mixes" the data." This may be within a survey where both open and closed questions are utilised or through different methods of data collection and where the "mixing" occurs within the analysis and interpretation stage of the study.

3.20.1 Concurrent Strategies Creswell (2013): Concurrent Triangulation Strategy

When the full quantitative analysis, of data had been undertaken and concomitantly the analysis of the qualitative data completed, it was ready for overall analysis and interpretation. The data, regardless of type, was considered of equal value and was further analysed, blended, compared and considered complementary when reviewing RVT from multiple perspectives. The process, known as triangulation, can be undertaken from different

stances but within the RVT research, the equal weighting, the parallel data collection and handling enabled the approach, articulated by Creswell (2003), of ‘concurrent triangulation’.



“+” “indicates simultaneous or concurrent form of data collection”. Capitalisation indicates emphasis and priority.

Figure 3.17: Illustration of concurrent triangulation strategy

Concurrent triangulation strategy enabled the researcher to utilise data obtained through different methods to “confirm, cross-validate, or collaborate findings within a single study” (Ibid.) and the parallel activity and equality of value is illustrated in Figure 3.17. The approach enabled a balance between the strengths and weaknesses of one approach with those of the other. The approach with interpretation was descriptive where observations, comparison, complementarity or contradiction across data, regardless of source or type, was documented. Convergence of results occurred across multiple sources gave an indication that the new knowledge, whether a likely outcome, benefit or disbenefit of RVT, was strengthened; and it assisted with substantiation or validation of findings. Equally, divergent data needed explanation and was illustrative of the interface of the system between different participants, i.e. from the stance of a patient, or a carer, or a clinical practitioner or a manager.

However, whilst the complementarity was sought, Saks and Allsop (2008) warned that conducting such a study could be difficult and would require skill to distil the results, whilst Creswell (1994) highlighted this could be mitigated by good project management. Although the effort within a healthcare

environment was beneficial as it enabled the triangulation of multiple sources of data to discover 'holistic' knowledge derived from multiple perspectives (Tritter in Saks and Allsop, 2008, pp301-318).

Combining the paradigms was difficult because of required expertise, time and risk of scope creep although it had the potential to balance bias from one paradigm or data source with another. However, the utilisation of software facilitated the transformation of qualitative data, counting codes, themes which allowed the generation of "a narrative that portrays the results comparing "quantitized" qualitative data with the quantitative data" (Creswell and Plano Clark, 2007). New perspectives were found through examining data that converged or offered complementarity and afforded a breadth and depth of results.

Populations that interact with RVT were different in terms of roles and relationships with system accessibility and volume. There were far more patients, fewer managers and practitioners with significantly different roles within the system. Therefore, utilising the same method of data collection would not permit the richness of meaningful data. The opportunity to maximise the number of patient participants was enabled through the use of a questionnaire. Such a survey tool, when applied to the entire service user population, afforded the researcher an opportunity to reach out and engage with the broadest base of service users. It was already known that sampling of the service user base could not be achieved to attain a representative sample across all disease groups, as numbers were small within some disease groups. Therefore, the data collection methodology had to be tailored to the potential participants. A known risk within the application of mixed methods included selection of different individuals to be surveyed through one paradigm or another; unequal samples sizes and the potential bias. Therefore, by recognising the differences in the potential participant groups different modes of engagement and data collection were devised. In effect, through the utilisation of a questionnaire with closed questions, quantitative data could be collected from patient and carer respondents including opportunities for free text enabled data as they felt fit. Therefore, whilst mixed data collection in the form of a questionnaire was given to the patient and

carer group the significant volume of data collected and analysed, in the overall research, would be qualitative. Equally, the two health and social care staff groups to be engaged in the research were the managers and the clinical practitioners. The research paradigm was that of qualitative data collection and analysis, and the data from both groups was kept separate, allowing an initial analysis of the two groups of participants independently.

The data collection from Health and Social Care staff was undertaken using semi-structured one-to-one interviews. The analysis was undertaken utilising software which enabled the generation of reports profiling, combination or comparison of codes by participant. The summary analysis generated a report that "quantized" qualitative data and as appropriate, permitted direct combination or comparison with true qualitative data obtained from the service user/ carer participants. (Creswell and Plano Clarke, 2007).

This study used mixed methods and therefore, mixed the findings to create an interpretation of the RVT service within the context of application within SET.

> "Researchers can merge the two data sets during the interpretation (by analysing them separately in a results section and then merging the two sets of results together during the interpretation or discussion phase)" (Ibid. p83).

However, of note within the qualitative analysis one piece of information, narrative data, was coded only once, whereas, there is a possibility that the quantitative data may be coded multiple times and the distinction in counting of data are made (Bowling, 2002, p389).

The pre-existing knowledge and experience of the researcher was considered to achieve balance. Whilst there was a recognised risk of bias, which was as far as practicable avoided, some knowledge was an advantage. Moreover, the researcher adhered to

> "a qualitative perspective and the main issue is to achieve the rigour and credibility that make the results as trustworthy as possible" (Bengtsson, 2016, p8-14).

All material was analysed with the purpose to organise and elicit meaning from data collected and draw realistic conclusions. As a method, content analysis was unique in that it has both a qualitative and a quantitative methodology and can be used in an inductive or deductive way (Ibid.) so that the blended data can be interpreted and given meaning.

3.21 Justification

In exploring the options that can enhance RVT for people with LTCs, the study aimed to suggest how to deploy new technologies to best effect where technology is integrated into care packages and determine if there was patient benefit. It was anticipated that the by understanding optimisation and/ or benefits of RVT would enable technology integration into “mainstream” health and social services.

3.22 Summary

In order to design and apply the appropriate research methodology to answer the research question there were five recognised methodologies investigated and considered, with the high-level summary of the decision-making being seen in Table 3.2. Moreover, full research governance and ethics approval was attained following the creation of data collection tools, research protocol and research support materials.

It was recognised that undertaking a mixed methods study could be complex and that data handling and management had to be executed with discipline and so IBM-SPSS Version 25 was utilised to manage quantitative data and QSR International’s NVivo Version 12 for qualitative data. There was no sampling of potential patient or carer participants with the full caseload of RVT participants being sent questionnaires and eligible clinical practitioners and managers being offered the opportunity to share their experiences through one-to-one semi structured interviews. The research was undertaken in accordance with the methodology and version-controlled documents as approved by the research ethics and governance committees.

4 Analysis of Service Users Data

4.1 Defining the Benefit of Empowerment

During the analysis of data evidence emerged suggesting that benefit could be obtained through the application of RVT for those with LTCs. However, nuance of language meant that the utilisation of multiple terms required a broad understanding of an overarching emergent theme. There were repeated concepts or language which were interpreted and considered as proxies for, or dimensions of, the overarching benefit of empowerment. Therefore, the researcher's interpretation of empowerment considered the knowledge, skills, attributes and abilities of a patient to be an active participant in their own self-care or management of their condition to be constituent elements. Moreover, language associated with patient-centredness was considered as a central tenant of empowerment. The benefit was not one where a practitioner abrogates responsibility or expects compliance rather the creation of a partnership, where power passes from the practitioner to the patient. In affording deeper meaning to the data, where acknowledgement of patients expressing an ability to feel supported, to gain a better understanding of their LTC, was to become active participants rather than passive recipients of care was again interpreted as empowerment.

The basis for defining the factors contributing to empowerment was articulated within the WHO Alma-Ata declaration (1978) which "…includes at least education concerning prevailing health problems and …individual self-reliance and participation." A constituent part of empowerment was the dimension of person-centredness:

> "... an approach to care that consciously adopt the perspectives of individuals, families and communities, and sees them as participants as well as beneficiaries of trusted healthcare systems that respond to

> their needs and preferences in humane and holistic ways. People-centred care requires that people have the education and support they need to make decisions and participate in their own care. It is organised around the health needs and expectations of people rather than diseases." (WHO. 2015. p19)

Two European collaborative networks have also focused effort upon defining empowerment within healthcare. ENOPE (2014) defined a framework of seven principles where the patient:

1. "Understands their health condition and its effect on their body.
2. Feels able to participate in decision-making with their healthcare professionals.
3. Feels able to make informed choices about treatment.
4. Understands the need to make necessary changes to their lifestyle for managing their condition.
5. Is able to challenge and ask questions of the healthcare professionals providing their care.
6. Takes responsibility for their health and actively seeks care only when necessary.
7. Actively seeks out, evaluates and makes use of information."

With CEmPaC (2020) extending the value base by building in person-centredness:

> "Person-centered care is the provision of care that places the patient at the center ensuring that the healthcare system is designed to meet the needs and preferences of patients as defined by patients themselves."

McCormack and McCance (2017) argued that empowerment consisted of two overarching principle types, firstly of 'structural empowerment' where authority is delegated in relation to resources and support and secondly 'psychological empowerment' where powerlessness is removed. Whereas, NHS England (2020) only articulated empowerment from a structural perspective, i.e. articulating physical resources rather than system and meaningful design in the 'empower the person roadmap'. The researcher acknowledges the tools articulated in the roadmap but considered it to be insufficient and failed to fully encapsulate the meaning of the narrative and ratings of the respondents within any of the participant groups.

Therefore, the concepts as described by the WHO, European collaborative networks and McCormack and McCance were adopted to understand and describe the benefit of empowerment within the research.

4.2 Introduction of the Analysis of the Patient and Carer Participant Questionnaires for both TF3 and U-Tell

Questionnaire packs and Participant Information had been issued, to the service users and carers as per the protocol. No sampling was undertaken, instead the entire cohort of 'current' RVT service users were sent a questionnaire along with a questionnaire for their carer, if appropriate, requesting completion. There were 32 patients who used the U-Tell Remote Telemonitoring Service and 242 patients who used the TF3 Remote Telemonitoring Service. Of note, the researcher could not determine how many carers may be likely to respond as records were not available to assess this, albeit an estimate of N=90 possible carers had been made which did not account for a possible response rate. The response rates 16 (50%) U-Tell questionnaires returned with one questionnaire was returned by a carer and for the TF3 service 242 questionnaires were issued and 81 returned, giving a response rate of 33.5%. In addition, there were 48 carer questionnaires returned for statistical analysis. Overall patient response rate was 35% with 97 of a possible 274 returned. Consistent with the research protocol, the questionnaires were pseudonymised and the researcher did not have access to list of service users invited to participate, so there were no opportunities to further encourage participation or improve the response rate. However, external reviewers for the BMJ were satisfied with participation rate and a paper discussing the findings was published (Walkden et al. 2019). 12% of patients had assistance from their carer to complete their questionnaire. As described in chapter 3, all questionnaire responses were entered into SPSS with two data bases created, one to enable analysis of patient participant opinion and experience and the other for the carer participants. Not all patients responded to every question indeed as the U-Tell service did not afford the patient access to the triage nurse the patients were not asked all of the questions as the TF3 patients were. Nine patients did not disclose their

gender and five did not report their age. Of the questions, requiring a rating of experience of RVT for both TF3 and U-Tell patients the mode of missing data was 6.

4.3 Quantitative Analysis of Patient Data

The first analysis to be undertaken was to review the high-level descriptions of data such as number of respondents, gender and diseases recorded. Whilst there were 97 respondents there were N=130 conditions reported of which N=123 were 'conditions of interest' i.e. chronic diseases and use of warfarin (INR reporting). This demonstrates that co-morbid non-communicable disease is present in the cohort.

4.3.1 High-level Demographics

4.3.1.1 Gender

The response to the question regarding gender, indicated most were male (N=49, 56%), nine respondents did not indicate their gender.

4.3.1.2 Service

The great majority of responses came from users of the regional 'TF3' service (N=81, 84%), with a minority using the local 'U-Tell' service (N=16, 17%). U-Tell for INR/ warfarin management and TF3 for diabetes, respiratory conditions, hypertension or CHF. There were N=97 valid responses overall. 50% reported that they had a carer to help them record

4.3.1.3 Age

It can be seen that of the N=92 respondents who disclosed their age, the mean age of RVT service users is 68.6-years (Table 4.1).

Table 4.1 Mean age of respondents by RVT service.

Which Service do you use?	Mean	N	Std. Deviation
0 (a)	74.0	1	.
TF3	69.5	76	10.9
U-Tell	64.0	15	12.1
Total	68.6	92	11.1

('a' calculation executed prior to status of omission changed to U-Tell)

4.3.1.4 Conditions

Participants reported health condition(s) being monitored. There were 14 potential options and it is recognised that co-morbidity is significant within the older segment of the population. Virtual Ward service users would typically have had multiple conditions, frequently a combination of CHF, respiratory, hypertension and diabetes. As the Virtual Ward patients were a small proportion of participants, it was assumed, that there may be minimal articulation of co-morbidity. Instead, it was found that the N=97 respondents recorded N=127 conditions (where age is disclosed) (Table 4.2) or N=130 (where age is not a factor) (Table 4.3). Moreover, whilst the care options for the conditions of dementia and renal were available through TF3 in other Trusts they were not utilised in SET. Furthermore, the weight management service and maternity service in SET were in fact the same service and was managed by a dietitian; there is a mismatch with the data as the number of participants being monitored who were pregnant and over-weight should be the same whereas there were three more participants noting weight management. Such cases illustrate the behaviour of participants reporting all clinical conditions rather than those for which RVT was prescribed. It can also be noted the average age of the pregnant woman whose care is augmented through RVT was 44.3-years with a standard deviation of 14.9; this was skewed by a respondent recording their age as 61-years. Most patients (66%) recorded one condition, 20% recorded two LTCs and the remainder with three or more; one of who recorded five LTCs demonstrating 34% of respondents had co-morbidity of LTCs.

In summary, the existence of co-morbidity meant the total number of conditions recorded exceeded the number of participants.

Table 4.2 Mean age profile of respondents by reported condition.

Condition (N)	Mean Age	Std. Deviation
CHF (6)	81.7	6.2
Dementia (1)	78.0	
Hypertension (6)	72.0	10.3
COPD (59)	71.2	8.8
Diabetes (17)	70.2	10.9
Bronchiectasis (9)	69.7	4.6
Renal (1)	69.0	
Stroke (2)	67.5	14.8
INR (18)	65.4	11.9
Weight Man. (5)	56.2	24.1
Maternity (3)	44.3	14.9

Table 4.3 Morbidity profile of respondents.

Condition	N
Chronic Obstructive Pulmonary Disease (COPD)	63
Warfarin Monitoring/INR	18
Diabetes	17
Bronchiectasis	9
Hypertension	7
Chronic Heart Failure	6
Weight management	6
Stroke	2
Renal	1
Dementia	1
Valid N (listwise)	0

4.3.2 Response Ratings Recorded by Patients

4.3.2.1 Rating given by patient respondents to experience based questions were categorised into four groupings, i) the RVT enabled self-care, ii) RWVT reduced the patient's demand or additional direct access services, iii) the patient's opinion regarding RVT technology and future use and iv) the patient's opinion of RVT response. (Table 4.4) It can be seen that the majority

of patient's indicated that RVT had enabled self-care defined across three domains of self-management, being involved in care rather than a passive recipient and giving peace of mind. Moreover, most patients indicated that RVT had reduced the demand upon primary care and outpatient services with 66% of patients reporting a belief that RVH had reduced hospital admissions. Whilst 44% of patients reported being worried about technology before it was installed, 90% believed that increased use of technology in the future would be of benefit albeit that 73% were happy for that to be through increased use of internet-based technologies.

Table 4.4 Rating reported by patients relating to four groups of questions relating to RVT experience

Question	Strongly Disagree Rating 1	Disagree Rating 2	Agree Rating 3	Strongly Agree Rating 4
Enabled Self-Care				
The remote monitoring system assisted me in managing my health on a day to day basis	0	3	21	66
Has helped me manage my own condition and become involved in health care	1	4	34	54
Given peace of mind	0	2	30	62
Reduced demand for other services				
Prevented or reduced need to attend OP appts	1	7	28	47
The monitoring system has reduced number of GP visits	1	5	27	55
The monitoring system has reduced the number of health professional visits	1	3	31	56
Has prevented the need to attend Emergency Department and/or GP Out of Hours Service	3	5	27	46
Prevented my admission to hospital	3	14	27	37
Technology now & future				
Worried about using new tech before installed	15	28	31	10

SET Practitioner explained system in enough detail before installation	0	1	33	58
Equipment easy to use	0	0	26	64
More interested in using tech in general	2	15	34	28
Questions on Hub or U-Tell readings page encouraged to think about symptoms	2	6	37	42
Internet portal to view readings useful	2	2	29	29
Happy to use internet to upload readings or send messages	5	11	24	29
Believe Increased tech in care and support of people at home will be of benefit in future	0	1	33	54
Consider Increased internet in care and support of people at home will be of benefit in future	2	8	30	41
Utility of messages & support				
TF3/ U-Tell message helpful	0	1	29	50
Clinician's telephone support helpful	0	1	29	55
Triage nurse helpful	0	0	10	53

4.3.2.2 Patient experience of contact by healthcare staff in relation to RVT

When comparing the data in Tables 4.4 and 4.5 it can see that the majority of patients reported having received contact by a healthcare practitioner in relation to their vital sign reading (N=76). Only a proportion of patients would have access to a triage nursing service and 60% reported having been contacted by a triage nurse and no patients reported that this service was not helpful.

Table 4.5 Patient reported contact with healthcare staff.

Contact with staff	YES	NO
Have you been contacted by a SET practitioner in connection with readings?	76	9
Receive a TF3 nurse triage service?	56	13
Contacted by a TF3 triage nurse?	58	4

4.3.2.3 Self-reported admission data

Patients were asked to report how many times they had been admitted to hospital when in receipt of the RVT service. Whilst, N=64 patients believed RVT had prevented admissions (Table 4.4) N=44 reported having been admitted into hospital (Table 4.6) with two patients reporting between 11 and 15 admissions and one patient more than 16 admissions.

Table 4.6 Patient reported admissions to hospital data whilst using RVT.

How many times admitted into hospital following RVT?	None	1-5 Times	6-10 Times	11-15 Times	16+ Times
Number of Patients	50	36	5	2	1
Percentage of Respondents	51.5%	37.1%	5.2%	2.1%	1%

4.3.3 Reported Benefit of RVT

The topic of 'Benefit' consisted of seven questions; the most critical of which was, 'The telemonitoring system has enabled me to better manage my own condition and become more involved in my health care'.

In considering the groupings of conditions for participants, not only was there reporting of multiple or co-morbidities but there were similar conditions which required the same peripheral devices and service to be given to the TF3 service users and so alternative two groupings were considered for the analysis of elements of the data; COPD and Bronchiectasis were classified as 'Respiratory'; Equally, a classification or reference group of Chest, Heart and Stroke (CHS) was created and participants would have reported Stroke, Chronic Heart Failure (CHF) and Hypertension (essentially circulatory system conditions). However, the mean response for both groups was the same at 3.5 indicating high levels of agreement (Table 4.7).

In considering the dimensions or interpretation of empowerment, the first question considered was *Has helped me manage my own condition and become involved in my healthcare.* Table 4.7 shows the mean and standard deviation for an overall positive or negative perspective of the topic with 4

being the high rating attributed to the value statement, ‘strongly agree’ and 1 being the low rating attributed to the value statement, ‘strongly disagree.’

The lowest rating was 1 and had been recorded by one participant but the utility is questionable as this participant recorded their diagnosis as dementia and the RVT services provided by SET were not designed to support the care of those with dementia and would not have been the reason for prescription of the system; this participant will have a dual diagnosis and so their attributed value was accounted for in the mean rating associated with their reason of inclusion in the program. The same is true for Stroke where the mean rating for two participants was 1.50 and yet again their response would be included in the condition; they were prescribed the service for i.e. a respiratory condition, diabetes or CHF etc. The utility for patients with such conditions could be determined as low and is consistent with their response. Conversely, where the service was well designed for the majority of conditions being monitored the respondents were more agreeable with the idea of the technology assisting with self-management. Equally, the one participant who has recorded a renal diagnosis responded with ‘4’, the highest rating and again as this RVT service was not given to support their condition, this single rating is ignored and it is accepted that their rating would be attributed within the condition for which they were prescribed the system within SET.

The accepted lowest mean rating was 3, ‘agree’ and was attributed by those N=15 participants with diabetes, whereas those nine with a diagnosis of bronchiectasis had a highest mean rating of 3.78. Overall CHS N=64 participants with CHS (which includes both respiratory conditions) was the largest cohort and had a high mean rating of 3.50. Of note, within the RVT data, the only participants to utilise the U-Tell system rather than the TF3 system were the participants recording that they were anticoagulated; N=18 warfarin participants with the mean rating 3.67. Therefore, it is concluded that there is consensus between participants believing there is a benefit to RVT service users from their own self-management and proactive involvement; indeed, one respondent wrote,

> “…because my oxygen levels can drop very quickly and suddenly, I can keep a check on my levels with oxymeter which keeps me from panicking. I can adjust my oxygen accordingly.”

Table 4.7 To articulate the mean and standard deviation in responses to the question *Has helped me manage my own condition and become involved in my healthcare*.

Condition (N)	Mean Rating	Std. Deviation
Diabetes (15)	3.0	.845
Stroke (2)	1.50	.707
CHF (6)	3.17	1.169
COPD (59)	3.49	.679
Renal (1)	4.00	
Hypertension (7)	3.17	.488
Weight Man. (6)	3.17	.753
Maternity (3)	3.00	1
Bronchiectasis (9)	3.78	.441
INR (18)	3.67	.485
Dementia (1)	1.0	
Total (127)		
Grouping		
Respiratory (60)	3.50	.676
CHS (64)	3.50	.632

4.3.4 Testing Reliability of the Service User Questionnaire

4.3.4.1 Patient Benefit Section

It is important to determine if the questionnaire itself could be considered as reliable to consider in turn the value of the participants' responses. To do this within the data set held within SPSS a test for reliability scale was undertaken. Crucially for the reliability of the key metrics for empowerment within Patient Benefit section of the questionnaire were tested (Appendix 3). Cronbach's Alpha of 0.914 for the seven items was indicated. The value of Alpha ranges from 0 to 1; the higher values of Alpha indicate the greater internal reliability with 0.70 and above being desirable. Moreover, the Table 4.8 demonstrates a Cronbach's Alpha of over 0.70 for each of the seven questions within the section. Therefore, the seven are consistent in their performance and the section be regarded as reliable.

Table 4.8 To illustrate reliability of each of the patient benefit questions within the questionnaire.

Seven Patient Benefit Questions	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
The remote monitoring system assisted me in managing my health on a day to day basis	21.43	10.158	.722	.904
The monitoring system has reduced the number of health professional visits	21.61	9.241	.828	.891
Prevented or reduced need to attend Out-Patient appointments	21.78	9.055	.715	.906
Has helped me manage my own condition and become involved in health care	21.63	9.783	.699	.905
Given peace of mind	21.51	10.405	.678	.908
The monitoring system has reduced number of GP visits:	21.58	9.308	.817	.893
Has prevented the need to attend Emergency Department and/or GP Out of Hours Service	21.72	8.843	.767	.899

4.3.4.2 Telemonitoring Equipment and Technology

The test for reliability of technology and equipment section followed, of these there were nine indicators of receptivity to equipment. The overall internal reliability as measured by Cronbach's Alpha was 0.902. Similarly, the Table 4.9 demonstrates a Cronbach's Alpha of over 0.70 for each of the nine questions within the section. Therefore, the nine are consistent in their performance and the section be regarded as reliable.

Table 4.9 To illustrate reliability of each of the health technology questions within the questionnaire.

Nine Questions Relating to Health Technologies	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
SET Practitioner explained system in enough detail before installation	26.13	50.555	.833	.882
Worried about using new tech before installed	27.10	55.073	.320	.917
Equipment easy to use	26.02	50.770	.803	.883
More interested in using tech in general	26.52	51.065	.531	.902
Questions on Hub or U-Tell readings page encouraged to think about symptoms	26.34	49.998	.717	.887
Internet portal to view readings useful	25.92	47.993	.704	.888
Happy to use internet to upload readings or send messages	26.22	47.963	.652	.893
Believe Increased tech in care and support of people at home will be of benefit in future	26.09	49.168	.899	.876
Consider Increased tech in care and support of people at home will be of benefit in future	26.20	48.367	.789	.881

4.3.4.3 Use of RVT Service Section

The test for reliability within the section examining the participant's experience of using the RVT service including interaction with practitioners was tested. The three questions had a combined Cronbach's Alpha of 0.676 suggesting a deficit of reliability. However, Table 4.10 demonstrates that the first question alone within this section, 'Have you been contacted by a SET practitioner in connection with readings?', had a Cronbach's Alpha score of 0.879 and was considered reliable.

Table 4.10 To illustrate reliability of each of the use of RVT questions within the questionnaire.

Three Questions Relating to Messaging or Phone Support.	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Have you been contacted by a SET Practitioner in connection with readings?	7.29	.932	.128	.879
Clinician's TF3/ U-Tell message helpful	4.70	.300	.760	.127
Clinician's telephone support helpful	4.64	.320	.754	.140

4.3.5 Ascribing Meaning to the Use of RVT

4.3.5.1 The Equipment

The first question in this section was reliable and related to how well the service users were supported at the beginning of their RVT care support and considers the explanation given to the participants, by their clinical practitioner, at the beginning of the intervention. Again, the statement asked if the practitioner explained the system and there were five possible responses, from strongly agree to strongly disagree and then not applicable. Five patients did not respond, one participant expressed lack of explanation but 34% of participants agreed and 60% strongly agreed. Therefore, it can be concluded that practitioners explained the RVT system before installation in enough detail.

The second question was designed to gauge service user apprehension prior to installation. Whilst recognising that possibly the most resistant service users did not accept the service, number unknown, and were not included in the sample, it was useful to consider a possible anxiety prior to experience. Again, the possible responses were rated as with the previous question but there was a greater distribution of responses. It was found that 44% of participants were not worried about using technology before it was installed and 42% were worried. This distribution of potential anxiety should be considered for future technology interventions but also it must be recognised

that even though 94% of participants felt the system was adequately explained the level of reassurance did not allay the anxiety of more than one third.

The final question within the section enquired if the participant found the RVT equipment easy to use. There was a 94.8% response rate for this query, N=92, with two stating the issue was not applicable and with N=90 agreeing that the equipment was easy to use; overall 64% of participants 'strongly agreed' that equipment was easy to use.

4.3.5.2 The TF3 Triage Nursing Response and Service

The reliability of the questionnaire in relation to the use of monitoring was less reliable as was the experience of triage nursing service as provided in the TF3 service alone.

4.3.5.3 The Receptivity to Future Use of Technology

An examination of receptivity towards the concept of future based provision, whereby technology or Internet-based services were developed, the findings across the three questions were found to be reliable; Cronbach's Alpha 0.890. With the Cronbach's Alpha for the three constituent questions within this section being displayed in Table 4.11.

Table 4.11 To indicate reliability of individual questions within the future use of technology in healthcare.

Three Questions Relating to Future technologies	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Happy to use internet to upload readings or send messages	6.85	4.195	.782	.873
Believe Increased tech in care and support of people at home will be of benefit in future	6.72	5.953	.775	.871
Consider Increased internet-based care and support of people at home will be of benefit in future	6.82	4.875	.852	.785

(Cronbach's Alpha above 0.70 being considered reliable.)

When considering the data recorded within the future data question section, all data were considered valid within this section and all participants responded to each of the three questions. The first question asked of the participants in this section was to consider the future use of the internet regarding the uploading RVT readings or sending messages; this question was reliable with a Cronbach's Alpha of 0.873. Despite, the almost consistently positive affirmations, two responses to this topic began to diverge in view. Table 4.12 illustrates distribution of ratings. Of note, 17% of participants disagreed with the statement whereas three times as many, 55% of participants, were happy to use the internet for uploading readings or messages. However, one voice within free-text responses was cautious for an unexpected reason,

> "… I did not fill in the questions regarding the internet as have been in A&E/ward/GP surgeries, the patients who are self-centred and think only of themselves, and I watched them abuse staff who were trying to help them was a disgrace, giving them access to the internet would be transferring that behaviour to the internet."

The view, clearly being a concern that Health and Social Care (HSC) practitioners should be protected from possible on-line abuse.

Table 4.12 To illustrate distribution of patients ratings of the use of the internet to upload readings or send messages to their practitioners.

		Frequency	Percent
Valid	N/s	6	6.2
	Strongly Disagree	5	5.2
	Disagree	11	11.3
	Agree	24	24.7
	Strongly Agree	29	29.9
	N/a	.22	22.7
	Total	97	100.0

The second question, in the section considering future receptivity to technology by RVT service users, examined if participant respondents believed the increased use of that technology in care and support of people at home will be of benefit in the future. Only one participant disagreed with the statement and N=88 agreed; 56% strongly agreed. However, the third question repeated the enquiry but specifically asked the participants to consider the internet. There was a negative move away from the previous question with ten disagreeing with the increased use of the internet, two of whom strongly disagreeing. N=71 agreed with the statement with 42% strongly agreeing with the consideration of a greater use of the Internet based care and support of people at home will be of benefit in the future. Therefore, there is a support for greater use of technology but with some reservation relating to technology that is Internet based.

4.3.6 Testing Normality

Before applying parametric tests, as appropriate, to the data sample, tests of Normality were undertaken utilising the SPSS software. The nonparametric test, Kolmogorov-Smirnov (KS), showed significance for patients with CHF (0.168) and diabetes (0.001) the residual significance is greater than zero. In examining skewness and kurtosis, a skewness result of zero would produce

a symmetrical bell-curve but a range between -0.5 and 0.5 indicates approximate symmetry. For other comparisons relating to variables i) manage own condition and ii) gave peace of mind it is known that the normality is supported albeit being positively skewed to the right, and distribution can be assumed as not normal leading to utilise non-parametric tests. (Tables 4.13 and 4.14)

4.3.6.1 Exploration of RVT having helped participant manage their own condition

It was found that the p-values show a significant difference from normality (Tables 4.13 and 4.14)

Table 4.13 To indicate the normality of the distribution of the responses examining the data as a whole to the hypothesis that RVT helped the participant manage their own condition.

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Has helped me manage my own condition and become involved in health care	93	95.9%	4	4.1%	97	100.0%

Descriptives

			Statistic	Std. Error
Has helped me manage my own condition and become involved in health care	Mean		3.52	.066
	95% Confidence Interval for Mean	Lower Bound	3.39	
		Upper Bound	3.65	
	5% Trimmed Mean		3.59	
	Median		4.00	
	Variance		.405	
	Std. Deviation		.636	
	Minimum		1	
	Maximum		4	
	Range		3	
	Interquartile Range		1	
	Skewness		-1.227	.250

	Kurtosis			1.618	.495
Extreme Values					
			Case Number	Participant number	Value
Has helped me manage my own condition and become involved in health care	Highest	1	1	1	4
		2	2	2	4
		3	4	4	4
		4	5	5	4
		5	6	6	4[a]
	Lowest	1	51	51	1
		2	76	76	2
		3	68	68	2
		4	67	67	2
		5	16	16	2

a. Only a partial list of cases with the value 4 are shown in the table of upper extremes.

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Has helped me manage my own condition and become involved in health care	.357	93	.000	.700	93	.000

a. Lilliefors Significance Correction

4.3.6.2 Exploration of RVT if it has helped the participant manage their own condition and become involved in their healthcare

Table 4.14 To indicate the normality of the distribution of responses examining the data by condition, system and gender in relation to the hypothesis that RVT helped the participant manage their own condition.

	Kolmogorov-Smirnov[a]	Kolmogorov-Smirnov[a]	Kolmogorov-Smirnov[a]	Shapiro-Wilk	Shapiro-Wilk[a]	Shapiro-Wilk[a]
Condition	Statistic	df	Sig.	Statistic	df	Sig.
Stroke	.260	2	.000			
CHF	.277	6	.168	.773	6	.033
Diabetes	.300	15	.001	.837	15	.011
COPD	.349	59	.000	.707	59	.000
Bronchiectasis	.471	9	.000	.536	9	.000
Non-Chronic (Excluded health status)	.357	93	.000	.700	93	.000
	Kolmogorov-Smirnov[a]	Kolmogorov-Smirnov[a]	Kolmogorov-Smirnov[a]	Shapiro-Wilk	Shapiro-Wilk[a]	Shapiro-Wilk[a]
SYSTEM (b)	Statistic	df	Sig.	Statistic	df	Sig.
TF3	.342	77	.000	.716	77	.000
U-TELL	.419	15	.000	.603	15	.000
	Kolmogorov-Smirnov[a]	Kolmogorov-Smirnov[a]	Kolmogorov-Smirnov[a]	Shapiro-Wilk	Shapiro-Wilk[a]	Shapiro-Wilk[a]
GENDER (b)	Statistic	df	Sig.	Statistic	df	Sig.
Male	.358	46	.000	.705	46	.000
Female	.363	38	.000	.705	38	.000

a. Lilliefors Significance Correction

b. Has helped me manage my own condition and become involved in health care is constant when Which Service do you use? System not defined = 0. It has been omitted.

With *p* values showing significant difference from normality.

4.3.6.3 The Data expressed within a series of histograms

The Tests of Normality and associated histograms express the data to demonstrate difference of, or consistency of, experience and opinion within the subgroups. The exploration considered similarity or difference between participants with different conditions, utilising either of the two RVT technologies or systems and binary gender linked responses. The initial review considered the statement that RVT helped them manage their own health and care. The second review area examining normality considered RVT affording the participant a 'peace of mind'. Across the two systems the participants highly rated to help them with their condition (Figure 4.1). With participants who utilised U-Tell highly rating the system as agree or strongly agree (Figure 4.3), for TF3 the majority of participants agreed or strongly agreed (Figure 4.2).

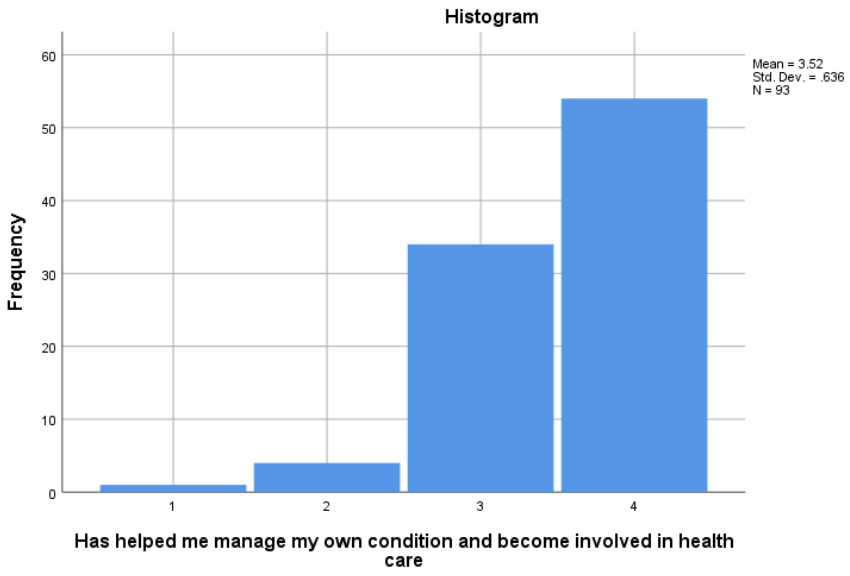


Figure 4.1: Histogram to illustrate the high rating of the systems to help the participants to manage their conditions across all conditions

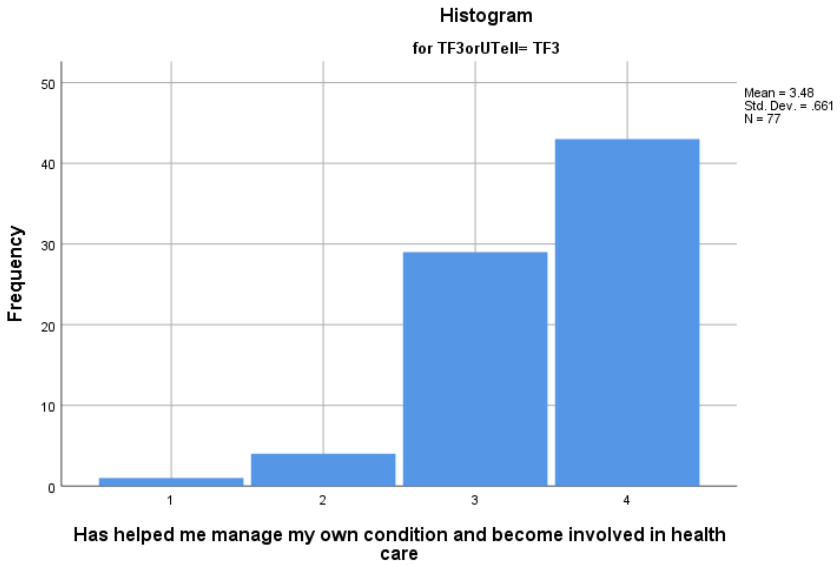


Figure 4.2: Histogram to demonstrate rating of the system to help the participants manage their own condition by TF3 respondents

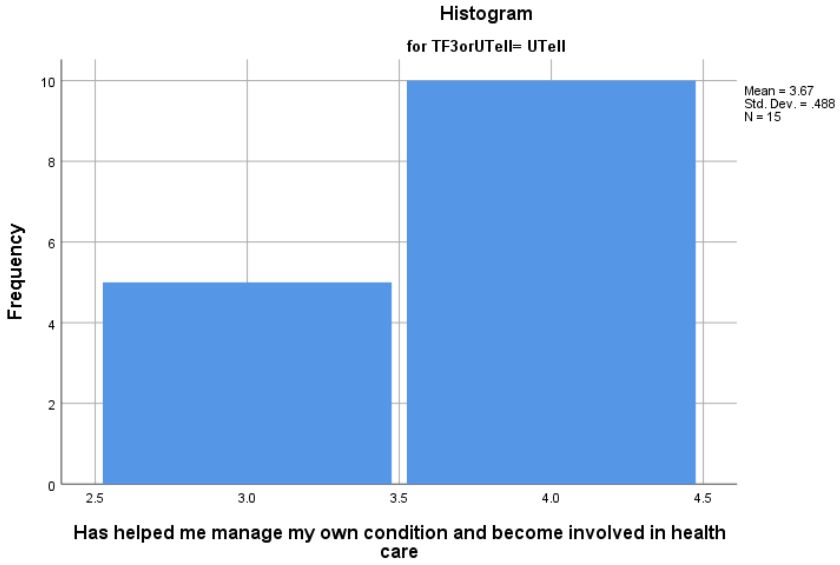


Figure 4.3: Histogram to demonstrate rating of the system to help the participant to manage their own condition by U-Tell respondents

4.3.6.4 Explore if RVT gave participants peace of mind

Table 4.15 To indicate if there is a normality of the distribution of the responses examining the data relating to RVT giving peace of mind.

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Given peace of mind	94	96.9%	3	3.1%	97	100.0%

Descriptives

			Statistic	Std. Error
Given peace of mind	Mean		3.64	.054
	95% Confidence Interval for Mean	Lower Bound	3.53	
		Upper Bound	3.75	
	5% Trimmed Mean		3.68	
	Median		4.00	
	Variance		.276	
	Std. Deviation		.526	
	Minimum		2	
	Maximum		4	
	Range		2	
	Interquartile Range		1	
	Skewness		-1.033	.249
	Kurtosis		-.029	.493

Extreme Values

			Case Number	Participant number	Value
Given peace of mind	Highest	1	1	1	4
		2	2	2	4
		3	4	4	4
		4	5	5	4
		5	6	6	4[a]
	Lowest	1	90	90	2
		2	76	76	2
		3	89	89	3
		4	87	87	3
		5	82	82	3[b]

a. Only a partial list of cases with the value 4 are shown in the table of upper extremes.

b. Only a partial list of cases with the value 3 are shown in the table of lower extremes.						
Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Given peace of mind	.414	94	.000	.640	94	.000
a. Lilliefors Significance Correction						

RVT has given peace of mind to participants with the KS significance being zero with no difference between the ratings of RVT regardless of system or gender. (Tables 4.15 and 4.16)

Table 4.16 To indicate the distribution of the responses examining the data by condition, system and gender in relation to the hypothesis that RVT has given peace of mind.

	Kolmogorov-Smirnov[a]	Kolmogorov-Smirnov[a]	Kolmogorov-Smirnov[a]	Shapiro-Wilk	Shapiro-Wilk[a]	Shapiro-Wilk[a]
All CONDITIONS	Statistic	df	Sig.	Statistic	df	Sig.
Respondents N=94	.414	94	.000	.640	94	.000
SYSTEM (b)	Statistic	df	Sig.	Statistic	df	Sig.
TF3	.414	78	.000	.634	78	.000
U-TELL	.439	15	.000	.606	15	.000
GENDER	Statistic	df	Sig.	Statistic	df	Sig.
Male	.395	48	.000	.660	48	.000
Female	.432	37	.000	.617	37	.000

a. Lilliefors Significance Correction

b. Has helped me manage my own condition and become involved in health care is constant when Which Service do you use? System not defined = 0. It has been omitted.

4.3.6.5 Data expressed within a series of histograms for RVT having given peace of mind

The patient's distribution of ratings showed that both systems were rated highly with regard to feeling 'peace of mind', regardless of the technology used, and can be observed in Figures 4.4, 4.5 and 4.6. Equally, the proportion of highly rated opinion was similar regardless of gender (Figures 4.7 and 4.8).

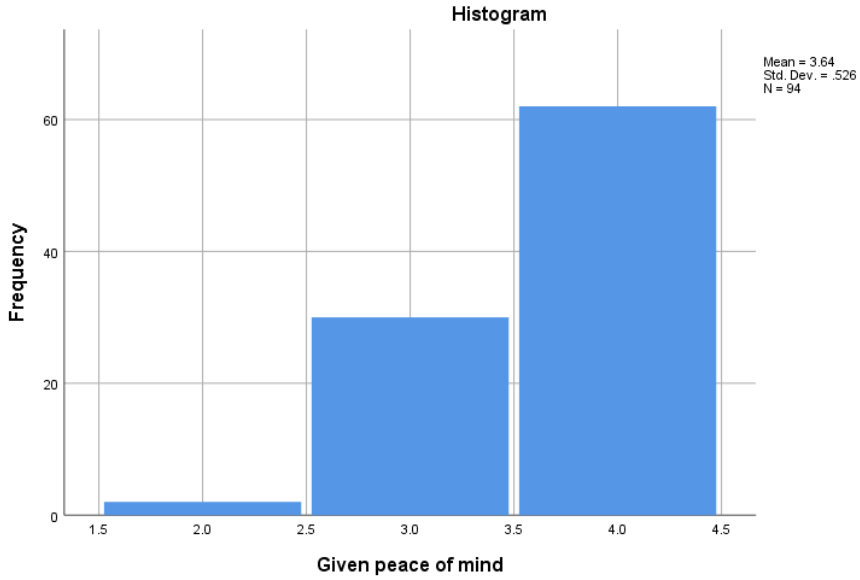


Figure 4.4: Histogram to demonstrate the rating of peace of mind across patient responded to the question (N=94)

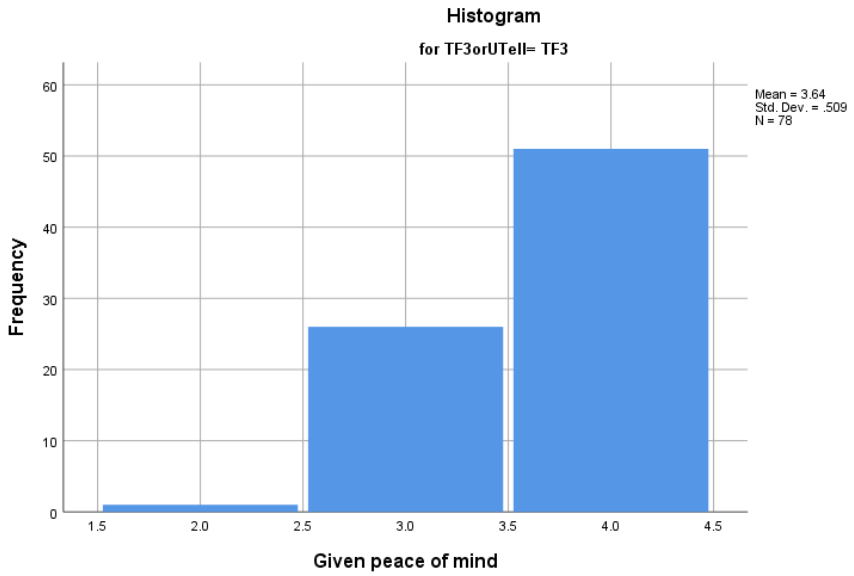


Figure 4.5: Histogram to demonstrate peace of mind by TF3 respondents

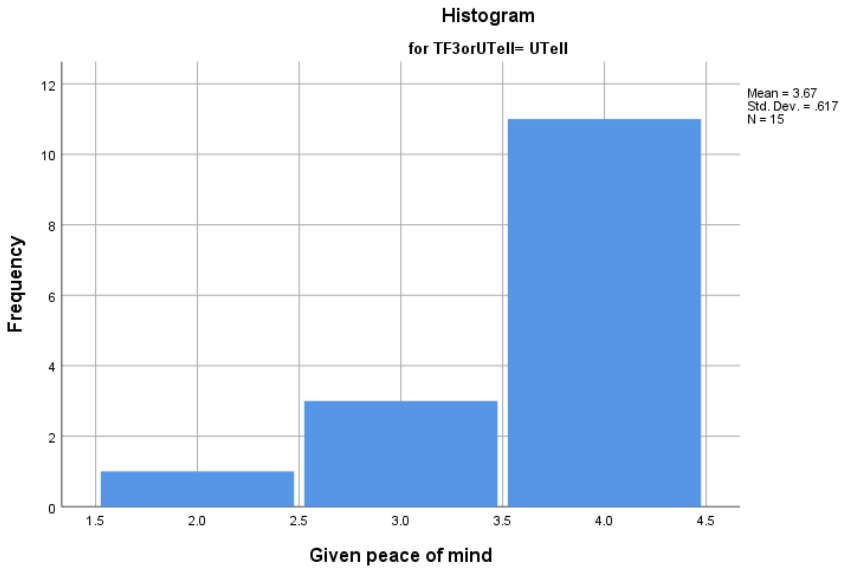


Figure 4.6: Histogram to demonstrate peace of mind by U-Tell respondents

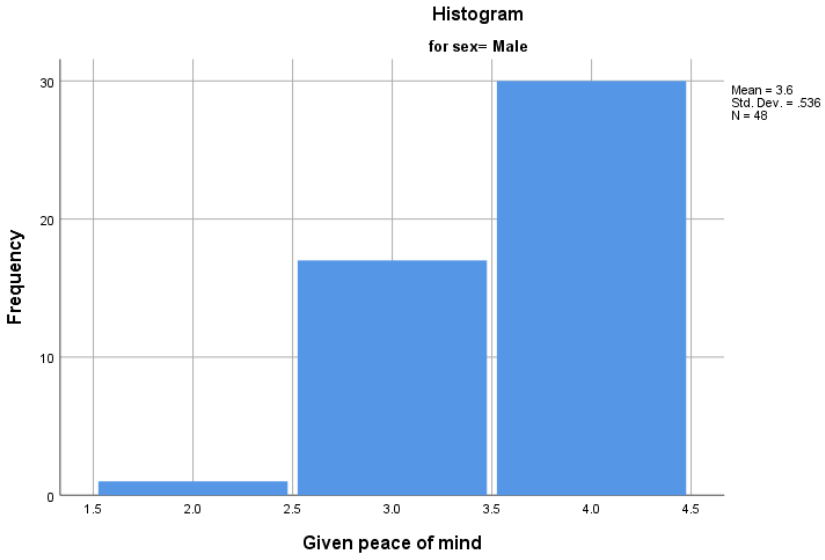


Figure 4.7: Histogram to demonstrate rating of peace of mind by male respondents, showing a similar distribution to the ratings recorded by female patients.

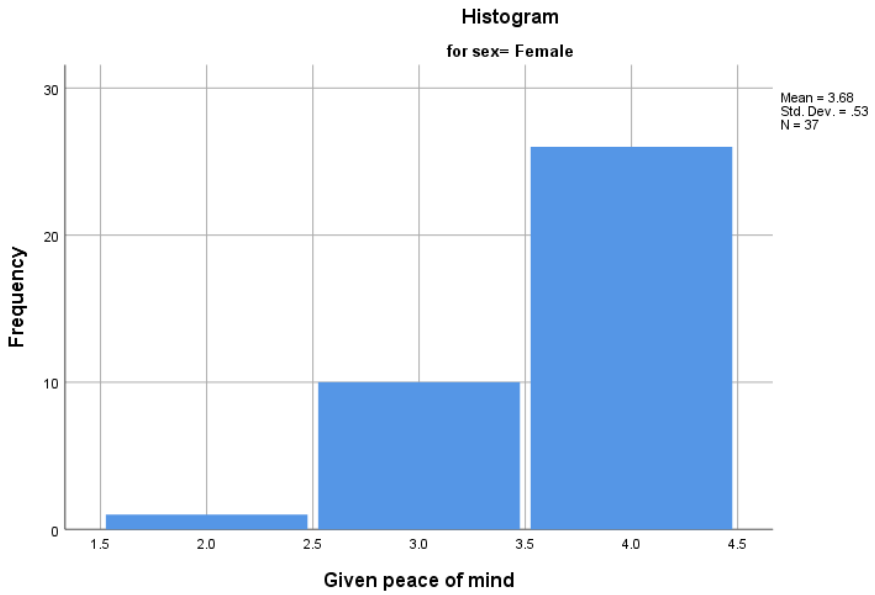


Figure 4.8: Histogram to demonstrate rating of peace of mind by female respondents showing most rate RVT highly in the metric of affording peace of mind.

4.3.7 Independent t-test

T-test enables the comparison of means between two groups and considers purpose and assumptions. The t-test can be used where groups are small as long as the normality of the distribution is assumed (Hill and Lewicki, 2006).

4.3.7.1 Empowerment – Participants using TF3 versus U-Tell System responses

Independent T-Test to compare U-Tell or TF3 to responses in the question '…has helped me manage my own condition' was undertaken. t-test assumes variance expressed as a standard deviation and is Levene's test F value and the significance of 0.5 or less indicates the variances or standard deviations. However, the proportionality in comparison is important as there were five times as many TF3 responders than U-Tell patients for this variable. (Tables 4.17 and 4.18)

T-Test Calculation Demonstrated – Service Group Statistics

Table 4.17 To indicate the t-test calculation.

	Which Service do you use?	N	Mean	Std. Deviation	Std. Error Mean
Has helped me manage my own condition and become involved in health care	TF3	77	3.48	.661	.075
	U-Tell	15	3.67	.488	.126

Table 4.18 To indicate the independent sample tests.

Independent Sample Test

		Levene's Test for Equality of Variances		t-test for Equality of Means
		F	Sig.	t
Has helped me manage my own condition and become involved in health care	Equal variances assumed	2.715	.103	-1.035
	Equal variances not assumed			-1.268

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
Has helped me manage my own condition and become involved in health care	Equal variances assumed	90	.303	-.186
	Equal variances not assumed	25.211	.216	-.186

	t-test for Equality of Means	
	Std. Error	95% Confidence Interval of the Difference

		Difference	Lower
Has helped me manage my own condition and become involved in health care	Equal variances assumed	.180	-.543
	Equal variances not assumed	.147	-.488

		t-test for Equality of Means
		95% Confidence Interval of the Difference
		Upper
Has helped me manage my own condition and become involved in health care	Equal variances assumed	.171
	Equal variances not assumed	.116

4.3.8 Nonparametric Tests

If a hypothesis is tested and it is null, it is possible to reject it in favour of an alternative hypothesis. To determine whether to accept or reject the hypothesis test depends on P-value proportions.

With the inclusion of the variable '…has helped me manage my own condition', examining the responses, (but not comparing disease, age, system or gender subsets), the SPSS Nonparametric test was undertaken and the results for the variable (Table 4.19).

Table 4.19 To demonstrate the findings of the nonparametric test for the variable RVT has helped with patient self-management.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Has helped me manage my own condition and become involved in health care is normal with mean 4 and standard deviation 0.636.	One-Sample Kolmogorov-Smirnov Test	.000[1]	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1] Lilliefors Corrected

It can be seen that the variable '*the telemonitoring system has enabled me to better manage my own condition and become more involved in my healthcare',* reject the null hypothesis was indicated. The Null hypothesis or rather nullifiable hypothesis is to undertake a "…reversal of the experimental hypothesis that your prediction is wrong and that the predicted effect does not exist" as explained by Field (2006). Therefore, it can be determined that the predicted hypothesis that patient/ service user respondents find that RVT enables them to better manage their own condition is accepted (Table 4.19).

The Nonparametric Test was then repeated to include the entire questionnaire.

With the inclusion of thirty-five variables statements examining the entire suite of responses, not comparing subsets of gender, disease, age or system, the SPSS Nonparametric test was undertaken and the results for the thirty-five variables can be seen in the Table 4.20 (a, b, c and d). Table 20a, consists of respondent 'demographics', Tables 20b, c and d describe distribution.

Table 4.20 To demonstrate the findings of the nonparametric test for the 35 variables/ statements/ questions.

Table Section 4.20a examines the initial category variables on the questionnaire. Variables 3 and 8 retained the null hypothesis; the data was a binary result with approximately equal distribution between each option.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The categories of Which Service do you use? occur with equal probabilities.	One-Sample Chi-Square Test	.000	Reject the null hypothesis.
2	The categories of Do you have a carer? occur with equal probabilities.	One-Sample Chi-Square Test	.000	Reject the null hypothesis.
3	The categories defined by If yes, does your carer help you take the readings? = No and Yes occur with probabilities 0.5 and 0.5.	One-Sample Binomial Test	.877	Retain the null hypothesis.
4	The categories defined by This questionnaire was completed by: = Patient and Carer on behalf of patient occur with probabilities 0.5 and 0.5.	One-Sample Binomial Test	.000	Reject the null hypothesis.
5	The categories defined by Are you a current user or previous User/Discharged from telemonitoring? = Current User and Previous User occur with probabilities 0.5 and 0.5.	One-Sample Binomial Test	.000	Reject the null hypothesis.
6	The categories defined by What is your health condition being monitored?Stroke = N/S and Yes occur with probabilities 0.5 and 0.5.	One-Sample Binomial Test	.000	Reject the null hypothesis.
7	The categories of Comments define condition occur with equal probabilities.	One-Sample Chi-Square Test	.000	Reject the null hypothesis.
8	The categories defined by What is your gender? = Male and Female occur with probabilities 0.5 and 0.5.	One-Sample Binomial Test	.337	Retain the null hypothesis.
9	The categories of How many admission times as a result of your condiiton since telemonitoring occur with equal probabilities.	One-Sample Chi-Square Test	.000	Reject the null hypothesis.
10	The categories defined by Receive a TF3 Nurse Traige Service? = Yes and No occur with probabilities 0.5 and 0.5.	One-Sample Binomial Test	.000	Reject the null hypothesis.
11	The categories defined by Contacted by a TF3 Triage Nurse? = Yes and No occur with probabilities 0.5 and 0.5.	One-Sample Binomial Test	.000	Reject the null hypothesis.
12	The categories of More than one set of readings a day - why? occur with equal probabilities.	One-Sample Chi-Square Test	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1] Lilliefors Corrected

[2] This is a lower bound of the true significance.

Table Section 4.20b examines the distribution of ratings for the variables and further tests normality. Variable 13 to be ignored as relates to the number assigned to a participant.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
13	The distribution of Participant number is normal with mean 49 and standard deviation 28.145.	One-Sample Kolmogorov-Smirnov Test	.200[1,2]	Retain the null hypothesis.
14	The distribution of What age are you? is normal with mean 69 and standard deviation 11.145.	One-Sample Kolmogorov-Smirnov Test	.000[1]	Reject the null hypothesis.
15	The distribution of The remote monitoring system assisted me in managing my health on a day to day basis is normal with mean 4 and standard deviation 0.529.	One-Sample Kolmogorov-Smirnov Test	.000[1]	Reject the null hypothesis.
16	The distribution of The monitoring system has reduced number of GP visits: is normal with mean 4 and standard deviation 0.659.	One-Sample Kolmogorov-Smirnov Test	.000[1]	Reject the null hypothesis.
17	The distribution of The monitoring system has reduced the number of health professional visits is normal with mean 4 and standard deviation 0.618.	One-Sample Kolmogorov-Smirnov Test	.000[1]	Reject the null hypothesis.
18	The distribution of Has prevented the need to attend Emergency Department and/or GP Out of Hours Service is normal with mean 3 and standard deviation 0.774.	One-Sample Kolmogorov-Smirnov Test	.000[1]	Reject the null hypothesis.
19	The distribution of Prevented or reduced need to attend OP appts is normal with mean 3 and standard deviation 0.704.	One-Sample Kolmogorov-Smirnov Test	.000[1]	Reject the null hypothesis.
20	The distribution of Prevented my admission to hospital is normal with mean 3 and standard deviation 0.862.	One-Sample Kolmogorov-Smirnov Test	.000[1]	Reject the null hypothesis.
21	The distribution of Has helped me manage my own condition and become involved in health care is normal with mean 4 and standard deviation 0.636.	One-Sample Kolmogorov-Smirnov Test	.000[1]	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1] Lilliefors Corrected

[2] This is a lower bound of the true significance.

Table Section 4.20c examines the distribution of ratings for the variables and further tests normality.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
22	The distribution of Given peace of mind is normal with mean 4 and standard deviation 0.526.	One-Sample Kolmogorov-Smirnov Test	.000[1]	Reject the null hypothesis.
23	The distribution of SET Practitioner explained system in enough detail before installation is normal with mean 3 and standard deviation 0.945.	One-Sample Kolmogorov-Smirnov Test	.000[1]	Reject the null hypothesis.
24	The distribution of Worried about using new tech before installed is normal with mean 2 and standard deviation 1.259.	One-Sample Kolmogorov-Smirnov Test	.000[1]	Reject the null hypothesis.
25	The distribution of Equipment easy to use is normal with mean 4 and standard deviation 0.958.	One-Sample Kolmogorov-Smirnov Test	.000[1]	Reject the null hypothesis.
26	The distribution of More interested in using tech in general is normal with mean 3 and standard deviation 1.302.	One-Sample Kolmogorov-Smirnov Test	.000[1]	Reject the null hypothesis.
27	The distribution of Questions on Hub or Utell readings page encouraged to think about symptoms is normal with mean 3 and standard deviation 1.123.	One-Sample Kolmogorov-Smirnov Test	.000[1]	Reject the null hypothesis.
28	The distribution of Internet portal to view readings useful is normal with mean 4 and standard deviation 1.323.	One-Sample Kolmogorov-Smirnov Test	.000[1]	Reject the null hypothesis.
29	The distribution of Happy to use internet to upload readings or send messages is normal with mean 3 and standard deviation 1.407.	One-Sample Kolmogorov-Smirnov Test	.000[1]	Reject the null hypothesis.
30	The distribution of Believe Increased tech in care and support of people at home will be of benefit in future is normal with mean 3 and standard deviation 0.991.	One-Sample Kolmogorov-Smirnov Test	.000[1]	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Lilliefors Corrected

[2]This is a lower bound of the true significance.

Table Section 4.20d examines the distribution of ratings for the variables and further tests normality.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
31	The distribution of Consider Increased tech in care and support of people at home will be of benefit in future is normal with mean 3 and standard deviation 1.175.	One-Sample Kolmogorov-Smirnov Test	.000[1]	Reject the null hypothesis.
32	The distribution of Have you been contacted by a SET Ptractitioner in connection with readings? is normal with mean 1 and standard deviation 0.310.	One-Sample Kolmogorov-Smirnov Test	.000[1]	Reject the null hypothesis.
33	The distribution of Clinican's TF3/ UTell message helpful is normal with mean 4 and standard deviation 0.515.	One-Sample Kolmogorov-Smirnov Test	.000[1]	Reject the null hypothesis.
34	The distribution of Clinician's telephone support helpful is normal with mean 4 and standard deviation 0.508.	One-Sample Kolmogorov-Smirnov Test	.000[1]	Reject the null hypothesis.
35	The distribution of Triage nurse helpful is normal with mean 4 and standard deviation 0.467.	One-Sample Kolmogorov-Smirnov Test	.000[1]	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1] Lilliefors Corrected

[2] This is a lower bound of the true significance.

Of note: where p=0.000 means 'absolute certainty'

It can be seen that in three of the 35 tests, it was recommended to retain the null hypothesis; the results for these variables are to be ignored - including numbers:

- #3 asking if a carer assisted the service user to access the RVT service and submit readings which required a yes/ no response,
- #8 which asked the responder to record gender with male/ female options
- #13 which recorded the participant identification number.

Therefore, in all critical variables/ questions enquiring the of service user's opinion, the decision was that the null hypothesis be rejected. Which was interpreted to mean that the high positive rating of patient experience indicated benefit of RVT was accepted as meaningful.

4.3.9 Correlation in Dimensions of Combined Data Variables

An exploration of relationships between some factors was undertaken. A new variable was created (within the IBM-SPSS Dataset) which described the concept of ‘Future Technologies’, which combined the variables of future use of technology in care and future use of internet base technology. It was found that there is a positive correlation between the age of a respondent and their support for the future use of technology; Pearson Correlation -0.098 and a significance (2-tailed) of 0.373. Therefore, as the respondent’s age increased, they were less likely to support an increased use of technology in future.

A new variable was created (within the IBM-SPSS Dataset) which described the concept of ‘Empowerment’, which combined the three variables (refer to Table 4.4, ‘Enabled Self-Care’ section). This was considered alongside the variable of future use of technology. In examining the skewness and kurtosis, a normal distribution was found for both empowerment and future technology. The skewness for future technology was 0.257 and empowerment 0.245, meaning approximate symmetry.

When considering the new variable of empowerment, against the variables of co-morbidity, using Automatic Linea Modelling, to determine predictor importance, it was found that the more conditions a patient reported the less empowering RVT was whereas the fewer LTC present the more empowered the patient reported they were (Figure 4.9).

When extending the exploration of this finding, a univariate analysis of variance between the two variables of empowerment and comorbidity, further testing the interrelationship, between-subject effects. The significance was found to be 0.039 and the null hypothesis was rejected (as *p* value is less than 0.05), there is a significant relationship between variables in this regression model.

Model Summary

Target	empowerment
Automatic Data Preparation	On
Model Selection Method	Forward Stepwise
Information Criterion	-132.942

The information criterion is used to compare to models. Models with smaller information criterion values fit better.

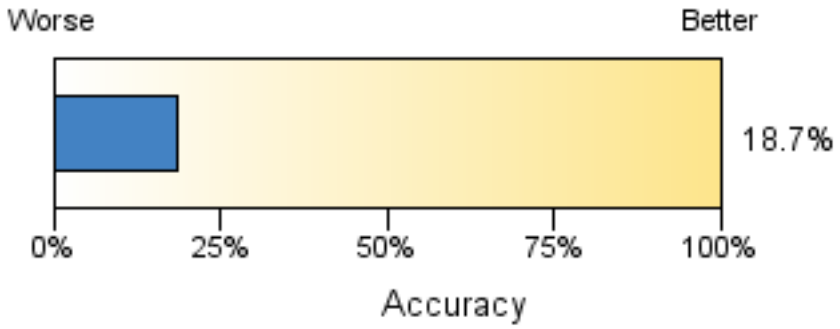


Figure 4.9: Chart to demonstrate predictor importance between empowerment and co-morbidity.

4.4 Qualitative Analysis of Patient Data

The service user/ patient questionnaires gave the participant respondents two opportunities to record free text narrative. The analysis of the qualitative data recorded by the service users of both RVT services, TF3 and U-Tell, were analysed as one data set. Service user participants were asked to record feedback under two separate headings, ‘Peace of Mind and Technology Comments’ and ‘Further Comments’. All comments were compiled, regardless of where a participant recorded their narrative explanations. The recorded comments for Peace of Mind and Technology N=27 comments were made by TF3 service users and six for U-Tell giving a total of N=33 comments. For the final comments section, TF3 N=23 comments, U-Tell N=10 giving a total of N=33 comments. However, of note, some participants went to great trouble to record extensive feedback with one participant writing a separate letter to review their service experience. Table 4.21 summarises the basic tally of sentiments expressed.

Table 4.21 The tally of sentiments expressed by service user participants in free text.

Summary Statement	Number of Comments Recorded by Service User Participants
Excellent service and staff (efficiency-based text)	13
Staff are helpful and caring (emotional wellbeing-based text)	4
Peace of mind	11
Immediate response from service when there is an issue	8
Patient taking control	7
Independence and patient freedom	6
Reduce anxiety	5
Reduce hospital visits	5
Communication	4
Free the time for practitioners	4
System to manage self	4
Thank you	3
Quality assurance checks	2
To know someone/ help is at hand	2
Reassurance	1
Assist diagnosis (hypertension)	1
Understand condition	1
Life-saving technology	1

Whilst the statistical analysis of the response ratings of the patient participants indicated a high level of user acceptability and technology utility regardless of technology package, service response or patient's condition the qualitative responses give greater insight as respondents articulated their personal experience. The sentiment of service excellence, from both a technology and practitioner contribution, was positively remarked upon N=13 times with a further three expressing gratitude and one stated that they considered it, "life-saving technology". Much consideration had been given to the deployment of RVT before services went live so that an integrated service offering, and response, was delivered rather than a new RVT being overlaid onto existing pathways or models of care. Moreover, at the time of the survey the RVT had been in operation for circa four years and it was likely that system teething problems had been overcome with practitioners also being more experienced

regarding effective utilisation of the technology. The service users were asked to participate in the enquiry of an established RVT service; with all forms of technology and service response being embedded into practice. Of note, only patients who were active recipients of the RVT services were asked to participate. Therefore, responses were contemporary and current rather than reflective upon past experience.

It was expected that service users would express their approval of technology, but this knowledge was expanded upon as the theme of patient empowerment emerged and whilst they may not have been liberated from chronic diseases the patient participants expressed their new level of well-being associated with LTC. N=11 users expressed how the technology gave them a peace of mind and concomitantly five wrote of their reduced anxiety. Indeed, four participants recognised how the technology was enabling their practitioners to target their time more productively towards patients most in need of direct care; a participant using U-Tell wrote,

> "It's convenience and immediate response make it a vital tool in the assessment of patient's condition. It freed medical staff to care for other patients who may be in poorer condition than myself. The patient is in control of his/her condition which reduces anxiety."

Dimensions of empowerment which emerged to demonstrate the well-considered benefit from a patient's perspective revolved around a feeling of connectedness to the healthcare system through technology. The five service users who shared a sense of reduced hospital visits did so positively, "Using self-monitoring has definitely given me more freedom of not having as many hospital visits to get venous samples taken." Patients repeatedly shared a sense of being safer through more monitoring, "It is a very welcome and needed extra pair of eyes and ears." Three wrote of being reassured by being monitored, whereas eight reported immediate services responses with four better communications with their practitioners. Timeliness of intervention was generally appreciated but Independence and freedom, six, was an important pillar in the empowerment of patients, "it means a lot of freedom for me but if I need help, they are only a phone call away". Most importantly, seven patient

participants wrote that they were taking control of their condition with one expressing how they better understood their condition,

> "Telemonitoring has given me a better understanding of (*my*) condition COPD… independence to live at home confident that I can manage my health and not be a burden on the NHS and my family."

Patient participants, who expressed their own experience did so bringing to life the importance of remote monitoring in the patient's journey, participation in self-care and empowerment.

4.5 Quantitative Analysis of Service Trend Patient Data

The intention, as articulated in objective 2 (cross reference 1.18), had been to analyse aggregated patient data to articulate service trend data. The TF3 service provider did not make this data available to the Trust nor was it available through the regional data brokerage service. The TF3 provider data output was only for the purpose of performance management and billing. The limited data could describe broad provision of service (Tables 1.3, 1.4, 1.5, 1.6 and 1.7) but ~~and~~ not offer insight into effect or benefit.

4.6 Quantitative Analysis of Carer Data

There were seven scaled variables in the carer questionnaire, possible responses included strongly agree (given value of 4), agree (3), disagree (2), strongly disagree (1), not applicable (coded '88') and missing ('99'). However, there were a total of 49 responses received from carers with 48 recording an opinion of experience with the TF3 RVT service and one with the U-Tell. The N=49 respondents' data were analysed together. Of the N=97 patient responses, 50% reported that they had a carer to assist them with their RVT service. N=36 patients stated that they would pass the carer questionnaire to their carer. Therefore, it was assumed that most carers, responded to the questionnaire.

The initial test computed for the questionnaire was Cronbach's Alpha for the seven variables, i.e. the scaled questions excluding demographics. A rate closer to 1 when testing reliability demonstrates more reliability, a rated value above 0.7 is acceptable and 0.8 or above is considered optimal. The

questionnaire is considered reliable, such that the construction of the questionnaire gave relatability between questions; with a Cronbach's Alpha rate of 0.866.

A descriptive analysis was undertaken. The mean and standard deviation for the responses to the seven variables are set out in the Table 4.22.

Table 4.22 To demonstrate the mean and standard deviation for the responses to the seven variables.

Descriptive Statistics Carer Respondent Questionnaire					
	N	Minimum	Maximum	Mean	Std. Deviation
I believe remote monitoring has improved the level of care given to the person I care for.	46	2	4	3.72	.502
I believe remote monitoring has helped prevent the person I care for being admitted to hospital.	45	2	4	3.56	.586
When assisting the person to operate the remote monitoring equipment, I found it easy to use.	41	2	4	3.61	.542
I think the use of telemonitoring as part of a care package is generally helpful	47	2	4	3.66	.522
I believe telemonitoring has given me peace of mind	46	2	4	3.72	.502
I believe increased use of tech will be of benefit in future	44	2	4	3.66	.526
I believe increased use of internet-based care will be of benefit in future	44	2	4	3.41	.658
Valid N (listwise)	37				

The mean of 3.72 for both the question relating to RVT improving the level of care received by a patient and the giving of peace of mind demonstrates support for RVT by those who care for patients with LTC. Indeed, responses

to the seven variables or questions demonstrated overall support with no mean being below 3; the lowest mean score was 3.41 and this question related to perceived benefit of future use of internet-based technology in the future; this demonstrates a general consensus of support.

A review of frequency of response was undertaken to enhance understanding beyond mean given the overall sample size was 49. Of note, it appeared to consistently demonstrate one or two ‘disagree’ responses relating to six questions with the final question associated with future use of internet-based technology receiving four ‘disagree’ responses (Table 4.23). The data base was then examined to determine if the experience of the one U-Tell carer respondent varied distinctly from the 48 TF3 carer respondents.

It was found that the one U-Tell carer respondent strongly agreed with all statements except with question/ statement relating to admission where they responded by agreeing that the service had prevented admission. It was found that the TF3 carer rated disagree with all statements except with statement relating to ease of use where they responded by agreeing that the service had been easy to use.

Table 4.23 To demonstrate the carer respondent option frequency.

I believe remote monitoring has improved the level of care given to the person I care for.					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	1	2.0	2.2	2.2
	Agree	11	22.4	23.9	26.1
	Strongly Agree	34	69.4	73.9	100.0
	Total	46	93.9	100.0	
Missing	N/a	3	6.1		
Total		49	100.0		
I believe remote monitoring has helped prevent the person I care for being admitted to hospital.					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	2	4.1	4.4	4.4
	Agree	16	32.7	35.6	40.0

	Strongly Agree	27	55.1	60.0	100.0
	Total	45	91.8	100.0	
Missing	N/a	4	8.2		
Total		49	100.0		

When assisting the person to operate the remote monitoring equipment, I found it easy to use.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	1	2.0	2.4	2.4
	Agree	14	28.6	34.1	36.6
	Strongly Agree	26	53.1	63.4	100.0
	Total	41	83.7	100.0	
Missing	N/a	5	10.2		
	Missing	3	6.1		
	Total	8	16.3		
Total		49	100.0		

I think the use of telemonitoring as part of a care package is generally helpful

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	1	2.0	2.1	2.1
	Agree	14	28.6	29.8	31.9
	Strongly Agree	32	65.3	68.1	100.0
	Total	47	95.9	100.0	
Missing	N/a	2	4.1		
Total		49	100.0		

I believe telemonitoring has given me peace of mind

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	1	2.0	2.2	2.2
	Agree	11	22.4	23.9	26.1
	Strongly Agree	34	69.4	73.9	100.0
	Total	46	93.9	100.0	
Missing	N/a	3	6.1		
Total		49	100.0		

I believe increased use of tech will be of benefit in future

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	1	2.0	2.3	2.3
	Agree	13	26.5	29.5	31.8

	Strongly Agree	30	61.2	68.2	100.0
	Total	44	89.8	100.0	
Missing	N/a	4	8.2		
	Missing	1	2.0		
	Total	5	10.2		
Total		49	100.0		

I believe increased use of internet-based care will be of benefit in future

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	4	8.2	9.1	9.1
	Agree	18	36.7	40.9	50.0
	Strongly Agree	22	44.9	50.0	100.0
	Total	44	89.8	100.0	
Missing	N/a	5	10.2		
Total		49	100.0		

The carer participants were supportive of the RVT service. The focus of the seven questions was to determine if there was a general acceptability of technology not simply from their direct and contemporaneous experience but also envisaging a health service of the future which is more dependent upon technology to maintain and improve the quality of life or health status of service users. Most carers (92%) reported that RVT had generally helped to improve the care of the service user illustrated in Figure 4.10. The responses to the question, *I believe telemonitoring has given me peace of mind*, mirrored the response pattern for the first question relating to improvement of care and was equally reflective of the views expressed by the service user/ patient participant respondents. Figure 4.13 illustrates the carer respondent's belief that RVT as part of a care package was generally helpful.

N=45 participants responded to the question considering belief that RVT had prevented hospital admission with only two reporting disagreement. 98% of ratings suggested that carers found the equipment easy to operate and they were equally receptivity to greater utilisation of technology in future, albeit a degree of reticence was expressed regarding internet based future options;

9% of responses disagreeing that increased use of the internet would be of benefit in the future.

In order to illustrate the carer respondent opinion frequency Table 4.25 a series of seven charts were created, each variable was illustrated by a simple bar chart (Figures 4.10 to 4.16).

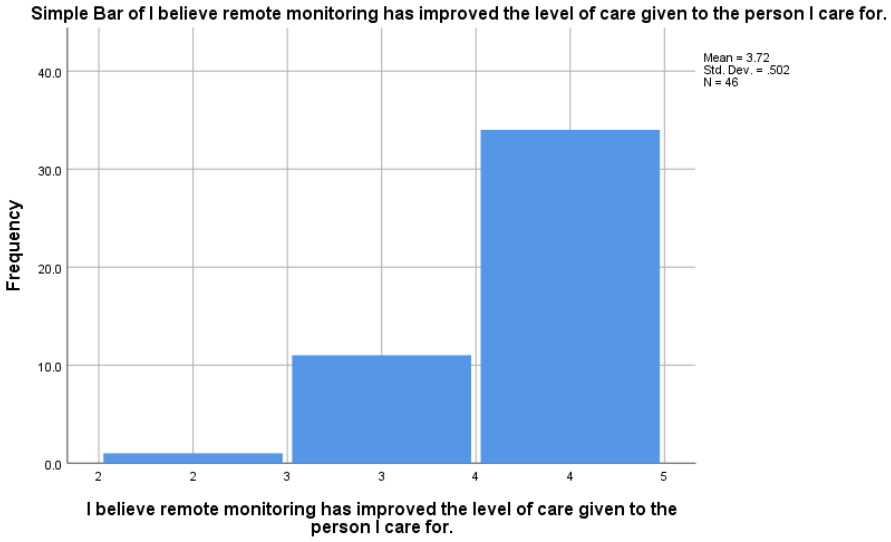


Figure 4.10: Bar chart to illustrate carer respondents belief that RVT has improved the level of care

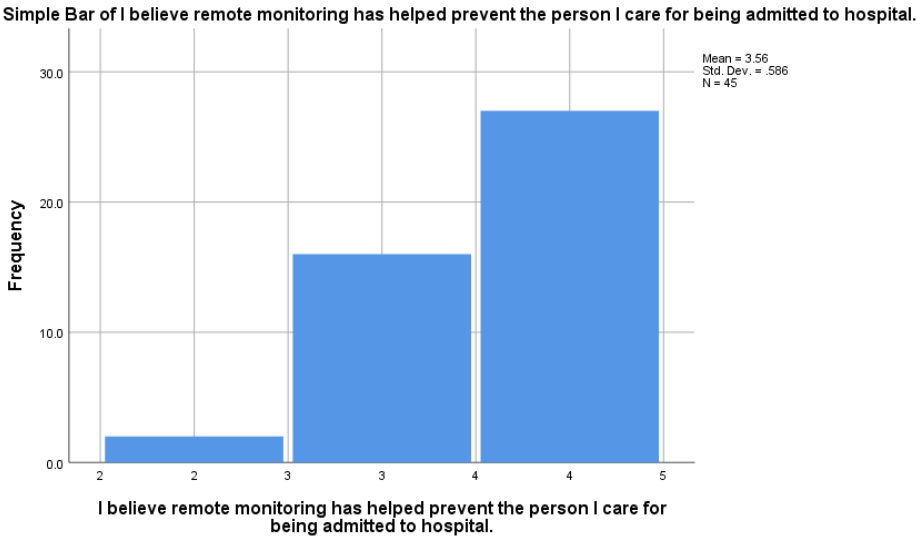


Figure 4.11: Bar chart to illustrate carer respondents belief that RVT has prevented hospital admissions

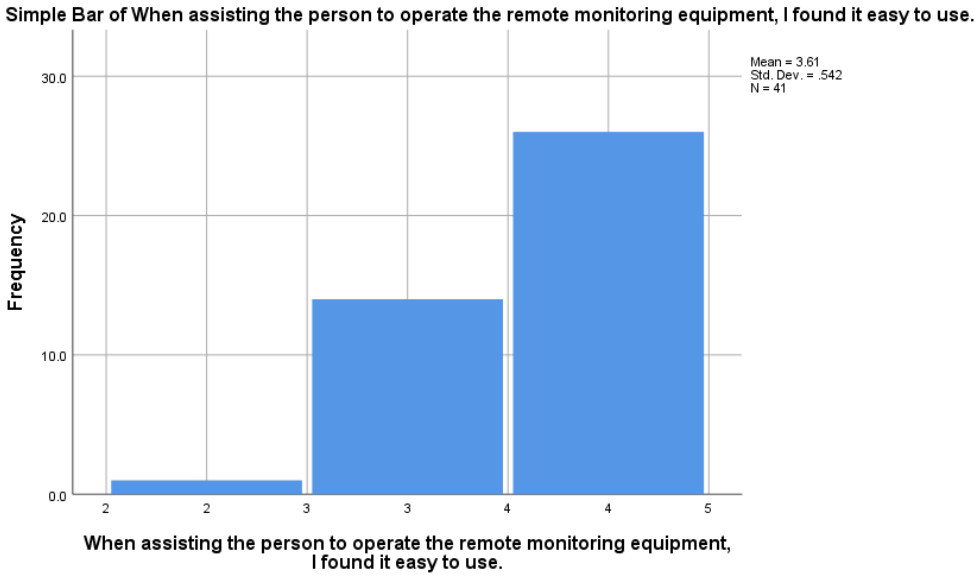


Figure 4.12: Bar chart to illustrate carer respondents belief that RVT equipment was easy to use

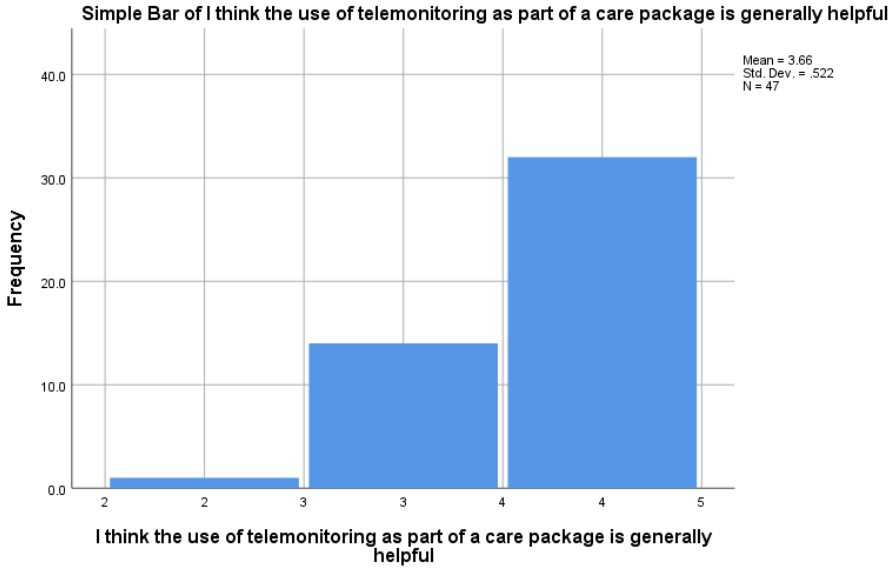


Figure 4.13: Bar chart to illustrate carer respondents belief that RVT as part of a package of care was generally helpful

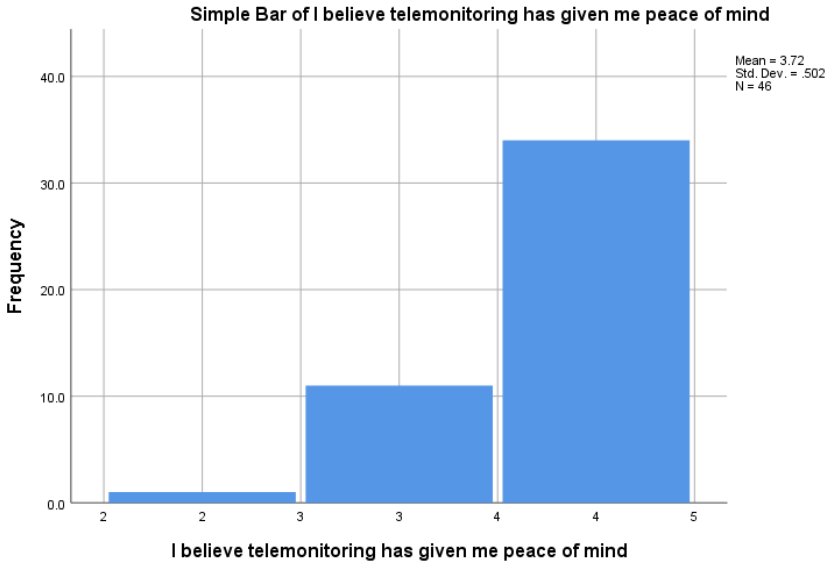


Figure 4.14: Bar chart to illustrate carer respondents belief that RVT has given peace of mind

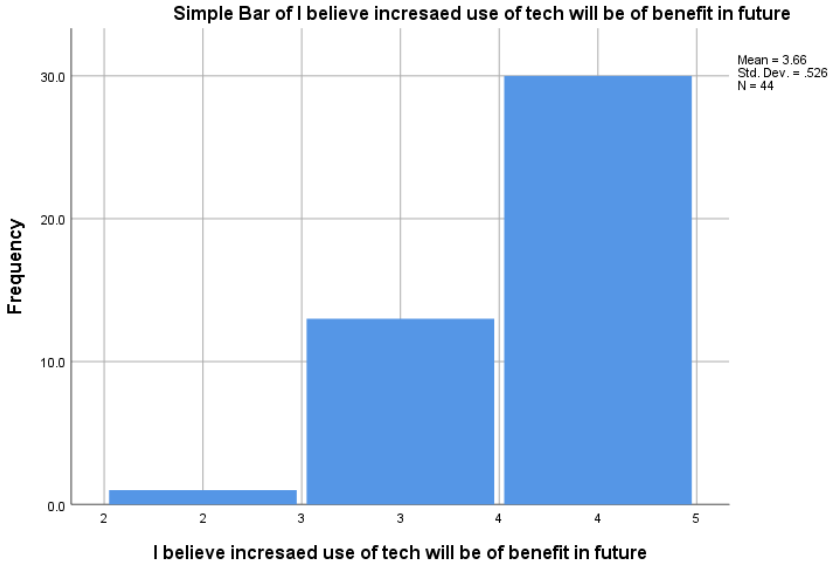


Figure 4.15: Bar chart to illustrate the respondents belief that increased use of technology in care will be of benefit in the future

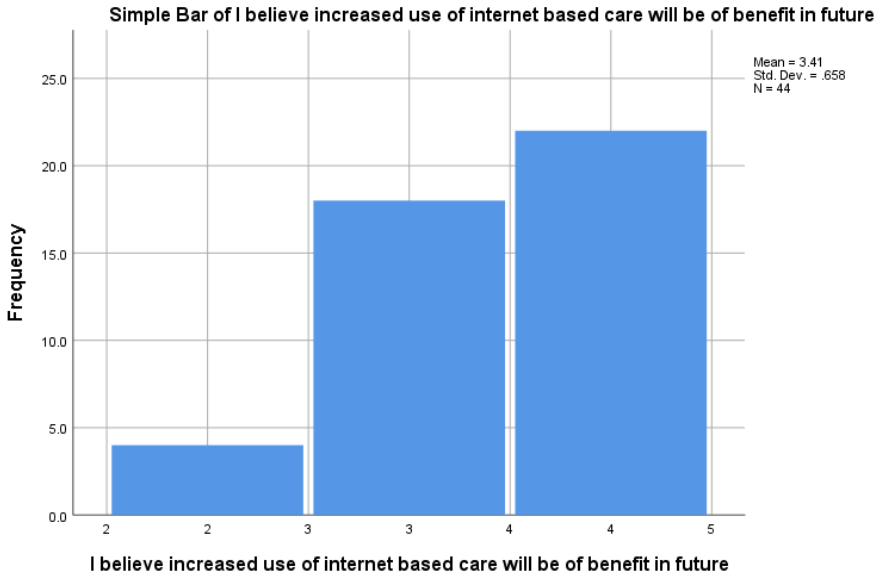


Figure 4.16: Bar chart to illustrate carer respondents belief that increased use of the internet in future will be of benefit

Six of the seven variables/ questions were grouped into three groups of two as they could be considered as testing the same dimension. The data were then charted to reflect the data triangulation (Table 4.24).

Table 4.24 The group and chart variable questions and statements.

Graph to illustrate	Variable/ Question/ Statement	Variable/ Question/ Statement
RVT Improved Health & Care	I believe remote monitoring has improved the level of care given to the person I care for.	I believe remote monitoring has helped prevent the person I care for being admitted to hospital.
RVT is Helpful & Gave Peace of Mind	I think the use of telemonitoring as part of a care package is generally helpful	I believe telemonitoring has given me peace of mind
Increased Use of Technology in Future Care	I believe increased use of tech will be of benefit in future	I believe increased use of internet-based care will be of benefit in future

The IBM-SPSS function ‘Ggraph’ was applied to variable data to illustrate the relationship between variables (Figures 4.17, 4.18 and 4.19). The series of three 3D graphs illustrate the depth and strength of opinions expressed by the

carer respondents and suggested correlation between variables. The first in the series, Figure 4.17 the overall improvement in care as a result of RVT, the second, Figure 4.18, the helpfulness and peace of mind and the third, Figure 4.19, the prospective receptivity of technology to support care in the future with the lack of support for internet juxtaposed to support for technology to assist in general.

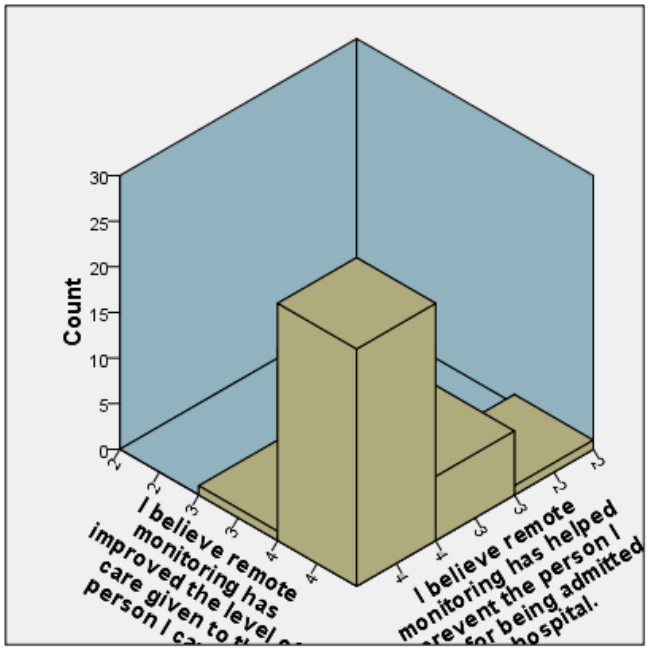


Figure 4.17: Graph to illustrate variable data - RVT improved health and care

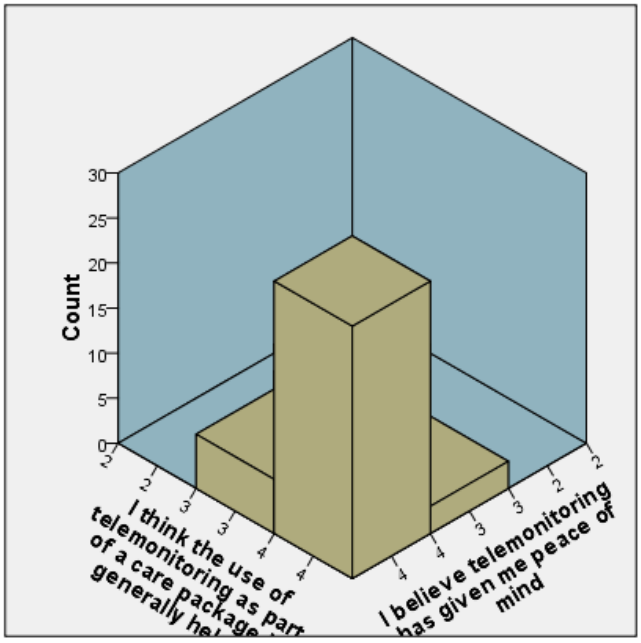


Figure 4.18: Graph to illustrate variable data - RVT is helpful and gave peace of mind

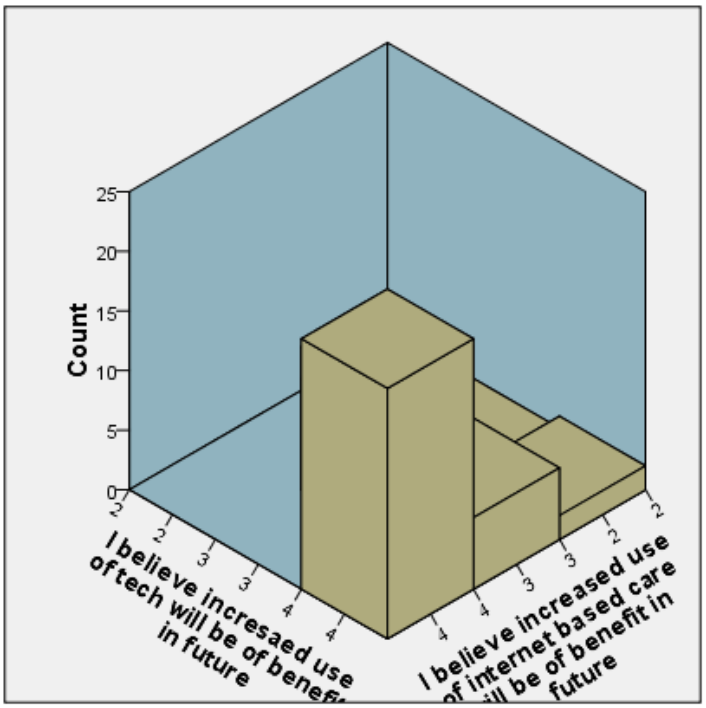


Figure 4.19: Graph to illustrate variable data - increased use of technology in future

4.6.1.1 Test of Normality

A one-sample Kolmogorov-Smimov Test, was calculated for each of the seven carer variables and all demonstrated evidence to reject the null hypothesis. The nullifiable hypothesis was to undertake a "…reversal of the experimental hypothesis that your prediction is wrong and that the predicted effect does not exist" as explained by Field (2006). Therefore, it was determined that the predicted hypothesis that carers would support RVT was confirmed. Consensus coalesced around general support for RVT to help support the care of the patient/ service users.

4.7 Qualitative Analysis of Carer Data

There were 23 written comments added to the carer participant questionnaires; 21 related to the TF3 service and two to U-Tell. For this brief descriptive analysis, the two RVT service responses were considered together. In considering the U-Tell two comments submitted relating to the RVT service were recorded by both the patient participant and carer participant. The patient stated that she only had a carer to remind her to undertake the test and so her husband spoke highly about the opportunities RVT afforded them to improve their lifestyle by allowing travelling abroad and reduced clinic visits,

> "If my wife did not have telemonitoring, I would have to take her to be tested, as she cannot drive. As we travel a lot in Europe, I would also have to locate somewhere to do the testing, so my wife's telemonitoring is a significant help to me as her carer."

Of note, the U-Tell service would instruct a user when to retest, for example on a date in a weeks' time, if forgotten the haematology nurse would contact the patient by telephone the patient to prompt whereas the TF3 service had a scheduled reminder integral to the home hub technology and failure to upload a reading would trigger a triage nurse response to prompt action. The comments were positive when reflecting upon the 23 qualitative data statements; there were only two comments with negative connotation, both were in relation to the TF3 service. The TF3 concerns related to technology was a burden to utilise albeit whether that concern was a proxy for the management of the chronic disease being a burden or technology

idiosyncrasies was not determined. The qualitative rating expressed by the majority of both carer and patient participants was that the technology was intrinsically simple. When considering the potential increased use of technology in the future one felt the increased use of the internet would make the situation worse and one shared that technical issues experienced with TF3 would need to be overcome. It was suggested by one carer respondent that,

> "Idea is good, but many older people do not have the technical capability and …attendant stress in how to use it correctly i.e. use of the internet could make some people opt out because of this."

However, it is suggested that as the majority of RVT users are elderly, i.e. over 65-years, and the majority found RVT a simple and helpful solution, the concern may be a personal perception rather that to be an ongoing concern for RVT. Moreover, it could be postulated that as the generations progress, as the middle-aged become elderly, they will be more technology attuned and receptive, with one carer respondent suggesting, "I am not a fluent user of internet but know it will be useful to younger people in the future."

There were five main positive topics expressed by carers across the TF3 and U-Tell surveys and these have been tabulated (Table 4.25).

Table 4.25 To summarise the positive opinions shared by carer respondents.

Primary Topic	Number of Carer Participant Responses
Time and travel as without RVT they would have to use a building-based service	5
Rapid access to help	5
Someone to talk to	2
Safety and peace of mind	7
Efficient and helpful	1

It is important to note that many comments contained multiple issues as respondents had taken the time elaborating upon their gratitude and support for RVT. Indeed, one respondent wrote,

> "I took care of my husband … until he passed away … He used Telemonitoring himself but I did it for him. For last two weeks we both

> find a great sense of having help at your fingertips… I was able to look after James at home."

It is judged that this single testimonial articulates true empowerment as the choice to remain at home was enabled, in part, by RVT. Across carer participants, the key messages of peace of mind, being able to manage at home, being integrated with care and that assistance was available when required were iterated. Not only does this demonstrate patient centred care and the empowerment of the patient and their carers but it demonstrates a system that is working, i.e. that technology had been appropriately inculcated into care. It is difficult to find support for this as a benefit in the literature to justify the application of RVT, by policy makers. Indeed, the agreed metric of success or end goal by policy makers was simply to demonstrate by the use of remote tele-monitoring to reduce requirement for secondary care services, providing an economic benefit. Whilst the health economic literature does not support RVT, nor was it an area of examination in this study, it has been suggested through the questionnaire that patients and their carers perceive a positive benefit of reducing admissions. One carer wrote at length her explanation of a positive improvement in care,

> "Prior to his using RTS *[their name for TF3 RVT]*, my father was being admitted to hospital on a monthly basis. Since RTS catches chest infections so early, he has not once been rushed to A&E or admitted to hospital. This has greatly improved his health and "recovery" and has improved both our stress levels and quality of life. A specialist nurse is just a phone call away and can prescribe drugs previously requiring a GP visit."

4.8 Summary of the Analysis of the Service User Participant and Carer Respondent Questionnaire for both TF3 and U-Tell

Questionnaires were analysed from 16 patients who used the U-Tell Remote Telemonitoring Service and 81 patients who used the TF3 Remote Telemonitoring Service. In addition, one questionnaire was returned by a carer of a patient who utilised the U-Tell service and 48 carer participant questionnaires related to the TF3 Service. Two SPSS data bases built and analysed, the patient questionnaire data base containing the responses from

97 participants and the other data base being for 49 carer questionnaire responses.

In the RVT patient quantitative data collection, there were 25 questions, of which there were seven which indicated healthcare utility and patient benefit and three key issues which examined the patient's involvement, participation and feelings which were interpreted as indicators of empowerment. (Table 4.4) These were:

1. The remote monitoring system assisted me in managing my health on a day to day basis
2. Has helped me manage my own condition and become involved in health care
3. Given me peace of mind

Descriptive statistical analyses were undertaken for both data sets which demonstrated that the two questionnaires could be considered as reliable and the null hypothesis was rejected for all critical questions. There was no notable difference between the responses given associated with gender, age, remote vital sign telemonitoring (RVT) technology used or LTC. It has been determined that patient and carer participants are supportive of the use of technology and that it gives them peace of mind and empowers them to 'better manage *their* own condition and become more involved in *their* healthcare'. Of note, whilst some apprehension was expressed by the patient participants when first asked by their practitioners to use RVT, the ease of use and reliability of technology was demonstrated.

Both patient and carer respondents included extensive narrative in 'additional comments sections' which provided a deeper appreciation and value for RVT in their lives. Qualitative analysis was undertaken and again there was consistency across respondents regardless of whether they were patients or carers and very few negative sentiments expressed. The respondents expressed their ability to live more freely being in control of their condition and being less anxious; given peace of mind. A general expression of being better connected to their practitioners through technology which was counter intuitive as an intention in the design of RVT was to reduce the number of

clinical face-to-face visits. It was clearly articulated that patients were being empowered to better manage their own conditions in a home environment supported by technology connection with their healthcare practitioners. Moreover, the receptivity of predominantly elderly patients to technology, and to a future with greater levels of technology enabled care was articulated. Whilst there was support for technology enabled care there was a low level of reticence regarding internet-based technologies and so these should be considered when designing easy to use, reliable healthcare technologies to support the care of patients with LTC at home by the healthcare system providers. However, U-Tell is primarily an internet-based technology and those patients accessing RVT through the internet expressed positive opinions of benefit just as the users of TF3, which is a direct hub to server system without the requirement of a patient to access the internet and enter data themselves.

5 ANALYSIS OF PRACTITIONER DATA

5.1 Analysis of Qualitative Data

5.1.1 Introduction

Results of qualitative analysis of practitioner interviews are presented by reference to eight main topics they raised: some negative, some positive. They referred to training needs that if addressed may help to ameliorate concerns over their many clinical issues. Targets for implementation were a mixed blessing – not always useful. In future they predict success through integration. This chapter will explain the experience of the practitioners and the knowledge they shared consolidated around the share themes that emerged.

5.1.2 Practitioner

In 2015 there were 37 acute and community practitioners, including a GP, Allied Health Professionals (AHP), consultant physicians, nurses and a pharmacist trained in the use of remote vital sign telemonitoring technology all employed by the SET. The majority of practitioners were acute hospital-based staff linked to multidisciplinary teams extending into the community having ongoing responsibility for care of patients diagnosed with chronic diseases and residents at home. Only those practitioners who worked with patients receiving long term anticoagulation/ warfarin were purely outpatient based and the pharmacist within the diabetes service was purely ward based. It was known that some of those trained in the use of the systems in 2011 had moved into service areas outside direct contact with RVT.

All practitioners were invited to participate in one-to-one interviews with the researcher and provided with material to ensure they were fully informed of the study purpose, data management, governance and methodology. It was estimated that, of the total, 29 practitioners were active users of RVT. Of those 16 practitioners responded positively to the request to participate, that is, 55% of the RVT practitioners volunteered to participate. Over a period of four months in the summer of 2016 these 16 practitioners were individually interviewed for approximately one hour. The data followed the semi-structured interview process with the participant's narrative captured through notetaking by the researcher and digital voice recording, then subsequently transcribed. The researcher delivered the semi-structured interview in such a way as to enable the practitioner to describe their experience, thoughts and feelings. As far as practicable the conditions for each interview were standardised and the approach to transcription was verbatim and was analysed in a positivist view being open and transparent (Lapadat, 2000). The spoken word was systematically transcribed into the standard semi-structured interview template so that the original framework for questioning was maintained. The narrative was transcribed in factual topic areas, following the semi-structured interview plan rather than considering the conversation, flow and tone of discussion; transcription was without interpretation of conversation (Edwards, 1991). Within qualitative analysis there is a possibility for inattention regarding the process of transcription (Davidson, 2009) and so care and planning were undertaken with approach so as not to introduce error or bias at point of transcription. In gathering data and evidence, it was known through traditional grounded theory, it was likely that at some point no new evidence would emerge in subsequent interviews that the qualitative data was said to have reached saturation so data collection could be concluded. It was estimated that at interview N=12 that new data would not emerge. However, the researcher decided to fulfil the commitment and interview the remaining four practitioners, most particularly given the broadness of the clinical experience being represented in the final four volunteer practitioners.

The professional spectrum of the N=16 practitioners covered a broad range of healthcare professionals and is set out in the Table 5.1

Table 5.1 To demonstrate the profile of practitioner respondents.

Profession	N=Interviewed
Nursing	10
Medical	2
Pharmacy	1
Allied Health Professions	3
TOTAL	16
Eligible Clinicians in SET (trained) (%)	37 (43%)
Eligible Clinicians in SET (trained & actively practicing using RVT) (%)	29 (55%)

The 16 practitioners also cared for people with a full range of diseases being managed through RVT (Table 5.2).

Table 5.2 To demonstrate the disease management groups.

Clinical Specialism	Number Practitioners
Diabetes	4
Respiratory	4
Stroke	2
INR	3
Virtual Ward/ General	2
Maternity/ Weight Management	1
TOTAL	16

There was a broad range of practitioners who were experienced within particular clinical specialties but also in the length of time as qualified practitioner. Each practitioner was asked to give their year of graduation, the most newly qualified practitioner was a respiratory physiotherapist, who qualified in 2011 and the first recorded clinical qualification was of a diabetes specialist nurse in 1980. The mean year of graduation was 1990, with qualifying decades, eleven in the 1980s, two in the 1990s, two in the first decade of 2001 in the subsequent decade. One practitioner, a consultant physician, utilised both TF3 and U-Tell systems with eleven practitioners utilising only TF3 and four the U-Tell system. A broad spectrum of experience, clinical backgrounds and clinical understanding of the use of all the RVT

system in the care of people with chronic diseases had been captured through the data given through the semi-structured interviews.

The group was 25% male and 75% female. Of note, none of the practitioner respondents reported having been formally educated about the presence or use of RVT at undergraduate level or attended post-graduate training prior to the commencement of the RTNI contract. Indeed, the AHP who graduated in 2011, the youngest participant, did so 3-years after the first remote telemonitoring pilots commenced in Northern Ireland and the year the RTNI contract went live, reported that it was still his understanding that the subject was not part of the curriculum in his school of physiotherapy.

The 16 transcripts were uploaded into (NVivo), the mean word count length of each was 3,403 words with the range being from 1,881 to 5,416 words, a total of 54,443 words. Therefore, the assistance of (NVivo) in permitting the researcher to create topic notes and concomitantly code narrative to the appropriate note for sorting, reporting and methodical analysis was beneficial.

A high-level summary report was tabulated within (NVivo) to demonstrate the distribution of opinions and perspectives shared by participants and can be seen in Table 12.6 Appendix 9. This expresses the topic code, the descriptive title of the topic area, up to two tiers of more focused response descriptive titles, the number of participants who expressed a view within the topic area and then the number of times that description was repeated. Therefore, if each participant expressed an opinion in a descriptive topic title area the number of practitioner respondents would be represented as N=16 and if each of those respondents mentioned the topic twice, the frequency would be 32.

5.1.3 Analysis of Practitioner Narrative by Descriptive Topics

Each descriptive topic area was tabulated with the number of participants who expressed an opinion and the number of times the topic was repeated or reinforced by them. The descriptive topic tables also include the working definition assigned to the description (by the researcher) to further enable understanding, grouping of sentiments and concomitant interpretation. (The

practitioner participants had been given assurances that their individual identities would not be discussed, nor their comments attributed to them).

5.1.3.1 Practitioner experience of RVT

With reference to practitioner responses in Topic Area Coded ‘a’, the topic area of Experience of the practitioner only referred to their experience of RVT prior to the TF3 or U-Tell services being in operation (Table 5.3). This topic area did not consider the formal professional qualification of the individual practitioner rather RVT experience. Three practitioners discussed this topic area with one making reference to the subject on four occasions. The clinical areas of stroke and respiratory were referenced and the practitioners shared their experience over 9 years of RVT including a period in advance of the regional services where they were involved in pilot projects. In essence, whilst reference was made to service implementation training the practitioners discussed their learning through trial and error, experiential learning.

Table 5.3 Practitioner responses in topic area coded ‘a’, examining the participant’s experience of RVT.

Name	Description	Files	References
P a Experience as a manager or commissioner practitioner	Background of or experience with RVT from the perspective of being a manager or commissioner practitioner. Comments may be about experience, qualification or advice gained from observation that does not fit within other Superior Hierarchical Node	3	6
long term service	Before the current RVT service there was a previous pilot service and patients from 2007/08 are still in receipt of RVT	3	6

5.1.3.2 Practitioner feelings towards RVT

With reference to practitioner responses in Topic Area Coded ‘b’, the topic area is the personal feelings the practitioner expressed about RVT (Table

5.4). The open question within the semi-structured interviews had been designed to start conversation and to in effect initiate reflective thinking. All practitioners answered the initial topic with N=49 references made to general feelings throughout the N=16 semi structured interviews. Whilst the majority, N=15 expressed positive feelings about their experience of RVT there were practitioners who expressed mixed feelings.

Two practitioners spoke about their concerns regarding the intrusively of technology particularly where a non-public sector supplier was managing the end-to-end service with references to shocked reactions of potential service users with the narrative of 'big brother' being expressed. The negative feelings expressed by five practitioners when reflecting upon RVT frequently revolved around the failings of technology or infrastructure including inability to prescribe and install TF3 when a service user did not have a plain-old-telephone (POTS) land line and was in a 3G 'black spot' as mobile remote access was also highlighted as a negative issue. Both medical practitioners independently expressed the same fundamental system criticisms whereby the TF3 RVT had failed to expand to scale, was not user friendly for clinicians with disappointment expressed regarding lack of progress over the term of the service. Of particular note was the inability to link the TF3 RVT to the Northern Ireland Electronic Care Record (NIECR). A complaint of practitioners mirrored those who referred to the TF3 service and was the length of time the electronic referral form took to complete and then if POTS or mobile signal could not be obtained by the supplier the nugatory effort to refer amounted to an unacceptable waste of time; a practitioner expressed discontentment of a '13-page referral form', a complaint echoed by a further five. One practitioner expressed serious concern about the level of training and concomitant knowledge of the triage nurses associated with the TF3 service. Linked to that was a concern that the triage nurses were insufficiently connected to the Trust specialist services and an improved service response may have been possible with better systems of working together. Also, the lack of basic local knowledge held by the triage nurses was another cause for concern with contact calls with Trust specialist nurses being made so late in the day that direct clinical responses by the patient's lead practitioner would be poorly planned and inconvenient. A negative feeling in one practitioner expressed a

concern about patients being capable of using the equipment and one considered a risk of patients becoming dependent upon RVT an issue. Three reflected that RVT had indeed increased workload with a view that this had not been highlighted as a risk to clinicians before they engaged with the system.

When considering the general orientation towards or against RVT the majority of practitioners, N=15 articulated feeling positivity; 63.2% of sentiments expressed being positive. There were key themes that demonstrated the overall benefit of RVT with the most common theme being that technology enables care and is the way forward as the four following quotations from four separate practitioner participants illustrate: -

> "I think technology is the way we are going in the Health Service. I don't think that they will ever find anything to replace our team of nurses here, computers or otherwise but I think it is a brilliant system and it is allowing patients a lot of freedom. We have found particularly in the anticoagulation and haematology our patients are getting younger, they're working and have busy lives so something like this is ideal for them as they're not having to take time off work to come to us here at the clinic and having to be at a specific point and cancel different things as they have to have their blood checked. So, I would be very positive about it." (P8) …"it is really the way forward and I think we really should be using technology more and more." (P12) … "Way forward, I think links with ECR for anything really successful and integrated." (P13) *and* "I think technology is the way forward. I don't know that Telehealth is quite where it should be yet, but I think it's moving in the right direction." (P2)

Practitioners expressed initial reticence but felt generally very positive when they experienced the benefit of having accurate, digitally transferred results rather than standard self-reporting. The speed of intervention was shared, particularly for those patients with respiratory conditions as RVT was described as a good

> "platform for monitoring of infections" (P10) and "…gives us a very good idea of how well or unwell they are." (P2) Equally, the real purpose of RVT was challenged with a view expressed that RVT is not a mechanism to keep people out of hospital but in fact it can be "…promoted as a way of improving quality of life for patients." (P2)

Table 5.4 Practitioner responses in topic area coded ‘b’, to express their general overarching feelings towards RVT.

Name	Description	Files	References
P b Feelings towards RVT	Where the participant expressed their feelings towards any aspect of RVT	16	49
Feel Negative	Where a participant does not feel positive about their experience of using RVT	5	13
Obtrusive	Staff are concerned about obtrusive nature of RVT	2	3
System can't be installed	Patients can’t access the system due to lack of phone lines or internet	3	3
Feel Neutral	Where a participant feels neither positive nor negative about their experience of using RVT	4	5
Feel Positive	Where a participant feels positive about their experience of using RVT	15	31

5.1.3.3 Practitioner expressed opinion of RVT

With reference to practitioner responses in Topic Area Coded ‘c’, the topic area is Opinion expressed by practitioner about the Regionally Procured Service and the comments could include reflections regarding any area from commissioning process to RTNI; from process of service design and procurement to end service (Table 5.5). All practitioners shared experience and qualitative data in a very practical explanatory topic area. There were 144 data points recorded with fourteen defined. The topic area with most opinions expressed was, ‘what didn’t work, with 11 practitioners discussing the solution difficulties thirty-four times.

Whilst the negative issues seem many in number, they follow consistent areas of concern, which may be resolved through technology evolution e.g.

thermometers not functioning correctly, technology being ‘clunky’ and not effective for younger mobile patients, lack of connectedness to other Healthcare Information Technology Systems and date time stamps for blood glucose readings in relation to meal times. Two further issues need consideration if further development of RVT were to occur. The first being added workload for practitioners and linked to that erroneous alerting. Such alerts could be caused by a respiratory patient undertaking their daily remote vital sign check too early; their actual vital signs may be within tolerances, but they may answer the wellbeing questions indicating that they feel worse than the day before. The second is the lack of practitioners working and training together; shared learning was not demonstrated and so issues such as management of patients who had become dependent upon RVT couldn’t be considered.

Practitioners also reported upon what worked well for RVT. Whilst some had previously reported an increased workload, others reported that if the system was utilised properly then the workload could be relieved. As clinicians they felt their patients were safer and more supported and that the system could be promoted to improve a patient’s quality of life and was seen as a worthwhile expenditure in the long run. However, the same practitioner reported that they would not prescribe the system on the first intervention and would then explain the system at length to increase the opportunity for acceptance and benefit. Practitioners reported that the systems were simple to use, and the end-to-end service provided by TF3 meant that the worry associated with the setting up of equipment was taken away. Whilst practitioners raised a concern regarding the health status questioning of patients’ others reported that these questions worked well and help give a clearer clinical picture especially for respiratory patients. There were other positive attributes with practitioners reporting that it was particularly useful to access data about health status on the computer to review progress, the empowerment of warfarin patients in being able to go on holiday and still report back to the anticoagulation nurse for medication dose management. Albeit the anticoagulation nurses day-to-day working experience with U-Tell could be improved if there was a direct feed from U-Tell to DAWN (clinical software) for warfarin dosing. Therefore,

there was a balanced approach by the practitioners with regard to their reflections upon what did not work so well in RVT and what worked well.

However, the element of working with RVT that exercised N=10 of the N=16 practitioners was the issue of the RVT service creating work. The work created is where patients breach their clinical parameters or tolerances and an alarm is raised that the triage nurse believes is best dealt with by the specialist practitioner. It was reported that this can lead to 1 to 2 calls a day that were not appropriate. Indeed, one practitioner reported a situation where the patient was confused, and the triage nurses would raise an alert which would mean the patient may mistakenly believe the practitioner would visit. Dedicated time to review RVT patients was an issue and it was noted that

> "…you need to be careful of what you ask for. If you get patients to record loads and loads and loads of health-related data you've got to be able to deal with it." (P5)

Indeed, lack of integration with other systems and no 'single sign-in' meant that the data were printed by the nurse for the consultant physician at a review clinic.

There were N=10, 62.5%, practitioners who expressed their feelings about their input into design. Practitioners acknowledged engagement and being able to see the equipment by possible suppliers to the regional RVT project but in general were not meaningfully engaged and expressed that more senior ranked officers were the ones who made the actual decisions. However, one supportive practitioner observed that those who would be the users of the equipment should have been involved in the process and were not; the patients. It was suggested that practitioners should have been offered the opportunity to be more engaged particularly those who had been part of the pilots. Of note, one practitioner who was familiar with the U-Tell system praised the implementation as the right approach but as it was part of a Randomised Controlled Trial, felt there were people randomised to the usual care group who missed out on a real opportunity to utilise a service that would have been of benefit to them.

There were 22 comments made by seven of the practitioner participants and all were universally concerned by the referral process. None of the practitioner participants who used the U-Tell service passed comment, primarily as the U-

Tell referral process was short, fast and straightforward. Therefore, 64% of TF3 practitioners discussed the referral process in very negative terms. Essentially the practitioner participants described a lengthy and slow process of completion with 13 pages of text to upload, with a page completed before the practitioner could move onto the next. Only a Diabetes Specialist practitioner had found a system to bypass data entry as they were simply requiring a 'track and trend' service and did not require TF3 triage nurse Intervention. However, this participant still described the referral process created by TF3 as the "…biggest deterrents" (P14). The practitioner, P4 described how the referral; process was the "… first issue that we had" describing it as "… long and tedious" exclaiming that, "…that sort of inefficiency really annoys me." P4 contrasted the process to the referral process to give patients 24-hour blood pressure monitor where "…30 seconds to order and put a sticker on a piece of paper and scribble my signature on it." Whereas, P5 suggested auto-population as most data was already in digital formats and P1 suggested administrative support. Linked to the referral process was that of discharge but only two practitioners considered this area suggesting that timeliness of discharge was important.

There were five practitioner participants who unitised the respiratory care peripheral devices with the TF3 service. All were very positive about the equipment finding SPO2, pulse oximetry, temperature with occasional blood pressure of use, particularly in highlighting those patients who were exacerbating. A further two practitioners were complementary with regard to blood pressure monitoring for Stroke patients and on the Virtual Ward. Equally, three of the diabetes practitioner participants discussed the peripheral devices and technologies supplied by TF3. Universally they were critical of the limited range of glucose meters and stated that it was not appropriate for most patients to be retrained on a new glucose meter; it would have been a more effective service with more referrals if a broader range of frequently used devices had been available. The lack of "patient choice" (P11) in glucose meters was an issue but also a service deficit where multi-specialty working was impossible. It was reported that when the same patient was to be monitored by two separate clinical specialties, in a situation of co-morbidity, where two groups wanted to use the TF3 RVT service with the same patient

e.g. diabetes team with weight management/ dietetics team or diabetes team with respiratory team. With the increased prevalence of co-morbid long-term conditions this limitation was not welcome. Conversely, two of the INR U-Tell practitioners were complementary about the peripheral device utilised. Further issues were unnecessary monitoring and remoteness leading to failure of connectivity. Both these related to TF3 service inadequacies and inefficiencies whereby technology was insufficiently developed or had limitations.

Table 5.5 Practitioner responses in topic area coded 'c', to express their wide-ranging opinions of the regional RVT service deployed in SET and U-Tell, as appropriate.

Name	Description	Files	References
P c Opinion expressed RTNI	Opinion expressed by manager or commissioner practitioner about the Regionally Procured Service and the comments could include reflections regarding any area from commissioning process to RTNI; from process of service design and procurement to end service	16	144
Sub-Nodes			
Administrative support	Administrative support may help practitioners to be more efficient	1	1
Blood Pressure Cuff	To measure blood pressure	2	2
Clinicians feeling about input into service design and technology	Whether practitioners felt they had influence or not	10	14
Contact by email	The main interface with the service provider is by email	2	3
Diabetes equipment	Issues and comments raised about equipment used for patients with Diabetes Mellitus	3	9
Discharge	The discharge of patients/ service users from the system	2	2

INR	Roche Coagucheck (INR Meter) and test strips only given to patient – near patient testing for warfarin. International Normalisation Ratio (INR)	2	2
Monitoring some unnecessary VS	Monitoring of too many vital sign parameters when perhaps the practitioner requires a single reading, but system forces a range or peripherals to capture data	2	2
Referral Process	The referral process practitioners found inefficient and cumbersome	7	22
Respiratory equipment	describes equipment chosen by practitioners in respiratory field and rationale	5	11
Rural remoteness connectivity	Rural remoteness combined with technology frailty meant that some patients cannot be connected to the service.	3	7
Service creating work	Where service could have been delivered more efficiently but instead it caused work	10	17
what didn't work	When tested with some groups of patients it did not seem to work particularly well	11	34
What worked well	What worked well so that RVT had a beneficial effect	11	18

5.1.3.4 Practitioner opinion of models of RVT

With reference to practitioner responses in Topic Area Coded ‘d’, it can be seen that the topic area is opinions of models of RVT (Table 5.6). 88% or rather 14 cited all availability of the models of RVT available 38 times. Essentially there was RVT with the support of a TF3 nurse and this is referred to triage and then there are RVT models where a central operator or triage nurse does not review the data of patient activity rather all recordings are solely reviewed by the Trust’s specialist practitioner or patient/ service users lead practitioner (model known as track and trend). The TF3 service offered both types of service model albeit to differing condition groups and the U-Tell RVT was solely track and trend.

Nine practitioners had sixteen of their comments assigned to the node of track and trend. It was reported that it depends upon the condition, frequency and meaning of reading as to whether track and trend is appropriate or not. Track and trend was not deemed appropriate for respiratory patients as it was believed that it would generate far too much work. It was helpful that the TF3 triage nurse would screen alerts and non-contacts so as to reduce the burden on the clinical respiratory team. The converse was true for weight management and diabetes mellitus. Participant P1 stated that triage “…was unnecessarily complex… for something non-clinically urgent as weight” and 5R reported that in diabetes care Triage was “…tricky so because we were track and trend, we had to take more responsibility for closing the loop…” and “triage would generate a lot of work”. Although another diabetes practitioner P11 aired concern that “…on occasions you could have forgotten about it...” continuing that to reduce this known risk that they would try to access results on a “… day when I wasn’t very busy at clinic.” In this topic area the U-Tell practitioners were silent as their way of working is a standard practice but there is variance with practice with regard to the use of track and trend provision across the professions and clinical areas. The risk associated with a lack of oversight and lack of dedicated sessions to ensure safe and effective care is of concern. There is an issue that the patient’s security and belief that they are being looked after by a healthcare professional and yet it is now

known that even remembering to look at vital signs, blood glucose readings, may be an issue for some.

Four practitioners reviewed track and trend and triage together exploring their own practices and questioning their own way of working. P10 reported within the context of a respiratory triage service and said that they were also disciplined to go through readings as a team a session a week. However, that practice was only possible when numbers were low and once, they moved up from15-to-20 patients per week to 51-to-60+ then the practice became too demanding. P11 reported that they tested triage with diabetes and changed as it led to patient calls.

Three practitioners reiterated triage was not available in U-Tell RVT and five practitioners expressed triage fifteen times in relation to their standard use of RVT and these practitioners work in either the respiratory service or the virtual ward. P7 reported how well the triage nurses worked, a view echoed by P13 from a patient safety perspective who stated that "…it gives me that security that I know patients are being checked up on" continuing that patients are at high risk of being admitted onto a ward due to deterioration. However, P10 gave seven distinct brief respiratory patient context responses including case histories and an audit that emphasised the essence of RVT with triage nurse intervention was so vitally important to ensuring fast access to interventional care as required up to rapid escalation to GP and onward emergency admission into hospital. P10 reported having received triage escalations during a 4-week period and so conducted an audit of cases. It was found that the majority of cases were associated with low oxygen saturation which is an expected pattern of disease within COPD. Upon more detailed review the saturation levels were within the normal ranges for each of the patients and in fact it was the patients' self-reporting not feeling well through the Respiratory questions on the home hubs and concomitantly triage nurses passing the information on to the team. Of the 30 case reviews there were three home visits and three escalations because the triage nurse was unable to contact the patient.

Table 5.6 Practitioner responses in topic area coded ‘d’, to express their opinions of the models of RVT delivered.

Name	Description	Files	References
P d Opinion of models of RVT	Opinion expressed by manager or commissioner practitioner about the models of RVT, that is the two main types of provision triage or track and trend. Both TF3 & U-Tell include track and trend.	14	38
Sub-Nodes			
Track & trend	Track & trend service is the RVT of choice	9	16
Triage	Triage service is the RVT of choice	9	18
Triage and track & trend	Triage and track & trend services are the RVT of choice	4	4

5.1.3.5 Practitioner opinion of training

With reference to practitioner responses in Topic Area Coded ‘e’, the topic area of Training was referenced 32 times by all N=16 practitioners (Table 5.7). Four practitioner participants spoke about training and awareness of RVT and technology in general at university. Two of these practitioners were nurses by profession and the other two physiotherapists in the clinical areas of respiratory care and diabetes mellitus. They expressed concern by both the absence of undergraduate training or awareness of technology and also the lack of interest. Five other practitioners of a range of professions, including physiotherapy, pharmacy, dietetics and medicine spoke about the need for more people being trained and that much training had been delivered ‘on the job’ by those more senior experienced practitioners. Indeed, a broader range of team members who support the patients should be trained; it was suggested administrative staff so that the burden of the referral process be removed from clinician practitioners. N=14, 87.5% of practitioner responders, including 100% of U-Tell practitioners spoke about their experiences and

opinions of training at the time of service initiation. The U-Tell practitioners spoke about their experience very positively which included specialist training in England on the use of the INR metre, the U-Tell peripheral and also training by the programme developers from Ulster University (UU). The UU team were commended for spending much time to train the anticoagulation nurse specialists in the use of the U-Tell programme and with follow-up site visits to support practice were appreciated. However, the opinions of the ten TF3 practitioners varied in range and opinion and certainly were not as complementary as the U-Tell practitioners expressed. Of these practitioners two referred to training they had received on the use of a forerunner service, a pilot supplied by a company called Home Telehealth which perhaps gave the cohort for the new regional RVT a foundation knowledge. However, there was a general consensus that the training for both user and 'train the trainer' was poor, only ameliorated by having good Help Desk support once the service commenced.

> P4 stated that, "…all quite excited about it going over but it quickly became clear that it wasn't as user friendly as we would have liked. We were trained in the IT training room."

TF3 training included instruction of the on-line referral system, viewing of cases and the patient on-line portal in a mocked-up digital environment in a Trust computer training suite in the Ulster Hospital but training did not meet practitioner's expectations.

Table 5.7 Practitioner responses in topic area coded 'e', to explain the participant's experience or opinion of RVT training and education.

Name	Description	Files	References
P e Training	This describes the RVT training received, any deficits or recommendations.	16	32
Sub-Nodes			
More People Trained	Would assist take up of service or understanding if more practitioners are trained in use of RVT	5	5

RVT Training at time of service initiation	The training the staff member received was at the time of the service implementation	14	22
Train at University as Student	Was trained in use of RVT as a student or at least told about the technology.	2	2
Training in RVT not on Uni curriculum	Instances where clinicians specifically referenced that RVT training or awareness not mentioned at University/ undergraduate training	2	3

5.1.3.6 Practitioner opinion of encouragement they may have received from managers

With reference to practitioner responses in Topic Area Coded ‘f’, it the topic area is staff engagement with RVT, considering if practitioners had the clinical freedom choose to use the system or not or if they were driven by management to use it through Trust or Centre for Connected Health performance management (Table 5.8). All practitioner participants responded to this topic with twenty-six references being made. The largest cohort, nine responded with regard to their personal choice to participate or even to proactively seek out an opportunity to test the RVT technology. One participant in this group utilised an older version of U-Tell for diabetic patients and felt they wanted to test the system to see if the patient’s hypertension could be monitored and driven downwards rather than risking ‘white-coat hypertension’, the practitioner participant clearly articulated a personal drive and motivation. All other respondents, eight, utilised TF3 across three specialty areas respiratory, diabetes mellitus and the Virtual Ward so were using the full TF3 triage service. The respondents positively affirmed their choice to utilise TF3 RVT. One spoke about how they were the newest member of the specialist service so was simply inducted into a way of working. Another articulated how they felt they could have reviewed the entire caseload and found patients that could have benefited from RVT, but their team’s resources were such that they could not have had the person-time to address the concomitant workload. However, a more senior practitioner from within the

same specialty but in a different location commented, “I know management have figures to hit, we can’t do anything bar the patients we have…we can’t go looking for people.” (P7). In hypertension management the practitioner participant shared their personal motivation to reduce the need for clinic attendance; a view echoed by their colleague P4, “…we were potentially very excited about it for our stroke patients as high blood pressure is a big risk factor… no pressure to use it… we were excited about it and wanted to use it.” Within the Virtual Ward the practitioner reported initiating the service as there was, “…one-person case managing the entire locality.” (P13). The free choice was still echoed within diabetes mellitus practitioners except other perspectives lessened the impact with one reporting that “…personally told that I had to put X on, yes numbers initially… I just never took it personally as I just knew myself, I was referring”. (P14) Whereas, P5 disclosed that “… in the beginning we did chose to use it, when we identified major constraints, we became a bit disappointed… disillusioned”. Therefore, in general, practitioners were aware of targets but articulated that they made the choice whether to use RVT or not.

Eight practitioners reported being encouraged to utilise RVT by peers or management. The four users of U-Tell, three with INR monitoring and one with blood pressure monitoring with patients with diabetes mellitus reported involvement because of research studies but they were interested. Within weight management the practitioner had no contention and within respiratory care there was a feeling expressed of enthusiasm for new innovative technologies which offered the opportunity of positive outcomes for patients. P16, within Virtual Wards, expressed having been encouraged but there was a chasm between what the clinicians believed was possible and the inflated idea of management. P2 reported that they never had a choice but that if they had, they would choose to use the system.

However, five practitioners reported feeling that they had no choice and were instructed to use RVT by management clearly articulating RVT usage by performance management targets. These were understood as having been set by the Minister and Department of Health and they understood the need to utilise resources effectively but the action of management to performance manage had a far more damaging and negative effect. Being told to increase

quota by management was unwelcome especially where it was to compensate for another service areas underperformance. Frustrations were expressed when targets were not met and P12 reported

> "…was where my negative attitude came from at the time because you were told that you were doing this, and you were wondering why am I doing it and then actually I set the quota at the very beginning... I set too high a target."

The irony in that scenario was that the practitioner considered the total number of patients and was assessing a reasonable proportion, which was an impossible task as they had never been involved in RVT and there was no literature to suggest an ideal number of cases for entire caseload for planning purposes. One practitioner observed that technology had moved on but that the "…service provision was stick in a deal, in a contract." (P5). In summary, where practitioners perceived freedoms to act there was receptivity but where management performance managed target attainment the resistance waxed, and the positivity waned.

Table 5.8 Practitioner responses in topic area coded 'f', to show the opinions expressed regarding the encouragement of practitioners to engage in particular the use of performance targets by managers.

Name	Description	Files	References
P f Staff Engagement target	This considers staff engagement from the perspectives of clinical freedom versus performance targets and mandates	16	26
Sub-Nodes			
Chose to use RVT	Where a practitioner proactively chose to seek out and use RVT	9	10
Encouraged to use RVT	Practitioners were encouraged to use RVT by peers or management.	8	9*
Management target	The practitioners had no choice and were instructed to use RVT by management. Performance management issue.	5*	7*

(* = data reclassified from management target to encouraged)

5.1.3.7 Practitioner opinion of RVT in relation to value for money

Whilst this thesis is not concerned about the health economics associated with RVT all practitioners discussed the concept of value for money and the quantitizing the narrative associated with value for money is Topic Area Coded ‘g’; this is only a perception (Table 5.9). Most practitioners did not know whether RVT was value for money (VFM) or not. Several expressed how they had no idea about cost of contract or even costs or value to service. P4 suggested that if they thought about it then there was doubt it was not value for money given the length of time it took practitioners to complete the referral form or be interrupted by unnecessary calls from triage nurses. However, two practitioners reported the value for patients and these quotations summarise the views on RVT VFM.

> “I honestly would be undecided, but the value is in the patients and the self-management of their conditions, that is where the value is and then you would have better health outcomes.” (P16) and “…from the patient point of view, the patients aren’t losing time off work, they’re not having to pay car parking fees…I think in the long run I think it would be very good value for money” (P8).

This latter opinion was echoed by three further practitioners as they expressed an opinion that they perceived RVT was value for money.

That said, five practitioners expressed an opinion that RVT was not good value for money. A U-Tell practitioner reflected that others may perceive it as poor value for money but did not express their own view. The remaining four practitioners were familiar with the RVT service provided by TF3 and were extremely negatively vocal in their belief of poor value for money albeit none had an idea of the actual financial cost of the TF3 contract to the Northern Ireland Health and Social Care system. One practitioner felt it was not money well spent and was under-utilised with another suggesting that local budgets for RVT for local teams would have been more cost effective. One practitioner had spent time reviewing the costs and values and said that there was a principle that an acute admission was very expensive so that if RVT could avert such admissions then the value would be clear but that the objective was not met. The practitioner continued that the value was based elsewhere with

"…value for money in healthcare utilisation or in terms of quality of life… just look at quality of life then it did improve that, so maybe it was an expense worthwhile in the long run." (P2).

Table 5.9 Practitioner responses in topic area coded 'g', to illustrate the perceived value for money of RVT.

Name	Description	Files	References
P g Value for Money	This considers aspects of value for money and the perceptions and knowledge expressed by manager or commissioner practitioner	16	25
Sub-Nodes			
Don't know if Value for Money	The practitioner does not know if the RVT is value for money	11	13
No not Value for Money	The practitioner believes the RVT is not value for money	5	9
Yes Value For Money	The practitioner believes the RVT is value for money	3	3

5.1.3.8 Practitioner opinion of outcome

With reference to practitioner responses in Topic Area Coded 'h', the topic area is outcome and benefit of RVT with fifteen of the sixteen practitioners making eighty-nine comments, this quantitizing of qualitative data demonstrates power of sentiment (Table 5.10) and (Creswell and Plano Clark, 2007).

One of the coding nodes considered the outcome and benefit from the perspective of hospital attendances. Seven practitioner responders mentioned this topic area sixteen times. This node considered if RVT had any affect upon hospital utilisation, admission, readmission or outpatients. Practitioners were from four therapeutic groups, (diabetes mellitus, INR,

Virtual Ward and Respiratory). The two diabetes practitioners said they were not trying to keep patients away from hospital, but it did mean that there were reduced numbers of out-patient appointments. The U-Tell RVT for INR had a "…huge impact on our workload because patients don't physically come to see us because they are doing it at home, and it has worked out fine" (P15). The Virtual Ward practitioner's role was to provide an alternative in the community for care rather than an acute hospital admission and the practitioner suggested the use of RVT by the district nurses would further relieve their pressures of home visits to monitor Blood Pressure and weight monitoring in chronic heart failure patients. The two respiratory practitioners had most to say on the topic with one not believing RVT reduced clinician contact, did not reduce Emergency Department (ED) attendances or hospitalisations. P10 observed that when their patients transitioned from their chronic disease phase to a palliative phase that the role and utilisation of RVT subtly changed away from "…on-going acute monitoring to try and then disengage from that to more of a symptom management rather than actual clinical parameters." Practitioner P2 spoke at length on this topic with a particularly clear minded view that the purpose of RVT had been to reduce the expense of hospital admissions but that was not realised and went on to say that there were some groups where a hospital admission would never be prevented; if the patient had asthma a hospital admission is unavoidable. This practitioner did propose that a more moderate patient could have a reduced hospital admission if RVT was deployed. P2 recounted a situation where a hospital admission had been averted as an exacerbation was detected early and emergency antibiotics administered. P7 supported such an assertion and case example suggesting that without the all-encompassing RVT and clinical team response patients may have delayed reporting the onset of an exacerbation and concomitantly been at higher risk of an admission.

Two practitioner participants reported their view that RVT had a negative impact upon readmission or outpatients articulating it as knowing what a patient's desired outcome is but that it couldn't be achieved through RVT. One practitioner described how a poor experience with TF3 peripherals and hubs/ equipment lead to a patient feeling quite stressed and the majority of RVT work was time consuming. The other practitioner rated outcomes as negative

when the patient is unable to use the peripheral device correctly or they fail, and this leads to additional work for the practitioner and a negative outcome for the patient. The two consultant medical practitioners reported neutral patient outcomes, one critical of a lack of user engagement and testing during the RVT design phase and the other (P5) reporting that the TF3 RVT service did not "… really impact much on the younger folk".

Eight practitioner participants reported a positive outcome for patients. In the 'Way to a healthy pregnancy project', patients monitored their weight and if during the course of the pregnancy an obese lady lost weight or remained neutral then the outcome was deemed as positive; P1 reported that the majority achieved that, so the outcome was successful. Two of the U-Tell practitioners reported positive outcomes as long as patient safety and a single point of contact was maintained for the patients. In the Virtual Ward P16 reported being "…able to hold on to the over 65's that have complex needs that don't fit under anybody else's remit." A practitioner within diabetes mellitus observed that the TF3 service was not so reactionary and worked better over time but because of technology it was better suited to the life styles of older people, part time worker or the retired. There were better outcomes reported for older type 2 patients with complex treatment regimes, poor control, hypos and variability in blood sugar.

> "… our initial evaluations of the results were really very spectacular, I think the drop in HB1C was nearly 2%, lower than 5% anyway, which is a very clinically significant improvement but the price we had to pay for this was great. Patients liked it definitely, patients loved it." (P5)

Three respiratory practitioner participants reported positive outcomes. P6 reported early deterioration detection, P2 emphasised the positive effect upon "… their quality of life and affected their healthcare utilisation" but the most detailed explanation was made by P10 who explained the multi organ and system disease that was COPD and the effects of medications long-term upon the person's health, it was within that context that they said, "…I am trying to optimise their health with Telehealth it has a positive impact on their general well-being."

All four of the U-Tell Practitioner participants and three quarters of the TF3 Practitioner participants reported within the node 'Help people keep track of their condition Empower'. Moreover, of all the nodes formed through the (NVivo) powered analysis of the N=16 Practitioner interviews, it had the second highest frequency of references, N=58 references made by the practitioner participants. The topic area of Empowerment is patient centric

whereas the other two high frequency comment areas are RTNI process based or references to needing to pursue further innovation. Therefore, it is assessed as the single most important patient centred observation made by 12 of the 16 practitioners.

The interpretation of empowerment broadly encapsulated the direct use or reference of the word ‘empower’ by five practitioners and also included concepts of ‘patient centred’, ‘patient orientated’, ‘independence’, ‘self-management’, ‘control’ and ‘individualised’. Therefore, this topic area essentially considered the wider benefit derived from the use of RVT that was not part of the initial regional programme design. The intention of the RTNI had been to keep people out of hospital and exert a downward pressure upon the hospital utilisation costs; benefit for the service user where not considered as a metric of value or a feature to articulate in the specification. However, it is argued that the real value of RVT did not rest with economic gain rather quality of life and benefit of well-being at the human level. Albeit, the metric of worth was not measured utilising methodologies such as Quality-adjusted life year (QALY) rather the interpretation of narrative reflections of clinical experience and observation.

When considering the practitioner participants of the U-Tell service, 75% utilised the service for the management of anticoagulation therapy, warfarin, measuring Blood INR and 25% for the management of blood pressure where patients had a diagnosis of diabetes mellitus. All four practitioners, three specialist anticoagulation nurses and one clinical pharmacist were consistent with their opinion of U-Tell in terms of patient, service user and carer benefit. Moreover, a consultant physician/ endocrinologist who had experienced both U-Tell and TF3, echoed the views of the fellow U-Tell practitioners in relation to that service. The generalised opinion of practitioners who used U-Tell RVT was that their patients were empowered by RVT and the summary benefits derived from practitioner data suggested the following seven key reasons:

1. The patient could reduce commitment to attend the Hospital as an out-patient which means they did not have to pay for car parking or have difficulty seeking a parking place.

2. The patient could reduce their travel time particularly if their condition was too difficult or complex for their local GP to manage and they were compelled to attend a regional service.
3. The patient could monitor themselves at a time that was convenient
4. The patient could increase monitoring and reporting if they felt unwell rather than having to wait for a scheduled appointment or seek an earlier out-patients appointment.
5. The patient could reduce the effect of their ill-health upon their employment so that they did not need to take time off work in order to attend hospital.
6. The patient could be mobile or travel freely abroad whilst maintaining their monitoring and dosing advice.
7. The patient learned about and understood their own condition, putting them in control.

Such benefits were expressed as having very real and tangible importance in the lives of patients taking warfarin as a means of anticoagulation. It was explained that the effect of warfarin could be significant upon the body and so the maintenance of a patient's INR within therapeutic range was vital. It is possible for patients to form thrombi where the INR is below therapeutic range or indeed suffer a haemorrhage if above therapeutic range. Some extraneous factors can have a significant effect upon the warfarin levels or metabolism within the body; these may include, heat, ill-health, alcohol, foods containing high vitamin K levels, a general change in diet and medication. Therefore, when a patient goes abroad on holiday, they may be at particular risk of their INR control becoming erratic. P15 when referring to U-Tell in such a scenario, "… definitely empowered them. I think that they are now controlling their lives instead of their condition controlling them."

The practitioners who reported that their patients utilising the TF3 RVT service were being empowered supported patients with the broad range of conditions the regional service was designed to address including weight management, respiratory medicine, diabetes mellitus and the Virtual Ward. Of note, neither the specialist stroke nurse nor the consultant geriatrician believed RVT in its current state of development benefitted the Stroke patients, a finding consistent with TF3 post stroke hypertension reported experiences. P12 had

reported the use in the Stroke service for RVT was short term blood pressure monitoring to exclude the effect of 'white coat hypertension' (cross reference anxiety coded narrative section 'i'). Therefore, there was probably not the opportunity for practitioners to observe, consider or even enable empowerment in such a limited functional application of RVT.

Within the Virtual Ward team, the views of the two specialist nurses were positively supportive of the service dimension and outcome of empowerment with P13 stating it "absolutely" empowers patients and continued with several case examples where patients' lives had been very positively impacted from this perspective. P13 was the first to expressly detail the benefits and effect of patient empowerment through becoming 'expert-patients'. P13 explained how patients changed not only their understanding of their conditions but also their language so at a time when they needed to seek medical attention, they were empowered to speak with authority rather than as a passive recipient of healthcare unable to articulately explain clinical observations. Concomitantly, this then affected how patients were received by their General Practitioners (GP);

> "I suppose from the GP's perspective they love it that patients have given them a complete clinical breakdown. It makes their lives so much easier" (P13).

In another example case P13 described how patients were independent as a result of RVT but that carers were helped considerably. A case was cited whereby a frail patient with both dementia and respiratory disease could be cared for by their family as they were able to understand vital signs that may indicate deterioration when the patient did not have the capacity to share how they felt. It could also be argued that this example demonstrates safety but also that carers are empowered to continue caring, having a proactive role in the maintenance of the patient's well-being. P16 equally supported this view within the context of a Virtual Ward and stated that the RVT had the "…patient at the centre."

The two remaining clinical areas had different approaches and technologies for RVT; respiratory with full triage TF3 RVT and diabetes mellitus with track and trend TF3 RVT. Whilst, again describing empowerment, the different

professional groupings and service responses triggered a response from differing viewpoints.

Two of the four respiratory practitioner participants contributed observations, one practitioner being a specialist physiotherapist and the other a specialist nurse. P2 clearly articulated "…empowerment and patient quality of life" setting into context the tangible benefit and value of patients being able to have "better control of their disease". P7 gave case examples where patients and their carers were empowered to be independent and manage early signs of infection describing the support provided by RVT as "phenomenal" which enabled them to "…just manage themselves better".

Within diabetes a specialist nurse observation, made through experience, commented that patients could become dependent upon RVT and so they had the time limit set from the outset of the prescription and an occasional extension enabled. The dependence was interpreted as a security issue and so the nurses ensured emphasis of purpose changed to reflect the need to understand diabetes and the effect of certain behaviours upon the body; an education tool. The reframing did not detract from the security patients expressed knowing that they were being monitored. The physician took a different approach to the articulation of empowerment through RVT of the diabetic patient. Indeed, from P5's perspective there was no doubt that RVT empowered patients, "…we were trying to improve their self-management skills and their overall diabetes control." Furthermore, P5 extended discussion to the wider and future opportunities that RVT could afford within the concept of patient empowerment. There was a vision of extended empowerment for the future with dynamic patient support groups through dedicated portals, "semi-automated" (P5) analysis of RVT data particularly where therapeutic intervention is through injectable medicines especially when considering difficulty when face-to-face access with practitioners is likely to become more limited.

Table 5.10 Practitioner responses in topic area coded ‘h’, to illustrate the perceived or actual outcome or benefit derived from the of RVT.

Name	Description	Files	References
P h Outcome and Benefit	This considers the aspect of outcome or benefits of the service expressed by manager or commissioner practitioner, whether actual, demonstrable, hypothetical or imagined.	15	89
Sub-Nodes			
Help people keep track Empower	RVT helps People keep track of their condition	12	58
Hospital attendances	Consider if RVT has affected the hospital utilisation, admission, readmission or outpatients	7	16
Patient outcome negative	Know what the Patient's desired outcome is but do not achieve it through use RVT	2	3
Patient Outcome Neutral	Know what the Patient's desired outcome is only partially achieved through use RVT	2	2
Patient Outcome Positive	Know what the Patient's desired outcome is and achieve that through use RVT	8	10

5.1.3.9 Practitioner opinion of clinical issues

With reference to practitioner responses in Topic Area Coded ‘i’, the topic area of Clinical Service Issues extended the thinking of practitioners beyond the high-level general feelings towards RVT as described in topic section ‘b’ or opinions as expressed in topic section ‘c’ (Table 5.11). The topic section ‘i’ did not discuss purely mechanical service clinical issues but explored wider concepts, the feelings and behaviours of others and technology in general. There were sixteen subheadings within the topic areas with two subheadings further divided into sub-subheadings. All practitioners discussed RVT within the context of the wider topic of Clinical Service Issues. The subheadings

considered by the researcher as most significant and impactful will be discussed. Of the N=24 sub-nodes and sub-sub-nodes, analysis was undertaken under three overarching themes, professional opinion of patient interaction with RVT, RVT System and RVT Technology.

When considering professional opinion of patient interaction with RVT, there were two main nodal topics anxiety and patient identification. Anxiety is described at length by six practitioners. It is a particularly interesting area as the practitioners who raised patient anxiety as an observation were almost split with an opinion that RVT had the potential to increase anxiety with others recognising an ability to reduce anxiety but there was consensus regarding knowing the individual patient. Through experience practitioners had built into their own personal unwritten assessment criteria for RVT whether or not they would have anxiety controlled or exacerbated by the use of RVT. From experience it was reported that post stroke patients were particularly prone to anxiety, a fear of the next stroke and the devastating consequences. On one hand RVT had been observed that RVT could reduce 'white-coat hypertension' (high blood pressure caused by clinicians) by self-managing at home and on the other elevate anxiety. In stroke care it was the experience of practitioners that the anxiety issue was unpredictable, and an example was given of a post stroke patient who was discharged from hospital with RVT. The individual was a highly qualified bank manager but very shortly after discharge be became 'fixated' upon his blood pressure, increasing frequency of measuring and concomitantly increased contact with the stroke specialist nurse. The same descriptor, 'fixated' was utilised by a dietitian who described RVT as unhelpful where individuals were obsessed with weight as in their experience they could not condone over monitoring of weight as it "heightened people's concerns." Within the general discussion about anxiety, situations were described where an overly anxious patient would create more anxiety and would "manipulate the system to make them worse than they are" (P16) particularly where the subjective psychosocial questions confuse the patient as they are unable to compare well-being from one day to the next and "over analyse the questions" (P13) where a question enquires if they would describe themselves as better or worse today than the day before. However, within respiratory and virtual wards there was a consensus the system can reduce

anxiety where the patient is quite unwell, is home alone and can be given a lifeline to the triage service and more anxious patients would tend to contact the practitioners more than less anxious patients and so by prescribing RVT they were given assurances. Situations where practitioners know their patients are socially isolated RVT can afford reduced anxiety. In summary, RVT can have both a positive and negative effect upon patient's anxiety levels and the key is to know the patient. There was a consensus that RVT had been found by practitioners in virtual wards and respiratory medicine to reduce anxiety and in post-stroke care and weight management to heighten anxiety.

N=13 practitioner participants referenced the topic of patient identification process fifty-eight times making it the second highest ranked topic across all of the one-to-one practitioner interviews and very much focused upon process. The opinions and recommendations of the practitioner participants are tabulated; demonstrates a summary of patient identification factors (Table 5.12).

Table 5.11 Practitioner responses in topic area coded 'i', which examines the clinical service issues as observed or perceived by the respondent.

Name	Description	Files	References
P i Clinical Service Issues	This considers any Clinical service issues beyond those documented within the node MP c Opinion expressed RTNI. It is more focused upon views, or perceived views (if made by a manager) of practitioners, service users, the change of practice and research evidence.	16	174
Sub-Nodes			
Anxiety	Observed a change in patient anxiety as a result of RVT	6	16
Increases Anxiety	Patients who utilise RVT experience increased anxiety	4	7
Reduced Anxiety	Patients on RVT experienced a reduced level of anxiety	3	5

Clinicians are reluctant	Some clinicians are reluctant to engage with the technology	5	6
Contact by Phone	Contacted by the service provider by Phone	8	13
Duration	Length of time patients utilise RVT	5	6
Extended Range of Conditions	Where practitioners have chosen to extend the range of conditions, they use RVT with	2	3
Monitoring to adjust treatment	The practitioners have purposefully decided to monitor a patient, their vial sign, so as to adjust care e.g. medication dose	5	10
Need for better research	Hard to determine effect and more research needed	4	6
Patient engagement with technology	Patient behaviour with regard to technology, the learning of new skills and use of technology	7	12
Patient Honesty	If patients record own reading and communicate directly with practitioner rather than via a direct data transfer	4	5
Patient identification process	This describes the decision-making steps and process a practitioner described and in most cases was developed in service following the experience of practitioners testing the system.	13	58
Patients fear of technology	Some patients are fearful or nervous about being asked to engage with technology.	9	11
patients own equipment	where the patients were asked to upload readings from their own home, un-calibrated equipment e.g. scales, BP cuff, glucose monitor	1	2
Portal	New on-line portal for RVT	3	5
Reading upload frequency	How frequently patients are asked to submit readings	5	6
Ad hoc submission	Reading submission is variable based upon previous reading and need	0	0
Frequent	Once a day submission of readings	1	1

Less than 3x per week	Patients are asked to submit readings less than 3 times per week but more than once a week	0	0
Once a week	Patients are asked to submit readings once a week	2	2
Very Frequent	Readings submitted more than once every day	0	0
Weekday submission	Patients are asked to upload readings Monday to Friday	1	1
Time	The Time associated with RVT can be problematic	5	11
Work in a new way	Practitioners proactively changed custom and practice	2	4

5.1.3.10 Practitioner opinion for patient inclusion and exclusion criteria

The tabulation of use case application of RVT across the professional and disease groupings demonstrates that only Respiratory reference a local set of referral criteria and that all other practitioners tend to utilise their clinical judgement and trial and error modified over time by experience. There are common themes such as anxiety reducing chances of referral and that all practitioners have a therapeutic purpose to enrol their patients onto the system; it appears to be purpose driven even if agreed evidence-based guidance was not driving clinical practice.

Further consideration of professional opinion of patient interaction with RVT included the nodal topic of ‘Patient Honesty’ which was raised by four practitioners working across weight management, diabetes mellitus, INR and Virtual Ward and in summary the practitioners experienced patient dishonesty as a critical factor. In fact, one practitioner gave a case example where a patient had her RVT removed as she was manipulating the data to cause an alert and receive attention and a home visit. The data from the peripheral devices would be transmitted to the Home Hub and on to the TF3 service without the requirement of a patient to self-record data. However, the psycho-

social well-being questions could be manipulated by the patient in order to elicit a response. Unusually, in INR there was a subtle difference associated with failure to upload data, sometimes due to forgetting and other times as the patient feels in control of their INR and feels fine. In addition, practitioners shared opinions that the range of practitioners and conditions RVT could be deployed with could be extended with P10 suggesting pre and post-operation transplantation patients. Four practitioners, across as many different professions emphasised the need for better research. There was a consensus that scepticism and apprehension existed amongst professionals as little evidence was available to support the Government's investment. However, it was recognised that would be the case with new technologies and so it was not a "reason to stop trying" (P4).

A salutary message was delivered by five practitioners across four clinical areas. Concerns were voiced that there were many practitioners who were reticent of technology and generally unaware of RVT. A positive message of engagement and motivation was required. A further two practitioners articulated the new way of working from a positive stance with P8 proclaiming. "…embrace technology… accept things are moving forward and we have to move with them."

The RVT System was a set of nodes that were discussed by all practitioners and covered a range of practical dimensions of RVT including duration, telephone contacts, method and frequency of uploading data and time. The narrative did not significantly move beyond the known planned type of service delivery. Practitioners did share how they engaged with the practical mechanistic operationalisation of the regional RVT contract, TF3. There was no contribution to knowledge beyond the known context of service.

Personal RVT Technology experience was an important reference point for practitioners to anchor their thoughts of technology utilisation moving forward to the future. The TF3 RVT project supported a Patient's Portal which was not universally accessed by patients and was only referenced by one practitioner whereas three supported the practitioner's portal for accessing the data associated with their patients. Patient owned devices were not utilised as part of either of the RVT systems and whilst it could be an option the lack of calibration was highlighted by one practitioner. Interestingly, a finding which

did not emerge to any great extent from the patient participant data was the consideration to be given to patient's fear of technology. Nine practitioner respondents across nursing and AHP, across all clinical areas, except weight management expressed the observation. It was recognised that some people, possibly older, with mental state issues and having had no experience of technology were afraid of technology. P13 gave a case example whereby a patient asked for the equipment to be removed after 3-days as it "…reminded him that he was ill."

Table 5.12 Summary of patient identification factors.

Long Term Condition/ Professional Area	Inclusion	Exclusion
Stroke	Hypertension/ blood pressure that is difficult to reduce	Cognitive impairment
	Suspected 'white-coat' hypertension	Anxiety
Care of Elderly (CoE)	Following experience with Stroke – consideration to monitoring CoE with weight in Heart Failure	
Virtual Ward	Patients that are well known to the service	Anxiety – find they may manipulate the system
	Avoid exacerbations	
	Looking for a trend	
	Frail with dementia if family could support	
	Young adults transitioning from paediatric services.	
	Mixed clinical pictures with co-morbid Congestive Heart Failure with COPD	
Diabetes Mellitus	Speech impediment as giving blood glucose information over the phone can be difficult	
	Patients that need extra support and Encouragement	
	Pre-surgery patients to get them to target	
	Where we want to make major therapeutic adjustments for a patient	
Anticoagulation - INR	Patient safety where stable	
	In future move to unstable INR for frequent monitoring	
	Only anticoagulated with warfarin	
	Live a long distance from the Acute Out Patients Clinic	

	Patients who work and would not have much time available to attend for clinic appointments	
	Computer literate and capable of utilising the Roche CoaguChek (INR Meter)	
	Mental Capacity	
Respiratory	Two exacerbations in previous 12-months	Asymptomatic patients
	Patients with poor family support	Patients who are very well
	Reassurance to patients on good days as the patients know there can be hospital admissions and serious consequences if observations are off.	Patients who are very ill e.g. lung cancer or pulmonary fibrosis who are deteriorating
	High healthcare utilisation in line with some locally agreed guidelines	Not where a patient tends to be poor in the morning generally unless RVT can be scheduled for later in the day i.e. after lunch
	High number of contacts with the GP or Respiratory Team.	Memory problems
	Locally agreed guidelines and team decision making	Anxiety
	When on a domiciliary visit always thinking if RVT would help in the situation	Independent and no infection over the past two-years
		Patient's with no 'know-how', computer illiterate and would not use a machine

5.1.3.11 Practitioner opinion of the future of RVT

With reference to practitioner responses in Topic Area Coded 'j', the topic area of Need More Innovative Technology was the single most thought-provoking topic across all practitioner one-to-one interviews with N=14, 85.7% of practitioner respondents referencing the nodal topic sixty-one times (Table 5.13). Of note, the two practitioners who did not articulate issues about the future utilisation of technology were the two most inexperienced both having worked with a few patients and on a solely track and trend TF3 service.

In summary, the fourteen practitioners who offered thoughts on the future of technology utilisation in healthcare were universally supportive and encouraging. A common theme was that with the staffing resources not keeping pace with demand for care, "…we are seeing doubling rates of maybe 10-15-years in terms of prevalence in diabetes, and we've got to do something different" (P5). Practitioners believed that there were no other opportunities in healthcare to address burgeoning demand other than to look to technology to support care. There were common practical themes shared by the practitioners, when they expressed their thoughts and feelings, within the context of the future for technology, particularly in relation to RVT. Across the narrative recorded under this node, based upon their experience of RVT, there were nine common predictions shared and these have been distilled as follows considering the future of technology:

1. Mobile technologies that automatically send data, in the background, that are easy for patients to use and do not require dexterity with cables and ports.
2. Technologies where there is a single sign on Electronic Patient Record that can be accessed by all Trust staff and GPs which includes the patient's own daily readings from RVT.
3. Technologies which are automated or semi-automated responses to patients generated by the technology embedded with data analytics to create a "Doctor-in-my-pocket" (P5)
4. Technologies which communicate automatically in an integrated way e.g. the INR reading transferring from U-Tell to the Dawn Dosing system (P5)
5. Technologies which include patient access such as internet Patient Portals. These should become interactive so that patient interfaces and technology enable push and pull information to enable training, health promotion, lifestyle, function, exercise and treatment compliance.
6. Technologies which are calibrated so the accuracy of peripheral devices and battery life are more reliable.
7. Technologies which enables two-way messaging between practitioner and patient for more timely personalised care and intervention. Including the option for video calling.

8. Technologies which permits the recording and transmission of new metrics e.g. carbohydrate counting and the date, time stamps included
9. Wider technology adoption across the services and professions not only the domain of a limited number of specialist practitioners.

Whilst there were calls for better collaborative working between practitioners and Information Technology experts, with a request for suppliers to be more forward thinking, there was a resounding sense of support and enthusiasm for RVT and the need for more innovative technology; "…is the future and we need to embrace the future and we need to think to a smarter way of working" (P4).

Table 5.13 Practitioner responses in topic area coded 'j', to enable the articulation of perceived vision for the future of RVT in Northern Ireland.

Name	Description	Files	References
P j Future of RVT the next generation	Considers all aspects for the future of RVT, looks forward to the future or articulates what next for RVT in Northern Ireland, including policy, equipment, models and engagement regardless of a pessimistic or optimistic stance taken by participant.	14	63
Sub-Nodes			
Electronic Record	Where the readings are collected and translated into a record for practitioners to access	2	2
Need more Innovative Technology	Clinicians recognise the need for more technology, new, broader range peripherals	12	61

5.2 Summary

There were 37 senior nurses, doctors and allied health professionals within the SET who had been trained in the utilisation of RVT, 16, agreed to be interviewed. Over 50,000 words of data were analysed utilising (NVivo). There

were eight main topics, ten overarching topic nodes (two of which were more demographic in nature) which contained 55 sub-nodes.

A criticism of the data may be that RVT enthusiasts had self-selected and that the more negative viewpoints were not expressed, and the data demonstrated that 15 of the 16 participants had positive feelings about RVT and were optimistic about future use. However, of practical application in the future participants were candid about what worked well, what did not, and from a very practical experience the inclusion and exclusion criteria the different clinical areas had developed.

The key message from the practitioners had been how RVT had changed their relationship with patients as they found patients became empowered through RVT. The summary experience of practitioners to articulate this belief included, self-management, reduced requirements for patients and carers to travel to appointments and pay parking fees, less impact on employment for those patients who were in work, could monitor themselves at a time that was convenient for them, could increase monitoring if they felt unwell, could travel abroad and maintain monitoring and support from clinical services and that they learned about and understood their own condition, putting them in control.

6 Analysis of Manager Data

6.1 Analysis of Qualitative Data Held within Nvivo

6.1.1 Introduction

Results of qualitative analysis of manager and commissioner interviews are presented by reference to eight main topics. To enable meaningful comparison between participant groups, that is the practitioner group with the manager group, the main topics are consistent with those of the practitioners, albeit the sub-topics demonstrate diversity and some divergence from the structure of the practitioners. Managers shared their experience and opinions of the collaborative design of RVT, implementation and then decommissioning. Options are varied, some favourable and some less so. This chapter will explain the experience of the managers and the knowledge they shared consolidated around the share themes.

6.1.2 Manager and Commissioner

There were eight interviews with senior officers from within the Northern Ireland Health and Social Care (HSC) system. The objective was to garner the opinions of senior officers from across a range of relevant clinical professionals and also non-clinical senior administrative staff. In principle, enough one-to-one interviews were to be undertaken until such time as no new evidence emerged as per the best practice within grounded theory (Aldiabat and Le Navenec, 2018). However, seeking participation within this group was time consuming as 40%, of those requested to participate, did not respond whilst an additional individual opposed participation as he said that his views of the TF3 service would be unpublishable. Within quite a broad

spectrum of senior managers from across the Trust, Public Health Authority, Health and Social Care Board and Department of Health and Social Care, eight senior managers were interviewed. Most of the managers did not have a clinical background (Table 6.1). The senior civil servant did not have a tertiary education and those with a business studies background classification had third level degrees in hospitality management, accountancy and accountancy with business law. Whilst these professional backgrounds do not naturally orientate towards remote telemonitoring, the four individuals had lengthy careers in the health service, and all were in experienced senior positions influencing and commissioning RVT for the region. None of the managers had received any prior training in RVT. The gender mix of the manager respondents was 50% male and 50% female. The years of highest qualification attained ranged between 1976 and 1997, with 75% graduating in the 1980's and the mean year of graduation being 1985.

Table 6.1 Profile of professional background of managerial respondents showing a range of positions in the healthcare system.

Professional Background	Number
Business	3
IT	1
Civil Servant	1
Nursing	2
Allied Health Professions	1
Total	8
Eligible Regional Managers	15
Percentage Responded	53%

The face-to-face interviews each lasted circa 1-hour, were digitally recorded and transcribed into Microsoft Word. The eight documents were uploaded into NVivo, the mean word count length of each was 4,826 words with the total number of words in the narrative being 38,608. Therefore, the assistance of NVivo in permitting the researcher to create topic notes and concomitantly code narrative to the appropriate note for sorting, reporting and methodical analysis was beneficial.

A high-level summary report was tabulated within (NVivo) to demonstrate the distribution of opinions and perspectives shared by participants (Table 12.7

Appendix 9). This expresses the topic code, the descriptive title of the topic area, up to two tiers of more focused response descriptive titles, the number of participants who expressed a broadly similar view within the topic area and then the number of times that description was repeated. Therefore, if each participant expressed an opinion in a descriptive topic title area the number of manager respondents would be represented as eight and if each of those respondents mentioned the topic twice during their total interview time, the frequency would be 16. It is recognised, in analysing the narrative that it may seem arbitrary to count multiple expressions by the same respondent in the same "unit" as if it was expressed by different respondents, but distinction and explanation will be made in the analysis. A unanimous view is considered as stronger than one person repeating a point eight times. Consideration of the qualitative data in this way is referred to as 'quantitizing' the data (Creswell and Plano Clark, 2007).

6.1.3 Analysis of Manager Narrative by Descriptive Topics

Each descriptive topic area has been tabulated to illustrate the number of source participants who expressed an opinion and also the frequency the topic was repeated or reinforced by the subset of participants who articulated the topic. The descriptive topic tables also include the working definition assigned to the description by the researcher to further enable understanding, grouping of sentiments and concomitant interpretation. The manager participants had been given assurances that their individual identities would not be discussed, nor their comments attributed to them. Therefore, within the qualitative analysis of the narrative any manager participant quotations was not attributed, rather recorded within speech marks.

6.1.3.1 Experience of RVT as a manager

With reference to manager responses in Topic Area Coded 'a', the topic area of experience as a manager or commissioner participant was discussed by all participants with all confirming that they had no personal experience of

actually using an RVT system (Table 6.2). Of the eight managers, only three had a clinical background, one dietitian and two nurses, but all had held senior positions without direct patient care for a number of years. The managers with a clinical background were able to explain their foundation knowledge, direct connection with their staff delivering care through RVT, exploration of theoretical clinical evidence base development and a strategic high-level overview. One manager held an Information Technology (IT) qualification and was able to articulate how their (expert) knowledge of technology enabled them to examine technology from the perspective of patient benefit. The remaining four managers did not have a clinical or IT foundation described their 'on the job' learning. Such activities included attendance at conferences, technical demonstrations, visit into the homes of patients utilising RVT, visiting services in other regions, learning through the pilots and learning through the creation of a specification of a new region RVT service, which TF3 was successfully awarded. One manager articulated their belief that it was an advantage not to be a clinician, arguing that they would not suffer from a perceived hierarchy within clinical ranks and that they were able to say, "look I'm not a clinician, what would you like?" (M2)

Table 6.2 Manager responses in topic area coded 'a', examining the participant's experience of RVT.

Name	Description	Files	References
M a Experience as a manager or commissioner practitioner	Background of or experience with RVT from the perspective of being a manager or commissioner practitioner. Comments may be about experience, qualification or advice gained from observation that does not fit within another Superior Hierarchical Node	8	21
Sub-Node			
Experience only as a manager or commissioner	No personal experience of actually using the system	8	21

6.1.3.2 Manager feelings towards RVT

With reference to manager responses in Topic Area Coded ‘b’, the topic area of feelings towards RVT was discussed by all manager participants (Table 6.3). One of the participants, (M5), expressed strongly negative feelings towards RVT, specifically referencing TF3, the expected benefits and outcomes were not being realised. They recognised that RVT was useful in certain aspects but was not maximising opportunity. Two manager participants expressed neutral feelings towards RVT, one of whom was indecisive but also expressed positive views, so the only truly neutral manager participant articulated that whilst patients did express benefit there were still many clinicians who were sceptics alongside those who were champions. However, six managers expressed generally positive feelings towards RVT. The majority were moderately positive with the strongest affirmation being that

> “… it is the only show in town… pressures are significant, and we need to start understanding how to use data…technology is about giving us data…in terms of decision making “(M8).

Of interest, M3’s positivity was contextualised within a concept of RVT, “… a patient collecting information and having a mechanism to share with health and care” and so framed RVT within a patient sharing data model (an action) rather than a fixed specific technological solution (hardware & software).

Table 6.3 Manager responses in topic area coded ‘b’, to express their general overarching feelings towards RVT.

Name	Description	Files	References
M b Feelings towards RVT	Where the participant expressed their feelings towards any aspect of RVT	8	11
Sub-Nodes			
Feel Negative		1	1
Feel Neutral		2	2
Feel Positive		6	8

6.1.3.3 Manager opinions of RVT

With reference to manager responses in Topic Area Coded ‘c’, the topic area of opinion expressed about RTNI was that, the RVT provided by TF3 did not include consideration of the U-Tell RVT solution (Table 6.4). All managers expressed opinions within this node with 84 references made. For interpretation and understanding there were 12 sub-nodes that grouped key opinions together for more detailed and focused analysis.

Seven of manager participants articulated what the ‘Commissioners get wrong’, defining the sub-node in terms of mistakes made by them or the process; there were 27 such comments from most managers. The problems revolve around the Contracting/ Commissioning authority. They indicated that the TF3 contract had too many restrictions, was slow and change was extremely difficult to enable. The fitness for purpose of the contract was questioned and whilst it might have been considered good at the outset by June 2016, one manager said that it was no longer fit for purpose at the time of interview (*June 2016)*. A sentiment echoed by M4 where the belief now was that an end-to-end service was not necessarily required by all as it was too restrictive of innovation and ‘lighter-touch’ solutions. They continued expressing that it also led to ‘finger pointing’ between the consortium partners when problems arose. Four managers thought that not only were analytics enabled or exploited to demonstrate service use, value and clinical interaction between patient and therapist but that the evaluation of the TF3 service should have been considered and built into the contract from inception instead of being an afterthought towards the end of the contract. An example of direct contract failure where the omission of evaluation was noted was with regard to the length of time practitioners were instructed to prescribe the TF3 RVT for, as one manager explained;

> “…What benefits the patient and that’s where the evaluation becomes really, really important because having an arbitrary cut-off date, for example, with no measure of effect… no definition of what a measurable effect is, how does that actually show value in anything?” (M8).

A recurrent theme was the failure of real and meaningful engagement with stakeholders so that a gap existed between the strategic vision and

operationalisation leading to a lack of foresight and understanding. To compound that, M7 spoke about the double-edged sword that was associated with ‘ring-fenced money’. The benefit being that the service funds are protected whilst on the other hand; the Trust’s management do not really have the motivation or ability to mainstream the service. From a senior level, there was criticism of the commissioning and a clear articulation as to how leadership was required to act clinically, financially and strategically.

The second most discussed opinion from the matrix of participants raising the topic was the sub-node of managers’ negative comments about the kit where six managers expressed negative opinions about the RVT equipment. They felt that the TF3 devices/ technologies were not state-of-the-art and that the technologies had not really changed over a decade. They described service limitations where patients were shoehorned into set packages rather than having peripheral devices that would fully support their needs i.e. enable the right vital sign metrics to be recorded based upon particular need rather than a ‘one-size-fits-all’ approach.

Others were more positive comments about kit. For example, one manager felt the accreditation, calibration, standardisation and general quality control was superior in a regional RVT service, whereas others expressed a view that a wider variety of ‘bring-your-own’ peripherals should be utilised and be patient specific. One manager (M6) spoke at length about the need to enable patients managing their weight gain or weight loss to do so with their own home scales. The lack of accurate calibration was not always seen as important as the key was a recorded difference (reduction) in weight. Such a change would have enabled a scalable difference to a weight management programme as the digital, Bluetooth calibrated scales within the TF3 service were one of the more expensive pieces of equipment and yet have only been utilised by the patient once a week to transmit data.

Five of the managers sought more clinical engagement in service design. They repeatedly said that clinicians were not engaged or involved enough in the design of the end-to-end managed service. Linked to this node was the node considering clinical engagement with service design and specification. The manager’s view is that (some) clinicians were engaged and were involved in the design of the managed service. Three managers mentioned this positive

engagement five times with only one manager participant making both positive and negative comments relating to the level of clinical involvement during the creation of the regional RVT service, the RTNI, which was supplied by TF3. Most of managers expressed the importance of clinical involvement and buy-in from the outset of RVT service design. The importance of "meaningful partnership" (M8) with clinicians was emphasised and whilst there was an engagement with a broad base of clinicians there was the view that more stakeholder engagement was required within the "…implementation of any significant change … clarity of vision from the outset …about having change champions" (M7).

Within this node the manager participants also passed comments on the functional issues of the service and technical specification including tender process, quality of TF3 service with some critical statements, "…solution that was actually procured was the wrong solution" (M8) and "…we have procured it this time round, it is a bit of a size 9 shoe, everyone has to wear it….to some extent it is successful but it is still clunky" (M1). Two managers commented on the referral form. Both said that the referral form was too long (16-pages) that the lack of auto-population was problematic, and they appreciated the level of difficulty experienced by the practitioners.

In summary, the managers had considered a broad range of factors when expressing opinions of the RVT. The managers were balanced understanding the commissioning and service issues that should have been addressed as well as a desire to support practitioners to become involved. It was a disappointment to the managers that there had not been more clinical engagement both in service design and the deployment.

Table 6.4 Manager responses in topic area coded 'c', to express their wide-ranging opinions of the regional RVT service deployed in SET.

Name	Description	Files	References
M c Opinion expressed RTNI	Opinion expressed by manager or commissioner practitioner about the Regionally Procured Service and the comments could include reflections regarding any area from commissioning process to RTNI; from process of service design and procurement to end service	8	84

Sub-Nodes			
Clinicians involved in service design	Managers view is that clinicians engaged and were involved in the design of the end-to-end managed service	3	5
Contract Development Issues	Views of managers regarding the process undertaken to commission the service	2	3
Managers negative comments about kit	Managers had negative thoughts about kit utilised in RVT	6	7
Managers positive comments about kit	Positive comments about technologies deployed	4	5
Managers view of Referral Form	Managers view of Referral Form	2	2
More clinical engagement in service design was required	Managers view is that clinicians were not engaged or involved enough in the design of the end-to-end managed service	5	12
Patient service user involvement in design of service	Managers view is that clinicians engaged and were involved in the design of the end-to-end managed service	1	3
RVT Purpose	How the manager describes their role/ objective in or the original purpose of RVT	1	4
RVT TF3 better	Managers views that the service was better than hoped for	3	4
RVT TF3 service poor	Managers views that the service was not what would have hoped for	3	6
Tech specification for contract	During the specification process to prepare for the call for tender, there was effort put into specifying service and equipment	2	6
What the commissioners get wrong	Upon reflection, issues managers pointed out as mistakes made by them or the process	7	27

6.1.3.4 Manager opinions of models of RVT

With reference to manager responses in Topic Area Coded ‘d’, the topic area is opinion of the models of RVT (Table 6.5). Seven managers discussed the two major types of service model as provided by TF3 with six discussing triage and four track and trend. Track and trend was likened to simply taking readings at the bedside enabling the clinician to make decisions with the patient about their care. It was thought to be the highest volume of activity and evolved to be a very low invention service whereby the originally planned role of the Service Provider, TF3, to intervene if a reading was missed was dropped as it was believed to be “too heavy handed” (M2) in practice.

One respondent (M8) suggested that the approach to remote monitoring should not be “mutually exclusive but they really should be designed in and around the patient”. The general debate amongst six other manager participants agreed the general definition or intention of the triage service with the key feature being that the Trust’s specialist practitioner would set the parameters for the patient; if they subsequently uploaded a reading outside then an alert would be raised with the first responder being the supplier’s triage nurse. One manager observed that the interventional element of triage, the triage nurse contact was provided “…by a 3rd sector party rather than through the Health Sector” (M5) which further raised a concern about an intervention from a general nurse rather than a specialist practitioner where patients were generally managed by specialist practitioners. It was suggested that triage was appropriate for a narrower range of patients and with another manager (M4) contributing with thoughts about data analysis within triage that were not considered i.e. patterns of alerting. Another manager equally queried understanding of the value triage brought,

> “…because we know that many patients’ readings are in excess of their parameters each day, but we know that only a fraction of those are escalated to healthcare professionals.” (M1).

The strongest opinion expressed by a non-clinically trained senior manager who blamed clinicians for alerts.

> “…trouble initially with the triage because parameters had to be set, clinicians would put patients on, set parameters and leave them on forever and a day then complain because they were constantly getting

> alerts and I think there is a question out there as to whose fault is that and ultimately it would be the fault of the clinician who didn't go back and view the patient and see are these true alerts or are the parameters not appropriate for this patient?" (M2)

However, this statement may demonstrate the manager's understanding of the mechanistic steps a practitioner may undertake in placing a patient onto a regime of care inculcating RVT as a modality rather than the knowledge and skills of a practitioner in the decision making to prescribe and planning of care.

Table 6.5 Manager responses in topic area coded 'd', to express their opinions of the models of RVT delivered.

Name	Description	Files	References
M d Opinion of models of RVT	Opinion expressed by manager or commissioner practitioner about the models of RVT, that is the two main types of provision triage or track and trend. Both TF3 & U-Tell include track and trend.	7	20
Sub-Nodes			
manager thoughts track and trend	Managers will not have had direct use of track and trend but will have a view on the solution	4	5
managers thoughts triage	Managers will not have had direct use of triage but will have a view on the solution	6	15

6.1.3.5 Manager opinion on training

All managers shared opinions in Topic Area Coded 'e', the topic area is training in relation to RVT (Table 6.6). One manager reported that there was currently no awareness being raised at the undergraduate stage of nurse training and that the Trust had wanted to pursue this. None of the managers reported having ever been trained in RVT. It was felt that training in the system was not appropriate as they undertook more strategic roles. Albeit the most senior officer within the Health and Social Care Board attended the TF3 site to observe proceedings and visited patients utilising the service in their own home. Attendance at awareness sessions, through contract negotiations, site

visits across the EU and England and regional service meetings M3 believed were sufficient in terms of the level of operational understanding required. Indeed, at the outset the most senior officer in the Public Health Agency visited sites in the USA. One manager reported that they had been directly involved in the design and development of a U-Tell research project and so in organising training and setting protocol ensured that they were personally well versed in the U-Tell approach to RVT but not with the TF3 service.

Table 6.6 Manager responses in topic area coded 'e', to explain the participant's experience or opinion of RVT training and education.

Name	Description	Files	References
M e Training	This describes the RVT training received, any deficits or recommendations.	8	16
Sub-Nodes			
Manager received awareness training	Manager received awareness training	3	4
Managers view is that more training is or was required	The overall reflections regarding training are that more should have been provided or is required	1	1
No management training	Manager did not receive training	7	11

6.1.3.6 Manager's opinion of encouragement of practitioners to use RVT

With reference to manager responses in Topic Area Coded 'f', the topic area is the encouragement of clinicians to utilise the RVT service; comments were only in relation to the regional TF3 service (Table 6.7). Most managers (N=7), spoke about performance management and quotas. Both Provider and Commissioning organisations in the Health and Social Care sector have a responsibility to report performance to the DoH. A theme throughout was summarised by one respondent,

"…engagement of health and social care professionals is much more important than target setting for them. So, target setting in its own right

> may be part of a range of engagement measures but will not be a solution in itself" (M3).

Another manager practitioner did echo this sentiment but then also contradicted themselves by remarking, "…think managing practitioners by quota is really an effective way of going" (M1). One manager (who was the architect of the RVT TF3 performance management and quota system) confirmed that the clinicians should be "free to use it, in an ideal world would use it because it was part of the normal care pathway" (M2) Another reinforced a view of patient centeredness as what the patients actually needed; likening the prescription of technology to pharmaceutical prescription, "…you'd prescribe the drug that was fit for purpose" (M8).

One manager participant shared that consideration of performance management and quota had been part of the managerial planning process and that they had recommended an outcome-based approach (M4). They explained the possibility of building perverse incentives into the system, recognising a disincentive to refer new patients as to have a currency of length of time on the system as it could lead clinicians to simply prescribe long durations of RVT and fail to review and take the patient off the service. Whereas a more clinically linked outcome focused metric would have been purpose driven; "… it would have been a lot more challenging to try and deploy… so in the end we opted for the target we did" (M4). The perverse incentives were eluded to as "a degree of sophistication" being needed in target-setting or else there is a risk of "…unintended consequences" (M7).

Table 6.7 Manager responses in topic area coded 'f', to show the opinions expressed regarding the encouragement of practitioners to engage in particular the use of performance targets.

Name	Description	Files	References
M f Staff Engagement target	This considers staff engagement from the perspectives of clinical freedom versus performance targets and mandates	7	14
Sub-Nodes			

Encouraged engagement	Encouraged engagement as a manager rather than mandating targets	4	5
Set performance targets	Either planned or instructed with regard to setting of performance targets	6	9

6.1.3.7 Manager perception of value for money

Whilst this thesis is not concerned about the health economics associated with RVT all managers discussed the concept of value for money and the quantitizing of the narrative associated with value for money is Topic Area Coded ‘g’ (Table 6.8). All managers described VFM as useful. Two managers comfortably explained that they did not objectively know if RVT worked, specifically speaking within the context of the regional TF3 service; both managers were senior Trust based managers. The opinion shared was that this was a problem with the RVT regional TF3 service as there had been repeated calls at the Regional Project Board for such an evaluation particularly regarding the review of the TF3 service that had been commissioned where,

> “I think it would be fair to say disappointment with the information that was forthcoming as a result of that…quantifiable quantitative particularly monetary benefits of the use of RTM” (M7).

A further hidden dimension articulated (by M8) was that the job plans of Trust practitioners were not adjusted to accommodate the implementation and adoption of RVT with their work associated with RVT not being credited; that is their work did not change, more was added and so no determination of maximising benefit of RVT could be assessed.

Three managers shared a view that the TF3 RVT was not value for money. However, one of whom had also expressed a view of not knowing if RVT worked, did so to explain that RVT had many opponents who believe it is an “inordinate waste of money that could be spent in better ways” (M7) recommending this be countered by better explanations of what RVT is and what it can deliver. A clinically trained Trust manager explained their rationale for not believing it represented value for money. The manager understood the

peripheral device was expensive simply to upload a single reading once a week and so a cheaper alternative to the TF3 type of RVT was possible. Therefore, their assessment was based upon a narrow service offering. One manager believed RVT was poor value for money service from the wider literature, referencing the economic reviews of the English Whole System Demonstrator projects;

> "… research promoted by the UK which reached the conclusion that on balance it did not represent good value for money as the conventional mechanisms of interaction" (M3) (cross reference Literature Review Chapter, Sanders et al. (2012)).

Managers demonstrated uncertainty with regard to value for money as although they all recorded in the overarching nodal topic comments. Half thought RVT was good value for money. The managers from the Trust who believed so explained that there were fewer domiciliary visits by staff and that if the service was "used in the right way" (M7) continued with an anecdote of service users getting benefit from RVT and "…there may be an inherent merit in that in itself, is that true value for money?" (M7). The two commissioning managers who expressed an opinion that RVT was good value for money justified their stance by explaining that a day of RVT per patient may only be a small amount of money and certainly a lot less than a day as an in-patient so on that basis it was considered good value for money. However, there was less certainty when the manager questioned themselves; the conundrum the manager posed during their interview was that for £1.5 to £2million of investment had the same value of benefit been derived and they answered themselves

> "I am not sure that we can confidently say that we achieved value for money at aggregate level but I think at a unit by unit basis it still has the potential to deliver value for money" (M1).

In summary, there was a hope that in future if RVT was integrated into care then as part of a package of care it would contribute and represent a perceived, if not actual, value for money.

Table 6.8 Manager responses in topic area coded ‘g’, to illustrate the perceived value for money of RVT.

Name	Description	Files	References
M g Value for Money	This considers aspects of value for money and the perceptions and knowledge expressed by manager or commissioner practitioner	8	15
Sub-Nodes			
Don’t know if Value for Money	The manager does not know if the RVT is value for money	5	7
No not Value for Money	The manager believes the RVT is not value for money	3	3
Yes Value For Money	The manager believes the RVT is value for money	4	5

6.1.3.8 Manager opinion of benefit or outcome

With reference to manager responses in Topic Area Coded ‘h’, it can be seen all the manager participants considered the aspect of outcome and or benefit of the service (Table 6.9). Participants expressed their thoughts across three sub-nodal topics with one considering hospital utilisation, directly suggesting that hospital admissions were reduced as a result of RVT. Most managers discussed their thoughts about strategic system integration and the realisation of benefits that RVT.

The theme within the concept of benefit realisation within an integrated system was that the managers said they lacked evidence of effect and lacked data to analyse. There was recognition of RVT being a complex intervention and therefore, it was likely to take longer to realise benefits whereas the funding and performance mechanisms within the health and social care system demanded a greater emphasis upon short-term gains. Of note ‘The Way to a Healthier Pregnancy Programme’ was an example of an RVT project service response from TF3 which was lighter-touch than their other disease group packages and was time limited had not been evaluated for evidence of

success or benefit. There was narrative anchoring the RVT benefit realisation into a framework which included the metric of citizen benefit whereby the system, in this example RVT, would help the patient maximise their well-being; albeit mainly aspirational. One tangible example of titration of medication to help control blood pressure post stroke was described but the associated system of permissions to change and implement dose adjustments between the hospital and GP remained a barrier to full-service efficiency.

There were theoretical or philosophical benefits proffered including the idea that RVT could be more effectively used as a preventative tool or that it could assist with the

> "…inexorable increase in demand …curbing the steepness of the trajectory upwards as oppose to causing a downward trend in demand and pressure" (M7).

The concept of understanding better the effect for patients including the possibility of feeling safer as they have a seven-day rather than a five-day-a-week service or are being monitored 24/7.

(As part of the benefit and outcome section) there was the sub-node of the manager's view of patient and service user empowerment with a meaning of patients having overall benefitted and as a result been empowered for self-care and being better informed assigned; most participants (N=6) spoke about this conceptual area of RVT (a total of 17 times). They all shared a common view that RVT enabled patient self-management, care and empowerment. The language of the managers was very much perception and conceptually based rather than key facts and none actually utilised the terms of 'patient-centred' or 'empowered' and so proxy indicators such as 'self-management' and 'maintain their independence' were utilised as an indicator in order to assign narrative to the sub-node.

One participant discussed at length empowerment and noted that the researchers had so far been unable to evaluate that aspect of the service which was, *"…attributed to the people conducting the evaluation, …running out of time to be able to recruit the necessary numbers*" (M4) She continued, articulating that this single factor was important and had been missed and suggested that people went from a position pre-RVT to one where they better

understood their condition, collect data on a daily basis, self-managing, make decisions themselves or with carers, change behaviours, lifestyles, medication and in general better self-care. M5 equally articulated how this opportunity had been missed from the beginning. However, as M4 observed at the beginning of the TF3 RTNI project patients did not generally have technologies which could assist, "…concept of people using technology to look after themselves was such a far-fetched idea". Whereas, M6 pointed out that patients just needed to feel supported and so were better able to take control of weight management by sharing information with professionals and described patient self-management as a "big societal thing". Even the concept of RVT providing a "comfort blanket" was attributed with merit by M8, whilst also reminding the researcher that the RVT programme should be outcome focused.

Table 6.9 Manager responses in topic area coded 'h', to illustrate the perceived or actual outcome or benefit derived from the use of RVT.

Name	Description	Files	References
M h Outcome and Benefit	This considers the aspect of outcome or benefits of the service expressed by manager or commissioner practitioner, whether actual, demonstrable, hypothetical or imagined.	8	36
Sub-Nodes			
Benefit realisation within an integrated system	Where managers think strategically about system integration and the realisation of benefits that RVT have contributed to	7	16
Managers view of Patient and service user empowerment	Manager has a view that the patients have overall benefitted and as a result been empowered for self-care and being better informed	6	17
Utilisation of Hospital services	Managers had an opinion on the utilisation of RTM instead of secondary care	1	3

6.1.3.9 Manager opinion of clinical issues

With reference to manager responses in Topic Area Coded ‘i’, the topic area of clinical services issues was discussed by all managers, with 110 statements coded to the node (Table 6.10). The node was divided into seven sub-nodes with the highest-ranking sub-node, containing narrative from all manager respondents with 34 statements coded, labelled as ‘change or changed clinical practice’. The sub-node encapsulated the thoughts of managers regarding how they may consider the way practitioners have or could change when RVT is utilised as part of a pathway of care.

Five participants spoke from a philosophical stance, articulating the sub-utopian world of effective healthcare delivered with the integration of technology. They spoke of needing leadership to ensure the critical mass of practitioners and services utilised RVT in a meaningful way. The vision of integrated healthcare, services and clinicians across the region could utilise RVT as the increasingly scarce resources and demographic pressure begins to take hold. The concepts of ownership, buy-in and “realisation of efficiencies and improvements associated with using technologies” (M3) were shared. Four participants spoke of resistance and cynicism within the clinical staff groupings.

> “I get frustrated with the fact that some people don’t appear to want to try and improve their patient’s lives and that is what RTM essentially offers us, within the right mode.” (M8).

Three spoke about tangible examples whereby clinical practice had changed but one participant reported an example which illustrated a success and a failure of an RVT COPD service simply because of staff attitudes (M2). Another spoke about how significant improvements in clinical practice had been achieved but felt that such behaviour changes needed to be forged ahead with Allied Health Professionals (AHPs) in general as in some clinical areas there had been a greater emphasis upon opportunities for nurses (M6). One manager shared personal experience of RVT changing practice but felt that a lack of leadership from the management hierarchy prevented real change (M8). The emphasis upon regional leadership was summarised by

one who stated that “we need the Commissioners to show the leadership…drive the changes” (M5).

The second most cited area of comments coded to a node within the clinical services issues was, clinical feedback, with seven manager participants making a total of 28 statements that were coded to the node. However, this section in general was an expression of feelings, twice clearly articulated as frustration, towards an inability to attain positive clinical engagement for RVT. One Manger participant took a positive stance with regard to nurse involvement but articulated a broader reluctance of General Practitioners. A view of GPs that was also reflected by a further two managers with one articulating that some GPs “portraying it as additional work …seeking recompense” (M7). The theme of ‘extra work’ for clinicians, regardless of profession was described by four of manager practitioners with one explaining at length that for a real change in models of care to shift, busy clinicians needed to be given protected time and space to think through the service changes to make it happen. One was concerned that it “didn’t matter how much evidence you gave them” (M2) there was still a lack of engagement and explained that clinicians were unable to describe benefit of triage beyond liking the fact “someone else was looking at the reading” (M2). This manager felt unable to satisfy the demands of clinicians. When they tried, and another problem arose it was ‘proof’ to clinicians that the TF3 service was unsafe. He took the most negative stance with regard to the practitioners whereas the remaining six manager participants held some prospect for RVT and clinical feedback and engagement.

The theme continued in a specific sub-node examining clinical staff’s resistance to engage with technology. Five managers spoke to this topic with 16 comments being captured. However, only one offered new insight into the issue of resistance to change and inculcate technology into practice. The currency of TF3 contract performance management at Trust level was cited (by M8) as an example of a service dimension causing barriers. The Trusts, ergo the practitioners, were performance managed through monthly tallies of patients utilising the TF3 service and it was observed that the number of patients

> "I have on RTM (*remote telemonitoring*) is not a measure of performance, it's a measure of the number of patients I have on it, that's it and you will face resistance at every point if you cannot show benefit". (M8).

This participant also articulated issues of silo working, protectionism and 'territorial paternalism' and the TF3 RVT implementation failed to address these (M8).

Two participants, who had clinical backgrounds, articulated high level issues vis-à-vis the identification of patients which revolved around ensuring the patient received the highest standards of tailored care. Linked to this was that staff required an infrastructure to support them in their new roles associated with the review of data.

Two participants spoke at length about the role of RVT within the context of Primary care; their data fundamentally pointed out the disappointing lack of GP engagement in the regional TF3 service. The degree of GP cynicism was again highlighted and the recognition that there are opportunities for GPs to work in a different way to enable their care of their patients to be more effective comparing possible current practice of a review every three weeks with a possible vital sign daily monitoring opportunity to provide a different and more meaningful picture of health. Equally, the different models of care between Primary and Secondary care were noted but that these should not prevent the use of RVT within a Primary Care environment.

Interestingly, six participants reflected upon the importance of service user feedback and all pointed out that patients were positive about RVT. One remarked that the voices of patients really needed to be harnessed (M4) and another hypothesised that patients would say that the service was value for money due to their positive experiences (M7).

Seven (of the eight) participants articulated many (26) issues regarding research within RVT, the majority of which coalesced around the need for more research as there were just too many unknowns. There was a hope that research could prove RVT was worthwhile and encourage clinicians to engage. One reported that whilst the RVT TF3 service in Northern Ireland, was successful and

> "within Europe and in some extent globally, did establish a leadership position, people referenced us as a place where we were actually doing something" (M1).

There was a "lack of insight" (M1) with regard to consensus, the effect of triage, benefits and evaluation. One participant wanted there to be an evaluation which gathered information to demonstrate that RVT 'worked' but did not define what a 'worked' metric might have looked like. Whilst another took a view of success was being "…measure the ability of the patient to self-manage which was key", M4 continuing to complain that the commissioned evaluation had failed to consider and measure this metric as second participant was equally critical of the output of this study. There was a consensus that the lack of evidence to support the application of RVT, lack of clinical engagement or co-creation activities and perceived additional burden of workload, drove cynicism and disengagement. Within this context, linked to inconclusive evaluations of projects in England, one asked if RVT was "…actually having an impact on efficiency and sustainability of health and care systems?" (M5). Two manager participants were highly critical of an evaluation of the TF3 service having been considered towards the end of the contract rather than having had a robust evaluation planned and contracted for from the outset.

In summary, meaningful evaluation and understanding of RVT was deemed essential to ensure the right service was being delivered and that practitioners could undertake evidence-based practice.

Table 6.10 Manager responses in topic area coded 'i', which examines the clinical service issues as observed or perceived by the respondent.

Name	Description	Files	References
M i Clinical Service Issues	This considers any Clinical service issues beyond those documented within the node MP c Opinion expressed RTNI. It is more focused upon views, or perceived views (if made by a manager) of practitioners, service users, the change of practice and research evidence.	8	110
Sub-Nodes			

Change or changed Clinical Practice		8	34
Managers view of patient identification		2	5
Clinical staff resistant to RVT	Some clinicians are reluctant to engage with the technology	5	16
Primary Care	The engagement of GPs within Primary Care	2	6
Research	Lack of evidence or lack of research.	7	26
Service user feedback	Opinions of service users and carers	6	11
Clinical Feedback	Opinions of practitioners in general	7	28

6.1.3.10 Manager opinion of the future of RVT

With reference to manager responses in Topic Area Coded ‘j’, the topic area of the future of RVT the next generation is the second largest nodal topic area of the data collected from manager participants with all participants making reference to this topic area a total of 74 times (Table 6.11). Managers, with little variation, described a service that would be more data driven and were technology agnostic about how or what should be used to deliver a service. The managers highlighted that learning had most certainly occurred over the course of RVT, but the consensus was that a more strategic approach to planning the future provision was required; M7 suggested that the Bengoa report (2016) should be reviewed to see if RVT was recommended and that “… improvement science methodology” be applied to RVT. Albeit, the contradictory position was also suggested by one with the suggestion that RVT should be normalised (M2). There was equally a debate between the manager participants regarding the role of triage service with a view expressed that it was required for those patients with heart failure or COPD and others minded that a ‘lighter touch’ was required. Opposing positions

were also observed with regard to an end-to-end service offering the reassurance of calibrated and maintained equipment being the responsibility of one supplier versus the opportunity patients may have regarding self-purchase of small items of technology e.g. pulse oximeters and blood pressure cuffs. M1 articulated the changes ahead, "… massive technological change in digital, the internet of things, the digitisation of everyday devices in people's homes…analyse data." Consideration of data analytics was a theme throughout particularly in relation to the long-term support of the patient's interaction with health and social care.

In general, the manager participant's view of the future appeared to be the development of and planning for a revised strategy for the application of technology per se, rather than a pragmatic view of actually improving care for the population. Whilst most managers discussion revolved around the experiences of contracting for a regional service, three mentioned technology enabling self-care in the future with one of those stating,

> "…the right data to make the right decision, at the right time for the patient or empower the patient to make decisions for themselves" (M7).

It is suggested that the generalised abstract nature of responses could be related to the fact that five manager respondents did not have a formal clinical qualification. Strategic fit into the mixed economy of health and social care was not well understood and four manager participants expressly articulated the need for service responses to be being powered by a lower level of complexity, *TF3*

> "…model has relatively high overhead per patient and models like U-Tell and others I think illustrate how we might go in future" (M3).

However, there were common practical themes shared by the managers when they shared their thoughts and feelings within the context of the future for technology, particularly in relation to RVT. Thinking about the future was popular with the respondents with many ideas being shared. Across the narrative recorded under this node there were ten common predictions apparent within the data having been shared by the managers and these have been distilled as follows, considering the future of technology:

1. As patients age, they will expect and demand their smart phones to be used in their care.
2. The Electronic Patient Record should include RVT information.
3. There should be automatic uploading of data, in the background, e.g. sleep pattern data.
4. Technologies communicate lifestyle and smart home data e.g. nutritional intake.
5. Patient portals with health promotion and lifestyle information, including authentication of patients to sign themselves onto and out of monitoring.
6. Accurate peripheral devices where calibration and servicing are maintained for the top 4% cases e.g. heart failure and COPD and enable low value patient purchased peripherals.
7. Text and email messaging from practitioner to patient, including the facility for patients to upload photographs of what they have eaten for nutritional value to be determined.
8. Video virtual ward rounds.
9. Routine collection of data with wearable or ingestible devices to transmit data.
10. Wider technology adoption and normalisation of RVT.

The manager participants suggested that better utilisation of data through data analytics would be part of healthcare for the future. The managers were optimistic for future technology utilisation within health care.

Table 6.11 Manager responses in topic area coded 'j', to enable the articulation of the perceived vision for the future of RVT in Northern Ireland.

Name	Description	Files	References
M j Future of RVT the next generation	Considers all aspects for the future of RVT, looks forward to the future or articulates what next for RVT in Northern Ireland, including policy, equipment, models and engagement regardless of a pessimistic or optimistic stance taken by participant.	8	74
Sub-Nodes			
Future service user engagement	Managers view of user engagement from using a range of media to share data, records, info etc. via various means	5	18
Information is required for decision making	Through the TF3 contract experience has demonstrated a need to have seamless integration of data for decision making	5	13
Managers thoughts on needing more innovative technology	Managers have a view as to what future service provision should be like	8	41
NIECR	Managers have an opinion that systems should be connected and link to NIECR	2	2

6.2 Summary

It was possible to elicit valuable insight in one-to-one conversations with senior managers regarding RVT in Northern Ireland. It was assessed that there were 15 eligible senior managers/ commissioners who were eligible to participate in the research and eight agreed, a participation rate of 53%. The participants were from a range of backgrounds with only three having nursing or AHP backgrounds, the five non-clinical managers included a career civil servant, Information Technology and business management qualifications. The researcher analysed the data and created ten overarching topic themes,

nodes, and sub-nodes. Managers expressed generally positive feelings towards RVT albeit none had practical day-to-day experience of RVT. Their experience was at a high-level overview with the perspective of those who had specified, designed, commissioned and then monitored RVT solutions. There was a general concern and frustration expressed by a lack of clinical leadership and involvement particularly from primary care. However, the managers were not deterred and expressed how they thought technology should be inculcated into care in the future noting that the current tech-savvy middle-aged people will demand technology in their later years, better utilisation of data, electronic patient records with patient portals, technology which are integrated into life being unobtrusive and reliable and basic messaging between clinician and patient. N=6 managers articulated many elements which can be understood to indicate empowerment of patients in terms such as, better self-management and care, patient better supported and more patient-centred care.

7 CONCURRENT TRIANGULATION OF DATA

7.1 Sources of Data

7.1.1 Review of Methodology:

The methodology of mixed methods including concurrent analysis of data was undertaken. Regardless of nature of the data or method of capture, the qualitative and the quantitative data, was given equal value and data compared for significance and understanding (Chapter 3, section 3.16). There were six streams of data collected from participants. All types of participants offered qualitative comment but only the patient and carer participants provided quantitative data (Table 7.1).

Table 7.1 To illustrate the summary data streams for analysis.

Participants	Qualitative	Quantitative
Patients	x	x
Carers	x	x
Practitioners	x	-
Managers	x	-

7.2 Triangulation of findings of both qualitative and quantitative data

The initial step in analysis was to compare the qualitative data derived from the participants, looking for both divergence and convergence of opinion. Of note, there was disproportionately more qualitative data from the clinical practitioners and managers than the patients and carers. In order to ensure a systematic approach, the concurrent analysis of the data followed the

structure established within the (NVivo) analysis, which followed the nodes topics ‘a’ to ‘j’. In addition, the findings of the patient and carer data were combined with the qualitative data with contradictions and corroboration described. A high-level summary of the convergence and divergence found within the data for nodes ‘a’ to ‘i’ was recorded in Table 7.2. Only the three nodal topics ‘h’ outcome or benefit, ‘i’ clinical service issues and ‘j’ future of RVT were considered as contributing to resolving the research question. Refer to Appendix 10 for the detailed narrative comparison of all data sources by nodal topics ‘a’ to ‘g’.

7.2.1 ‘h’, Perceived or actual outcome or benefit derived from the use of RVT

Arguably a beneficial patient outcome is singularly the most important narrative to consider within the analysis of the patient and carer questionnaire data and the interview narrative conducted with both practitioner and manager participants. However, it was within this node that the difference in stance between manager and practitioner emerged but there was concordance between patients, carers and the practitioners. The manager’s experiences of RVT were from the perspective of an onlooker, strategic leader, a vested interest in making it work, given their role. They had a theoretical and contract management experience of working with TF3 and practitioners. Whereas, the practitioner grounded their responses as clinicians immersed in patient care, trial and error of utilisation of RVT and repeated experience rather than anecdote or theory. Equally, patients and carers expressed their direct experience and personal beneficial outcome associated with the use of RVT. The manager participants had a difficulty with articulating tangible benefits and outcomes as at the outset of the TF3 contract the only metrics being collected looked at the number of cases within particular charging bands which then indicated the referral and utilisation rates (not any outcomes). The aspirational outcomes of reducing demand for secondary care had not been evaluated fully and a retrospective review through a formally commissioned evaluation was beginning to report first findings at the time of the manager data collection phase and there were no indicators demonstrating success

against the aspirational metric. Albeit, the patient and carer data suggested that they felt they utilised secondary care services less than they did when just in receipt of usual care without RVT (Table 4.4). The manager participants reported their opinion of benefit for the citizen, service user and patient. These benefits were believed to revolve around the concept of RVT enabling patients to self-manage. Indeed, one manager spoke at length about state-of-the-art technology in 2008 when the first ideas of developing a regional RVT were articulated. Indeed, the emergence of patient participation in self-care and compliance, through the use of technology, was being discussed through anecdotal evidence, speculation (but not formal evaluation). It was significant that 75% of senior health and social care managers involved in the strategic delivery of the RVT service TF3 believed that RVT enabled patient empowerment through self-management, learning about own condition, independence, behaviour change, lifestyle, medication management and self-care (Chapter 6). This view was convergent with data collected from patents and carers. However, whilst not formally evaluated, early in the drafting of the RTNI contract (cross reference Chapter 1 and Appendix 1) there was some consideration given to the idea and possibility of the patient being an active participant in care. Self-Management was defined within the RTNI contract. (RTNI Contract, File 1 of 4, p134, refer to Appendix 2). The data indicating that there was empowerment of patients, through the use of RVT in collaboration with their clinical practitioners, emerged through utilisation and was expressed during data collection and subsequent analysis. The patient voice clearly stated that RVT empowered across three variables, i) assisted them to manage their own care day to day basis, ii) managed their own condition and become more involved in their health care and iii) they were afforded peace of mind. The realisation of such a possibility was articulated by the practitioners who illustrated a vibrant picture of direct patient benefit and outcome as a direct result of RVT; this is deemed to be a most significant finding as 97% of patients shared the practitioners' view that RVT helped them manage their own condition.

Essentially the managers had created an environment whereby practitioners could work with RVT; where managers had envisaged collecting data remotely, providing vital sign data to the practitioners would enable patients

to be monitored and cared for at home (rather than within secondary care environments). Beyond basic mechanics of system operation, the practitioners had not been trained in the utilisation of such remote technology, nor how to work with new levels of data. Therefore, relatively diverse professional groupings were able to use new technologies and to weave into practice without constraint beyond their usual professional roles of practice. Clinical deployment of RVT was not considered by practitioners to pose a risk for patients and so new experiences became embedded into practice.

There were benefits articulated such as weight loss in obese pregnant women, reduction of 'white coat hypertension', reduced use of outpatients and suggestions of reduced hospital admission for some types of patients. Practitioners spoke of subtly changing their monitoring emphasis as patient's conditions changed beyond the initial goals of optimisation of vital signs and early medication intervention as soon as early signs of exacerbation occurred through to medication and symptom control as they slipped into the palliative end stages. The single emergent benefit from RVT, as articulated by specialist practitioners, was empowerment with 100% of the U-Tell practitioner participants and 67% of the TF3 practitioner participants describing how their patients were empowered by RVT.

The language of empowerment was both direct and indirect with the following terms utilised by practitioner participants, patient-centred, patient orientated, independence, self-management, control and individualised. Practitioner participants described their intention to optimise patient care through the utilisation of RVT which included the education of patients and their empowerment to maintain their own well-being through monitoring vital signs. Practitioners shared, how through a patient's greater understanding of their condition and interpretation of their own vital sign readings, patients were not only educated but empowered to converse with their GPs from an informed base; patients became experts in their own conditions. Whilst the overall quality of life improved for patients empowered through RVT, the practitioner participants who had utilised U-Tell ably articulated seven key features of their care that put the patient in control of their care and lifestyle, which above all empowered through freedom (Chapter 5, 5.1.3.8). This in turn, afforded the carers freedom also from the constraints and burdens associated with

frequent out-patient attendances. These views were magnified by patients and carers where freedom, understanding, self-management and control being recurrent themes in both qualitative and quantitative data; a positive patient evaluation rating relating to peace of mind afforded by RVT was recorded (mean 3.72).

In summary, both groups of staff participants recognised and articulated the new and unexpected phenomenon of empowerment through RVT. Empowerment emerged with the insightful observation that instead of the conditions controlling the patients; the patients could control their own lives. Freedoms, safety, assurance and a quality of life returned. This was exemplified by the patient's and carer free text narrative. Contributors articulated a reduction of anxiety, freedom from the burden of their disease, being better able to manage their condition and the feelings of being in control. Freedom was also expressed practically as they were enabled to travel; highlighted as a feature by U-Tell service user responders. Patients and their carers particularly appreciated having access to someone to talk to; with such access reducing hospital admissions. The sense of peace of mind and a sense of safety were described. With the high mean rating (3.64), most patients (92 of 94 who rated the variable) expressed 'peace of mind' was afforded by RVT. Whilst one practitioner had articulated that in the beginning, they were reticent that a distance between herself and her patients may develop, not only discovered that did not happen, patients and carers in fact articulated a connectedness with the healthcare system, with help only being a phone call away.

7.2.2 'i', Examination of the clinical service issues as observed or perceived by the respondent

The nodal section of clinical service issues was designed to broadly encapsulate clinical issues discussed by participants beyond their feelings towards RVT. It was a more focused node where tangible clinical issues were considered along with the formal evaluation of RVT services through research and evidence-based practice. The managers have a strategic overview of RVT and were removed from the direct service provision of RVT; they were

well versed in strategic deployment, service design, commissioning and contracting for RVT particularly in relation to the regional service provided by TF3. Therefore, the range and depth of topics, i.e. sub-nodes and sub-sub-nodes was larger for the practitioner participants than for the manager participants with the ratio of 22:8.

The manager participants were preoccupied with two overarching clinical issues. The first was a failure of the service to engage with clinicians; with GPs being cynical about RVT and expecting remuneration for their participation in the scheme. Secondly, the level of failure to engage was linked by the managers to an unwillingness to engage with a service model or technology for which there is very little evidence. Evidence based practice was a mantra cited by the managers and so the lack of formal evaluation caused concern. Some managers took the position that formal training should have been built into the programme from the outset (instead of being an afterthought). The commissioned evaluation of the TF3 contract undertaken by McElnay et.al (2016) was criticised by the managers, who suggested that there had been little engagement with clinicians utilising the service or patients in receipt of it.

The practitioners gave a full and varied summary of a broad range of clinical service issues. Indeed, they spoke at length about which types of patients and conditions they would and would not prescribe RVT to. A summary of patient identification factors; in the absence of known referral criteria for RVT, should assist with future service implementation and design (see Table 5.12). Whilst the cynical behaviours of clinicians were cited by the managers as a service issue, anxiety behaviours of some patients were cited as a reason to exclude certain patients from RVT. Equally, whilst some managers believed that alerting patients was as a result of practitioners failing to engage and raise the alerting threshold for vital sign parameters, the practitioners undertook investigative clinical audit to discover the meaning of alerts. It was discovered that most alerts were triggered not because of the breaching of the vital sign parameter, but alerts to the psychosocial or well-being questions, and in fact some patients manipulated responses to trigger contact. However, 25% of practitioners agreed with 88% of manager participants that better research and evaluation was required in order to improve RVT service delivery.

The patients and carer respondents recorded narrative in free text. RVT was appreciated as technology being inculcated into their care packages affording an immediate service response. One patient hypothesised that RVT could allow staff to focus upon their most sick patients whilst having the oversight of those on the system. It was clear that the improved level of communication was appreciated as was a gratitude for having access to triage staff. The patient and carer qualitative data were interpreted to indicate that the service users appreciated the apparent immediate response and the perceived 'human' contact RVT technology enabled.

Table 7.2 To demonstrate notable convergence and divergence of themes and opinions within the data.

Overarching Node	Convergent Findings	Divergent Findings
'a', Experience of RVT	No group had experienced training prior to the regional RVT project	Only patients, carers and practitioners received comprehensive practical training.
'b', Summary overarching feelings towards RVT	All groups were generally positive with the user and practitioner groups reflecting a sense of patient centredness.	Some practitioners shared concerns regarding a poor technology referral system and others of intrusion. Whereas, managers were discontent with the failure to deliver expected outcomes.
'c', Wide-ranging opinions of RVT	Both staff groups believed co-creation and stakeholder engagement were essential. Both practitioners and users shared opinions on benefit and utility for patients and an increased use of technology in the future.	Managers were observers of the outworking's of a contract whereas practitioners and users had lived experiences. Managers complained that GPs were not engaged, and practitioners complained that managers made the final commissioning decisions.
'd', Opinions of the models of RVT delivered	There was consensus regarding the integration of triage nursing into the RVT model for particular LTCs.	Managers complained about practitioners not adjusting parameters to prevent alerts whereas practitioners had a

		strategy for application and an understanding of alerts at a clinical rather than mechanistic level.
‘e’, The participants’ experience or opinion of RVT training and education	Most users and practitioners appreciated a comprehensive training programme.	A limited number of practitioners were disappointed with the training provided by TF3. Managers were not trained.
‘f’, The encouragement of practitioners to engage, in particular the use of performance targets by managers	Service users and practitioners recognised human benefits of RVT and described the improvement in quality of life as the motivator.	Managers were performance management driven with key performance indicators being a key feature. Whereas, practitioners were aware of this and dismissed the manager’s attempts to attain contract targets.
‘g’, Perceived value for money of RVT	All participants were unaware if there was a real value for money with RVT albeit some users and a practitioner suggested it was but only in relation to quality of life outcomes.	
‘h’, Perceived or actual outcome or benefit derived from the use of RVT	There was concordance between user and practitioner with a full range of patient centred benefits articulated. The direct patient benefits articulated by managers were fewer in number and more limited in range but were clearly articulated as enabling patient empowerment. There was concordance in that disbenefit, or harm were not described.	The perspective of the manager’s was different from that of the practitioners which can be explained by role and distance from direct care.
‘i’, Examination of the clinical service issues as observed	Practitioners and patients recognised how RVT enabled early intervention and a	The managers suggested that GPs were cynical describing frustration that there had been a

or perceived by the respondent	targeted approach to contact and therapy.	refusal to engage with technology or the service. Whereas, the practitioners explained at lengths the application of RVT and the types of patients with particular conditions could and did benefit. Indeed, one practitioner complained that managers had taken the service off them.

7.2.3 ‘j’, Future of RVT

This was the only topic area where patient and carer participants had qualitative narrative, beyond gratitude and peace of mind that could be directly compared with the qualitative narrative derived from clinical practitioner and manager participants. The contrast between the views of the future was interesting, demonstrating divergence between those articulated by practitioners, patients and carers and those articulated by managers. Moreover, patients and carers were receptive to the increased utilisation of technology, (mean carer rating of 3.66), whilst some carers were cautious about the use of internet-based solutions (the mean carer rating 3.41); 75% of patients welcomed the future use of the internet to report to their clinicians. The practitioners took a pragmatic approach to the application of technology articulating a message that from a practical perspective there was no other option but to utilise technologies in the support of patient care and patient empowered self-care. The managers adopted a more conservative approach where use of data was more universally promoted but that a strategic review and planning was higher up the agenda. The practitioners were clearly more purpose-driven. The common practical themes shared by the managers and equally practical themes shared by the practitioners when they expressed their thoughts and feelings within the context of the future for technology, particularly in relation to RVT were tabulated (Table 7.3). Across the narrative recorded under this node there were ten common predictions shared by managers and nine by practitioners. Set in the third column are remarks recorded in free text by patients and their carers in relation to the future of

technology. Patient and carer free text data were considered as qualitative and comparable to the themes distilled from face-to-face interviews with Health and Social Care Staff. There was consensus from all data sources that the future of technology should be enabled particularly as tech-savvy people get older; with improved peripheral or near patient testing devices and more internet based supporting care. There were six themes that were shared by both managers and clinical practitioners. However, they can be further summarised to suggest a requirement for technologies which operate in the background automatically sending relevant data with minimal effort which, are then made available to practitioners via an electronic healthcare record where interfaces between systems are streamlined and automatic. Equally, innovation of technologies to extend the range of data that can be collected and for two-way digital communication between patient and practitioner is enhanced. The patients, carers and practitioners shared the vision of increased use of RVT in the future.

Table 7.3 To capture the practical themes regarding the future use of technology, within the context of RVT, expressed by clinical practitioner and manager participants set alongside relevant patient and carer comments (summarised from free text).

#	Practitioner Participant Summary	Manager Participant Summary	Patient & Carer Participant Summary Comments
1	Mobile technologies that automatically send data, in the background, that are easy for patients to use and do not require dexterity with cables and ports.	Mobile technologies as patients age, they will expect and demand their smart phones to be used in their care	
2	That there is a single sign on Electronic Patient Record that can be accessed by all Trust staff and GPs which includes the patient's own daily readings from RVT.	That there is an Electronic Patient Record that includes RVT information	
3	Automated or semi-automated responses to patients generated by the technology embedded with data analytics to create a "Doctor-in-my-pocket" (P5)	Automatic uploading of data, in the background, e.g. sleep pattern data	
4	Technologies communicate automatically in an integrated way e.g. the INR reading transferring from U-Tell to the Dawn Dosing system (P15)	Technologies communicate lifestyle and smart home data e.g. nutritional intake	
5	Patient Portals become interactive and that patient interfaces and technology enable push and pull for training, health promotion, lifestyle, function, exercise and treatment compliance.	Patient Portals with health promotion and lifestyle information. Including Authentication of Patients to sign themselves onto and out of monitoring	Increased use of technology in future but not internet based.
6	Accurate peripheral devices where calibration and battery life are more reliable.	Accurate peripheral devices where calibration and servicing are maintained for the top 4% cases e.g. Heart Failure & COPD and enable low value patient purchased peripherals.	Some technical issues with peripheral devices and hub need to be overcome.

7	Two-way messaging between practitioner and patient for more timely personalised care and intervention. Including the option for video calling.	Text & email messaging from practitioner to patient, including the facility for patients to upload photographs of what they have eaten.	
8	Recording and transmission of new metrics e.g. carbohydrate counting and the date, time stamps included	Video virtual ward rounds	
9	Wider technology adoption across the services and professions not simply the domain of a limited number of specialist practitioners.	Routine collection of data with wearable or ingestible devices to transmit data	As time passes and as the young age, technology adoption will increase – tech-savvy population
10		Wider technology adoption and normalisation of RVT	Increased use of RVT in the future.

7.3 Summary of Concurrent Analysis

The concurrent analysis suggests the benefit of RVT extended beyond the original intentions of service at point of design, albeit the original aspiration of reduced admissions and length of stay was not realised (McElnay et al. 2016).

To extend the theme of patient centred-care into a home environment through RVT technologies may deliver desired therapeutic benefits. Enabled by technology, RVT, enhanced and developed the connectedness and relationship between patient and clinician. RVT enabled patient empowerment and that it should be recognised as the beneficial outcome rather than the use of a crude count of days of monitoring as a performance metric.

8 DISCUSSION AND CONCLUSIONS

8.1 Emergent Benefit of Patient Empowerment

The RVT services were designed to yield economic benefit for the healthcare system with metrics of success, considered at point of design and commissioning of the regional TF3 service, being the reduction of hospital admissions, earlier discharges and concomitant reduction of length of stay for patients with long term chronic diseases such as diabetes, COPD and heart conditions. These were not observed and subsequently the regional contract was not renewed, and the service was withdrawn by the Centre for Connected Health, Public Health Agency, following the publication of a commissioned evaluation (McElnay et al. 2016). The Trust's in-house RVT service for warfarinised patients, U-Tell, continued to operate and was not affected by the regional review. Concurrently, Bengoa. et al. (2016) encouraged both the utilisation of technology and the enhancement of better patient outcomes. Within this conflicted regional policy environment, the research study embarked to discover if RVT could yield patient benefit for people with long term conditions when utilised as part of a package of care.

Examination of available literature yielded largely equivocal findings with a generalised scarcity of relevant research literature. However, recurrent themes included a requirement for more research, improved methodology, an emerging consensus that RVT did not add direct economic value but that there was a general acceptance by patients. The researcher engaged with four groups of participants including patients, carers and as appropriate, their carers and data were collected in two differing paradigms, qualitative data from Health and Social Care employees and predominantly quantitative data from service users.

A theme began to emerge from the data to suggest that RVT could engender a sense of greater involvement for the patients in their own care, ergo a patient centric model of care had developed through the deployment of RVT. For example, one TF3 service user wrote in free text,

> "give me a better understanding of condition COPD it has also give me independence to live at home confident that I can manage my health and not be a burden on the NHS and my family."

The findings of the research, echoed literature review observations in that patient knowledge was enhanced (Stevenson and Bardsley, 2012), patients felt reassured (McDowell, 2015) and that technology could empower (Wyatt, 2011). There was no evidence to support the predominantly negative view expressed by Scullion (2018) that patients somehow abrogated responsibility. The research did describe how some patients felt better able to manage their own condition and yet felt able to access immediate assistance from a health care practitioner if required. Three patient participants wrote the following three comments in the free-text comments section of the questionnaires which illustrate a sense of a safety net giving assurance that they can reach professional help promptly, "…I am very happy with the Telemonitoring service – I know if I am worried about my condition I can seek help with them," "…It is very reassuring to have this in my home both for me and my husband to know help and advice is always at hand" and "My mind is completely at rest knowing these people are able and willing to help my illness." Equally, the practitioners articulated support for RVT as it enabled them to target intervention more appropriately and see patient empowerment be enabled.

Many (N=58) references, made by (N=16) practitioners, were coded within the node 'Help people keep track of their condition: Empower' which supports the notion of patient-centric empowerment from a professional perspective. This is an important patient centred observation.

For practitioners it is important for their patients to comply with the treatment regimen prescribed for them and practitioners however they did not equate compliance with empowerment. Empowerment, as defined in Chapter 4, includes education which affords the patient the knowledge, skills, competencies, attitude and self-awareness to make better informed choices

whereas compliance is simply an activity of following instruction (Feste and Anderson, 1995). The concept of empowerment as a direct benefit of RVT gained weight given the practitioners interpretation of the concept. As already stated in Chapters 4 & 5, the interpretation of empowerment broadly encapsulated the direct use or reference of the word ‘empower’ by five practitioners and also included concepts of ‘patient centred’, ‘patient orientated’, ‘independence’, ‘self-management’, ‘control’ and ‘individualised’. This topic area is considered the wider benefit derived from the use of RVT that was not part of the initial regional programme design. Given the emergence of a general theme of empowerment as an outcome orientated patient benefit from all research participant sources, it is believed that this new knowledge is likely to be transferable to other patient-centred self-monitoring technologies deployed in healthcare.

McElnay et al. (2016) suggested that as RVT becomes routinised that “… patients are empowered to be more active in their self-care” this was set within the context of a background, reflecting the forms of the RTNI contract, rather than data analysis, findings or recommendations. Whilst participation was low, they reported that the patient focus groups indicated, “…unanimously positive about telemonitoring, with the main benefit being the reassurance it gave them that a health professional was monitoring them constantly.” (Ibid.)

Pulvirenti (2012) cited Alma Ata 1977 in setting empowerment as a key philosophy. How empowerment is understood is important and that care should be taken when recognising empowerment by recognising self-determination (Aujoulat et al. 2007). When delivered effectively, empowerment could yield health outcomes through education (Anderson et al. 1995) but by 2002 collaboration to improve the patient and carer self-management and knowledge emerged (Von Korff et al. 2002). With Ciccone et al. (2010) arguing that patient empowerment within Primary Care should elevate the patient to the most important team member in the collaboration. So that the practitioner has a clinical goal to empower the patient to make informed decisions about their own care (Anderson and Funnell, 2010). Equally, complementary to empowerment in the concept of patient-centeredness, was the ability of patients to attain empowerment themselves not simply an action of the system (Holmström and Röing, 2010). Kennedy et

al. (2007) considered self-care as essential in long-term management of chronic disease conditions but that practitioners needed to reconsider the benefits of such empowerment. (Redman, 2007) observed that patient self-management was not without issues as there could be a lack of competence, suggesting that empowerment could hide a transfer of responsibility from clinician to patient. This ignores the possibility that such a transfer could be problematic and assumes it is without harm if only patient follows instruction and is could lack patient selection standards. Ergo there was a possibility suggested that the use of RVT could enable ongoing patient education, support and clinical access that the early principles of self-management failed to deliver.

In the RVT patient quantitative data, the most important direct indicator of empowerment and self-care was the variable “Has helped me manage my own condition and become involved in health care”. The mean average patient participant rating for this key metric for TF3 was 3.48 and U-Tell 3.67 which demonstrated that most people strongly agreed that RVT empowered (Table 4.17).

In the UK Donaldson (2003) advocated that the “…expertise of patients could be harnessed” to tackle the pressure of chronic disease although this was interpreted by Lindsay and Vrijhoef (2009) as an opportunity for cost saving in the NHS. Empowerment and self-care through RVT could be viewed as important to challenge the traditional care models as Vadiee (2015) found evidence to suggest clinicians failed to engage with expert patient model and failed to create an alliance between patient and practitioner. Therefore, in this research it was accepted that there was a need to understand what practitioners utilising RVT were trying to achieve by enabling empowered expert patients; and it was argued that it is someone who has the confidence and knowledge to undertake key self-management activities, not a patient who undertakes internet searches and asks clinicians for obscure care regimen (Shaw and Baker, 2004).

The wider role of eHealth technologies in empowerment should not be overlooked and in this research the role of RVT was critically important. It is argued that RVT is a mode of eHealth technology that enables empowerment as a philosophical benefit where ongoing collaboration between patient, carer

and clinical practitioner occurs in a supportive and educational way. RVT enabled an interconnectedness permitting access to practitioners in a timely manner, one TF3 user reported, “Knowing that there is someone only a phone call away has improved my ability to function a lot better and give me peace of mind,” and RVT addresses a caution articulated by Donnelly et al. (2008) where patients empowered by eHealth technology are concerned by reduced face-to-face contact with clinicians.

For there to be success with eHealth technologies, in particular RVT, as measured by dimensions of patient empowerment, behaviour, receptivity and attitude should be considered. The evidence from the qualitative data, comparing the general opinions of clinical practitioners with managers suggested a broad variance of attitude and technology orientation. Indeed, one practitioner stated, “…just when we learnt how to use the technology, they [*the managers*] took it off us.” (P5). Brown Cooper (2015) observed similar findings suggesting that successful organisational leaders involved with telehealth required “…innovativeness” to yield success. Staff attitude was a determinant of success within eHealth initiatives (Farhaan et al. 2008). Townsend et al. (2015) articulated ambivalence found within healthcare professionals with regard to application of effective eHealth interventions particularly relating to three dimensions, role changes, patient collaboration and patient burden but these factors were not found in the RVT research amongst patients or clinical practitioners, albeit, managers suggested clinical reluctance to change. As already stated in Chapter 6, four participants spoke of resistance and cynicism within the clinical staff groupings.;

> “I get frustrated with the fact that some people don’t appear to want to try and improve their patient’s lives and that is what RTM [*RVT*] essentially offers us, within the right mode.” (M8).

Three spoke about tangible examples whereby clinical practice had changed but one participant reported an example which illustrated a success and a failure of an RVT COPD service simply because of staff attitudes (M2). Hardisty et al. (2011) suggested a failure to technology integration into care could be overcome by co-creation which was echoed within the RVT practitioners. As already stated in Chapter 6, managers reported a lack of clinical engagement or co-creation activities and perceived additional burden of workload drove cynicism and disengagement. When considering similar

eHealth technology intervention for chronic disease management there prevailed the theme that interventions fail to demonstrate cost effectiveness or benefit (Louis et al. 2003.) and a consensus that meta-analysis revealed a continued lack of effective study methodologies demonstrating effectiveness or benefit, (Kitsiou et al. 2013 and Bolton et al. 2010).

It is equally argued that sight must not be lost of the very positive opportunities information technologies can afford the healthcare system as there are ever increasing numbers of patients in the community who need to be cared for by a limited resource of healthcare clinical practitioners. As already stated in Chapter 5, a common theme was that with the staffing resources could not keeping pace with demand for care, "…we are seeing doubling rates of maybe 10-15-years in terms of prevalence in diabetes, and we've got to do something different… there was no other opportunity than to look to technology to support care" (P5). Atkin and Barrett (2012) suggest technology was important to optimise patient outcome but could not describe the role of the practitioner. Whereas, without considering the role of the practitioner Storni (2014) proposed that self-care ICT could, in future, enable patient empowerment particularly for the area of chronic disease management and discussed ramifications for future design of technology; a view shared by three manager participants, as already stated in Chapter 6, they articulated technology enabling self-care in the future with one of those stating,

> "…the right data to make the right decision, at the right time for the patient or empower the patient to make decisions for themselves" (M7).

Three studies, Shany and Hession (2016) a COPD RCT, Inglis et al. (2015) a Cochran review of non-invasive telemonitoring for heart failure and Alrajab et al. (2012) a COPD RVT study all reported positive clinical benefits but unlike the SET RVT research did not articulate a beneficial patient or carer, human, perspective.

Calvillo et al (2013) undertook a literature review to identify if current technology could empower patients and their findings suggested that almost all types of technology would be capable of assisting. They proposed that there were factors or 'milestones' which, if included, would define that the patient was aware of their condition, i) patient participation in self-care, ii) self-

management, iii) patient education in condition and iv) patient access to technology. None of the technologies studied were RVT but conclusions could broadly be applied to the RVT findings albeit, in RVT empowerment is extended. The RVT research revealed in addition that i) support by practitioner, ii) a safety net, iii) targeted and timely response and iv) a true collaboration in care to empower the patient and their carer and afford peace of mind and an active contribution to self-care.

Hypothesis in Suter et al. (2011) may have predicted the outcome of the RVT research, as they proposed that an RVT type telemedicine could be used to provide self-management, improve outcomes and empower patients through behaviour change (assumed not proven). This was determined through a theoretical study based on behaviour theory rather than findings of the trial and whilst was interesting and supported use of technology in healthcare to empower, the theoretical approach was not indicated by the RVT research. RVT as an instrument to change behaviour was not found albeit the introduction of new technological equipment into normal routine care was disruptive and patterns of behaviour changed. SET RVT research data communicated a sense of having freedom, collaboration, and safety through rapid access to support when required but of course technology enabled this change and ergo behaviour change.

Most patients (>90%) when responding to empowerment variables, believed that RVT assisted self-management, allowed them to become more involved in healthcare, and benefit from peace of mind. This was echoed in detail by most of the practitioners (75%) and supported by most managers. All data sources indicated that self-care, self-management, co-creation, better support, collaboration and the affirmation of empowerment as a genuine patient beneficial outcome and utility of RVT, which were not proven in previous studies.

8.2 Limitations of the Research

Within the research study there were limitations found that, if predicted, would have led to a change in the research methodology. Although accepted by the BMJ peer reviewers, the patient response rate for the questionnaire was lower

than anticipated. Therefore, whilst there was a pseudonymous questionnaire process utilised, response rates could have been improved if automatic reminder letters had been generated. Whilst RVT as a service model was explored as a whole, it was not a homogeneous service, instead having multiple variables. If greater volumes of patient participants had participated deeper understanding of the effect of each service variant may have been better understood and recommendations for particular conditions delineated. However, this was not a problem based in poor return rate rather founded in the overall deployment and adoption of RVT within SET. A broader base of potential participants could have been selected if past service users had been invited to participate but the research governance and ethics principles held by SET advised against engaging anyone other than current users as there may have been a risk of causing distress to family members where a past service user had passed away.

Equally, access to data regarding the service utilisation and care activity or service delivery for the regionally commissioned service was not available. During the planning and development of the research methodology the researcher had been assured by the Trust of availability, but the data was not produced by the service supplier nor were extracts of data supplied to the regional data warehouse. This meant that one of the objectives of the research could not be fully explored as only high level utilisation rates were available expressed in a currency of monitored patient days. The metric lacked any depth of meaning and did not afford interpretation or insight.

8.3 Confirmation of Aim and Objectives

The Aim of the thesis was to critically assess whether RVT is perceived to have derived benefits for patients.

The thesis confirmed patient benefit was derived by the use of RVT and was demonstrated through an articulation of patient empowerment.

This was achieved through four objectives: -

1. To describe, summarise, critically evaluate and clarify the current state of knowledge on implementation of RVT.

   a. A review of the RVT context, local approach and technologies along with a literature review, endeavoured to capture the essence of the state of the art, known service attributes and coalesce the common theoretic understanding or beliefs at the time of the RVT services being implemented. A theme emerged suggesting that more meaningful studies should be conducted within the field of RVT.
2. To identify and describe service data trends from service user and practitioner perspectives.
   a. The trend data for local RVT was found to be of limited utility, for the RVT research, as it was focused upon a metric known as monitored patient day, which was designed to measure service uptake (contract performance) rather than an outcome for patients or a healthcare system.
3. To determine the factors of patient benefit which are enabled using Remote Vital Sign Telemonitoring (RVT), taking the views of practitioners and senior managers into account and identify service benefits and risks.
   a. The new knowledge emerged from all data sources with findings from one paradigm corroborating or challenging the findings from another; determining congruence or dissonance.
4. To devise recommendations to enable future deployments for optimal patient care.
   a. There was support for the future implementation of service user technologies in healthcare and recommendations to assist service and technology development and deployment.
   b. Patient inclusion and exclusion criteria were documented based upon practitioner experience of prescribing RVT.

8.4 Emergent Model of Care with RVT

The new dynamic technology-enabled partnership between clinician and patient was able to flourish when management committed to creating an

enabling environment and provide the required infrastructure. The managers did not intend to constrain practitioners or RVT by the application of ineffective metrics rather they wanted to create a system where effective care was delivered. In 2018, when the TF3 service was terminated the real benefit had not been articulated. The summary RVT research findings suggest the triumvirate which created the opportunity for user empowerment as an outcome of RVT to augment care or enable practitioner intervention was important (Figure 8.1). RVT was found to enable an equal collaboration between clinical practitioner and patient, and as appropriate their carers. This collaboration, which challenged the past models of care where the power was nested with the clinician and required compliance of patients. There was a consensus found between all data streams which indicated that the real benefit and consequence of RVT was to create this new patient-clinician collaboration which enabled the patients to learn, self-manage and to become more independent whilst sharing the responsibility by accessing the timely support of their clinical practitioners to ensure health was optimised. There was consensus that RVT had been beneficial but not as the originators had envisaged, the (management) metrics used had not captured the real benefit and changing dynamic; RVT had disrupted the status quo of usual care and had created an opportunity for empowerment.

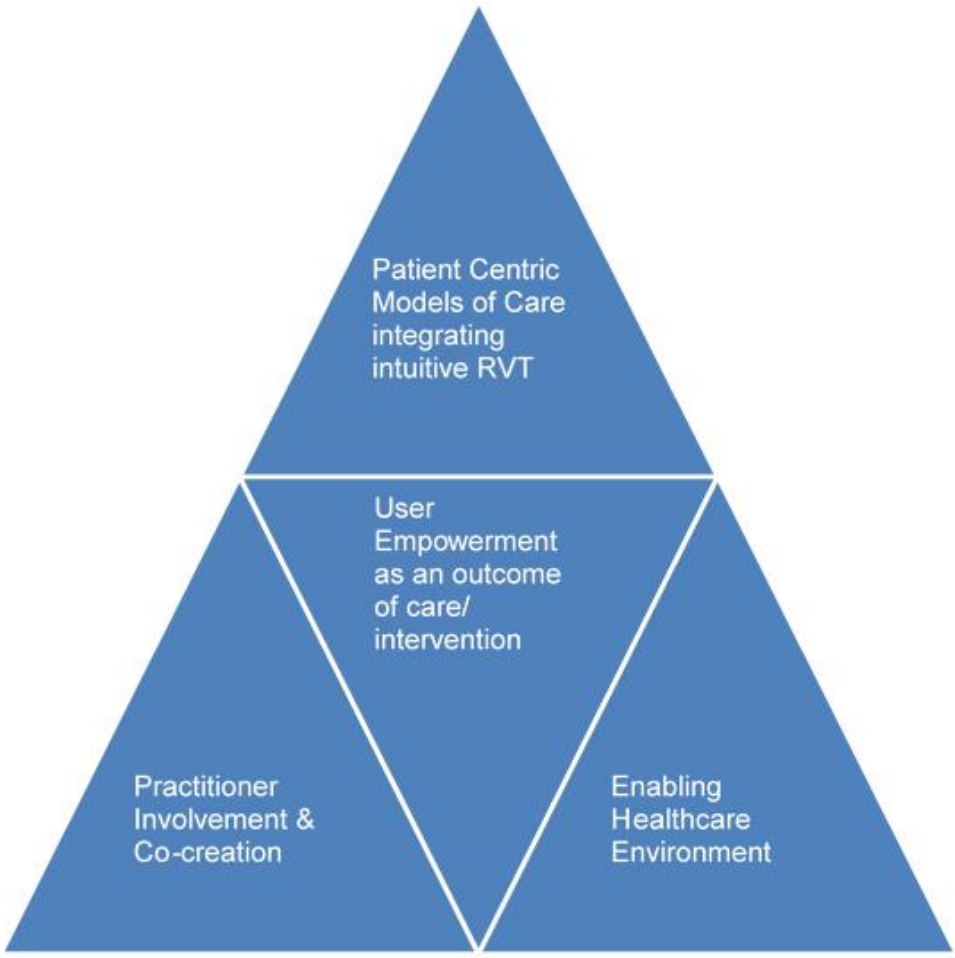


Figure 8.1: Model of RVT integration into care to demonstrate the factors to achieve patient empowerment

8.5 Conclusion

The demographic profile within the SET area mirrored that of the western world. Whilst there was co-morbidity within the primary care caseload, most patients who utilised RVT had LTC as COPD, heart failure or diabetes mellitus. Additionally, complex anticoagulated patients with a track and trend RVT. Literature suggested RVT had little or no economic value for deployment and little ability to reduce the overall cost of care by reducing hospital admissions and hospital length of stay. In summary, the findings of the literature review were equivocal. Whilst general optimism for potential savings to the secondary healthcare environment was speculated, no such benefit was articulated. Moreover, the lived experience of patients, their carers or clinical practitioners was not articulated beyond a general sense of technology

acceptance by patients. Moreover, there was little or no evidence to suggest thought had been given to how usual care could be augmented or changed through the application of RVT.

Mixed methods study was undertaken which demanded data collection in both the paradigm of qualitative and that of quantitative analysis. The blending, synthesis of data to determine and corroborate findings was undertaken utilising concurrent analysis. Data were collected from patients and, as appropriate, their carers by the means of questionnaires. There was no sampling of the patient caseload given the heterogeneous nature of the RVT technology deployed to a range of patients with differing LTC. Practitioners and managers were engaged through semi-structured one-to-one interviews.

There were N=16 U-Tell patient respondents and N=81 TF3, response rates of 50% and 33.5%, in addition N=49 carers participated. The data was uploaded into (IBM-SPSS Version 25 database) and analysed. There was no significant difference found between patient groups so that ratings were largely unaffected by condition, gender, age or RVT technology utilised; albeit, there was an indication that with an increased number of co-morbid LTCs a patient is diagnosed with, the less benefit is derived from RVT when compared with patients with one LTC. A new variable was created ‘Empowerment’, which combined the three variables (refer to section 8.1 and Table 4.4, ‘Enabled Self-Care’). When analysed with the variable of ‘future use of technology’ the skewness and kurtosis indicated a normal distribution with approximate symmetry for both empowerment and future technology.

It was found that the carer data demonstrated support for both RVT and increased future use of technology. Patients reported that RVT was easy to use, would support increased use of technology and that they had used primary and secondary care service less when their care was augmented with RVT when compared to usual care. Consensus coalesced around general support for RVT to help support the care of the patient/ service users. However, patient respondents went further and expressed strong agreement that RVT gave them peace of mind, was able to enable them to better manage their condition on a day-to-day basis, become more involved in their care, reduced use of other healthcare resources particularly in primary care and in recognising the benefits and ease of RVT were more receptive to technology

in future. Of note, the qualitative data shared by patients and their carers expressed, a sense of freedom afforded to them by RVT and that they felt able to take action in a timely manner, including accessing their clinical practitioners, easily. The findings not only expressed acceptance of RVT and unidimensional benefits but when synthesised holistically presented a picture of empowerment, where patients were no longer passive recipients of healthcare, or complied with treatment regimen, rather were supported through RVT to take direct responsibility and be active in self-care.

Data were collected from N=16 senior medical, nursing and allied health professionals who actively utilised RVT in the care of their patients and N=8 senior managers/ commissioners who had responsibility for commissioning RVT or managing services where RVT was deployed. There were 24-hours of digitally recorded verbal data transcribed and analysed within the supporting database of (NVivo). As far as practicable the high-level nodes were utilised to sort the data for both staff groups to facilitate comparison and observe and describe findings through analysis. The initial construction of the clinical practitioner's data topic nodes was reviewed, quality assured and ratified by a subgroup of the clinical participants. Data did corroborate the views of patients, but it was apparent that the perception of managers was not driven by a lived experience or direct observation of RVT. Managers were frustrated by the lack of clinical engagement whereas clinical practitioners sought co-creation and extended use. There was an opinion that technology was required in the future to enable care, but the managers articulated data management and data analytics, whilst the clinical practitioners wanted practical solutions such as electronic patient records and more importantly, the next generation RVT. It is noteworthy, and of real practical use for the next generation of RVT, that the practitioner participants shared their learning to enable the future optimisation of RVT in particular patient groups, driven by the symptom patterns and requirements of patients with varying chronic diseases. The relevant data was compiled into a comprehensive list of inclusion and exclusion criteria and duly tabulated, (refer to Table 5.13 summary of patient identification factors).

Both staff groups articulated patient-centric care and whilst the managers did not directly utilise the term 'empowerment' much narrative articulated

empowerment using proxy language, for example, self-management and learning. Whereas, the clinical practitioner participants directly spoke about the power RVT had to directly influence the clinical/ patient dynamic relationship. The qualitative empowerment narrative was quantitized, through the use of (NVivo), which demonstrated that 75% of clinical practitioner participants articulated concepts of empowerment 58 times. This narrative was recorded under the high-level node of patient benefit and accounted for 65% of all practitioner participant data describing patient benefit.

The overarching finding following the data analysis is a confirmation of the hypothesis being tested, that is RVT, when successfully integrated into the treatment regimens of patients with chronic disease, enabled patients to feel better supported, better able to contribute to their own care, understand their condition and therefore be empowered.

The theoretical speculation proposed by Suter et al. (2011) that almost any kind of RVT type of telehealth technology could induce a behaviour change and empower patients is supported by this research albeit the fundamental difference is about the effective deployment. The clinical practitioner participants were granted an enabling environment by the manager participants within the system and then through co-creation had the freedom to inculcate RVT into practice. Their ‘trial and error’ approach to learning how to effectively integrate technology into the therapeutic regimen and consideration of patient selection has enabled new knowledge to emerge. Practitioners expressed how they were keen to practice evidence-based care and so needed to discover new ways of working and to create the evidence to indicate optimisation of RVT in treatment regimens.

8.6 Confirming the Hypothesis

The findings of the research confirmed the hypothesis which stated:

If the healthcare system successfully integrates remote vital sign telemonitoring into the treatment regimens for patients with chronic disease, then the effect will be that patients will feel better supported and empowered.

8.7 Contribution

The research demonstrated that whilst the initial desired economic outcome was not realised for the region, RVT did afford benefit. The perceived benefit for service users was in line with international standards for the delivery of primary and community care services, particularly for those patients with LTC. RVT was found to effectively connect practitioners and patients and enable effective care to be delivered. RVT was accepted by patients, carers and practitioners, all of whom were positive regarding a technology enabled future for healthcare. There were several distinct and generalisable contributions to knowledge found as a result of the research undertaken, including:

1. Demonstrated that whist the original ambition for the service (reduced secondary care utilisation and improved cost effectiveness of care for LCT care) had not been realised there was clearly a perceived benefit for service users.
2. Patient empowerment was found to be a perceived benefit of RVT. This was in line with international goals for healthcare for all, most particularly for people with LTC.
3. There was high user acceptability for RVT; an enthusiasm and acceptance of technology, positively indicating greater future application and use in future.
4. There had been fears that RVT would create a distance between practitioners and patients when, in fact, the opposite was articulated. So that in the future service users could be better connected to the health services using remote technology.

5. Practitioners not only demonstrated a receptiveness to technology but observed that with growing demand and diminishing resources or access to conventional models of care, the application of technology was seen as vital for service sustainability.
6. To enable a smooth transition to a technology enabled future the research demonstrated patient selection criteria and clinical application, based on practitioner experience, and shared best practice to date.

8.8 Recommendations

1. To advise the Department of Health and Public Health Agency, within the context of the regional eHealth Strategy, that they should reconsider their position relating to RVT. The Authorities should look beyond the blunt instruments utilised in the past for performance management of RVT and instead look for real patient outcome measures to indicate value.
2. When introducing new disruptive eHealth technologies into the system, consider that patient technology acceptance was not influenced by disease group, age, gender or the type of technology but that simplicity, direct benefit and fitting with lifestyle were important. The lower value mobile RVT technology demonstrated equal benefit to the patient as the higher cost RVT solution and so the Health and Social Care system must look to lower cost, dynamic, mobile technologies with favour to enable patient empowerment, particularly as the next generation of tech-savvy smartphone owners begin to require care for chronic diseases.
3. To advise the Health and Social Care system to enable clinical practitioners to flourish and participate in systemic decision making. Care can be improved through the creation of enabling environments which allow co-creation and a meaningful clinical contribution to the improvement agenda. Previous reviews of the RVT service failed to engage with the practitioners who utilised RVT and instead the system should learn that for future technology introduction those clinicians responsible for utilisation and prescription of technology must be proactively engaged in decision making.

4. To ensure the ongoing engagement of clinical practitioners by enabling co-creation, benefit realisation, the development of new care pathways and the focus upon health and well-being outcomes.
5. The pursuit of performance management targets, which only credits activity and disregards clinical benefit, is counterproductive and should be avoided. However, evaluation of technology projects is important and should be planned at the beginning whereby objectives are set, and metrics, along with a mode of capture, are agreed.
6. To ensure commissioners build into their contracts, with technology solution suppliers, the means to enable data to be open and available for researchers. Suppliers must not be permitted to employ restrictive practices, instead the capture and then the sharing of meaningful clinical data, in a format which is accessible, to demonstrate effect, benefit and outcome, should be evident from the outset. This also requires commissioners to set outcome measures prior to project commencement so that impactful post project evaluations can be undertaken rather than a commissioner tracking the simple delivery of units of service against a contract value.
7. Equally, within the context of General Data Protection Regulation (GDPR), purposeful clinical data must be collected with the consent of service users, anonymised and then made accessible to researchers through the regional data warehouse.
8. To share the new knowledge of patient inclusion and exclusion criteria, gained through clinical experience RVT, across the chronic disease networks so that future technology adoption can be accelerated and appropriately targeted or technology adapted to overcome barriers (Table 5.12).
9. To deploy RVT in scenarios which require minimal practitioner movement for example in a pandemic situation where reduced footfall into domiciliary or residential or nursing home environments reduces the risks of practitioners being vectors of a disease. For efficiency to enable practitioners to effectively target their actions to those in most need whist monitoring a larger patient cohort. For the development of virtual wards or outpatient services which are environmentally friendly reducing the use of

fuels for travel or where geography and transport networks are problematic.

10. To allow patient-centric care to be developed with the deployment of technology to better support the patient in their own journey with their chronic disease. To enable a real collaboration between practitioner, patient and their carer that goes beyond the past expectation of patient compliance. Where a patient is liberated to undertake self-manage effectively their own self-care, where education and knowledge can drive their decisions and choices, rather than the binary option to follow or disregard clinical instruction. This recommendation is about harnessing the patient and carer resource to maximise the opportunity for healing or symptom control of chronic diseases.
11. In accepting RVT empowers patients to self-manage their chronic disease, to undertake further research to understand the actual behaviour change and how an individual's motivation can be sustained and extended over time as new disruptive technologies emerge.
12. RVT and the future of technology enabled care should be included in the undergraduate training of a range of health care practitioners to enable the development of service and an improved acceptance and trust within the clinical community.

The research findings are transferable and describe how to practically optimise RVT into clinical practice, share the crucial selection criteria, by disease group, and for participants to envisage the use of technology in the future. It demonstrates technology acceptance for the future of self-monitoring, self-management, behaviour change and the active participation in self-care and wellness. It also demonstrated the benefit of RVT was not to realise a cost saving in secondary care, rather to develop and enhance patient-centred care at home.

However, the real importance, to redefine the collaborative relationship between patient and their clinical practitioner, to support the patient and their carers to take responsibility for their own care and self-management through learning, shared knowledge and rapid access to support. RVT, when deployed effectively, does yield the benefit of patient-centric care through the real and meaningful empowerment of the patient.

8.9 Peer Reviewed Publication

Walkden J, McCullagh PJ, Kernohan WG

Patient and carer survey of remote vital sign telemonitoring for self-management of long-term conditions

BMJ Health & Care Informatics 2019;26**:**e100079. doi: 10.1136/bmjhci-2019-100079

Volume 26, Issue 1, 18th December 2019

http://informatics.bmj.com/cgi/content/abstract/bmjhci-2019-100079.

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10 APPENDICES

APPENDIX 1 DETAILED DESCRIPTION OF SOUTH EASTERN TRUST, HISTORY WITH TECHNOLOGY AND EUROPEAN CENTRE FOR CONNECTED OPERATIONS TO AWARD OF RTNI CONTRACT

10.1 Profile of South Eastern Health and Social Care Trust

The SET was established on 1st April 2007 and as already stated is one of five acute and community health and social care Trusts commissioning RVT to enable its provision. The Trust is an integrated organisation, incorporating acute hospital services and community health and social services and serves a population of approximately 345,000 people. The Trust encompasses the local government districts of Ards, North Down, Lisburn, Down and part of Castlereagh. The clinical facilities include Ards Community Hospital, Bangor Community Hospital, Downe Hospital, Downshire Hospital, Lagan Valley Hospital and the Ulster Hospital. Community bases are located in many local towns and villages from Moira in the West to Portaferry in the East and from Bangor in the North to Newcastle in the South. The Trust is committed to providing health and social care to the local population it serves, from conception to death, and strives to meet the needs of the community within a budget of approximately £500,000,000 per annum. The population is located in both rural and urban communities and affords residents care within the domiciliary environment, primary care health centres, community hospitals and acute General Hospitals.

Figure 10.1: Map to illustrate geographic catchment area of SET

In addition, to the geographical spread, graph depicted in Figure 10.1, there are areas of both relative wealth and deprivation. The Trust employs in the region of 9,100 staff across a range of disciplines:- administration and clerical, maintenance, ancillary and general, nurses and midwives, social work, professional and technical, medical and dental and the Trust is split into a number of Directorates as follows: Children's Services and Social Work, Adult Services, Nursing, Primary Care and Older People's Services, Hospital Services, Human Resources and Corporate Affairs, Finance and Estates and Planning, and Performance and Informatics. However, the utilisation of RVT was limited to particular staff groups including specialist nursing services or multidisciplinary teams including nurses, allied health professionals and medical staff and within the thesis will generically be referred to as practitioners. Moreover, only practitioners from two directorates, Nursing, Primary Care and Older People's Services and Acute Hospital Services were included in the research as access to RVT services was not universally available to practitioners across all programmes of care.

The five Trust arrangement in Northern Ireland (NI) has been in situ since a structural re-organisation in 2007 called 'Review of Public Administration'. Prior to the constitution of SET, within the geographic boundary, there were

two historic Trusts; Down and Lisburn (DLT) and Ulster Community and Hospitals Trust (UCHT). Therefore, at the time of the regional contract for RVT the Trust was relatively new and systems of operation and culture were still being developed.

10.2 Pre-South Eastern Trust Interest in RVT

Ulster Community and Hospital Trust (UCHT) had a reputation for engagement of practitioners with new technologies and in 1997 the first technology based medical governance system was created, 'The Path.Finder Governance Committee'. The group consisted of Consultant Medical Practitioners, the Deputy Director of Nursing, General Practitioners, Academics from Ulster University (UU) and Senior Trust Management. Whilst the majority of the Path.Finder programme had focused upon, the creation of clinical guidances for medical staff, and the transmission of this material via the intranet, early development of innovation vis-á-vis near patient testing and Remote Vital-sign Telemonitoring were muted. The desire to allow remote monitoring of warfarinised patients was of interest to the committee but adequately calibrated near patient testing devices and safe modes of data transmission had not emerged.

In 2004, UCHT Path.Finder group was terminated with the Trust's Governance Committee assuming responsibility for Guidelines, Guidances Protocols and Pathways of Care. However, the interest in the development and deployment of technology resided with a core group of practitioners and one Consultant Physician in particular. By the close of 2005 the Trust's Senior Planning Manager had secured £100,000 of capital resources to invest in technology and the Trust commissioned from Tunstall a Remote Monitoring System for the local community. This was designed as a pilot to care for 24 complex dementia patients with ambient technologies and 24 patients with diabetes mellitus with vital sign monitoring technologies and was called a 'Smart Homes Project'. However, not only was the future of UCHT halted with the Review of Public Administration, the project was not enabled to progress. The Department of Health and Social Services and Public Safety (DHSS&PS)

retracted further revenue funding from the Trusts which had been designated, by UCHT, to enable Remote Vital-sign Telemonitoring. Whilst the UCHT Smart Homes Project had early plans to include remote vital-sign monitoring linked to ambient monitoring and early alerts, nothing could progress as funding was withheld. However, a key feature of both the Path.Finder Medical Committee and Smart Homes Project was a core group of technology enthusiasts, early adopters, senior clinicians and leadership with a vision of a technology enabled dispersed health care model.

Equally, DLT had commissioned exploratory RVT from a Lisburn based Small to Medium Sized Enterprise (SME), Home Telehealth, which focused upon remote vital sign telemonitoring, with triage nurse support for patients with Chronic Obstructive Pulmonary Disorder (COPD). The integrated specialist nurse and physiotherapy community respiratory team based within the Lagan Valley Hospital trialled the service. In 2007/8 an internal review of service and care, unpublished, undertaken by lead specialist nurse concluded that their triage based RVT service reduced GP attendances, improved patient well-being and assured practitioners with regard to their health status. A later RCT conducted by the same team, McDowell et al. (2015) concluded there was little discernible difference in health outcome between patients with RVT and those receiving standard care from the team; but that the little difference that was shown indicated improved quality of life for patients who received usual care plus RVT. However, this team is unusual within Northern Ireland as it has clearly had longer to develop clinical practice of utilising RVT supported by nurse triage.

10.3 SET's Development of RVT U-Tell and RCT Findings

The Randomised Controlled Trial (RCT) also considered cost as an indicator of utility of alternative RVT care and determined a Quality Adjusted Life Year (QALY) to cost £26,423pa (Ibid.). The test strips, box of 48, were required by patients who wanted to continue to utilise the RVT facility rather than to revert to traditional care. Patients were asked to source these through GP Prescription. Whilst most GPs were supportive two were not prepared to utilise their prescription budget to support RVT. However, excluding the

consumable cost, that is the test strip cost for post RCT INR patients, the running costs for U-Tell:INR diminished to almost zero whereas during the RCT the cost of U-Tell:INR per annum was £10,000 for SpeechStorm voice recognition technology. In 2013, it was found that of the 70 patients utilising U-Tell:INR for both diabetes and INR only two utilised VRT by means of data upload. Over the 10-year evolution from Di@l-log to U-Tell:INR the patient behaviour had shifted; patients preferred to access the service via the internet using computer or smart phone rather than VRT. Therefore, SET ended the contract with the technology company Kainos who hosted the VRT product called SpeechStorm. The two very elderly patients who were dependent upon VRT changed their practice in order to benefit from U-Tell:INR rather than traditional care, and their family members assisting with data uploads. The study concluded that service users were satisfied with the service and their quality of life improved (El-Agnaf, 2014).

10.4 European Centre for Connected Health Schedule of Operations Leading to Contract Award.

The ECCH Senior Team established a programme Schedule of Work utilising ‘Programme Management’ and ‘Prince II’ Project Management Methodology (Office of Government Commerce, 2009). As part of this, each Trust established a project team attended by an ECCH Director. The inaugural SET Meeting occurred in August 2008. The ECCH then hosted a Provider Engagement Day. Forty companies made representation to several ECCH Panels demonstrating the systems and processes they were proposing to create the end-to-end service within Northern Ireland. End-to-End concept being one whereby a service provider would undertake every aspect of service delivery enabling the practitioner to refer a patient and subsequently is given access to the recorded readings. A competitive tender was then launched, and bidders invited to participate in a process of competitive dialogue. The 40 companies who expressed an interest were invited to submit a tender to become part of the competitive process. The procurement was being undertaken by the ECCH on behalf of a five -Trust consortium. Innovative procurement methods were deployed as both the specification was unclear and ‘off-the-shelf’ solutions limited.

The ECCH was supported by the Regional Procurement and Logistics Agency (PALS) which is a division of the Business Services Organisation (BSO). Consultancy support was engaged and included DLA Piper (legal support) and an Independent Procurement Adviser. Following the first round of tenders the long short-list was created consisting of the top ten bidding organisations. Of these, three local Telecare call centre providers were partnered with ten multinational technology providers. Interestingly, one local call centre provider was partnered with six of the lead Tenderers. This company Home Telehealth Ltd, later to become a subsidiary of Alere Healthcare, was to become the sole provider for SET during the Pilot phase of the Regional Remote Vital-sign Telemonitoring Procurement. Home Telehealth Ltd had not been able to bid as an independent tenderer at that time as their annual turnover had not been sufficient to meet the selection criteria. In effect, Small to Medium-sized Enterprises (SMEs) were precluded from leading bids leaving only large multi-national companies to be shortlisted by the Contract Adjudication Group (CAG). Significant annual capital turnover was required given that in 2008, the then Minister for Health, had allocated upwards of £40M to commission the service over 4-years. The Procurement Advisers set criteria; the lead contractor must have a turnover of sufficient value to demonstrate an ability to deliver a contract of the value of £40M. SMEs could only be afforded the opportunity to act as a subcontractor or consortium member with a lead contractor of sufficient financial stability. There was a risk with the chosen criterion as one of the initial objectives of the creation of the ECCH was to help with sustainable local business. There was then a dissonance created between the two Governmental Departments as ECCH drove ahead with the procurement within two opposing sets of criteria.

By the summer of 2009 a further round of shortlisting occurred with the final short list of four companies being created. It was thought that four companies would enable competition whilst fostering productive working relationships to develop effectively the creation of a workable and dynamic service specification for an end-to-end RVT service through a competitive dialogue process. The final four companies were British Telecom (BT), TF3 (a

consortium consisting of Tunstall as lead contractor and a connected health equipment provider, Fold a provider of remote Telecare, and S3 a technology/ programming/ service developer), Bosch and Hewlett Packard (HP). Each week the Trusts, ECCH, the two procurement advisors and each Tenderer met. Each Tenderer had a regular defined half day session. The meetings were an opportunity for the Authority (defined as the five Trusts and ECCH supported by Legal and Procurement Advisers) to develop thinking and understanding of what was actually deliverable so that the translation of vision into reality was pragmatic whilst enabling innovation. Over the period of the following two-years the service was developed and refined, based upon discussion with each organisation and also service experience obtained by each of the Trusts during the pilot phase.

However, running alongside the work of the ECCH was political turmoil as the world's financial markets began to collapse and the full ramification of fiduciary management within a time of austerity began to develop within the public sector. Regional Governmental budgets were under increasing pressure which concomitantly placed the Minister for Health and Social Services and Public Safety under scrutiny and challenges were made to terminate programmes not deemed to be effective.

In 2009, the ECCH engaged the accountancy firm, BDO Stoy Hayward, to undertake an evaluation of the pilot programmes canvassing the views of patients, carers and practitioners. The findings of BDO Stoy Hayward study were embargoed until post-procurement so as not to risk giving an unfair commercial advantage but it is suggested that the BDO Stoy Hayward report gave an added impetus to the pursuit of an RVT system via procurement. During this time there was a hiatus within the specification development phase and several key members of personnel from the ECCH left, including the Chief Executive, a key RVT Director and Medical Advisor.

Several influential politicians and health professionals had castigated the programme as without clinical foundation, without objective evidence of efficacy and branded RVT a luxury that could be ill-afforded when existing clinical services were stretched. However, following months of doubt the Minister gave his imprimatur for the programme to continue albeit with a significantly reduced budget.

Indeed, the budget was cut from the anticipated £10M per annum to £4.5M. The four Tenderers agreed to remain in the competitive procurement process at that stage and the work to reinvigorate the production of the service specification commenced in earnest. There were two final rounds of a competitive process and at the first hurdle HP fell and soon after Bosch leaving BT and TF3 as the last Tenderers willing to make a best and final offer.

The events of November and December 2010 before final procurement stages were quite precarious as some Tenderers had not accepted the model being specified. Bosch wanted to impose their tried and tested model of RVT rather than tailor their equipment and service to match the commissioner's required specification. Members of the Authority, commissioning team, felt that the complexities of NI actual requirements were such that a bespoke service specification was essential. HP wanted to postpone the creation of their technology interface to an activity post award and so was unwilling to respond to those elements of the tender specification. The Authority was attempting to envisage every element of provision and that meant a timely end-to-end service encompassing technology, vital sign equipment and triage nurses; embedded within a transforming integrated health and care system. The creation of something new, for not only Northern Ireland, but the Western World, was on the agenda.

By the close of December 2010, the final two Tenderers had submitted their proposal and concomitantly the Contract Adjudication Group (CAG) was convened to score the submissions. The Financial CAG occurred independently for the IT Technical CAG assessment which in turn was separate again from the front-line Quality Service Specification CAG assessment. Whilst the two final bids were scored across all dimensions and some elements of service offering were superior to others, there was an overall winning bid. The adjudication required a service Provider to not only commit to deliver to the service specification but also to be the Most Economically Advantageous Tender (MEAT) and the contract was awarded to the consortium TF3.

APPENDIX 2 SUMMARY OF RTNI REGIONAL CONTRACT BETWEEN THE AUTHORITY AND TF3

10.5 RTNI Managed Service Agreement Definitions

DLA Piper Global law firm wrote and managed the production of the agreement between the five Health and Social Care Trusts within Northern Ireland and Tunstall Healthcare (UK) Limited, relating to the provision of managed remote tele monitoring services in Northern Ireland.

The agreement extended to four leaver arch volumes along with a supplementary binder containing the six relevant signatories dated the 16th March 2011. The 5th signed file is a duplicate copy of file 1 of 4 containing the original signatures. The contents of each of the four master folders will be summarised and the relevant content noted.

10.6 RTNI File 1 of 4

This file contains the overarching definitions of services and establishes the implementation of the programme. The folder describes the standards by which the service is to be delivered.

Within the definitions section of the RTNI Project Agreement there are key definitions to be noted and a glossary of terms to ensure any risk of ambiguity is minimised.

The key definitions are quoted as follows in Table 12.1:

Table 10.1 To illustrate the key glossary of terms as sampled from the RTNI contract to inform context and intended purpose of RVT.

Page	Defined Term	Meaning
109	Electronic Care Record.	Means Patient's details or Client's details (as relevant) such as name, address, medication and GP which are held and sent electronically (rather than in hard copy format).
109	Emergency.	An unforeseen and /or sudden occurrence of danger that demands immediate action.

109	Emergency Response.	Means immediate action to be taken in response to a life-threatening situation. For example, this may include calling for ambulance service, attendance and assistance.
110	Entry level.	Means the market position which is the bottom quartile of specification and performance currently available within the tele monitoring, telehealth, telecare or telemedicine market.
111	Equipment Replacement Plan (RCP).	The terms set out at Annex A to schedule 2-4 (Replacement of Equipment) as updated in accordance with schedule 2-4 (Replacement of Equipment).
116	Health and Care Number H&CN.	Means a unique Health and Social Services identification number. This number is used by both the hospital and community services in Northern Ireland to identify patients/clients and issues in the recording of their treatments/care.
116	HSC Staff.	Means employees of the Authority and other HSC personnel included in caring for patients or clients (as relevant) who are receiving the Managed Service. This includes General Practitioners and their staff.
116	Hub.	Means the item of patient equipment or client equipment (as relevant) to which monitoring data is sent by peripherals and which transmits the monitoring data to the central solution.
117	Informed consent.	Means obtaining and recording consent by a patient or client (as relevant) to undergo a particular treatment or avail of a service after the patient or client (as relevant) has demonstrated an understanding of the aforementioned and any potential risks involved.
118	Interpretability.	Means the ability of two or more systems or components to exchange information and to use the information that has been exchanged.
121	Local Response Team.	Means HSC Staff with responsibility for overseeing the care of the patient or client (as relevant) during the monitoring period and who will attend to patient or client (as relevant) needs when an alert/alarm (as relevant) has been escalated. The Local Response Team may be a group of staff or an individual.
121	Machine Automated Questions.	Means questions that are displayed automatically by the patient equipment/client equipment for response as part of the patients/ clients receipt of Managed Service.
112	Managed Service.	Any and all elements of the services to be provided by the contracts under this agreement including as set out in schedule 2-1 (service description) including the pre-operational services, operational services, additional services and/or future services.
124	Monitored Client Volume Change.	Has the meaning given in paragraph 2.5 of schedule 7.1 (charging and invoicing).
124	Monitored Patient Day.	Means a day during which the Patient Equipment, installed/delivered at the request of the Authority is functioning in accordance with this agreement. The day of installation/delivery of patient equipment (in accordance with this agreement) shall be a Monitored Patient Day, but the day of

		de-installation/removal specified by authority and any day of thereafter shall not.
124	Monitoring.	Means the collection and reporting of vital signs and other patient data or client data (as relevant) by the Managed Service.
124	Monitoring data.	Means the data items that are collected and reported to the Managed Service.
124	Monitoring parameters.	Means the tolerance levels that are set for the identification of which monitoring data is referred to the triage service.
124	Monitoring period.	Means the duration of monitoring (normally measured in weeks).
124	Monitoring threshold.	Means the tolerance levels that are set for track and trend patients to indicate monitoring data has exceeded those indicated in the patient plan.
127	Out of hours.	The hours after 5pm and prior to 9am each day, including weekends and public holidays in Northern Ireland.
128	Patient.	Means a person requiring health services.
128	Patient equipment.	Means equipment used by the patient to record and report monitoring data (including home based or mobile equipment).
128	Patient plan.	Means the instructions included on the Referral form the Authority regarding the management of the patient under the Managed Service. The patient portal shall include: i. Vital signs to be monitored, monitoring parameters and frequency of data collection. ii. Machine Automated Questions including frequency and duration of collection. iii. self-reported data. iv. clinical information including diagnosis, co-morbidities, contraindications, allergies and/or medical history.
128	Patient Portal	Means the patients view of their patient records including any associated relevant information.
129	Peripheral.	Means an item of patient equipment or client equipment (as relevant) other than the Hub.
130	Project.	Means the project to procure and deliver the Managed Service pursuant to the OJEU (Official Journal of the European Union). Notice submitted for publication on 28th August 2008 for this project under reference 2008/5 166-223785.
131	Referral.	Means the instruction from the HSC staff to the contract to commence the provision of the Managed Service to a Patient/Client (as relevant).
131	Responsible clinician.	Means the medical practitioner with overall responsibility for the care of the Patient/Client (as relevant).
133	RTNI.	Means Remote Tele monitoring for Northern Ireland.
134	Self-Management.	Means a person-centred approach in which the individual is empowered and has ownership over the management of their life and conditions. The role of health and social care professionals,

		services and treatment is to support the person journey towards living well in the presence of absence of symptoms.
134	Self-reported data.	Means monitoring data which is entered by the Patient/Client directly rather than being recorded by an item of patient equipment/client equipment (as relevant).
127	Service user.	The patients, clients and carers and authorised medical personnel who use/receive the Managed Service.
142	Telehealth or Telehealth monitoring.	Means the remote tele monitoring and delivery of support services through information and communication technology, using vital signs monitoring and /or interpreting changes to a Patient's health.
142	Telehealth Key Worker	Means the person with responsibility for the telehealth aspect of a patients care – such person will be in close contact with the patient throughout the period of time that they are receiving the Managed Service.
144	Track and trend.	Means a tabular and graphical report of individual patient monitoring data against monitoring parameters.
145	Triage or triage service.	Means the service that assesses the patients' alert, validates the vital signs when an Alert has been raised, reviews monitoring data, obtains more information from the patient by asking questions designed to clarify or elicit more detail on clinical issues and deciding the action to be taken as a consequence including escalation to the Local Response Team.
146	Vital signs.	Means physical signs such as heartbeat, breathing rate and temperature, that assess a Patient's condition.

10.7 RTNI File 2 of 4

The definition of the RTNI per se does not appear within the definitions and is rather within file 2 of 4, schedule 2.1.

"A1 overview of Manged Service. The contracts shall ensure the provision of an end-to-end Managed Service to facilitate the following:

- The processing of patient referrals;
- The delivery and/or installation of appropriate patient equipment to/in a Patient's home and/or the provision of a mobile solution as determined by the HSC staff and be responsible for any remedial repair work as a consequence of installation;
- The provision of training to the HSC staff and patients/carers;
- The collection of accurate and reliable monitoring data;

- A triage service which validates monitoring data and provides patient advice where appropriate and/or the escalation of their care to the local response team as appropriate;
- The provision of relevant monitoring data to HSC staff in an appropriate manner and;
- The removal and/or de-installation and decontamination of patient equipment".

The Manged Service shall be provided to patients with Long Term conditions including CHD/ CHF COPD and Diabetes.

The Managed Service shall also be provided for the management of secondary prevention of stroke.

The Managed Service Agreement file 2 of 4 sets out the detail of service to be provided in terms of service development, implementation and testing. The progress is to be measured against pre-agreed targets and the issuing of a 'milestone Achievement Certificate' was documented. Any delays and concomitant correction plans and remedial actions were discussed along with the actions of the Liaison Committee. These elements were specifically designed to enable the development of an entirely new end-to-end service recognising that technological developments in the real-world may need more time to adapt than in theory or a laboratory. Indeed, the risk of delay was well accounted for with reasonable actions for both parties exclusively documented.

At section 9 the document begins to address directly the matters relating to the Managed Service with the onus placed upon the contracts to fulfil obligations with regard to service standards as detailed within the schedule 2-1 (Service Description).

At clause 9.8 reference is made to an 'Additional Service Implementation Timetable'

Similarly, at 9.17 1 the 'future service implementation plan' referenced enabled the provider to protract potential charges to point of non-progress.

Of note is clause 9.22

'At the same time as provision of additional and/or future service is commenced, the contract shall at no additional cost to the Authority, implement and commence provisions of any other services, functions and

responsibilities which are both necessary for and incidental to the paper performance by the contractor of their additional and/or future services.

Section 10 considers the service levels and quality failures.

10.8 RTNI File 3 of 4

This file contains the service offering and commitment made by the supplier

10.9 RTNI File 4 of 4

This file contains special provisions within the contract including, for example, commercial sensitivity, software, optional services, licencing, change provision, exit, staff transfer, governance and guarantees etc.

10.10 RTNI Financial Contract Information

Table 10.2 The standing charges for the RTNI contract in 2014/15.

Standing Charge 2014-15					
				Total	Month
				£	
				883,353	73,613
Belfast		20.9%		184,621	15,385
Northern		24.3%		214,655	17,888
Southern		19.6%		173,137	14,428
South Eastern		18.0%		159,004	13,250
Western		17.2%		151,937	12,661
		100.0%		883,353	73,613

(*Taken from a TF3 new charges for 2014/15 document supplied to Centre for Connected Health and the 5 Trusts*)

Table 10.3 The input package charges per monitored patient day (MPD) in 2014/15.

		Discount	10.4%	10.4%	
Package		Charge per Monitored patient day			6-year patient days
		Band A ≤ 48,000	Band B 48,001 – 53,000	Band C > 53,000	
A	Diabetes Home Based – track and trend 80%	£ 1.72	£ 1.54	£ 1.38	181,418
A	Diabetes Home Based 20%	£ 2.83	£ 2.53	£ 2.27	45,354
B	Diabetes Mobile – track and trend 80%	£ 1.74	£ 1.56	£ 1.40	346,382
B	Diabetes Mobile 20%	£ 2.85	£ 2.56	£ 2.29	86,596
C	COPD	£ 2.45	£ 2.20	£ 1.97	461,825
D	Heart Failure	£ 2.56	£ 2.30	£ 2.06	763,581
E	Heart Failure ECG	£ 2.55	£ 2.28	£ 2.05	24,752
F	Stroke – track and trend 95%	£ 1.20	£ 1.08	£ 0.96	201,435
F	Stroke 5%	£ 2.28	£ 2.04	£ 1.83	10,602
G	Diabetes/Heart Failure	£ 3.00	£ 2.69	£ 2.41	42,315
H	Diabetes/COPD	£ 2.88	£ 2.59	£ 2.32	42,497
I	COPD/Heart Failure	£ 2.66	£ 2.39	£ 2.14	55,146
J	Stroke /Diabetes – track and trend 100%	£ 1.68	£ 1.51	£ 1.35	55,146
K	ECG only	£ -	£ -	£ -	0
Q	Stroke Mobile	£ 2.73	£ 2.44	£ 2.19	75,985
Z	COPD with BP	£ 2.53	£ 2.27	£ 2.04	461,825
L	Hypertension – track and trend (Additional service)	£ -	£ -	£ -	0
M	Hypertension – (Additional service)	£ -	£ -	£ -	0
	INR – track and trend (Additional service)				
		Total			2,854,859
		Total (excl. Track & Trend)			2,070,478

(*Taken from a TF3 new charges for 2014/15 document supplied to Centre for Connected Health and the 5 Trusts*)

Table 10.4 The additional variable charges for installation and de-installation of equipment.

Installation Charge (as described in Schedule 7.1) :		£33.22
Delivery Charge (as described in Schedule 7.1) :		£33.22
De-Installation Charge (as described in Schedule 7.1):		£33.22
Removal Charge (as described in Schedule 7.1):		£33.22

Table 10.5 The calculation of installation, delivery, de-installation and removal charges.

Number of visits	29,659			
Direct labour cost	£	652,022	£	22
Overhead recovery	£	260,809	£	9
Margin	£	72,447	£	2
Total	£	985,277	£	33
Charge	£	33.22		

(*Taken from a TF3 new charges for 2014/15 document supplied to Centre for Connected Health and the 5 Trusts*)

So that SET would pay a monthly standing charge of 1/12th of £159,004 plus the direct costs associated with all MPD. Reporting for the variable element of the contract was broken down by package. The annual element of the SET cost and contribution was expected, at outset, to be 18% of the BAFO offer the total cost, for a 6-year contract for the 5 Health and Social Care Trusts of £12,493,338. The cost of provision was not a cost pressure for SET as access to this service was funded via the Regional Commissioning framework for Trusts and the additional resource was added to Trust funding baselines. Of note, there were service financial penalties for breaches in quality standards, for example installation times and call response times and a number of key milestones from a performance management perspective. From the signing of the contract it then took a further 8-month period for the service to be fully operationalised; with first SET patient live on the system on 4th December 2011.

APPENDIX 3 QUESTIONNAIRES

10.11 RTNI Patient and Carer Questionnaires

Service User Questionnaire – Remote Telemonitoring Service – TF3

By returning the completed questionnaire you will have agreed to participate in the research. Your questionnaires will be kept confidential and comments will not be attributed to anyone but your views will help shape the future development of the service. The questionnaire responses will be compiled by the Trust's Safe & Effective Care Team and I will have access to the Trust's summary report. If you wish to participate please could you return your questionnaires by Friday 18th September 2015. Many thanks in anticipation, Julie-Ann Augusto

(Please tick one box only for each of the questions below)

Patient Details

1. **Do you have a carer?** Yes ☐ No ☐ **If yes, does your carer help you take your readings?** Yes ☐ No ☐

   If yes, will you pass the Carer Survey onto them? Yes ☐ No ☐

2. **This questionnaire was completed by the: Me** ☐ **My Carer** ☐

3. **Are you a current user of telemonitoring** ☐ **Previous User / Discharged from telemonitoring** ☐

4. **What is your health condition being monitored through TF3? Please tick all that apply.**

Stroke ☐ Chronic Heart Failure ☐ Diabetes ☐
Chronic Obstructive Pulmonary Disease (COPD) ☐
Renal ☐ Gestational Diabetes ☐ Hypertension ☐
Weight Management ☐ Maternity ☐
Bronchiectasis ☐ Warfarin Monitoring/INR ☐ Dementia ☐
Paediatrics ☐ Other ☐

5. **What is your gender?** Male ☐ Female ☐

6. **What age are you? _____- years**

Patient Benefits

1. **The telemonitoring system assisted me in managing my health on a day to day basis.**

   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐
   Not Applicable ☐

2. **I believe the telemonitoring system has reduced the number of my GP visits.**

   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐
   Not Applicable ☐

3. **I believe my own monitoring of my condition has reduced the number of nurse/community team/health professional visits.**

   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐
   Not Applicable ☐

4. **I believe that during the telemonitoring period, the system has prevented the need to attend Accident & Emergency Department and /or GP Out Of Hours services.**

   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐
   Not Applicable ☐

5. **I believe that during the telemonitoring period, the system has prevented or reduced the need to attend Out Patient appointments.**

   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐
   Not Applicable ☐

6. **I believe that during the telemonitoring period, the system has prevented my admission to hospital.**

   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐
   Not Applicable ☐

7. **The telemonitoring system has enabled me to better manage my own condition and become more involved in my health care.**

   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐
   Not Applicable ☐

8. **Since you have been on telemonitoring how many times have you been admitted to hospital as a result of your condition?**

   None☐ 1 - 5☐ 6 - 10☐ 11 - 15☐
   16 or more☐

9. **I believe telemonitoring has given me peace of mind.**

   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

   If you would like to add anything here about **peace of mind and technology**, please comment here:

Telemonitoring Equipment and Technology

10. **My South Eastern Trust Practitioner explained the Telemonitoring system to me in enough detail before installation.**

Strongly Agree ☐ Agree ☐ Disagree ☐
Strongly Disagree ☐ Not Applicable ☐

11. I was worried about using the new telemonitoring technology before it was installed.
Strongly Agree ☐ Agree ☐ Disagree ☐
Strongly Disagree ☐ Not Applicable ☐

12. The telemonitoring system equipment in my home was easy for me to use.

Strongly Agree ☐ Agree ☐ Disagree ☐
Strongly Disagree ☐ Not Applicable ☐

13. I am more interested in using technology in general following my use of the telemonitoring system.

Strongly Agree ☐ Agree ☐ Disagree ☐
Strongly Disagree ☐ Not Applicable ☐

14. I believe the telemonitoring questions displayed on the home-hub equipment encouraged me to think about my symptoms.
Strongly Agree ☐ Agree ☐ Disagree ☐
Strongly Disagree ☐ Not Applicable ☐

15. I have found the internet portal to view my readings useful.

Strongly Agree ☐ Agree ☐ Disagree ☐
Strongly Disagree ☐ Not Applicable ☐

16. I would be happy to use the internet upload my readings or send messages to my South Eastern Trust Practitioner.

Strongly Agree ☐ Agree ☐ Disagree ☐
Strongly Disagree ☐ Not Applicable ☐

17. I believe increased use of technology in the care and support of people at home will be of benefit in the future.

Strongly Agree ☐ Agree ☐ Disagree ☐
Strongly Disagree ☐ Not Applicable ☐

18. I consider increased use of internet based care and support for people at home will be of benefit in the future.

Strongly Agree ☐ Agree ☐ Disagree ☐
Strongly Disagree ☐ Not Applicable ☐

Use of TF3 Telemonitoring Service

19. Have you been contacted by a South Eastern Trust Practitioner in connection with your readings? Yes ☐ No ☐

20. My Clinician's TF3 service messages were helpful:

Strongly Agree ☐ Agree ☐ Disagree ☐
Strongly Disagree ☐ Not Applicable ☐

21. My Clinician's telephone support was helpful:

Strongly Agree ☐ Agree ☐ Disagree ☐
Strongly Disagree ☐ Not Applicable ☐

22. Did you receive a Remote Telemonitoring TF3 Nurse Triage Service?

Yes ☐ No ☐
(If yes, please answer questions 23 to 25)

23. Have you been contacted by a TF3 Triage Nurse?

Yes ☐ No ☐

24. The Triage Nurse I spoke to was helpful:

Strongly Agree ☐ Agree ☐ Disagree ☐
Strongly Disagree ☐ Not Applicable ☐

25. If you had to take more than one set of readings during a day, why was this? (Please tick)

Readings didn't go through the first time ☐ Asked to do so by Triage Nurse ☐ For confirmation or reassurance ☐
I have a more frequent monitoring programme ☐ Other ☐

If you would like to add anything, please comment here:

Thank you for taking time to complete this Evaluation Questionnaire. A summary of the questionnaire findings will be available on the Trust's Website, www.setrust.hscni.net from 31st March 2016.

Service User Questionnaire – Remote Telemonitoring Service - U-Tell

By returning the completed questionnaire you will have agreed to participate in the research. Your questionnaires will be kept confidential and comments will not be attributed to anyone but your views will help shape the future development of the service. The questionnaire responses will be compiled by the Trust's Safe & Effective Care Team and I will have access to the Trust's summary report. If you wish to participate please could you return your questionnaires by Friday 18th September 2015. Many thanks in anticipation, Julie-Ann Augusto

(Please tick one box only for each of the questions below)

Patient Details

1. **Do you have a carer?** Yes ☐ No ☐ **If yes, does your carer help you take your readings?** Yes ☐ No ☐

   If yes, will you pass the Carer Survey onto them? Yes ☐ No ☐

2. **This questionnaire was completed by the: Me** ☐ **My carer** ☐

3. **Are you a current user of telemonitoring** ☐ **Previous User / Discharged from telemonitoring** ☐

4. **What is your health condition being monitored through U-Tell?**

   Stroke ☐ Chronic Heart Failure ☐ Diabetes ☐
   Chronic Obstructive Pulmonary Disease (COPD) ☐

   Renal ☐ Gestational Diabetes ☐ Hypertension ☐
   Weight Management ☐ Maternity ☐

   Bronchiectasis ☐ Warfarin Monitoring/INR ☐ Dementia ☐
   Paediatrics ☐ Other ☐

5. **What is your gender?** Male ☐ Female ☐

6. **What age are you? _____- years**

Patient Benefits

7. **The telemonitoring system assisted me in managing my health on a day to day basis.**

   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐
   Not Applicable ☐

8. **I believe the telemonitoring system has reduced the number of my GP visits.**

   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

9. **I believe my own monitoring of my condition has reduced the number of nurse/community team/health professional visits.**

   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐
   Not Applicable ☐

10. **I believe that during the telemonitoring period, the system has prevented the need to attend Accident & Emergency Department and /or GP Out Of Hours services.**

    Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐
    Not Applicable ☐

11. I believe that during the telemonitoring period, the system has prevented or reduced the need to attend Out Patient appointments.

Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

12. I believe that during the telemonitoring period, the system has prevented my admission to hospital.

Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

13. The telemonitoring system has enabled me to better manage my own condition and become more involved in my health care.

Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

14. Since you have been on telemonitoring how many times have you been admitted to hospital as a result of your condition?

None☐ 1 - 5☐ 6 - 10☐ 11 - 15☐ 16 or more☐

15. I believe telemonitoring has given me peace of mind.

Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

If you would like to add anything here about **peace of mind and technology**, please comment here:

Telemonitoring Equipment and Technology

16. My South Eastern Trust Practitioner explained the Telemonitoring system to me in enough detail before installation.

Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

17. I was worried about using the new telemonitoring technology before it was installed.

Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

18. The telemonitoring system equipment in my home was easy for me to use.

Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

19. I am more interested in using technology in general following my use of the telemonitoring system.

Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

20. I believe the telemonitoring questions on the U-Tell 'Readings' page encouraged me to think about my symptoms.

Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

21. I have found the internet portal to view my readings useful.

Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

22. I would be happy to use the internet to upload my readings or send messages to my South Eastern Trust Practitioner.

Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

23. I believe increased use of technology in the care and support of people at home will be of benefit in the future.

Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

24. I consider increased use of internet based care and support for people at home will be of benefit in the future.

Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

Use of U-Tell Telemonitoring Service

25. Have you been contacted by a South Eastern Trust Practitioner in connection with your readings? Yes ☐ No ☐

26. My Clinician's U-Tell messages were helpful:

Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

27. My Clinician's telephone support was helpful:

Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

would like to add anything, please comment here:

Thank you for taking time to complete this Evaluation Questionnaire.

A summary of the questionnaire findings will be available on the Trust's Website, www.setrust.hscni.net from 31st March 2016.

Carer Questionnaire – Remote Telemonitoring Service

By returning the completed questionnaire you will have agreed to participate in the research. Your questionnaires will be kept confidential and comments will not be attributed to anyone but your views will help shape the future development of the service. The questionnaire responses will be compiled by the Trust's Safe & Effective Care Team and I will have access to the Trust's summary report. If you wish to participate please could you return your questionnaires by Friday 18th September 2015. Many thanks in anticipation, Julie-Ann Augusto

(Please tick one box only for each of the questions below)

1. **I believe telemonitoring has improved the overall level of health and social care given to the person I care for.**

   Strongly Agree ☐ Agree ☐ Disagree ☐
   Strongly Disagree ☐ Not Applicable ☐

2. **I believe telemonitoring has helped prevent the person I care for being admitted to hospital.**

   Strongly Agree ☐ Agree ☐ Disagree ☐
   Strongly Disagree ☐ Not Applicable ☐

3. **When assisting the person to operate the telemonitoring equipment, I found it easy to use.**

   Strongly Agree ☐ Agree ☐ Disagree ☐
   Strongly Disagree ☐ Not Applicable ☐

4. **I think the use of telemonitoring as part of a care package is generally helpful.**

   Strongly Agree ☐ Agree ☐ Disagree ☐
   Strongly Disagree ☐ Not Applicable ☐

5. **I believe telemonitoring has given me peace of mind.**

   Strongly Agree ☐ Agree ☐ Disagree ☐
   Strongly Disagree ☐ Not Applicable ☐

6. **I believe increased use of technology in the care and support of people at home will be of benefit in the future.**

   Strongly Agree ☐ Agree ☐ Disagree ☐
   Strongly Disagree ☐ Not Applicable ☐

7. **I believe increased use of internet based care and support for people at home will be of benefit in the future.**

   Strongly Agree ☐ Agree ☐ Disagree ☐
   Strongly Disagree ☐ Not Applicable ☐

Please add any further comments here:

Carer Questionnaire – Remote Telemonitoring Service

By returning the completed questionnaire you will have agreed to participate in the research. Your questionnaires will be kept confidential and comments will not be attributed to anyone but your views will help shape the future development of the service. The questionnaire responses will be compiled by the Trust's Safe & Effective Care Team and I will have access to the Trust's summary report. If you wish to participate please could you return your questionnaires by Friday 18th September 2015. Many thanks in anticipation, Julie-Ann Augusto

(Please tick one box only for each of the questions below)

1. **I believe telemonitoring has improved the overall level of health and social care given to the person I care for.**

   Strongly Agree ☐ Agree ☐ Disagree ☐
   Strongly Disagree ☐ Not Applicable ☐

2. **I believe telemonitoring has helped prevent the person I care for being admitted to hospital.**

   Strongly Agree ☐ Agree ☐ Disagree ☐
   Strongly Disagree ☐ Not Applicable ☐

3. **When assisting the person to operate the telemonitoring equipment, I found it easy to use.**

   Strongly Agree ☐ Agree ☐ Disagree ☐
   Strongly Disagree ☐ Not Applicable ☐

4. **I think the use of telemonitoring as part of a care package is generally helpful.**

   Strongly Agree ☐ Agree ☐ Disagree ☐
   Strongly Disagree ☐ Not Applicable ☐

5. **I believe telemonitoring has given me peace of mind.**

   Strongly Agree ☐ Agree ☐ Disagree ☐
   Strongly Disagree ☐ Not Applicable ☐

6. **I believe increased use of technology in the care and support of people at home will be of benefit in the future.**

   Strongly Agree ☐ Agree ☐ Disagree ☐
   Strongly Disagree ☐ Not Applicable ☐

7. **I believe increased use of internet based care and support for people at home will be of benefit in the future.**

   Strongly Agree ☐ Agree ☐ Disagree ☐
   Strongly Disagree ☐ Not Applicable ☐

Please add any further comments here:

10.12 Coded Patient Questionnaire

South Eastern Health and Social Care Trust CODING FOR SPSS 27:03:17

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1. ID
2. TF3 / U-TELL 1 = TF3 2 = U-TELL N/S = No response

Service User Questionnaire – Remote Telemonitoring Service – TF3

By returning the completed questionnaire you will have agreed to participate in the research. Your questionnaires will be kept confidential and comments will not be attributed to anyone but your views will help shape the future development of the service. The questionnaire responses will be compiled by the Trust's Safe & Effective Care Team and I will have access to the Trust's summary report. If you wish to participate please could you return your questionnaires by Friday 18th September 2015. Many thanks in anticipation, Julie-Ann Augusto

(Please tick one box only for each of the questions below)

Patient Details Not Applicable = NA & No Response = NS

Carer
1. Do you have a carer? Yes ☐1 No ☐2
2. CarerHelp If yes, does your carer help you take your readings? Yes ☐1 No ☐ 2 NA3 NS0
3. CarerQ If yes, will you pass the Carer Survey onto them? Yes ☐1 No ☐ 2 NA3 NS0

CarerGroup 4. This questionnaire was completed by the: Me ☐ 1 My Carer ☐ 2 0 N/S

NewPastUser 5. Are you a current user of telemonitoring ☐ 1 Previous User / Discharged from telemonitoring ☐ 2 0 = N/S

6. What is your health condition being monitored through TF3? Please tick all that apply. Yes = 1 N/S = 2

Stroke	☐1	Chronic Heart Failure	☐ 1	Diabetes	☐ 1	Chronic Obstructive Pulmonary Disease (COPD)	☐ 1		
Renal	☐1	Gestational Diabetes	☐ 1	Hypertension	☐ 1	Weight Management	☐	Maternity	☐ 1
Bronchiectasis	☐ 1	Warfarin Monitoring/INR	☐ 1	Dementia	☐ 1	Paediatrics	☐	Other	☐ 1

Please specify:_____

Sex 7. What is your gender? Male ☐ 1 Female ☐ 2 N/S = 2

Age 8. What age are you? _____- years

Patient Benefits FROM HERE TO END SURVEY 0 = None Response (N/S) & 5 = N/A

1. The telemonitoring system assisted me in managing my health on a day to day basis.
   Strongly Agree ☐ =4 Agree ☐ =3 Disagree ☐ =2 Strongly Disagree ☐ =1 Not Applicable ☐ =5 N/S=0
   b1helpmeman

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2. I believe the telemonitoring system has reduced the number of my GP visits.
   Strongly Agree ☐ =4 Agree ☐ =3 Disagree ☐ =2 Strongly Disagree ☐ =1 Not Applicable ☐ =5 N/S=0
   b2lessGP

3. I believe my own monitoring of my condition has reduced the number of nurse/community team/health professional visits.
   Strongly Agree ☐ =4 Agree ☐ =3 Disagree ☐ =2 Strongly Disagree ☐ =1 Not Applicable ☐ =5 N/S=0
   b3lessnurse

4. I believe that during the telemonitoring period, the system has prevented the need to attend Accident & Emergency Department and /or GP Out Of Hours services.
   Strongly Agree ☐ =4 Agree ☐ =3 Disagree ☐ =2 Strongly Disagree ☐ =1 Not Applicable ☐ =5 N/S=0
   b4noAEGPOO

5. I believe that during the telemonitoring period, the system has prevented or reduced the need to attend Out Patient appointments.
   Strongly Agree ☐ =4 Agree ☐ =3 Disagree ☐ =2 Strongly Disagree ☐ =1 Not Applicable ☐ =5 N/S=0
   b5lessOP

6. I believe that during the telemonitoring period, the system has prevented my admission to hospital.
   Strongly Agree ☐ =4 Agree ☐ =3 Disagree ☐ =2 Strongly Disagree ☐ =1 Not Applicable ☐ =5 N/S=0
   b6noadmiss

7. The telemonitoring system has enabled me to better manage my own condition and become more involved in my health care.
   Strongly Agree ☐ =4 Agree ☐ =3 Disagree ☐ =2 Strongly Disagree ☐ =1 Not Applicable ☐ =5 N/S=0
   b7empower

8. Since you have been on telemonitoring how many times have you been admitted to hospital as a result of your condition?
   None☐ 1 1 - 5☐ 2 6 - 10☐ 3 11 - 15☐ 4 16 or more☐ 5 N/A = 6 N/S=0
   b8hospadmiss

2 V4 14:07:15

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9. I believe telemonitoring has given me peace of mind.
Strongly Agree ☐ =4 Agree ☐ =3 Disagree ☐ =2 Strongly Disagree ☐ =1 Not Applicable ☐ =5 N/S=0
b9peacemind

If you would like to add anything here about **peace of mind and technology**, please comment here:

Telemonitoring Equipment and Technology

10. My South Eastern Trust Practitioner explained the Telemonitoring system to me in enough detail before installation.
Strongly Agree ☐ =4 Agree ☐ =3 Disagree ☐ =2 Strongly Disagree ☐ =1 Not Applicable ☐ =5 N/S=0
c10pracexpl

11. I was worried about using the new telemonitoring technology before it was installed.
Strongly Agree ☐ =4 Agree ☐ =3 Disagree ☐ =2 Strongly Disagree ☐ =1 Not Applicable ☐ =5 N/S=0
c11worried1st

12. The telemonitoring system equipment in my home was easy for me to use.
Strongly Agree ☐ =4 Agree ☐ =3 Disagree ☐ =2 Strongly Disagree ☐ =1 Not Applicable ☐ =5 N/S=0
c12RTMeasy

13. I am more interested in using technology in general following my use of the telemonitoring system.
Strongly Agree ☐ =4 Agree ☐ =3 Disagree ☐ =2 Strongly Disagree ☐ =1 Not Applicable ☐ =5 N/S=0
c13Techinterest

14. I believe the telemonitoring questions displayed on the home-hub equipment encouraged me to think about my symptoms.
Strongly Agree ☐ =4 Agree ☐ =3 Disagree ☐ =2 Strongly Disagree ☐ =1 Not Applicable ☐ =5 N/S=0
c14Qthink

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15. I have found the internet portal to view my readings useful.
Strongly Agree ☐ =4 Agree ☐ =3 Disagree ☐ =2 Strongly Disagree ☐ =1 Not Applicable ☐ =5 N/S=0
c15portal

16. I would be happy to use the internet upload my readings or send messages to my South Eastern Trust Practitioner.
Strongly Agree ☐ =4 Agree ☐ =3 Disagree ☐ =2 Strongly Disagree ☐ =1 Not Applicable ☐ =5 N/S=0
c16IntNetMail

17. I believe increased use of technology in the care and support of people at home will be of benefit in the future.
Strongly Agree ☐ =4 Agree ☐ =3 Disagree ☐ =2 Strongly Disagree ☐ =1 Not Applicable ☐ =5 N/S=0
c17IncRTM

18. I consider increased use of internet based care and support for people at home will be of benefit in the future.
Strongly Agree ☐ =4 Agree ☐ =3 Disagree ☐ =2 Strongly Disagree ☐ =1 Not Applicable ☐ =5 N/S=0
c18IncInternet

Use of TF3 Telemonitoring Service

19. Have you been contacted by a South Eastern Trust Practitioner in connection with your readings? Yes ☐ 1 No ☐ 2 0 = N/S
c19SETcont

20. My Clinician's TF3 service messages were helpful:
Strongly Agree ☐ =4 Agree ☐ =3 Disagree ☐ =2 Strongly Disagree ☐ =1 Not Applicable ☐ =5 N/S=0
c20RTMmessage

21. My Clinician's telephone support was helpful:
Strongly Agree ☐ =4 Agree ☐ =3 Disagree ☐ =2 Strongly Disagree ☐ =1 Not Applicable ☐ =5 N/S=0
c21SETPhonesup

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22. **Did you receive a Remote Telemonitoring TF3 Nurse Triage Service?** Yes ☐ 1 No ☐ 2 N/S=0
c22TF3Triage

(If 'Yes' please answer questions 23 to 25)

23. **Have you been contacted by a TF3 Triage Nurse?** Yes ☐ 1 No ☐ 2 N/S=0
c23Triagecont

24. **The Triage Nurse I spoke to was helpful:**
Strongly Agree ☐ =4 Agree ☐ =3 Disagree ☐ =2 Strongly Disagree ☐ =1 Not Applicable ☐ =5 N/S=0
c24TNurseHelp

25. **If you had to take more than one set of readings during a day, why was this? (Please tick)**
Readings didn't go through the first time ☐ 1 Asked to do so by Triage Nurse ☐ 2 For confirmation or reassurance ☐ 3
I have a more frequent monitoring programme ☐ 4 Other ☐ 5
c25FreqRead
For Q25 or rather c25FreqRead COMBINATION OF ANSWERS MAY OCCUR…
NS = 0; 6 = 1 & 2; 7 = 1, 2 & 4; 8 = 1 & 3; 9 = 2 & 3; 10 Option 1, 2 & 3; 11 = 2, 3 & 4

If you would like to add anything, please comment here:

and questions 22, 23, 24 & 25 on U-Tell '88' as all are N/A U-Tell

Thank you for taking time to complete this Evaluation Questionnaire. A summary of the questionnaire findings will be available on the Trust's Website, www.setrust.hscni.net from 31st March 2016.

5 V4 14:07:15

TF3 - w		September 2015

10.13 Coded Carer Questionnaire

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Q1 TF3 YELLOW = TF3 = 1 and U-TELL PINK = U-TELL =2

Carer Questionnaire – Remote Telemonitoring Service

By returning the completed questionnaire you will have agreed to participate in the research. Your questionnaires will be kept confidential and comments will not be attributed to anyone but your views will help shape the future development of the service. The questionnaire responses will be compiled by the Trust's Safe & Effective Care Team and I will have access to the Trust's summary report. If you wish to participate please could you return your questionnaires by Friday 18th September 2015. Many thanks in anticipation, Julie-Ann Augusto

(Please tick one box only for each of the questions below) In all cases Not Responded = 88 & Not Applicable = 99

1. **I believe telemonitoring has improved the overall level of health and social care given to the person I care for.**
Strongly Agree ☐ =4 Agree ☐ =3 Disagree ☐ =2 Strongly Disagree ☐ =1 Not Applicable ☐ Techimp

2. **I believe telemonitoring has helped prevent the person I care for being admitted to hospital.**
Strongly Agree ☐ =4 Agree ☐ =3 Disagree ☐ =2 Strongly Disagree ☐ =1 Not Applicable ☐ Prevadm

3. **When assisting the person to operate the telemonitoring equipment, I found it easy to use.**
Strongly Agree ☐ =4 Agree ☐ =3 Disagree ☐ =2 Strongly Disagree ☐ =1 Not Applicable ☐ Easyuse

4. **I think the use of telemonitoring as part of a care package is generally helpful.**
Strongly Agree ☐ =4 Agree ☐ =3 Disagree ☐ =2 Strongly Disagree ☐ =1 Not Applicable ☐ RTMuseful

5. **I believe telemonitoring has given me peace of mind.**
Strongly Agree ☐ =4 Agree ☐ =3 Disagree ☐ =2 Strongly Disagree ☐ =1 Not Applicable ☐ Peacemind

6. **I believe increased use of technology in the care and support of people at home will be of benefit in the future.**
Strongly Agree ☐ =4 Agree ☐ =3 Disagree ☐ =2 Strongly Disagree ☐ =1 Not Applicable ☐ IncrRTM

7. **I believe increased use of internet based care and support for people at home will be of benefit in the future.**
Strongly Agree ☐ =4 Agree ☐ =3 Disagree ☐ =2 Strongly Disagree ☐ =1 Not Applicable ☐ IncrInternet

Please add any further comments here:

UTel-p		September 2015

V3 14:07:15

APPENDIX 4 RESEARCH PROTOCOL DOCUMENTS

10.14 Protocol V6 040616

Exploring the conditions for optimisation of vital sign remote telemonitoring in the care of people with long term conditions

(Short Working Title: Optimisation of Vital Sign Remote Telemonitoring)

Julie-Ann Walkden (PhD Candidate)

Abstract: The Health and Social Care system must identify and implement new ways of managing chronic disease within constrained resources. Technology has a role in supporting people with chronic illness but current evidence to guide decision-making is limited. Remote Vital Sign Telemonitoring may enable effective care but the mode of deployment varies and requires optimisation from the user, carer, practitioner, service and commissioner perspectives. This study aims to explore and understand the factors required for effective deployment of Remote Vital Sign Telemonitoring in one large mixed Trust. Taken from an evaluative stance, this is an observational study of experienced health care practitioners where Multiple Methods will be used in a broad-based programme of enquiry. Both qualitative and quantitative data will be collected by means of a Trust-wide service user questionnaire (approx. 370) and one-to-one interviews with Health and Social care staff (approx. 20). Descriptive and comparative methods will be used to analyse data, to identify trends, relationships and themes This analysis will be used in practice development to assist practitioners improve patient care.

Background

It has been estimated that chronic illness may cost up to 7% of gross domestic product (Nolte & McKee, 2008). According to the World Health Organisation, chronic illnesses are the main cause of deaths worldwide at 63% (WHO 2013). In Northern Ireland it was agreed (in 2008) to invest in a new model of care for three diseases: Chronic obstructive pulmonary disease, heart failure and diabetes. Several (N=16) Remote Telemonitoring (RTM) pilots were developed and local evaluations were largely positive: patient satisfaction levels were favourable whereas in general Trust Staff were less supportive. Subsequently a region-wide service was commissioned to address care of people with one of these conditions (Tunstall. 2014). Although service detail and standards were developed carefully, wide practice variation has led to variability in uptake rates, clinical opinion, variance in care standards and unclear expectation of outcomes. Anecdotal evidence within SET, reported by Practitioners, has suggested circumstances where RTM is beneficial or can cause harm, however, no clear pattern has been established to demonstrate optimisation or RTM to best effect; the debate has moved beyond relative success or failure. RTM is a home-based service whereby a computer system provides a series of functions: reminders, data collection, storage, processing and transfer. The patient is reminded to undertake daily monitoring using recording peripheral devices provided. Then compiled data is transmitted via phone-line to a central data centre. If there is an unacceptable reading, the system will generate an appropriate alert. Web based technologies enable the review of readings by patient, triage nurse and practitioner. The triage nurse is employed by TF3 to be the practitioner to contact the patient after the computer system has indicated an issue and who decides the primary action to take which may include raising an alert with the patient's own specialist practitioner, referred to as Trust practitioner in the study. There is a shared understanding between practitioner, patient and carer that the proactive monitoring of vital signs remotely will improve the patient's well-being. The service provider enables the transmission of relevant vital sign and as appropriate responses to psycho-social questions to the practitioner for interpretation and action. Equally, the feedback

process empowers the patient and carer to better self-manage and be empowered through understanding of condition. It is suggested that this relationship may influence the successful operation of the service.

From a practice perspective, within the service across Northern Ireland in general and in particular within South Eastern Health and Social Care Trust (SET) there is little or no agreement with regard to which subset of patients should avail of the service. For example, the Respiratory Service within the Ulster Hospital developed a Care Bundle to ensure that practitioners consider RTM as an option for each patient; this is illustrated in Figure 1. Care Bundles are not universally accepted by all practitioners, some of whom prefer to use other approaches. All other services utilising RTM have taken a less formal approach to application permitting practitioner preference and freedom.

(SEE FIGURE 1.6)

Figure 1 Flow chart to illustrate RTM "Care Bundle" as a process for a patient with a chronic disease as used within the Ulster Hospital by the Respiratory Specialist Team.

Literature review

To date approximately 50 studies have reported on Telemedicine deployed within the context of chronic disease; where key literature search words of implementation, outcome measures and practice development were used to seek studies with development of RTM to optimise service provision. The following eight papers referred to "*success factors*" including topics such as service user perception and practitioner experience following deployment.

Sanders et al (2012) suggested that implementation and deployment should be considered in more detailed and an explanation of the systems and technology to recipients be undertaken so as to overcome barriers for utilisation.

Currell et al (2010) highlighted the need for practitioners to ensure both clinical rationale and clinical skills are considered when considering a clinical RTM intervention. Many small-scale studies have indicated positive value of RTM.

McLean et al (2011) reported benefits for people with Chronic Obstructive Pulmonary Disorder: RTM yielded improved quality of life with fewer exacerbations/ deterioration of health related to their respiratory condition and hospital admissions.

However, some individual studies had less favourable conclusions, where the outcomes were less clear. Pinnock et al (2013) conducted a large-scale study in Scotland and failed to demonstrate a discernible difference between hospital admissions rates for patients with *Chronic Obstructive Pulmonary Disorder* who utilised RTM compared with a control group. Wyatt has argued that there are too many variables for an RCT to ever be conclusive (Wyatt. 2012).

In England, a review of a trial involving 6,191 patients 'Whole System Demonstrator' suggested some benefits (DoH. 2011). Bower et al (2011) suggested benefits as articulated within five categories: use (applicability to condition and ease of operation), effectiveness both clinical and cost, user-experience and organisational. These benefits were later challenged by Steventon and Bardsley (2012) who suggested variable technology and variable mode of deployment could affect outcome. It has also been argued that the large trials failed to recognise system-benefits, and some studies fail to consider the time required to enable embedded change (Vinegar.2013). Henderson et al (2013) concluded that the *Whole System*

Demonstrator did "…not seem to be a cost effective addition to standard support and treatment."

Therefore, evidence to date does not suggest how to optimise RTM technologies, rather it suggests that the technology was found to be acceptable by users, or if outcomes, measured in hospital admission rates, were altered. Thus there is a need to further explore the practice of RTM, in a systematic way, in order to achieve optimal performance, taking account of key influences upon outcome.

Aim: To critically assess if the application of Remote Vital Sign Monitoring, as part of the package of care for people with Long Term Conditions, is appropriate and to determine how and when to deploy RTM to best effect. This will be addressed through a series of six objectives.

Objectives:

Undertake a systematic literature review to achieve current state of RTM knowledge.

Identify from (existing) service data trends: User opinion and practitioner application over the past three years.

To critically evaluate the RTM service and permit public engagement and involvement from the service users perspective.

Determine the factors which enable Remote Vital Sign Monitoring (RTM) to be optimised taking the views of practitioners and senior officers into account.

Identify key performance indicators; quantifying service benefits and risks

Devise a model of application to enable future deployments to be optimised where appropriate.

Methodology:

Multiple Methods will be used in a broad-based programme evaluation. Following the systematic review of literature, it is proposed to- ;

Analyse existing service data at Trust and regional level;

This includes service statistics and reports relating to previous service evaluations and customer surveys (Refer to appendix r)

Evaluation of existing Regional service use data.

Confirming this prospectively through user and carer surveys;

Questionnaires will be sent to all current South Eastern Trust RTM Service Users, N= 280 patients are on the system at any given time), with responses returned for collation and analysis. (Refer to appendices b, c, d, g & f)

Where an informal carer plays a role in RTM, they will be invited to provide data from their perspective (From experience of pilot studies it is anticipated there are approximately 30% of RTM patients who are assisted by carers); N=90. (Refer to appendices h & i)

Interviews on RTM with Health professionals at all levels;

One-to-one semi-structured interviews with practitioners with experience of utilising RTM and Senior Health and Social Care leaders; N=20 (Refer to appendices ia, j, k, l, m & n)

Workshop for Trust practitioners; N=15

Quantitative (statistical) analysis of numerical data (from 1 & 2, above): descriptive, exploratory and explanatory; (Refer to appendix zc)

Qualitative analysis of transcripts (from 3) following a descriptive thematic approach.

Summary Framework:

INPUT		OUTPUT	
Designed four tailored questionnaires: - a service user and a carer questionnaire for each of the two services (TF3 & U-Tell) – These were based upon BDO 2009 RTM questionnaire, then piloted and reviewed by Patient Client Council	To Patients (Pa) N= 280 & Carers (C) N=90	Quantitative Data Questionnaires [Pa,C] analysed using SPSS	Qualitative Information
One-to-one Semi-structured Interviews	Senior HPSS Executives (E) N=6 to 8] dependent upon voluntary participation Practitioners (Pr) N=15 to 20] dependent upon voluntary participation		Qualitative Information
Workshop: Bryson Technique for Cognitive Mapping will be used to help practitioners review initial findings, group issues and find common meaning and critical success factors	Practitioners [Pr, N=10 to 20] dependent upon voluntary participation		Qualitative Information

Approach with Practitioners

A descriptive approach will be taken, in the form of questionnaires and interviews with staff. It is recognised that a manager within SET conducting interviews of staff may have introduced bias into the process and positively skew findings. Therefore, the researcher proactively moved out of the Trust to join the Business Services Organisation and no longer is in a position to influence outcomes for staff. The researcher will ensure that potential Participants will not feel obliged to participate in the research and through the Participant Information Sheet and Consent Forms ensure that only Practitioners open and willing to confidentially share their experiences are enabled to participate.

Henderson et al (2013) evaluated the English RTM Whole System Demonstrator Sites using a questionnaire. Whilst, this questionnaire was tested to scale it focused upon service user acceptability and the instrument will not be repeated in the SET context but the principle of using questionnaires as an instrument with patients will be applied. Indeed, this was a questionnaire-based study to determine economic benefit with three main dimensions being examined, acceptability and effectiveness and cost effectiveness. This project is not concerned with cost effectiveness rather effective use of the system. The method of data collection from the service user is being undertaken by the use of a tailored questionnaire offering the ability to engage with many individuals and assess relevant elements of accessibility and effectiveness. In the design of the methods and instruments to be applied within the study other studies examining optimisation of healthcare systems were reviewed. Estabrooks et al (2009) suggested factors that would influence critical success within the paediatric healthcare environment which have been later tested within elder care. This study created the Alberta Context Tool which described the structural elements,

resourcing and interactions between staff. The resultant Tool was created following the engagement of practitioners through interviews and workshops. In turn, such engagement has been modified within the Optimisation of RTM research project and it is expected that a framework of factors will result.

In addition, selected practitioners will be invited to participate in one-to-one semi-structured interviews in a safe environment, they will be given the opportunity to express their views from the stance of developing future practice based upon direct experience of RTM. The researcher has written to the existing SET practitioners with experience of RTM to seek expressions of interest as possible participants; only practitioners with experience of using either the TF3 or U-Tell service will be able to participate. This data base of potential participants will be approached initially and if further participants are required all remaining SET RTM practitioners will be offered the opportunity to participate. The researcher will seek from the practitioners what works best, for whom and when. The one-to-one interviews were piloted with two senior nurses in May 2014 and the outcome of the meeting used to create the semi-structured interview plan for the research. Practitioners will be given the opportunity to share with the researcher their experiences of learning to use RTM, within the semi-structured interviews. They will be given the opportunity to describe their view of how to enable effective future deployment. The semi-structured interviews will be conducted purposefully to enable the practitioners to describe their personal experience of changing and developing care through RTM. (Titchen, McCormack and Manley. 2013). From the perspective of evaluation of experience, this research will be dependent upon personal practitioner experience and will enable practitioners to reflect upon the lessons they have learned from using RTM in the natural clinical environment.

The semi-structured interviews will permit the practitioners to reflect upon their experience and share their views and experience. This approach has been selected because it permits a degree of freedom of expression for practitioners and for the researcher to empower through allowing the practitioner to influence the direction of future service development and outcome of research. The researcher will return the written-up findings to the practitioner participants to enable them further opportunity to comment and sense check. In order to minimise the risk of Interviewer bias the broad themes emerging from the data will be presented to the practitioner participants to discuss in a half-day workshop. This activity will further enable reflection upon clinical practice, analysis and validation of theory being built and if RTM could be appropriately embedded into clinical practice. The results of quantitative analysis and findings from qualitative analysis will be synthesised to determine the factors required to achieve effective deployment. This will be undertaken by coding qualitative data to enable tabulation and comparison. (Oppenheim.2003). Themes in comments will be reflected and articulated within the narrative of analysis. In addition, to explore in detail environmental issues, the most senior executives, N= 6 to 8] dependent upon voluntary participation, within the HPSS with an influencing position in RTM will be interviewed to specifically determine views relating to environmental and management factors. These semi-structured one-to-one interviews will contribute to reflection upon and interpretation of findings. The data will be sorted into common themes in order of magnitude and consistency of opinion with be considered with finding compared and contrasted with the direct experiences of practitioners. It is recognised within the study that the complex intervention that is RTM needs to be examined from several perspectives. Simply taking a quantitative methodology would be likely to omit the psychosocial dimensions associated with the application of innovative technologies from the perspectives of patient, carer, practitioner and manager. Equally, simply examining the issues from a purely qualitative perspective the study may lack objectivity. Within the context of ensuring a comprehensive review, Multiple Methods, has been

selected and aims to ensure "…complementarity, completeness, confirmation" (Parahoo.2014.p88).

The participants will be self-selecting and it assumed likely that those who are enthusiastic about utilisation of RTM will be more likely to join the Research. Whilst, this may risk the introduction of bias, the enthusiastic Nurses, Allied Health Professions and Medical personnel, Band 6 and above will contribute to future application of RTM. Whereas, those with a less favourable disposition may exclude themselves from reflective practice focusing upon RTM. Whilst, early voluntary self-nomination to participate has 12 potential participants from across a range of practitioners and clinical field it may be necessary to trawl further until the one-to-one interviews have reached saturation of topic and no new material is forthcoming. However, if it is found that there are widely divergent views, the interpretation of the data will express the views of Practitioners from across the spectrum. Only once the practitioners are able to articulate their outcomes and experiences, can a determination be made about the nature of success factors which optimise the RTM intervention.

Approach with Patients and Carers

All service users within the SET will be given the opportunity to complete the anonymous questionnaire. The entire patient base will be surveyed as pilot questionnaires applied to the whole group have been successful and also the 280 patients are not a homogeneous group suffering from one condition. SET have many service users experiencing several combinations of RTM. Some service users have a track and trend service, whilst others self-entered data on PC through and a then others are in receipt of a full triage service. Also, there is a broad range of medical conditions that mean they may be offered RTM for example, heart conditions, diabetes, respiratory, weight control, warfarin therapy, high blood pressure and stroke. The differing conditions mean that practitioners select particular RTM peripheral devices to meet particular clinical observation needs. The findings of including all current patients will be less likely to be skewed or inadvertently unrepresentative of patient views whereas sampling may introduce such difficulties.

They will be returned to the Trust's safe and effective care team via free-post envelopes and will be compiled and results entered into (IBM- SPSS) to enable the researcher to analyse the responses. The questionnaire material will be returned to the researcher and the resultant report will contain both narrative and numeric articulation of findings. Commonality in theme of service user's free text will be collated and reviewed to assess relative benefit or perceived risk of harm both through statistical analysis of coded text (Oppenheim. 2003) and researcher interpretation of narrative.

Initial service user satisfaction questionnaires were undertaken by SET in 2013 and 2014 and a pilot service evaluation in 2009 by BDO. These contain a rich narrative, particularly in the form of open responses. The 2013 and 2014 questionnaire that was developed by the researcher to assess service user RTM service satisfaction for the Trusts was agreed for use across the region by the five Trusts, Public Health Agency and the service provider. Distribution of the survey tool on a quarterly cycle across all service users within Northern Ireland has been undertaken by the service provider, TF3, but SET directly issued the questionnaire to all its service users on the annual basis; N=204 in 2014. The 2014 service evaluation questionnaires were analysed and from 184 anonymous questionnaires 127 service users contributed and further survey responses were received from 47 carers and 9 practitioners.

The service user and carer questionnaires have been modified to enable further enquiry and enable tracking of service perception over time. The researcher has garnered support from stakeholders and in particular incorporated particular advice and feedback received following independent review from the Patient Client Council.

The data from the earlier service evaluation questionnaires will be reviewed for commonality in theme, analysed and examined for development of experience and comment over time. The prospective questionnaire will retain particular key questions from earlier iterations but will elicit deeper opinion upon the effect upon self-care and utilisation of technology. The questionnaire will be issued within the context of voluntary participation in evaluation rather than simply service satisfaction. The questionnaire will enable Personal & Public Involvement (PPI) activity so that patients, as well as practitioners, can be enabled to inform development and deployment. The questions directed at service users in the prospective questionnaires will focus upon benefits, harm, service user recommendation to practitioner emphasising the transformation of practice, care and application of technology; albeit elements of satisfaction will be retained to enable comparison over time. Patients will be able to directly influence practitioner behaviour, responses or actions and RTM programme design, embracing PPI and enabling the regional strategy, Transforming Your Care (TYC), HSCB (2010). The focus of the study will remain the future deployment of service through the effective optimisation of care and the deployment of technology.

Ethical issues

Research participation, at all points along the research journey for the service user, carer, practitioner and senior officer will be voluntary with the participants being free to withdraw at any stage up to data entry; withdrawal after data collection will mean that they will not take any further part in data collection or review of findings. Material submitted to the date of withdrawal will be analysed and form part of the research findings. The questionnaires posted to service users and carers will be accompanied by a stamped addressed return envelope along with a cover letter to explain, study purpose, ethical consideration, confidentiality and consent. The questionnaire will be sent to 280 service users with the option of them being able to pass a supplementary questionnaire on to further participants; that is the service user's carer, if available; their responses will also be returned in a separate sealed envelope. The management of sensitive issues has been considered so that the safeguards are in place to protect vulnerable adult issues if identified through a 'red flag' system ensuring such matters are addressed through the Trust governance administration (Refer to appendices o, q & p). Patients will not be identified in the research findings and their contribution will be retained securely and confidentially for 10-years in line with the Ulster University standards; The Code of Practice for Research Integrity and the Data Handling procedures and the Data Archiving procedures. Pseudo anonymity will be achieved through the coding of the questionnaires so that, should the need arise to identify a particular service user, direct action can be taken. The file containing participant study identification codes and personal details will be kept under secure conditions by the chief investigator, in a password-controlled computer system with access for the researcher. Any hard copies of data will be kept under locked conditions, designed for the purpose. The chief investigator will be custodian and have control of the data generated from the study. Confidentiality will be respected but not guaranteed. Any disclosure of poor practice will follow normal management protocols. The proposal has been scrutinised through peer review and the Research Integrity and Ethics Filter Committee Faculty of Life and Health Science, Ulster University, with comments and actions undertaken documented. (Refer to appendices u, v, w, y, yaa & yb). The proposal was then scrutinised by The Proportionate Review Sub-Committee of the Health Research Authority, NRES Committee South Central – Oxford C reviewed the research proposal in July 2015. (Refer to appendices 'ox a' and 'ox b')

Access to Regional Data: Honest Broker Service

The Honest Broker Service (HBS), based within Health and Social Care - Business Services Organisation (BSO), provides aggregate anonymised or pseudonymised

data for research that has been ethically approved. Access to Regional anonymised/ non-identifiable data will be sought within the research programme in order to evaluate the overall use of the TF3 service.

Scope

Consideration was given to the comparison between disease specific groups versus a single disease area. The enquiry will comprise of groups of practitioners who may be of varied professional backgrounds and specialising in the care of patients with various chronic illnesses whilst having commonality in possessing the ability to access the TF3 RTM service. This approach will enable greater opportunity of a transferable framework of success factors, enable cross fertilisation between professional areas and maximise the number of eligible practitioners. Criteria for selection was defined as participants must be of HPSS Band 6 or above with a professional clinical background (defined as someone with a Medical, Nursing or Allied Health Professional registration).

Risks

No serious risk attach to participation nor to data collection. There have been four systemic risks identified with the research project and these include: (1) service capability of provider restricting operation of remote monitoring, (2) technology advancement providing new alternatives to service under review, confounding findings, (3) engagement with clinical participants being limited by other service requirements and (4) separate, Public Health Authority commissioned service evaluation to judge if the service should be re-commissioned in 2017. Each risk was reviewed with regard to possible impact and affect upon both research progress and the participants. None of the identified risks are anticipated to be likely to seriously conflict with the research project or negatively affect research participants.

Project planning

A Project flow chart is below, figure 2, to illustrate the steps of the research programme associated with data collection. Permissions have been granted to access relevant Trust data. The researcher has commenced the personal development training programmes and has undertaken training specifically related to Human Subjects, Ethics and Research Governance. Application for ethical approval is underway for survey work and interviews and in line with the original project plan that approval will be given to proceed with the issuing of the service user evaluation questionnaires and one-to-one interviews at the end of the second quarter 2015.

(SEE FIGURE 3.2)

Figure 2. Flow Chart to illustrate the steps within the data collection and analysis process.

(SEE FIGURE 3.3)

Figure 3. Gantt Chart to demonstrate the data collection and analysis timeline.

Justification

In exploring the options that can enhance RTM for people with Long Term Conditions, the study aims to suggest how to deploy new technologies to best effect where technology is integrated into care packages. It is anticipated the optimisation of RTM it will enable technology integration into “mainstream” health & social services.

Supervision

JAA is a Health Professional (refer to appendix s) currently employed in a related field as Small Business Research Initiative Executive with the Business Services Organisation. The work will contribute to a PhD being undertaken by JAA who is supervised by Prof George Kernohan (Nursing and Health Research) (refer to appendix zb) and Dr Paul McCullagh (Computer Science). *March 2015 (Revised following Peer Reviews undertaken by Prof Sinclair and Dr Stinson)*

References

(SEE References in Chapter 9)

10.15 ia ox Participant Consent Form - Staff

Participant Consent Form – Staff Member

Title of Project : Optimisation of Vital Sign Remote Telemonitoring

_____

_____***Name of Chief Investigator:*** Prof George Kernohan BSc PhD Professor of Health Research, Institute for Nursing and Health Research, Ulster University

Shore Road, Newtownabbey. BT37 0QB

Please initial

• I confirm that I have been given, have read and understood the Participant Information Sheet for the above study and have asked and received answers to any questions raised [ ]

• I understand that my participation is voluntary and that I am free to withdraw at any time without giving a reason and without my rights being affected in any way [ ]

• I understand that my data collected up to the point of withdrawal, will still be utilised within the research [ ]

• I agree for my interview to be recorded using digital audio equipment. [ ]

• I understand that the researchers will disclose evidence of poor practice [ ]

• I understand that the researchers will hold all information and data collected securely and in confidence and that all efforts will be made to ensure that I cannot be identified as a participant in the study (except as might be required by law) and I give permission for the researchers to hold relevant personal data [ ]

• I agree to take part in the above study [ ]

Name of Subject Signature Date:

_____

_____

Name of person taking consent Signature Date:

_____

Name of researcher Signature Date:

_____

One copy for the subject; one copy for the researcher.

Contact details

Should you require any further details about this study please contact the researcher, Julie-Ann Augusto, on Telephone number 07979365939 or walkden-j@email.ulster.ac.uk

10.16 b ox Subject Information sheet – Patient

Research Title: optimisation of Vital Sign remote Telemonitoring

This means that I want to look at the best way we can use Remote Telemonitoring equipment and services to help our patients.

You are being invited to take part in a research study. Before you decide whether or not to take part, it is important that you understand what the research is for and what you will be asked to do. Please read the following information and do not hesitate to ask any questions about anything that might not be clear to you. Make sure that you are happy before you decide what to do. Thank you for taking the time to consider this invitation. This study is part of an academic qualification for a current PhD candidate.

What is the purpose of the study?

I would like to learn about your experience of the U-Tell or TF3 service so that we can try to improve the care and support offered to patients in the future. I am interested in your experiences, whether you are a current user or you have used Remote Telemonitoring in the recent past or a carer of someone who has used the system. Your answers will be useful and will only be used for the purpose of this project.

Why have you been chosen?

You have been chosen to participate in this research project as you are currently recorded as a service user of either the U-Tell or TF3 Remote Telemonitoring services. All patients over the age of 18-years have been asked to participate and I expect about 280 patients and 90 carers to receive a questionnaire. Equally, if you are a carer for someone who is using the service you may be asked by the service user to participate.

Do I have to take part?
It is up to you to decide whether or not to take part. If you do decide to take part, by returning the completed questionnaire you will have given consent. If you choose to take part, you can change your mind at any time and withdraw from the study without giving a reason.

What will happen to me if I take part?

If you are a patient who uses either the U-Tell or TF3 Remote Telemonitoring Service you will be sent a questionnaire. If you are a carer of someone who uses the Remote Telemonitoring Service, you may be asked to complete a separate questionnaire by the person you help. If you consent to participate you complete the questionnaire and return in the stamped addressed envelope to the South Eastern Trust's Safe and Effective Care Team. This then will be the end of your contribution. The Safe and Effective Care Team will compile the responses to all the returned questionnaires and then the researcher will analyse the results.

Risks and/ or disadvantages?

There are no risks or disadvantages associated with your decision to participate or not. Your decision will not affect your future care or ability to access the service.

Are there any possible benefits in taking part?

There will be no direct benefit provided to you for volunteering to participate but it is hoped that your participation will help shape future services and provide benefit for patients.

What happens when the study ends?

At the end of the study a PhD Thesis will be published, and it is hoped that this will advise other people in the future how best to use remote vital sign telemonitoring.

What if something goes wrong?

It is very unlikely that anything will go wrong. The Ulster University has procedures in place for reporting, investigating, recording and handling adverse events and if the researcher discovers a concerning matter then strict processes will be followed to ensure patient safety is maintained at all times through engagement with Trust Management. Any complaints about this research project or the researcher will be taken seriously and should be made to Professor George Kernohan, Chief Investigator, Ulster University Shore Road, Newtownabbey. BT37 0QB or Nick Curry Senior Administrative Officer, Room 01H12, Research an Innovation, Ulster University Shore Road, Newtownabbey. BT37 0QB.

Will my taking part in this study be kept confidential?

Data will be held securely and in confidence and that any identifiers will be removed prior to publication as required under Data Protection legislation. However, Freedom of Information legislation will allow access to certain non-personal or generalised data. It might also be in a participant's best interests to have certain disclosures shared with a relevant Trust manager where concerns regarding Patient care or safety are shared.

What will happen to the results of the study?

The results of this study will be published in professional academic journals to help share the findings. It is also anticipated that the findings will contribute to future service improvements/ changes in procedures, treatment and established practice. If you would like a copy of the results summary, it will be available on the Trust's Website, www.setrust.hscni.net from 31st March 2016.

Who is organising and funding the research?

The research has been funded by the South Eastern Trust and by the researcher.

Who has reviewed this study?

The Proportionate Review Sub-Committee of the Health Research Authority, NRES Committee South Central – Oxford C reviewed the research proposal in July 2015. The Ulster University's Research Integrity and Ethics Filter Committee Faculty of Life and Health Science and South Eastern Trust's Research Governance Committee have reviewed the research study in accordance with procedures. If you are interested you can contact the University or Trust for further details if you require them.

Contact details

Should you require any further details about this study please contact the researcher, Julie-Ann Augusto, on Telephone number 07979365939 or walkden-j@email.ulster.ac.uk

10.17 c ox Letter User Questionnaire TF3

1st September 2015

Dear Sir/Madam

Re: - Remote Telemonitoring User Questionnaire

You are being invited to take part in a research study by the Ulster University. Before you decide whether or not to participate in the project, it is important that you understand what the research is for and what you will be asked to do. Please read the enclosed Participant Information Sheet and do not hesitate to ask any questions about anything that is unclear. Please make

sure that you are happy before you decide what to do. Thank you for taking the time to consider this invitation.

I would like to learn about your experience of the U-Tell or TF3 Remote Telemonitoring Service so that we can try to improve the care and support offered to patients in the future. I am interested in your experiences, whether you are a current user or you have used Remote Telemonitoring in the recent past or are a carer of someone who has used the system. Your answers will be useful and will only be used for the purpose of this project.

There are two questionnaires, the service user questionnaire on white paper and the carer questionnaire on yellow paper. Please return both questionnaires in the same free return envelope but the carer questionnaire should be sealed in the envelope marked 'carer questionnaire', placed inside the freepost envelope provided and posted by Friday 18th September 2015. You do not have to answer but it will help with the project if you do.

If you prefer to speak to me, please phone me on 07979365939. I will return your call and complete your questionnaire with you over the phone.

A summary of the questionnaire findings will be available on the Trust's Website, www.setrust.hscni.net from 31st March 2016.

Many thanks in anticipation.

Yours sincerely

Julie-Ann Augusto (formerly Walkden) PhD Research Student

10.18 d ox Letter User Questionnaire U-Tell

1st September 2015

Dear Sir/Madam

Re: - Remote Telemonitoring User Questionnaire

You are being invited to take part in a research study by the Ulster University. Before you decide whether or not to participate in the project, it is important that you understand what the research is for and what you will be asked to do. Please read the enclosed Participant Information Sheet and do not hesitate to ask any questions about anything that is unclear. Please make

sure that you are happy before you decide what to do. Thank you for taking the time to consider this invitation.

I would like to learn about your experience of the U-Tell or TF3 Remote Telemonitoring Service so that we can try to improve the care and support offered to patients in the future. I am interested in your experiences, whether you are a current user or you have used Remote Telemonitoring in the recent past or are a carer of someone who has used the system. Your answers will be useful and will only be used for the purpose of this project.

There are two questionnaires, the service user questionnaire on blue paper and the carer questionnaire on pink paper. Please return both questionnaires in the same free return envelope but the carer questionnaire should be sealed in the envelope marked 'carer questionnaire', placed inside the freepost envelope provided and posted by Friday 18th September 2015. You do not have to answer but it will help with the project if you do.

If you prefer to speak to me, please phone me on 07979365939. I will return your call and complete your questionnaire with you over the phone.

A summary of the questionnaire findings will be available on the Trust's Website, www.setrust.hscni.net from 31st March 2016.

Many thanks in anticipation.

Yours sincerely

Julie-Ann Augusto (formerly Walkden) PhD Research Student

10.19 f ox Service User Questionnaire TF3

South Eastern Health and Social Care Trust

Ulster University

Service User Questionnaire – Remote Telemonitoring Service – TF3

By returning the completed questionnaire you will have agreed to participate in the research. Your questionnaires will be kept confidential and comments will not be attributed to anyone but your views will help shape the future development of the service. The questionnaire responses will be compiled by the Trust's Safe & Effective Care Team and I will have access to the Trust's summary report. If you wish to participate please could you return your questionnaires by Friday 18th September 2015. Many thanks in anticipation, Julie-Ann Augusto

(Please tick one box only for each of the questions below)

Patient Details

1. **Do you have a carer?** Yes ☐ No ☐ **If yes, does your carer help you take your readings?** Yes ☐ No ☐ **If yes, will you pass the Carer Survey onto them?** Yes ☐ No ☐

2. **This questionnaire was completed by the: Me** ☐ **My Carer** ☐

3. **Are you a current user of telemonitoring** ☐ **Previous User / Discharged from telemonitoring** ☐

4. **What is your health condition being monitored through TF3? Please tick all that apply.**

Stroke	☐	Chronic Heart Failure	☐	Diabetes	☐	Chronic Obstructive Pulmonary Disease (COPD)	☐		
Renal	☐	Gestational Diabetes	☐	Hypertension	☐	Weight Management	☐	Maternity	☐
Bronchiectasis	☐	Warfarin Monitoring/INR	☐	Dementia	☐	Paediatrics	☐	Other	☐

Please specify: _____

5. **What is your gender?** Male ☐ Female ☐

6. **What age are you?** _____ **- years**

Patient Benefits

1. **The telemonitoring system assisted me in managing my health on a day to day basis.**
   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

2. **I believe the telemonitoring system has reduced the number of my GP visits.**
   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

South Eastern Health and Social Care Trust

Ulster University

3. **I believe my own monitoring of my condition has reduced the number of nurse/community team/health professional visits.**
   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

4. **I believe that during the telemonitoring period, the system has prevented the need to attend Accident & Emergency Department and /or GP Out Of Hours services.**
   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

5. **I believe that during the telemonitoring period, the system has prevented or reduced the need to attend Out Patient appointments.**
   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

6. **I believe that during the telemonitoring period, the system has prevented my admission to hospital.**
   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

7. **The telemonitoring system has enabled me to better manage my own condition and become more involved in my health care.**
   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

8. **Since you have been on telemonitoring how many times have you been admitted to hospital as a result of your condition?**
   None☐ 1 - 5☐ 6 - 10☐ 11 - 15☐ 16 or more☐

9. **I believe telemonitoring has given me peace of mind.**
   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

If you would like to add anything here about **peace of mind and technology**, please comment here:

South Eastern Health and Social Care Trust

Ulster University

Telemonitoring Equipment and Technology

10. My South Eastern Trust Practitioner explained the Telemonitoring system to me in enough detail before installation.
Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

11. I was worried about using the new telemonitoring technology before it was installed.
Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

12. The telemonitoring system equipment in my home was easy for me to use.
Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

13. I am more interested in using technology in general following my use of the telemonitoring system.
Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

14. I believe the telemonitoring questions displayed on the home-hub equipment encouraged me to think about my symptoms.
Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

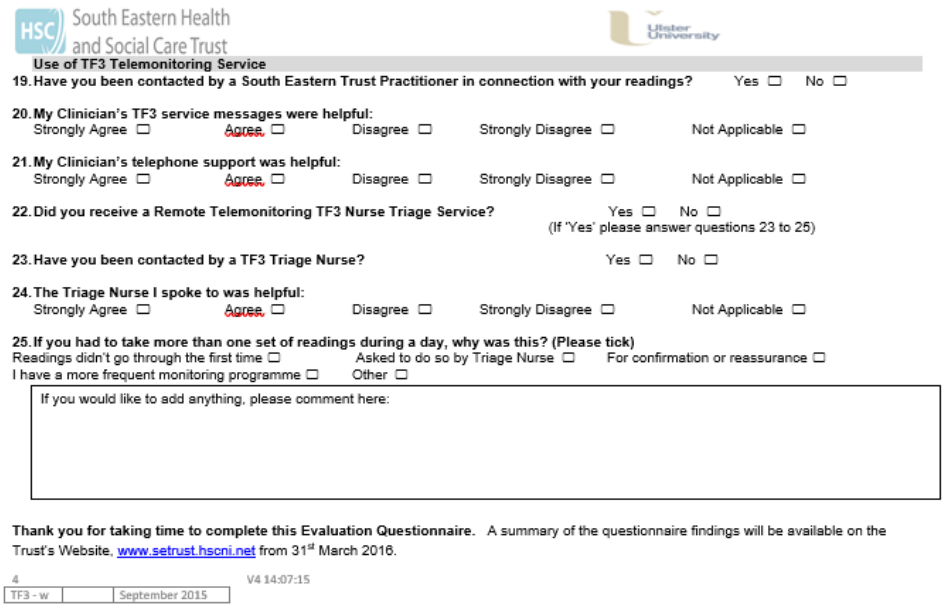
15. I have found the internet portal to view my readings useful.
Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

16. I would be happy to use the internet upload my readings or send messages to my South Eastern Trust Practitioner.
Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

17. I believe increased use of technology in the care and support of people at home will be of benefit in the future.
Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

18. I consider increased use of internet based care and support for people at home will be of benefit in the future.
Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

3 V4 14:07:15
TF3 - w | | September 2015



South Eastern Health and Social Care Trust

Ulster University

Use of TF3 Telemonitoring Service

19. Have you been contacted by a South Eastern Trust Practitioner in connection with your readings? Yes ☐ No ☐

20. My Clinician's TF3 service messages were helpful:
Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

21. My Clinician's telephone support was helpful:
Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

22. Did you receive a Remote Telemonitoring TF3 Nurse Triage Service? Yes ☐ No ☐
(If 'Yes' please answer questions 23 to 25)

23. Have you been contacted by a TF3 Triage Nurse? Yes ☐ No ☐

24. The Triage Nurse I spoke to was helpful:
Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

25. If you had to take more than one set of readings during a day, why was this? (Please tick)
Readings didn't go through the first time ☐ Asked to do so by Triage Nurse ☐ For confirmation or reassurance ☐
I have a more frequent monitoring programme ☐ Other ☐

If you would like to add anything, please comment here:

Thank you for taking time to complete this Evaluation Questionnaire. A summary of the questionnaire findings will be available on the Trust's Website, www.setrust.hscni.net from 31st March 2016.

4 V4 14:07:15
TF3 - w | | September 2015

10.20 g ox Service User Questionnaire U-Tell

South Eastern Health and Social Care Trust

Ulster University

Service User Questionnaire – Remote Telemonitoring Service - U-Tell

By returning the completed questionnaire you will have agreed to participate in the research. Your questionnaires will be kept confidential and comments will not be attributed to anyone but your views will help shape the future development of the service. The questionnaire responses will be compiled by the Trust's Safe & Effective Care Team and I will have access to the Trust's summary report. If you wish to participate please could you return your questionnaires by Friday 18th September 2015. Many thanks in anticipation, Julie-Ann Augusto

(Please tick one box only for each of the questions below)

Patient Details

1. **Do you have a carer?** Yes ☐ No ☐ **If yes, does your carer help you take your readings?** Yes ☐ No ☐
   If yes, will you pass the Carer Survey onto them? Yes ☐ No ☐
2. **This questionnaire was completed by the:** **Me** ☐ **My carer** ☐
3. **Are you a current user of telemonitoring** ☐ **Previous User / Discharged from telemonitoring** ☐
4. **What is your health condition being monitored through U-Tell?**

Stroke	☐	Chronic Heart Failure	☐	Diabetes	☐	Chronic Obstructive Pulmonary Disease (COPD)	☐		
Renal	☐	Gestational Diabetes	☐	Hypertension	☐	Weight Management	☐	Maternity	☐
Bronchiectasis	☐	Warfarin Monitoring/INR	☐	Dementia	☐	Paediatrics	☐	Other	☐

Please specify: _____

5. **What is your gender?** Male ☐ Female ☐
6. **What age are you?** _____- years

Patient Benefits

1. **The telemonitoring system assisted me in managing my health on a day to day basis.**
   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐
2. **I believe the telemonitoring system has reduced the number of my GP visits.**
   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

1 V3 14:07:15
U-Tell b | | September 2015

South Eastern Health and Social Care Trust

Ulster University

3. **I believe my own monitoring of my condition has reduced the number of nurse/community team/health professional visits.**
   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐
4. **I believe that during the telemonitoring period, the system has prevented the need to attend Accident & Emergency Department and /or GP Out Of Hours services.**
   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐
5. **I believe that during the telemonitoring period, the system has prevented or reduced the need to attend Out Patient appointments.**
   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐
6. **I believe that during the telemonitoring period, the system has prevented my admission to hospital.**
   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐
7. **The telemonitoring system has enabled me to better manage my own condition and become more involved in my health care.**
   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐
8. **Since you have been on telemonitoring how many times have you been admitted to hospital as a result of your condition?**
   None☐ 1 - 5☐ 6 - 10☐ 11 - 15☐ 16 or more☐
9. **I believe telemonitoring has given me peace of mind.**
   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

If you would like to add anything here about **peace of mind and technology**, please comment here:

2 V3 14:07:15
U-Tell b | | September 2015

South Eastern Health and Social Care Trust

Ulster University

Telemonitoring Equipment and Technology

10. My South Eastern Trust Practitioner explained the Telemonitoring system to me in enough detail before installation.
Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

11. I was worried about using the new telemonitoring technology before it was installed.
Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

12. The telemonitoring system equipment in my home was easy for me to use.
Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

13. I am more interested in using technology in general following my use of the telemonitoring system.
Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

14. I believe the telemonitoring questions on the U-Tell 'Readings' page encouraged me to think about my symptoms.
Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

15. I have found the internet portal to view my readings useful.
Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

16. I would be happy to use the internet to upload my readings or send messages to my South Eastern Trust Practitioner.
Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

17. I believe increased use of technology in the care and support of people at home will be of benefit in the future.
Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

18. I consider increased use of internet based care and support for people at home will be of benefit in the future.
Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

3 V3 14:07:15
U-Tell b | | September 2015

South Eastern Health and Social Care Trust

Ulster University

Use of U-Tell Telemonitoring Service

19. Have you been contacted by a South Eastern Trust Practitioner in connection with your readings? Yes ☐ No ☐

20. My Clinician's U-Tell messages were helpful:
Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

21. My Clinician's telephone support was helpful:
Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

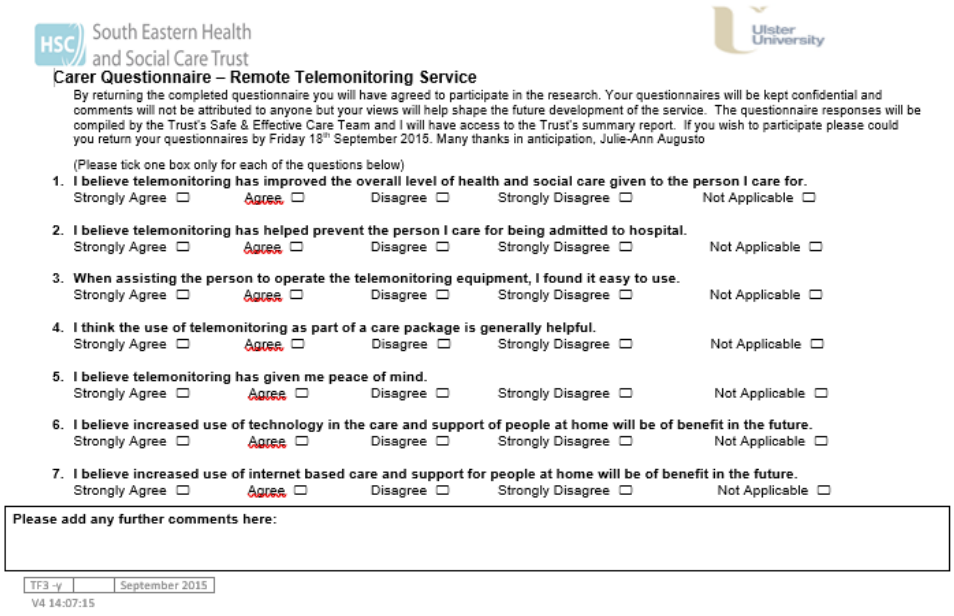
If you would like to add anything, please comment here:

Thank you for taking time to complete this Evaluation Questionnaire.

A summary of the questionnaire findings will be available on the Trust's Website, www.setrust.hscni.net from 31st March 2016.

4 V3 14:07:15
U-Tell b | | September 2015

10.21 h ox Carer Questionnaire TF3



South Eastern Health and Social Care Trust

Ulster University

Carer Questionnaire – Remote Telemonitoring Service

By returning the completed questionnaire you will have agreed to participate in the research. Your questionnaires will be kept confidential and comments will not be attributed to anyone but your views will help shape the future development of the service. The questionnaire responses will be compiled by the Trust's Safe & Effective Care Team and I will have access to the Trust's summary report. If you wish to participate please could you return your questionnaires by Friday 18th September 2015. Many thanks in anticipation, Julie-Ann Augusto

(Please tick one box only for each of the questions below)

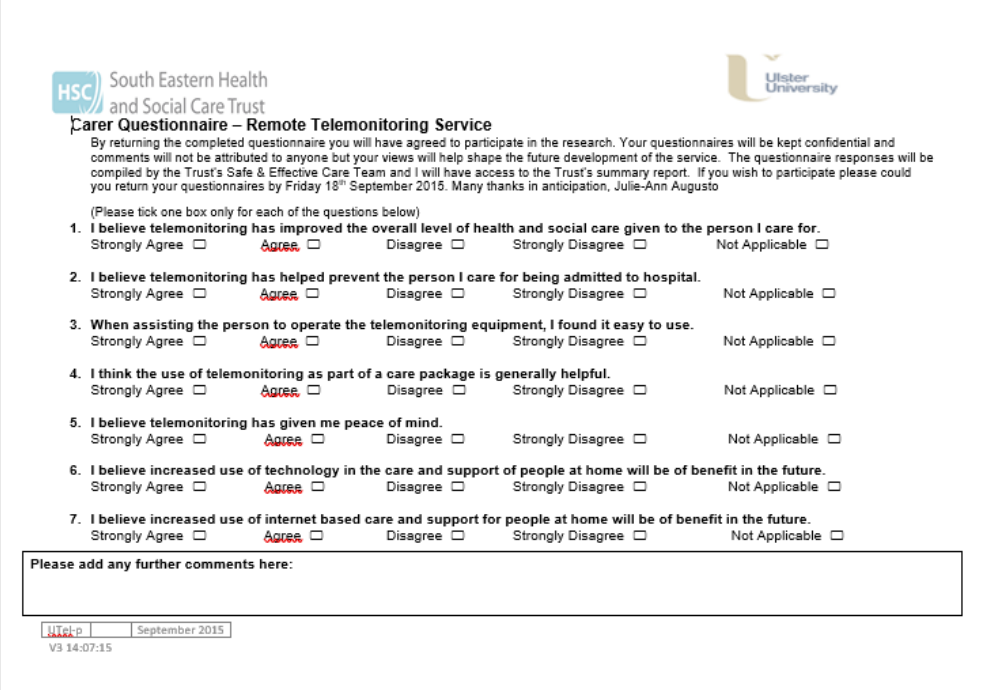
1. **I believe telemonitoring has improved the overall level of health and social care given to the person I care for.**
   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐
2. **I believe telemonitoring has helped prevent the person I care for being admitted to hospital.**
   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐
3. **When assisting the person to operate the telemonitoring equipment, I found it easy to use.**
   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐
4. **I think the use of telemonitoring as part of a care package is generally helpful.**
   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐
5. **I believe telemonitoring has given me peace of mind.**
   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐
6. **I believe increased use of technology in the care and support of people at home will be of benefit in the future.**
   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐
7. **I believe increased use of internet based care and support for people at home will be of benefit in the future.**
   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

Please add any further comments here:

TF3 -y | | September 2015

V4 14:07:15

10.22 i ox Carer Questionnaire U-Tell



South Eastern Health and Social Care Trust

Ulster University

Carer Questionnaire – Remote Telemonitoring Service

By returning the completed questionnaire you will have agreed to participate in the research. Your questionnaires will be kept confidential and comments will not be attributed to anyone but your views will help shape the future development of the service. The questionnaire responses will be compiled by the Trust's Safe & Effective Care Team and I will have access to the Trust's summary report. If you wish to participate please could you return your questionnaires by Friday 18th September 2015. Many thanks in anticipation, Julie-Ann Augusto

(Please tick one box only for each of the questions below)

1. **I believe telemonitoring has improved the overall level of health and social care given to the person I care for.**
   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐
2. **I believe telemonitoring has helped prevent the person I care for being admitted to hospital.**
   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐
3. **When assisting the person to operate the telemonitoring equipment, I found it easy to use.**
   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐
4. **I think the use of telemonitoring as part of a care package is generally helpful.**
   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐
5. **I believe telemonitoring has given me peace of mind.**
   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐
6. **I believe increased use of technology in the care and support of people at home will be of benefit in the future.**
   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐
7. **I believe increased use of internet based care and support for people at home will be of benefit in the future.**
   Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable ☐

Please add any further comments here:

UTel-p | September 2015

V3 14:07:15

10.23 j ox Subject Information Sheet Staff

Research Title: Optimisation of Vital Sign Remote Telemonitoring

This means that the researcher wants to look at the best way we can use remote Telemonitoring equipment and services to help our patients.

You are being invited to take part in a research study. Before you decide whether or not to take part, it is important that you understand what the research is for and what you will be asked to do. Please read the following information and do not hesitate to ask any questions about anything that might not be clear to you. Make sure that you are happy before you decide what to do. Thank you for taking the time to consider this invitation. This study is part of the researcher's academic qualification as a current PhD candidate.

What is the purpose of the study?

I would like to learn about your experience of the U-Tell or TF3 service so that we can try to improve the care and support offered to patients in the future. I am interested in your experiences, whether you are a current user or you have used Remote Telemonitoring in the recent past. Your answers will be useful and will only be used for the purpose of this project.

Why have you been chosen?

You have been chosen to participate in this research project as you are currently recorded as a staff member who has access to either the U-Tell or TF3 Remote Telemonitoring Services.

Do I have to take part?
Participation is entirely voluntary. It is up to you to decide whether or not to take part. If you do decide to take part, you will be given this information sheet to keep. You will also be asked to sign a consent form. If you choose to take part, you can change your mind at any time and withdraw from the study without giving a reason.

What will happen to me if I take part?

If you are a South Eastern Trust member of staff who uses either the U-Tell or TF3 Remote Telemonitoring Service you will be given an opportunity to contribute to the research project by participating in a one-to-one interview with the researcher. The interview will be conducted in a venue and at a time suitable to yourself. You will be able to talk freely about your views and talk about your experience. The interview should last about an hour and there is no expectation that any further contribution will be made by you. However, 6-months after the interviews a one-off workshop will be held lasting approximately 2-hours in the Innovation Centre, Ulster Hospital. This will be to enable you to hear the anonymous views of the staff and afford you with an opportunity to make further comment and contribute to a group discuss.

Risks and/or disadvantages?

There are no risks or disadvantages associated with your decision to participate or not. Your decision will not affect your future career within the Trust and you are certainly not under any obligation to participate.

Are there any possible benefits in taking part?

There will be no direct benefit provided to you for volunteering to participate but it is hoped that your participation will help shape future services and provide benefit for patients in the future.

What happens when the study ends?

At the end of the study a PhD Thesis will be published and it is hoped that this will advise other people in the future how best to use remote vital sign Telemonitoring.

What if something goes wrong?

It is very unlikely that anything will go wrong. The Ulster University has procedures in place for reporting, investigating, recording and handling adverse events and if the researcher discovers a concerning matter then strict processes will be followed to ensure patient safety is maintained at all times through engagement with Trust Management. Any complaints about this research project or the researcher will be taken seriously and should be made to Professor George Kernohan, Chief Investigator, Ulster University Shore Road, Newtownabbey. BT37 0QB or Nick Curry Senior Administrative

Officer, Room 01H12, Research an Innovation, Ulster University Shore Road, Newtownabbey. BT37 0QB.

Will my taking part in this study be kept confidential?

Data will be held securely and in confidence and that any identifiers will be removed prior to publication as required under Data Protection legislation. However, Freedom of Information legislation will allow access to certain non-personal or generalised data. It might also be in a participant's best interests to have certain disclosures shared with a relevant Trust manager where concerns regarding Patient Care or Adult Safeguarding are shared.

What will happen to the results of the study?

The results of this study will be published in professional academic journals to help share the findings. It is also anticipated that the findings will contribute to future service improvements/ changes in procedures, treatment and established practice.

Who is organising and funding the research?

The research has been funded by the South Eastern Trust and by the researcher.

Who has reviewed this study?

The Proportionate Review Sub-Committee of the Health Research Authority, NRES Committee South Central – Oxford C reviewed the research proposal in July 2015. The Ulster University's Research Integrity and Ethics Filter Committee Faculty of Life and Health Science and South Eastern Trust's Research Governance Committee have reviewed the research study in accordance with procedures. If you are interested you can contact the University or Trust for further details if you require them.

Contact details

Should you require any further details about this study please contact the researcher, Julie-Ann Augusto, on Telephone number 07979365939 or walkden-j@email.ulster.ac.uk

(Of note: Augusto was the married name of the researcher, who is now Walkden)

10.24 k ox Invitation letter - Practitioner

1st September 2015

Dear _____

Re: - Optimisation of Vital Sign Remote Telemonitoring (Practitioner Semi-Structured Interviews)

You are being invited to take part in a research study by the Ulster University. Before you decide whether or not to participate in the project, it is important that you understand what the research is for and what you will be asked to do. Please read the enclosed Participant Information Sheet and do not hesitate to ask any questions about anything that is unclear. Please make sure that you are happy before you decide what to do. Thank you for taking the time to consider this invitation.

I would like to learn about your experience of Remote Telemonitoring Service so that I can understand what works for whom in what circumstances. I am interested in your experiences, whether you are a current staff user or you have used Remote Telemonitoring in the recent past. Your answers will be useful and will only be used for the purpose of this project.

If you agree, I ask you to do three things:

1. To spend some personal private reflective time, before we meet, considering your experiences as a practitioner of observing, directing or commissioning RTM.
2. To participate in a one-to-one semi-structured interview with me. This is your time to share your reflections, feelings, experiences, attitudes and thoughts about RTM. The one-to-one interview can be conducted at a venue and time of your choice and is expected to last about an-hour. It will be your opportunity to share your experience and knowledge.
3. To consider participating in a workshop that will last up to 2-hours to be held in the Innovation Centre, Ulster Hospital. If you choose to attend this workshop in addition to the interview, you will be able to discuss initial findings with fellow participants.

The record of your interview and follow-up workshop will be kept confidential and securely. Your comments will not be attributable but your views will help create recommendations to shape the future development of the RTM service.

Whilst you may make reference to case studies you may have known about to help illustrate your experience during interview session, it is understood and accepted that patient confidentiality must not be breached and the identities of patients must not be disclosed.

It must also be noted that if you disclose information of a concerning nature during interview, e.g. information relating to matters of governance, I will be

duty bound to report serious concerns to the Trust's Research Governance Manager.

I hope you remain willing to participate and I will contact you shortly to offer possible interview dates.

Many thanks in anticipation for your help and support.

Yours sincerely

Julie-Ann Augusto (formerly Walkden)

PhD Research Student

10.25 l ox Invitation Letter – Manager

1st September 2015

Dear _____

Re: - Optimisation of Vital Sign Remote Telemonitoring (Senior Officer Semi-Structured Interviews)

You are being invited to take part in a research study by the Ulster University. Before you decide whether or not to participate in the project, it is important that you understand what the research is for and what you will be asked to do. Please read the enclosed Participant Information Sheet and do not hesitate to ask any questions about anything that is unclear. Please make sure that you are happy before you decide what to do. Thank you for taking the time to consider this invitation.

I would like to learn about your experience of Remote Telemonitoring Service so that I can understand what works for whom in what circumstances. I am interested in your experiences, whether you are a current or past manager/ director related to Telemonitoring. Your answers will be useful and will only be used for the purpose of this project.

If you agree, I ask you to do two things:

1. To spend some personal private reflective time, before we meet, considering your experiences as a practitioner of observing, directing or commissioning RTM.
2. To participate in a one-to-one semi-structured interview with me. This is your time to share your reflections, feelings, experiences, attitudes and

thoughts about RTM. The one-to-one interview can be conducted at a venue and time of your choice and is expected to last about an-hour. It will be your opportunity to share your experience and knowledge.

The record of your interview will be kept confidential and securely. Your comments will not be attributable, but your views will help create recommendations to shape the future development of the RTM service.

Many thanks in anticipation for your help and support.

Yours sincerely

Julie-Ann Augusto (formerly Walkden)

PhD Research Student

10.26 m ox Semi-Structured Interviews - Practitioner

INTERVIEW GUIDE

Optimisation of Vital Sign Remote Telemonitoring (RTM) - PhD Programme

(RTM Senior Healthcare Professionals Semi-Structured Interviews)

Participant Name: _____

Designation: _____

Year of Graduation: _____

Primary Qualification: _____

Contact Phone Number: _____

Contact e-mail address: _____

Experience of RTM Patient/ Disease Group:

_____

Date and time Interview conducted by Julie-Ann Augusto, researcher and Small Business Research Initiative Executive in Business Services Organisation: _____

SEMI-STRUCTURED QUESTIONS:-

1. Describe your experience with RTM and feel free to illustrate your experiences with reference to anonymous case studies – please remember not to disclose patient or carer details…

2. Have you received training in RTM?
    a. If so please could you describe it and your views relating to RTM training…
3. Please tell me about how you use RTM.
    a. Do you tend to use track and trend or triage?
    b. Why do you make this choice?
4. Which peripheral devices do you tend to choose and why?
5. Please tell me what you have found works best for your patients and in what circumstances
6. Are your thoughts and feelings generally positive, neutral or negative about RTM?...
7. Do you choose to use RTM or are you given a quota by management to use the service?
8. Do you think RTM is value for money?...
9. If we now think just about the HPSS commissioned end-to-end service provided by the supplying consortium TF3 or U-TELL *(Depends on practitioner's experience – will be one or the other*)
    a. What are your thoughts on this service?
    b. If you think the service could have been delivered more effectively please describe this?
    c. What do you believe are or would be the key factors to make deployment of this type of service most effective?
    d. What are our lessons learned from your perspective?
10. What are the barriers to RTM from your perspective?...
11. What is the future for RTM from your perspective?...
12. Is there anything else you would like to tell me about RTM or technology in healthcare in general?....

10.27 I ox Semi-Structured Interviews - Manager

INTERVIEW GUIDE

Optimisation of Vital Sign Remote Telemonitoring (RTM) - PhD Programme

(RTM Senior Healthcare Officer Semi-Structured Interviews)

Participant Name: _____

Designation: _____

Year of Graduation: _____

Primary Qualification: _____

Contact Phone Number: _____

Contact e-mail address: _____

Experience of RTM Patient/ Disease Group:

_____

Date & time Interview conducted by Julie-Ann Augusto, researcher and Small Business Research Initiative Executive in Business Services Organisation: -

_____

SEMI-STRUCTURED QUESTIONS:-

1. Describe your experience with RTM and feel free to illustrate your experiences with reference to anonymous case studies – please remember not to disclose patient or carer details…

2. Have you received training in RTM?
    a. If so please could you describe it and your views relating to RTM training…
3. Please tell me about how you think we could use RTM.
    a. Describe use of track and trend or triage?
    b. Why would you make this choice?
4. Which peripheral devices do you are or would be useful and why?
5. Please tell me what you think works best for which patients and in what circumstances
6. Are your thoughts and feelings generally positive, neutral or negative about RTM?...
7. Do you think practitioners should have the choice to use RTM or should they be given a quota by management to use the service?
8. Do you think RTM is value for money?...
9. If we now think just about the HPSS commissioned end-to-end service provided by the supplying consortium TF3 or U-TELL
    a. What are your thoughts on this service?

   b. If you think the service could have been delivered more effectively please describe this?
   c. What do you believe are or would be the key factors to make deployment of this type of service most effective?
   d. What are our lessons learned from your perspective?
10. What are the barriers to RTM from your perspective?...
11. What is the future for RTM from your perspective?...
12. Is there anything else you would like to tell me about RTM or technology in healthcare in general?....

APPENDIX 5 ACTION RESEARCH EXPANDED EXPLANATION

10.28 Option 4 – Action Research: a fuller explanation of the methodology as the initial design was to utilise this approach.

It was proposed that Action Research would be utilised given that the thoughts, feelings and behaviours of research participants was of interest within a context of patient centred care. Action Research, and most particularly Transformational Action Research, was initially selected as the Methodology to be applied and has been defined as follows...

> "Transformational action research promotes transformation as both end and means of research. In addition to knowledge creation, there is a concern with transformation of self and, if they so wish, with facilitated transformation of co-researchers, participants and other stakeholders …. It can lead to human flourishing, in creative, spiritual and ethical senses, of both recipients of the research and those undertaking it (adapted from Titchen and Armstrong. 2007)" (Titchen, McCormack and Manley, 2013).

It was proposed that through the Methodology of Action Research, complemented and informed by the structured methods of data collection, the specific framework for success in RVT deployment would be synthesised to demonstrate alternative value and the expressed opinions of research participants. Early indications suggested a degree of correlation between a model for optimisation of RVT with the Alberta Context Tool but recognising the need to extend beyond to encompass purposeful application, multi-professional learning, support with specific training, enabling environment and supportive leadership. Furthermore, the MRC Framework (Craig et al. 2008) recognised that the complex interventions may demonstrate success if designed within a local context. However, any potential framework of critical success factors or added value created within the context of the South Eastern Trust's RVT could be designed and suggested with transferability as an outcome or suggested utility but would be dependent upon data analysis. Transformational Action Research recognised the softer more creative metrics and allowed the clinical practitioners to analyse, interpret and personally develop themselves.

The utilisation of existing data was proposed as a method of enquiry to inform the workshops. It was proposed that the Transformational Action Research would add creative ecological and spiritual dimension to practice development, essentially permitting practitioners to develop their service and modality of care. As a methodology it is useful in the context of RVT as there are many variables, fluidity within a developing arena and the need for on-going iterative improvement and experimentation. It was believed that for this to happen the current context must be evaluated to inform programme development. Essentially when transformation action research commences practitioners would be proactively encouraged and enabled to make iterative improvements, but the context should be known to promote innovation and freedom to practice. A significant feature of the research is the development of practitioners, within the context of adoption of technology, and the improvement of patient care. In order to reduce the risk of bias or influence by the researcher within the iterative development expected in Transformational Action Research, the enquiry may be generated by those involved in the service rather than channelled by the researcher. It was recognised that it may not be possible, or even necessary to eliminate all researcher-bias. By involving service users and carers, through the application of a questionnaire it was deemed likely to maintain the patient centric focus; service user perception utilised to encourage and harness practitioners to change practice thus permitting patients to contribute to the shape of care to come.

The possible modes of enquiry could have included the utilisation of a questionnaire and direct engagement of practitioners within workshops/ cycles of intervention. Practitioners, regardless of discipline or disease area, would be enabled to participate in a safe environment, where they could be given the opportunity to expressively share, learn, flourish and create. Transformational Action Research could be applied purposefully, and it is anticipated that it will enable practitioners to innovate, change, reform, develop and enable time for reflective practice (Titchen, McCormack and Manley. 2013). The practitioner group sessions, whilst permitting time for reflective activity, could be augmented by the application of Bryson's Cognitive Mapping (Bryson. 1995) to elicit answers to intrinsic conundrums that exist revolving around the notion of Enabling Environments

(Hackman.2002). As a starting point, researcher intended to challenge practitioners with the question, 'what do we/ I need to do to utilise RVT effectively within our/ my area of service delivery?' In addition, the findings of the questionnaires from across the participant groups would provide quantitative data to demonstrate if the service had improved and qualitative narrative to describe the change and benefit. Three Transformational Action Research cycles were proposed as illustrated in the Figure 10.2.

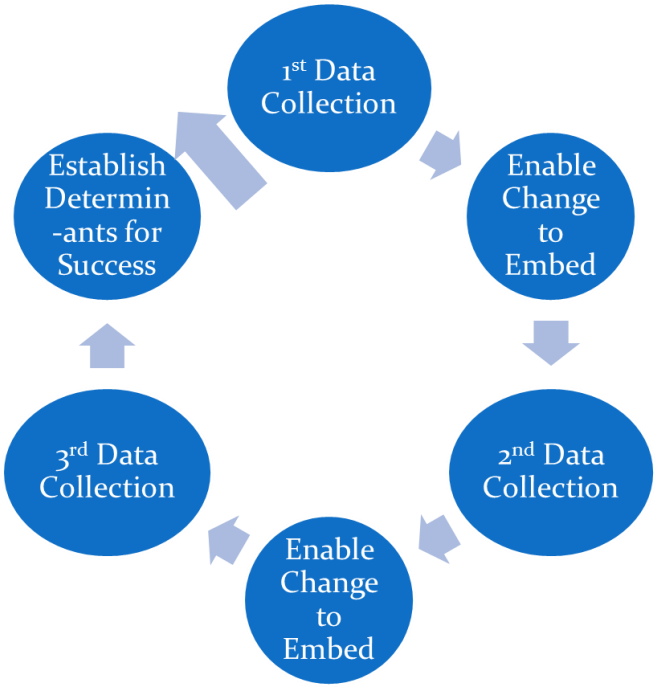


Figure 10.2: To illustrate the transformation action research cycle

In planning the Transformational Action Research and determination of the critical success factors, it was planned that practitioners would be engaged in up to three cycles of group work following the principles of Action Research. The nature of the second and third cycles could have varied dependent upon the outcome of the first cycle or intervention. In each cycle the expectation is that the practitioners are expected to learn and adapt the mode of deployment to test if improvement has been made. This process acknowledged that only once the practitioners can articulate their outcomes and experiences, can a determination be made about the nature of the second intervention. Ergo, there would be a need to allow the second and third cycles, in the iterative process of Transformational Action Research, to vary and set their own improvement agenda. This approach

was seriously considered because it permitted freedom of expression for practitioners and for the researcher to enable through allowing the practitioner to control the direction of service development and outcome of research. Prior to the group sessions practitioners were to be encouraged to be reflexive and to complete a short on-line questionnaire. It was intended that the findings from the questionnaires would influence the design of the discussion to elicit from the practitioners the environmental factors to optimise RVT application and practitioner development. Whilst Hermeneutic Analysis was suggested to be applied to the findings of the initial part of the Transformational Action Research session the group of practitioners were to be encouraged to participate in Bryson's technique for Cognitive Mapping, an example of a potential map is illustrated in Figure 10.3

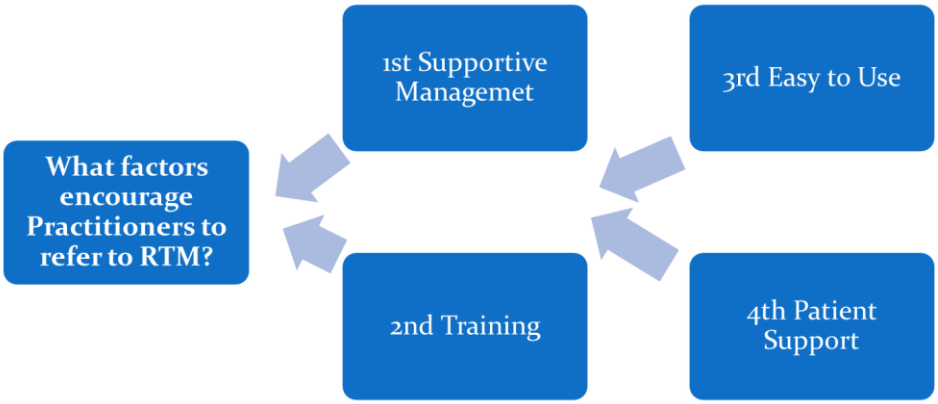


Figure 10.3: An illustration of an example cognitive map

It was proposed that Bryson's Technique for Cognitive Mapping Software would be applied to show power relationships and order of magnitude of emerging factors, benefits, issues and topics for consideration. The Bryson Technique permits the voices of all practitioners to be heard. As a process of engagement and eliciting ideas ergo data acquisition it facilitates anonymity, if the contributor prefers, during the group sessions and equally permits open discussion and disclosure (Bryson et al. 1995). The participants themselves make sense of the information presented which further enhances ownership. Within the context of Transformational Action Research, a key objective is that practitioners

themselves benefit and flourish through the process of participation. Indeed, it was expected to take practitioners from the present, to the future of technology appropriately embedded into practice to improve therapeutic benefit and patient outcomes. The output of the Action Session will be three-fold, through the utilisation of photographs the practitioners will be able express how they feel about connected health and that can be tracked over time, an affinity diagram/ cognitive map and an individually tailored action plan for each participant. The third output being the change to be evaluated; understanding of the outcome benefits.

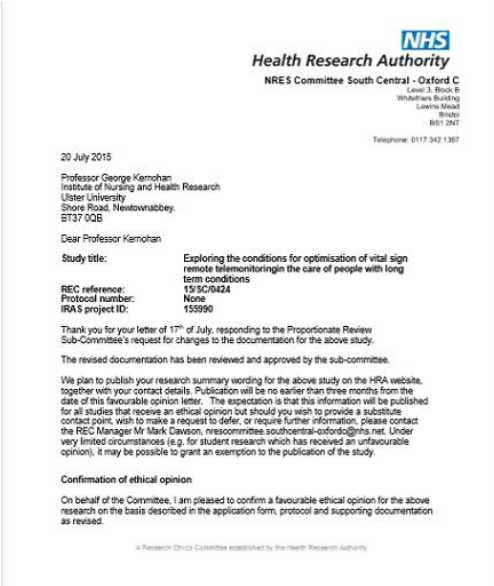
Moreover, to augment this method, Hermeneutic Phenomenological research method was proposed to be utilised to capture the essence of how practitioner's lived experience shapes the development of practice within RVT (Karle. 2011). This was only to be undertaken during the opening session to enable free expression to be evaluated. It was intended that the practitioners would benefit from a safe environment to constructively express their issues and concerns and to enable iterative learning across clinical specialisms and professions. Learning, growth, practice and service development will be enabled. Concomitantly, practitioner debate and sharing of opinions were to be observed, challenged, documented and ideas deployed. There were to be three cycles of practitioner development at 6-monthly intervals involving representative RVT practitioners from across the disease groups and geography of SET. It was considered that if after two cycles, it was determined that options were exhausted or responses from participants saturated the third and final cycle may encompass a wider group of participants from across the region to test acceptability of beneficial factors. This approach was designed to enable the scope to be controlled whilst permitting a holistic and in-depth review of optimisation of RVT, identification of service user perceived benefits and/ or harm and enabling new knowledge to be created.

However, whilst the methodology of Transformational Action Research was initially favoured to determine the answer to the overarching research question, a decision was taken to terminate the plan and change methodology. There were two key drivers, the first was that the methodology was far too complex and although compelling was not well proven. The second driver for change of

research methodology was a serious lack of willingness to participate if Action Research was utilised, this was derived from a group meeting with SET RVT practitioners. Given that Action Research as a methodology is structured to embolden the practitioner to direct the research the methodology and data collection tools, methods and activities were shared with potential research participants. The response was such that researcher decided that pursuing the approach would be unproductive; 80% of the practitioners confirming that they would feel uncomfortable, were sceptical, decided it was too demanding of their time and resources and so could not consider consenting to participate. Therefore, whilst the researcher believed there were significant merits to the methodology the research design process would have to be reconsidered as without willing voluntary participation the outcome of research would be weak and findings inconclusive. Despite the methodology being planned to an advanced stage there were too many barriers to proceed.

APPENDIX 6 RESEARCH ETHICS AND GOVERNANCE APPROVALS

10.29 Health Research Authority Approval



NHS
Health Research Authority

NRES Committee South Central - Oxford C
Level 3, Block 6
Whitefriars Building
Lewins Mead
Bristol
BS1 2NT

Telephone: 0117 342 1387

20 July 2015

Professor George Kernohan
Institute of Nursing and Health Research
Ulster University
Shore Road, Newtownabbey.
BT37 0QB

Dear Professor Kernohan

Study title:	**Exploring the conditions for optimisation of vital sign remote telemonitoringin the care of people with long term conditions**
REC reference:	**15/SC/0424**
Protocol number:	**None**
IRAS project ID:	**155990**

Thank you for your letter of 17th of July, responding to the Proportionate Review Sub-Committee's request for changes to the documentation for the above study.

The revised documentation has been reviewed and approved by the sub-committee.

We plan to publish your research summary wording for the above study on the HRA website, together with your contact details. Publication will be no earlier than three months from the date of this favourable opinion letter. The expectation is that this information will be published for all studies that receive an ethical opinion but should you wish to provide a substitute contact point, wish to make a request to defer, or require further information, please contact the REC Manager Mr Mark Dawson, nrescommittee.southcentral-oxford@nhs.net. Under very limited circumstances (e.g. for student research which has received an unfavourable opinion), it may be possible to grant an exemption to the publication of the study.

Confirmation of ethical opinion

On behalf of the Committee, I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form, protocol and supporting documentation as revised.

A Research Ethics Committee established by the Health Research Authority

Conditions of the favourable opinion

The favourable opinion is subject to the following conditions being met prior to the start of the study.

Management permission or approval must be obtained from each host organisation prior to the start of the study at the site concerned.

Management permission ("R&D approval") should be sought from all NHS organisations involved in the study in accordance with NHS research governance arrangements.

Guidance on applying for NHS permission for research is available in the Integrated Research Application System or at http://www.rdforum.nhs.uk.

Where a NHS organisation's role in the study is limited to identifying and referring potential participants to research sites ("participant identification centre"), guidance should be sought from the R&D office on the information it requires to give permission for this activity.

For non-NHS sites, site management permission should be obtained in accordance with the procedures of the relevant host organisation.

Sponsors are not required to notify the Committee of approvals from host organisations.

Registration of Clinical Trials

All clinical trials (defined as the first four categories on the IRAS filter page) must be registered on a publically accessible database. This should be before the first participant is recruited but no later than 6 weeks after recruitment of the first participant.

There is no requirement to separately notify the REC but you should do so at the earliest opportunity e.g. when submitting an amendment. We will audit the registration details as part of the annual progress reporting process.

To ensure transparency in research, we strongly recommend that all research is registered but for non-clinical trials this is not currently mandatory.

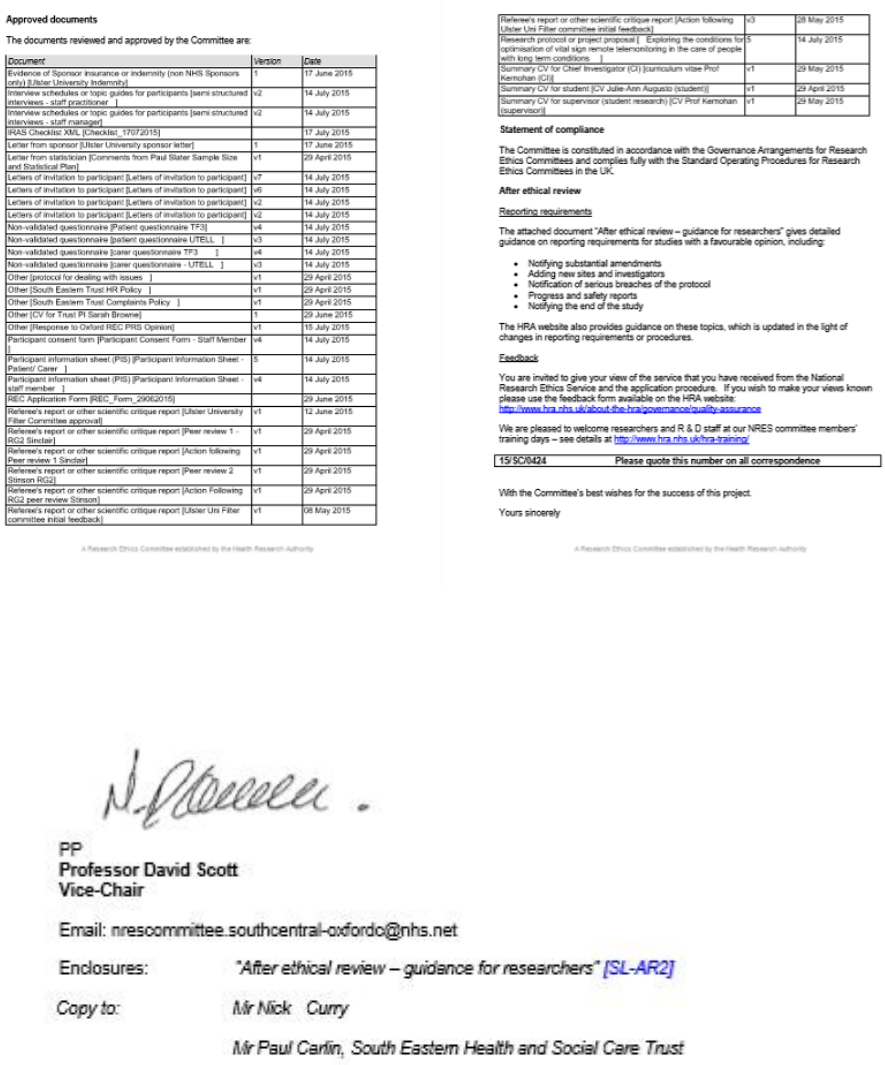
If a sponsor wishes to request a deferral for study registration within the required timeframe, they should contact hra.studyregistration@nhs.net. The expectation is that all clinical trials will be registered, however, in exceptional circumstances non registration may be permissible with prior agreement from NRES. Guidance on where to register is provided on the HRA website.

It is the responsibility of the sponsor to ensure that all the conditions are complied with before the start of the study or its initiation at a particular site (as applicable).

Ethical review of research sites

The favourable opinion applies to all NHS sites taking part in the study, subject to management permission being obtained from the NHS/HSC R&D office prior to the start of the study (see "Conditions of the favourable opinion" above).

A Research Ethics Committee established by the Health Research Authority



Approved documents

The documents reviewed and approved by the Committee are:

Document	Version	Date
Evidence of Sponsor insurance or indemnity (non NHS Sponsors only) [Ulster University Indemnity]	1	17 June 2015
Interview schedules or topic guides for participants [semi structured interviews - staff practitioner]	v2	14 July 2015
Interview schedules or topic guides for participants [semi structured interviews - staff manager]	v2	14 July 2015
[IRAS Checklist XML [Checklist_17072015]		17 July 2015
Letter from sponsor [Ulster University sponsor letter]	1	17 June 2015
Letter from statistician [Comments from Paul Slater Sample Size and Statistical Plan]	v1	29 April 2015
Letters of invitation to participant [Letters of invitation to participant]	v7	14 July 2015
Letters of invitation to participant [Letters of invitation to participant]	v6	14 July 2015
Letters of invitation to participant [Letters of invitation to participant]	v2	14 July 2015
Letters of invitation to participant [Letters of invitation to participant]	v2	14 July 2015
Non-validated questionnaire [Patient questionnaire TF3]	v4	14 July 2015
Non-validated questionnaire [patient questionnaire UTELL]	v3	14 July 2015
Non-validated questionnaire [carer questionnaire TF3]	v4	14 July 2015
Non-validated questionnaire [carer questionnaire - UTELL]	v3	14 July 2015
Other [protocol for dealing with issues]	v1	29 April 2015
Other [South Eastern Trust HR Policy]	v1	29 April 2015
Other [South Eastern Trust Complaints Policy]	v1	29 April 2015
Other [CV for Trust PI Sarah Browne]	1	29 June 2015
Other [Response to Oxford REC PRS Opinion]	v1	15 July 2015
Participant consent form [Participant Consent Form - Staff Member]	v4	14 July 2015
Participant information sheet (PIS) [Participant Information Sheet - Patient/ Carer]	5	14 July 2015
Participant information sheet (PIS) [Participant Information Sheet - staff member]	v4	14 July 2015
REC Application Form [REC_Form_29062015]		29 June 2015
Referee's report or other scientific critique report [Ulster University Filter Committee approval]	v1	12 June 2015
Referee's report or other scientific critique report [Peer review 1 - RG2 Sinclair]	v1	29 April 2015
Referee's report or other scientific critique report [Action following Peer review 1 Sinclair]	v1	29 April 2015
Referee's report or other scientific critique report [Peer review 2 Stinson RG2]	v1	29 April 2015
Referee's report or other scientific critique report [Action Following RG2 peer review Stinson]	v1	29 April 2015
Referee's report or other scientific critique report [Ulster Uni Filter committee initial feedback]	v1	08 May 2015
Referee's report or other scientific critique report [Action following Ulster Uni Filter committee initial feedback]	v3	28 May 2015
Research protocol or project proposal [Exploring the conditions for optimisation of vital sign remote telemonitoring in the care of people with long term conditions.]	5	14 July 2015
Summary CV for Chief Investigator (CI) [curriculum vitae Prof Kernohan (CI)]	v1	29 May 2015
Summary CV for student [CV Julie-Ann Augusto (student)]	v1	29 April 2015
Summary CV for supervisor (student research) [CV Prof Kernohan (supervisor)]	v1	29 May 2015

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

After ethical review

Reporting requirements

The attached document "After ethical review – guidance for researchers" gives detailed guidance on reporting requirements for studies with a favourable opinion, including:

- Notifying substantial amendments
- Adding new sites and investigators
- Notification of serious breaches of the protocol
- Progress and safety reports
- Notifying the end of the study

The HRA website also provides guidance on these topics, which is updated in the light of changes in reporting requirements or procedures.

Feedback

You are invited to give your view of the service that you have received from the National Research Ethics Service and the application procedure. If you wish to make your views known please use the feedback form available on the HRA website:
http://www.hra.nhs.uk/about-the-hra/governance/quality-assurance

We are pleased to welcome researchers and R & D staff at our NRES committee members' training days – see details at http://www.hra.nhs.uk/hra-training/

15/SC/0424	Please quote this number on all correspondence

With the Committee's best wishes for the success of this project.

Yours sincerely

PP
Professor David Scott
Vice-Chair

Email: nrescommittee.southcentral-oxford@nhs.net

Enclosures: *"After ethical review – guidance for researchers" [SL-AR2]*

Copy to: *Mr Nick Curry*

Mr Paul Carlin, South Eastern Health and Social Care Trust

Health Research Authority's reproduced text:-
20 July 2015

Professor George Kernohan Institute of Nursing and Health Research Ulster University Shore Road, Newtownabbey. BT37 0QB

Dear Professor Kernohan

Study title: Exploring the conditions for optimisation of vital sign remote telemonitoring in the care of people with long term conditions REC reference: 15/SC/0424 Protocol number: None IRAS project ID: 155990

Thank you for your letter of 17th of July, responding to the Proportionate Review Sub-Committee's request for changes to the documentation for the above study.

The revised documentation has been reviewed and approved by the sub-committee.

We plan to publish your research summary wording for the above study on the HRA website, together with your contact details. Publication will be no earlier than three months from the date of this favourable opinion letter. The expectation is that this information will be published for all studies that receive an ethical opinion but should you wish to provide a substitute contact point, wish to make a request to defer, or require further information, please contact the REC Manager Mr Mark Dawson, nrescommittee.southcentral-oxfordc@nhs.net. Under very limited circumstances (e.g. for student research which has received an unfavourable opinion), it may be possible to grant an exemption to the publication of the study.

Confirmation of ethical opinion

On behalf of the Committee, I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form, protocol and supporting documentation as revised.

Conditions of the favourable opinion

The favourable opinion is subject to the following conditions being met prior to the start of the study.

Management permission or approval must be obtained from each host organisation prior to the start of the study at the site concerned.

Management permission ("R&D approval") should be sought from all NHS organisations involved in the study in accordance with NHS research governance arrangements.

Guidance on applying for NHS permission for research is available in the Integrated Research Application System or at http://www.rdforum.nhs.uk.

Where a NHS organisation's role in the study is limited to identifying and referring potential participants to research sites ("participant identification centre"), guidance should be sought from the R&D office on the information it requires to give permission for this activity.

For non-NHS sites, site management permission should be obtained in accordance with the procedures of the relevant host organisation.

Sponsors are not required to notify the Committee of approvals from host organisations.

Registration of Clinical Trials

All clinical trials (defined as the first four categories on the IRAS filter page) must be registered on a publicly accessible database. This should be before the first participant is recruited but no later than 6 weeks after recruitment of the first participant.
There is no requirement to separately notify the REC but you should do so at the earliest opportunity e.g. when submitting an amendment. We will audit the registration details as part of the annual progress reporting process. To ensure transparency in research, we strongly recommend that all research is registered but for non-clinical trials this is not currently mandatory. If a sponsor wishes to request a deferral for study registration within the required timeframe, they should contact hra.studyregistration@nhs.net. The expectation is that all clinical trials will be registered, however, in exceptional circumstances non registration may be permissible with prior agreement from NRES. Guidance on where to register is provided on the HRA website.

It is the responsibility of the sponsor to ensure that all the conditions are complied with before the start of the study or its initiation at a particular site (as applicable).

Ethical review of research sites

The favourable opinion applies to all NHS sites taking part in the study, subject to management permission being obtained from the NHS/HSC R&D office prior to the start of the study (see “Conditions of the favourable opinion” above).

Approved documents

The documents reviewed and approved by the Committee are:

Document Version Date Evidence of Sponsor insurance or indemnity (non NHS Sponsors only) [Ulster University Indemnity] 1 17 June 2015 Interview schedules or topic guides for participants [semi structured interviews - staff practitioner] v2 14 July 2015 Interview schedules or topic guides for participants [semi structured interviews - staff manager] v2 14 July 2015 IRAS Checklist XML [Checklist_17072015] 17 July 2015 Letter from sponsor [Ulster University sponsor letter] 1 17 June 2015 Letter from statistician [Comments from Paul Slater Sample Size and Statistical Plan] v1 29 April 2015 Letters of invitation to participant [Letters of invitation to participant] v7 14 July 2015 Letters of invitation to participant [Letters of invitation to participant] v6 14 July 2015 Letters of invitation to participant [Letters of invitation to participant] v2 14 July 2015 Letters of invitation to participant [Letters of invitation to participant] v2 14 July 2015 Non-validated questionnaire [Patient questionnaire TF3] v4 14 July 2015 Non-validated questionnaire [patient questionnaire UTELL] v3 14 July 2015 Non-validated questionnaire [carer questionnaire TF3] v4 14 July 2015 Non-validated questionnaire [carer questionnaire - UTELL] v3 14 July 2015 Other [protocol

for dealing with issues] v1 29 April 2015 Other [South Eastern Trust HR Policy] v1 29 April 2015 Other [South Eastern Trust Complaints Policy] v1 29 April 2015 Other [CV for Trust PI Sarah Browne] 1 29 June 2015 Other [Response to Oxford REC PRS Opinion] v1 15 July 2015 Participant consent form [Participant Consent Form - Staff Member] v4 14 July 2015 Participant information sheet (PIS) [Participant Information Sheet - Patient/ Carer] 5 14 July 2015 Participant information sheet (PIS) [Participant Information Sheet - staff member] v4 14 July 2015 REC Application Form [REC_Form_29062015] 29 June 2015 Referee's report or other scientific critique report [Ulster University Filter Committee approval] v1 12 June 2015 Referee's report or other scientific critique report [Peer review 1 - RG2 Sinclair] v1 29 April 2015 Referee's report or other scientific critique report [Action following Peer review 1 Sinclair] v1 29 April 2015 Referee's report or other scientific critique report [Peer review 2 Stinson RG2] v1 29 April 2015 Referee's report or other scientific critique report [Action Following RG2 peer review Stinson] v1 29 April 2015 Referee's report or other scientific critique report [Ulster Uni Filter committee initial feedback] v1 08 May 2015

Referee's report or other scientific critique report [Action following Ulster Uni Filter committee initial feedback]
v3 28 May 2015
Research protocol or project proposal [Exploring the conditions for optimisation of vital sign remote telemonitoring in the care of people with long term conditions]
5 14 July 2015
Summary CV for Chief Investigator (CI) [curriculum vitae Prof Kernohan (CI)] v1 29 May 2015
Summary CV for student [CV Julie-Ann Augusto (student)] v1 29 April 2015
Summary CV for supervisor (student research) [CV Prof Kernohan (supervisor)] v1 29 May 2015

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

After ethical review

Reporting requirements

The attached document “After ethical review – guidance for researchers” gives detailed guidance on reporting requirements for studies with a favourable opinion, including:

□□ Notifying substantial amendments □□ Adding new sites and investigators □□ Notification of serious breaches of the protocol □□ Progress and safety reports □□ Notifying the end of the study

The HRA website also provides guidance on these topics, which is updated in the light of changes in reporting requirements or procedures.

Feedback

You are invited to give your view of the service that you have received from the National Research Ethics Service and the application procedure. If you wish to make your views known please use the feedback form available on the HRA website: http://www.hra.nhs.uk/about-the-hra/governance/quality-assurance

We are pleased to welcome researchers and R & D staff at our NRES committee members' training days – see details at http://www.hra.nhs.uk/hra-training/

15/SC/0424 Please quote this number on all correspondence

With the Committee's best wishes for the success of this project.

Yours sincerely

PP Professor David Scott Vice-Chair

Email: nrescommittee.southcentral-oxfordc@nhs.net

Enclosures: "After ethical review – guidance for researchers" [SL-AR2]

Copy to: Mr Nick Curry

Mr Paul Carlin, South Eastern Health and Social Care Trust

07 January 2017

Professor George Kernohan Institute of Nursing and Health Research Ulster University Shore Road, Newtownabbey. BT37 0QB

Dear Professor Kernohan

Study Title: Exploring the conditions for optimisation of vital sign remote telemonitoringin the care of people with long term conditions REC reference: 15/SC/0424 Protocol number: None IRAS project ID: 155990

Thank you for sending the progress report for the above study dated 17 August 2016. The report will be reviewed by the Chair of the Research Ethics Committee, and I will let you know if any further information is requested.

The favourable ethical opinion for the study continues to apply for the duration of the research as agreed by the REC.

15/SC/0424: Please quote this number on all correspondence

Yours sincerely

Amy Peters REC Assistant

E-mail: nrescommittee.southcentral-oxfordc@nhs.net

Copy to: Mr Nick Curry Mr Paul Carlin, South Eastern Health and Social Care Trust

10.30 South Eastern Trust Research Governance and Ethics Approval Letter

Professor George Kernohan
Institute of Nursing and Health Research
Ulster University
Shore Road, Newtownabbey
BT37 0QB

25 August 2015 **Our Ref:** **SET/15/17**

Dear Professor Kernohan

Study Title: **Exploring the conditions for optimisation of vital sign remote telemonitoring in the care of people with long term conditions**

HSC Trust Ref: SET/15/17(Please quote this number in all future correspondence)
IRAS Ref: 155990

I am pleased to advise that the South Eastern H&SC Trust has given Research Governance Permission for the above project to commence. Permission is granted for the duration of the project to 31/08/2016

The following documents have been approved for use in the project:

Document	Version	Date
Protocol	5	14/07/15
Interview schedules or topic guides for participants (Semi structured interviews – staff practitioner)	2	14/07/15
Interview schedules or topic guides for participants (Semi structured interviews – staff manager)	2	14/07/15
Letters of Invitation to participant	7	14/07/15
Letters of Invitation to participant	6	14/07/15
Letters of Invitation to participant	2	14/07/15
Letters of Invitation to participant	2	14/07/15
Non –validated questionnaire (Patient Questionnaire TF3)	4	14/07/15
Non-Validated Questionnaire (Patient Questionnaire UTELL)	3	14/07/15
Non-Validated Questionnaire (Carer questionnaire TF3)	4	14/07/15

Non-Validated Questionnaire (Carer questionnaire UTELL)	3	14/07/15
Other Protocol for dealing with issues	1	29/04/15
Other SEHSCT HR Policy	1	29/04/15
Other SEHSCT Complaints Policy	1	29/04/15
Participant Consent Form – Staff Member)	4	14/07/15
Participant Information Sheet (PIS) – Patient/Carer	5	14/07/15
Participant Information Sheet (PIS) – Staff Member	4	14/07/15

The following personnel have been approved to work on the study at this Trust:

Name	Indemnity Provided by
Julie-Ann Augusto	HSCNI
Sarah Browne	SET

Permission is granted subject to the attached conditions which I would ask you to please ensure that all members of the research team make themselves familiar. Failure to abide by these conditions will invalidate permission and may result in the cessation of the research.

I wish you every success with your project.
Yours sincerely,

Mr Paul Carlin
Research Manager
Copy to: Julie-Ann Augusto

Conditions of Permission

Research Governance permission is issued provided the researcher(s) involved adhere to and abide by the conditions below.

- The researcher(s) must adhere strictly to the research protocol.
- There must be no changes to the research protocol or approved study documentation without the prior consent of the Trust, the Research Ethics Committee and, where applicable, the MHRA.
- There must be no changes in research staff without prior consent of the Trust.
- The Research Office should be informed if the Chief Investigator or Principal Investigator(CI/PI) is unable to continue to fulfil his/her duties as CI/PI for any reason such as long term absence, change in employment etc.
- There must be no increase in the resources required without prior consent of the Trust.
- Researcher(s) must report all untoward incidents and serious adverse events to the Trust.
- Any concerns in relation to the research protocol must be reported to the Trust.
- Researcher(s) must adhere to good research practice principles in line with the ICH Good Clinical Practice (GCP) guidelines.
- Researcher(s) must adhere to the Trust's Research & Development Standard Operating Procedures (available from the Research Office on request)
- On request, researcher(s) must make their research project available to Trust appointed monitors.
- The lead researcher must make an annual report to the Research Office for the duration of the project.
- The lead researcher should inform the Research Office on completion or termination of the project. Completion reports must be sent to the Research Office, Research Ethics Committee and, if applicable, MHRA.

10.31 Ulster University Filter Committee Approval

UNIVERSITY OF ULSTER RESEARCH GOVERNANCE

RG3 Filter Committee Report Form

Project Title	Exploring the conditions for optimisation of vital sign remote telemonitoring in the care of people with long term conditions.
Chief Investigator	Professor George Kernohan
Filter Committee	Nursing and Health Research

This form should be completed by Filter Committees for all research project applications in categories A to D (*for categories A, B, and D the University's own application form – RG1a and RG1b – will have been submitted; for category C, the national, or ORECNI, application form will have been submitted).

Where substantial changes are required the Filter Committee should return an application to the Chief Investigator for clarification/amendment; the Filter Committee can reject an application if it is thought to be unethical, inappropriate, incomplete or not valid/viable.

Only when satisfied that its requirements have been met in full and any amendments are complete, the Filter Committee should make one of the following recommendations:

The research proposal is complete, of an appropriate standard and is in

- category A and the study may proceed* ☐
- category B and the study must be submitted to the University's Research Ethics Committee** Please indicate briefly the reason(s) for this categorisation ☐

  [ ]
- category C and the study must be submitted for approval along with the necessary supporting materials from the Research Governance Section*** ☐
- category D and the study must be submitted to the University's Research Ethics Committee** ☐

Signed: 

***The application form and this assessment should now be returned to the Chief Investigator. The Filter Committee should retain a copy of the complete set of forms.**

** **The application form and this assessment should now be returned to the Chief Investigator so that he/she can submit the application to the UUREC via the Research Governance section. The Filter Committee should retain a copy of the complete set of forms for their own records.**

*** **The application form and this assessment should now be returned to the Chief Investigator so that he/she can prepare for application to an appropriate committee. The Filter Committee should retain a copy of the complete set of forms for their own records.**

For all categories, details of the application and review outcome should be minuted using the agreed format and forwarded to the Research Governance section

Please complete the following

The application should be accompanied by an appropriate and favourable Peer Review Report Form (if not, the Filter Committee should be prepared to address this as part of its review). Please comment on the peer review (include whether or not there is evidence that the comments of the peer reviewers have been addressed).

Peer review is complete and issues arising in ethical review have been addressed.

Please provide an assessment of all component parts of the application, including questionnaires, interview schedules or outline areas for group discussion/unstructured interviews.

This is a service-user questionnaire survey; one-to-one interviews with relevant staff, followed by a staff workshop to further verify findings.

Please comment on the consent form and information sheet, in particular the level of language and accessibility.

Completion of the survey may be taken to imply consent for the data to be used for research purpose and this will be explained. This project will not include data of a personal nature Committee noted that service use data is accessible as per Trust approval.

Please comment on the qualifications of the Chief and other Investigators.

Acceptable qualifications of the investigators for the proposed work. The researcher has a permanent and substantive contract of employment with SET and so is governed by governance relating to patient confidentiality.

Please comment on the risks present in conducting the study and whether or not they have been addressed.

No serious risk of harm has been identified.

Please indicate whether or not the ethical issues have been identified and addressed.

The benefit in new knowledge gained will outweigh any risk of harm or inconvenience. In order to address any specific disclosure of poor practice in remote monitors, data will be

pseudo-anonymous (coded). The code will only be used in this event, so participant withdrawal will not affect data analysis.

Please comment on whether or not the subjects are appropriate to the study and the inclusion/exclusion criteria have been identified and listed

Appropriate subjects have been identified for study based upon their involvement as a user or provider of remote telemonitoring within one Trust.

APPENDIX 7 RESEARCH GOVERNANCE AUDIT REPORT

10.32 Undertaken Ulster University Jordanstown 16th October 2017

RESEARCH GOVERNANCE AUDIT REPORT (Responses on page 2)
Date: 16/10/17 Location: Jordanstown

Title: Exploring the conditions for optimisation of vital sign remote telemonitoring in the care of people with long term conditions

Number: 15/0065

Investigators interviewed: CI: Prof G Kernohan; Dr P McCullagh

Proposed start date: 01/09/15

Proposed end date: 30/11/17

Date of approval by ORECNI: 20/07/15

Original protocol being followed: Yes, data collection completed

Number of participants approved: 280 service users – questionnaire
estimated 90 carers – questionnaire
20 staff – semi-structured interviews
12 Trust practitioners (validation workshop)

Number recruited to date: 168 service users and carers
16 staff

Tissue or blood samples: N/A

Transfer of samples: N/A

Data anonymised: Yes

Data storage/retention: Hard copies presented for this review but are normally kept on Trust premises. Will be transferred to CI after study completion. Electronic date will be transferred to CI after study completion. The office in the Trust is locked. No patient identifiers. Separate hard copy control list

Retention of correspondence: UU approval letter - No
Indemnity statement - Yes
Copy of CI undertaking - No

Consent forms:	Counted and checked, no issues.
Information sheet:	The patient/carer info sheet had a version number discrepancy. CI to check
Data Protection, IP, Publication:	Aware.
Adverse events:	None.

Comments/recommendations:

1. Research Governance to provide a copy of University approval letter and indemnity statement

Done. Received with thanks, 17/11/17

2. CI to check and confirm that the approved version of the patient/carer information sheet was used

Checked at PhD supervision 22/11/17. Investigators are satisfied that the correct version of information sheets were used. In detail:
The versions of participant information sheets and all 4 questionnaires issued were correct and as per the version numbering on IRAS. Some documents were V3 (U-Tell) and others V4 (TF3 & general info sheet) but the critical date of 14/07/15 denoted that they were in fact the correct documents and final version.

3. PhD student to discuss the back-up of electronic data with the CI, to prevent data loss

Checked at supervision 22/11/17. All material is backed up:- on laptop, on HSC Server and on 2 encrypted pen drives.

APPENDIX 8 INITIAL FINDINGS OF QUANTITATIVE DATA REPORTED TO PARTICIPANTS VIA TRUST WEBSITE

10.33 Patient and Carer Questionnaire Basic Findings Report

SOUTH EASTERN TRUST & ULSTER UNIVERSITY

REMOTE TELEMONITORING SERVICE

SURVEY REPORT

Report compiled by:

Julie-Ann Walkden

Introduction

A survey was carried out as part of a research data collection phase for a PhD research project. All South Eastern Trust patients in receipt of a Remote Telemonitoring Service in August 2015 were invited to participate in the research. On the 1st September, the PhD student sent to all eligible patients a pack containing:

- A cover letter inviting participation in research
- A participant information sheet to explain the research
- A patient questionnaire
- A questionnaire to be given to carers as appropriate
- Stamped addressed return envelopes

For those wanting to participate they returned their completed questionnaires to the Safe and Effective Care Department, South Eastern Trust by 18th September.

In July, 2015, the researchers gave an undertaking to the Committee which reviewed the ethical considerations of the research project (the Proportionate Review Sub-Committee of the Health Research Authority, NRES Committee South Central – Oxford C), to share basic feedback with participants by publishing a short report on the Trust's Website, www.setrust.hscni.net from 31st March 2016.

Further detailed findings will be available following the completion of the PhD thesis/ report.

Methodology

The researcher wanted to learn about the experience of patients who used either the u-Tell or TF3 Remote Telemonitoring Service so that care could be improved in the future. The research was interested in patient and user experiences, whether a current user or user in the recent past or are a carer of someone who had used the system. All answers were of interest and will only be used for the purpose of this project.

The questionnaires were colour coded:

- u-Tell patient questionnaire was printed on blue paper
- u-Tell carer questionnaire was printed on pink paper
- TF3 patient questionnaire was printed on white paper
- TF3 carer questionnaire was printed on yellow paper

Sample Population

The research identified patients who were eligible to become participants and would be asked to complete the questionnaires.

- There were 32 patients who used the u-Tell Remote Telemonitoring Service
- There were 242 patients who used the TF3 Remote Telemonitoring Service
    - Of note, the researcher could not determine how many carers may be likely to respond as records were not available to assess this.

Response rate

- Of the 32 u-Tell questionnaires issued, 17 were returned, thereby yielding a response rate of 53% (blue questionnaires)
    - There was 1 Carer questionnaire returned completed (pink questionnaires)
- Of the 242 TF3 questionnaires issued, 74 were returned, thereby yielding a response rate of 30.5% (white questionnaires)
    - There were 59 Carer questionnaires returned completed (yellow questionnaires)

Analysis of questionnaires

Questionnaires were analysed using the analytical tool SPSS (Statistical Package for Social Services). All responses to, both ‘tick box’ questions and ‘free text’ narrative descriptions of service and experience were transcribed and typed. These records will be analysed in detail as part of the PhD research and will be discussed within the final report. However, a general overview of opinion expressed by patients and carers is that they were generally happy with Remote Telemonitoring. Many patients believed they were better supported with some participants using u-Tell reporting that Remote Telemonitoring gave them freedom. Some participants made practical suggestions as to how the Remote Telemonitoring services should be improved.

The researchers wish to thank all the patients and carers who participated and to Claire Robinson of the South Eastern Trust’s Safe and Effective Care Department for compiling the responses.

Julie-Ann Walkden

PhD Student

APPENDIX 9 QUALITATIVE DATA SUMMARY TABLES

10.34 Practitioner NVivo Data

Table 10.6 To demonstrate the distribution of opinions and perspectives shared by practitioners highlighting the topic areas and the constituent subordinate topics.

Topic	Descriptive Topic Title	Sub Description	Sub-Sub Description	N= 16 Practitioners (Source)	References (Frequency)
a	Experience as a manager commissioner or Practitioner			3	6
a		Long term service		3	6
b	Feelings towards RVT			16	49
b		Feel negative		5	13
b			obtrusive	2	3
b			System can't be installed	3	3
b		Feel neutral		4	5
b		Feel Positive		15	31
c	Opinion expressed RTNI			16	144
c		Administrative support		1	1
c		Blood Pressure Cuff		2	2
c		Clinicians feeling about input into service design and technology		10	14
c		Contact by email		2	3
c		Diabetes equipment		3	9
c		Discharge		2	2
c		INR		2	2
c		Monitoring some		2	2

		unnecessary VS			
c		Referral Process		7	22
c		Respiratory Equipment		5	11
c		Rural remoteness connectivity		3	7
c		Service creating work		10	17
c		What didn't work		11	34
c		What worked well		11	18
d	Opinion of models of RVT			14	38
d		Track & trend		9	16
d		Triage		9	18
d		Triage & track & trend		4	4
e	Training			16	32
e		More People Trained		5	5
e		RVT Training at time of service initiation		14	22
e		Train at University as Student		2	2
e		Training in RVT not on Uni curriculum		2	3
f	Staff Engagement Target			16	26
f		Chose to use RVT		9	10
f		Encouraged to use RVT		8	8
f		Management target		6	8
g	Value for money			16	25
g		Don’t know if Value for Money		11	13
g		No not Value for Money		5	9
g		Yes Value for Money		3	3
h	Outcome and Benefit			15	89

h		Help people keep track Empower		12	58
h		Hospital attendances		7	16
h		Patient outcome negative		2	3
h		Patient outcome neutral		2	2
h		Patient outcome positive		8	10
i	Clinical Issues			16	174
i		Anxiety		6	16
i			Increase Anxiety	4	7
i			Decrease Anxiety	3	5
i		Clinicians are Reluctant		5	6
i		Contact by Phone		8	13
i		Duration		5	6
i		Extended Range of Conditions		2	3
i		Monitoring to adjust treatment		5	10
i		Need for better research		4	6
i		Patient engagement with technology		7	12
i		Patient Honesty		4	5
i		Patient identification process		13	58
i		Patient fear of technology		9	11
i		Patients own equipment		1	2
i		Portal		3	5
i		Reading upload Frequency		5	6
i			Ad hoc submission	0	0

i			Frequent	1	1
i			Less than 3x per week	0	0
i			Once a week	2	2
i			Very Frequent	0	0
i			Weekday submission	1	1
i		Time		5	11
i		Work in a new way		2	4
j	Future of RVT the next generation			14	63
j		Electronic record		2	2
j		Need more Innovative Technology		12	61

.

10.35 Manager NVivo Data

Table 10.7 To demonstrate the distribution of opinions and perspectives shared by managers highlighting the topic areas and the constituent subordinate topics.

Topic	Descriptive Topic Title	Sub Description	Sub-Sub Description	N=8 Managers (Source)	References (Frequency)
a	Experience as a manager commissioner or Practitioner			8	21
a		Experience only as a manager or commissioner		8	21
b	Feelings towards RVT			8	11
b		Feel negative		1	1
b		Feel neutral		2	2
b		Feel Positive		6	8
c	Opinion expressed RTNI			8	84
c		Managers positive comments about kit		4	5
c		Managers negative comments about kit		6	7
c		RVT TF3 service poor		3	6
c		Managers view of Referral Form		2	2
c		RVT TF3 better		3	4
c		What the commissioners get wrong		7	27
c		Clinicians involved in service design		3	5
c		Contract Development Issues		2	3
c		More clinical engagement in service design was required		5	12

c		Patient service user involvement in design of service		1	3
c		RVT purpose		1	4
c		Tech specification for contract		2	6
d	Opinion of models of RVT			7	20
d		Manager thoughts of track & trend		4	5
d		Managers thoughts triage		6	15
e	Training			8	16
e		No management training		7	11
e		Managers received awareness training		3	4
e		Managers view is that more training is or was required		1	1
f	Staff Engagement Target			7	14
f		Set performance targets		6	9
f		Encourage engagement		4	5
g	Value for money			8	15
g		Don’t know if Value for Money		5	7
g		Not value for money		3	3
g		Yes value for money		4	5
h	Outcome and Benefit			8	36
h		Managers view of Patient and service user empowerment		6	17
h		Benefit realisation within an integrated system		7	16
h		Utilisation Hospital Services		1	3

h			RVT appropriate effect	0	0
h			RVT no effect	0	0
h			RVT reduced effect	0	0
i	Clinical Issues			8	110
i		Change or changed Clinical Practice		8	34
i		Clinical feedback		7	28
i			Clinical staff resistant to RVT	5	16
i		Managers view of Patient Identification		2	5
i		Primary Care		2	6
i		Research		7	26
i		Service user feedback		6	11
j	Future of RVT the next generation			8	74
j		Future service user engagement		5	18
j		Information is required for decision making		5	13
j		Managers thoughts on needing more innovative technology		8	41
j		NIECR		2	2

APPENDIX 10 DETAILED TRIANGULATION OF DATA

10.36 Detailed Comparison of Data Streams

10.36.1 ‘a’, Experience of RVT

The overarching topic area of experience as a manager or commissioner or practitioner participant was split with noteworthy difference between the groups. The practitioner participants received formal training by the suppliers of technology, some had experience of early trials and all had developed their own personal knowledge through extended clinical practice. At least 50% had gained expert knowledge through being involved with research based clinical trials of the technology. The manager participant group had no direct experience with none having received formal training. Three of the managers had a clinical background and whilst holding strategic positions had close working with their specialist clinicians utilising the technology. One manager had an IT qualification so at least had a scientific understanding of possible case use and patient benefit but 50% only had observational and second-hand information. Therefore, whilst the experience, skills and knowledge of senior executives within the Health and Social Care system was respected, greater weight and value was placed upon the opinions of practitioner participants. Moreover, as the nodal data was explored across the full range of topic areas the richness, apparent validity and the authority behind the narrative of the practitioner participants was recognised. Whereas, patient and carer participants received one-to-one training on a case by case basis and so were knowledgeable in the use of the equipment relevant for their own healthcare needs. The training received by patients at the time of installation helped to reduce anxiety associated with anticipation of being given new technology. Most (90) patients stated that the equipment was easy to use with 64% strongly agreed with the statement that the equipment was easy to use. However, from a patient and carer perspective, whilst the technology was easy to use, there were two comments to suggest the reliability of the TF3 home hub was questionable with ‘failure to upload' being cited as a reason for the triage nurses from the service contacting patients to repeat tests. In summary, overall training and experience of equipment was limited for

managers and was sufficient to enable use by practitioners, patients and carers.

10.36.2 ‘b’, Summary overarching feelings towards RVT

The two groups of staff participants had positive feelings towards RVT albeit the richness of data articulated by the practitioners gave a far fuller understanding of the rationale behind their feelings and their continued involvement in the service at the time of interview. On the other hand, the manager participants were positive but not to any meaningfully objective level with the positive affirmation relating to the opportunity to learn and to utilise information for decision making. Moreover, the strength of message from the Senior Civil Servant about failure to genuinely deliver the expected outcomes and therefore feelings were concomitantly negative. Five practitioner participants who expressed less than positive feelings did so framed within a potential risk of RVT becoming intrusive within a patient’s home, the very poor and laborious referral system associated with the TF3 service and limitation of the TF3 technology particularly connectivity where a mobile telephone network reception was limited or compromised. Such issues with the TF3 system drove negativity for practitioners and failure to deliver expected outcomes for managers with positivity only reflected by better patient centred care for practitioners and the opportunity to exploit data for managers. Positive feelings towards RVT were generally expressed by patients and carers with a sense that care was patient centred due to an increased awareness of condition, peace of mind and feelings associated with empowerment.

10.36.3 ‘c’, Wide-ranging opinions of RVT

To compare and contrast this qualitative analysis section from the two data sources, the practitioner participants and the manager participants was interesting. These reflect the stance adopted by the manager participants who really were the commissioners of RVT for the region but for all intent and purposes were ‘onlookers’ who observed the outworking of a contract they had contrived and orchestrated. Whereas, the ‘lived experience’, expressed

by the practitioner participants, sharing RVT knowledge from personal clinical activity. Moreover, not only were the stances different but the manager participants only reflected upon their experience of the TF3 RVT whereas at least one quarter of practitioner participants also brought their experience of the U-Tell RVT into the discussion. The range of topics within this section varied where the manager participants demonstrated superficiality, if not frustration. From a strategic implementation perspective, the practitioner participants reflected a sense of ownership, personal contribution and effort with an improvement agenda being articulated. There were minor sub-node topics that could be compared; there were two significant contrasting sets of opinions expressed. The first is the referral form and the recognition of difference is clear. Two of the managers expressed a concern that the electronic referral form was a problem whereas most of practitioner participants (75% of those who primarily utilised the TF3 service) articulated a serious practical service issue with only the clinicians explaining the extent the barrier acted as a deterrent to referral and general use of the TF3 RVT service.

The second area considered for comparison of the points of view is the idea of stakeholder engagement and the involvement of clinicians and or service users in service design. Both groups believe that co-creation, stakeholder engagement and meaningful clinical participation in the design phase were essential. The manager participants stated that clinical engagement did happen but that it could have had a broader base of engagement and been improved. The practitioner participants reported that they were involved and wanted to be involved but that the final decision making was made by the management. Therefore, real and meaningful engagement in future technology developments should be embedded and give authority for choice to the practitioners. The patients and carers did not express their opinions of RVT at the system or strategic perspectives rather from their own personal experience. Opinions were generally positive and supportive, articulated through agreement with statements to affirm utility and benefit with very few patients having a poor experience or less than encouraging opinion. Most patients (62) believed that they were more interested in using technology in general as a result of their experience with RVT.

10.36.4 ‘d’, Opinions of the models of RVT delivered

Both participant groups shared their opinions of the different types of RVT albeit only four were able to reflect upon U-Tell RVT and the managers could only reflect upon the TF3 service. Overall, 21 participants contributed to the nodal topic. This topic really demonstrated the depth of understanding and meaning in relation to case use of triage versus track and trend. The managers all reiterated the contract narrative whereas the practitioner participants articulated their journey of learning and clinical application. No doubt clinical practitioners had given thought to the type of data collection and RVT that was appropriate for a group of patients but where parameters had to be set the task was undertaken on a personalised basis. One manager, with a non-clinical background, referred to a fault of clinical practice and a failure of clinicians to review cases as a reason for high alert rates i.e. suggesting the practitioners set parameters too low; whereas, the narrative of the practitioner respondents described a different scenario. Practitioners described exploratory activity when first utilising triage and how to effectively set patient vital sign parameters. Instead of ignoring alerts and resetting parameters, so as alerts would not occur, respiratory practitioners undertook an audit of clinical practice and alert data. The practitioners demonstrated meaning and effective utilisation of a well understood service for patients who were inherently unwell with chronic ill-health, seriously ill patients with non-communicable diseases, particularly COPD, where there was not going to be a radicle improvement of health but the patient’s quality of life and well-being could undoubtedly be assisted through the appropriate and targeted intervention of a triage nurse and RVT. Patients and carers were not asked direct questions relating to models of care but as appropriate were asked about particular elements. The TF3 patients who required a triage service were asked about helpfulness; 93% of 68 TF3 patients agreed or strongly agreed that the actions of the triage nurses were generally helpful. Analysis from the two data paradigms would suggest general convergence in favour of the triage model for certain conditions.

10.36.5 ‘e’, The participants’ experience or opinion of RVT training and education

The managers reported not having received any formal training beyond awareness sessions or three site visits; whereas the practitioner respondents did receive training in RVT. The staff and patients who used U-Tell received one-to-one tuition on three occasions prior to commencement whereas the staff who used TF3 reported group computer training on a dummy system and single demonstration at point of installation for patients. The U-Tell training was reported as superior to that provided to the practitioners who accessed TF3 as their mode of RVT. Five participants, one of whom was a manager, expressed concern by the absence of RVT awareness training in the undergraduate curriculum.

As already discussed in 7.2.1, the patient’s and carer respondents recorded narrative in free text spaces of the questionnaires offering qualitative data as a contribution to the discussion in this topic area. Half of the participant service users expressed apprehension at the time of the RVT prescription but most (90) reflected the adequacy of one-to-one training at time of installation and that the systems were easy to use (Table 4.4).

10.36.6 ‘f’, The encouragement of practitioners to engage, in particular the use of performance targets by managers

This was an interesting topic to observe from the staff recipient’s experience and the perspective of the manager, as essentially it considers the management techniques to encourage or coerce practitioners to participate in RVT. In summary, the practitioner recognised that the managers had targets to achieve driven by simple contract performance metrics of patients utilising the system but took an approach not to be concerned by them. There certainly was not a naivety with the practitioners with regard to the need for resources to be put to good use as in general they reported that they utilised RVT as they wanted to, and observed, the wider clinical benefit of quality of life for their patients; empowering patients and improving quality of life was a motivator not management’s target setting. On the other hand, the managers

acknowledged that they did have targets and a performance management system with some contradictions, for example person-to-person engagement rather than the setting of targets versus performance target setting as a justified management tool. The one manager participant who lamented the notion of outcome-based metrics, which did not come to fruition, was in fact closer to the subjective measures clinician's set themselves; using soft measures of personal experience on patient well-being as a driver to prescribe RVT. The patient and carer participants were not asked about system deployment or performance management nor did any participant express this topic area in free text opportunities.

10.36.7 'g', Perceived value for money of RVT

The practitioner participants were removed from the practicalities of agreeing service levels, contract terms and conditions and payment of invoices and were only ever privy to the public announcements made by Permanent Secretaries at the Department of Health or Health Ministers. The majority, 69% admitted not having the information to judge whether or not it was value for money. There were thoughts by some that it was poor value but countered by others who experienced U-Tell as being perceived as good value. However, one practitioner participant who had previously undertaken a research study within their own sector believed that the real value could not be articulated from a financial perspective but rather from the stance of direct benefit to the patient with an improved quality of life. The practitioners were aware of RVT being a service that was expected to drive down acute hospital utilisation and the associated costs, but none believed that was realistic or had been achieved.

Six of the managers expressed views regarding perceived value for money with some contradictions. Even those with most authority in the commissioning of RVT did not definitively know the if the regional version of RVT, represented value for money or not and they did identify a need for a meaningful review and evaluation of the TF3 service.

Whilst the managers recognised that RVT was a complex intervention, they needed a mechanism to distribute funding and monitor performance: they

used Monitored Patient Days (MPDs). This metric only indicated cost of a day of monitoring and indicated short-term activity rather than value or worth. This apparent mismatch in expectations was a potential barrier to RVT implementation and systemic change and may have impeded the benefit realisation or genuine consideration of value for money. Therefore, whilst there was no value for money demonstrated by the formal commissioned evaluation, there were mixed perceptions across the range of participants. There was a suggestion that the real value lies with patient benefit albeit the benefits associated with increased quality of life were not considered in the commissioned evaluation of the RTNI/ TF3 contract. One participant explained that RVT allowed the practitioners to focus their time on those patients who required direct clinical intervention whilst monitoring the progress of others. This is interpreted as efficient deployment of staff time if not seen as value for money. Service users did not contribute to this data beyond free text expressing the value.

APPENDIX 11 RECORD OF ADDITIONAL SUPPORTIVE STUDY / PHD TRAINING

10.37 Record of Training

JULIE-ANN WALKDEN B00549428 Part-Time PhD

Record of Additional Research Studies

Date	Agency	Topic	Time hours
07.02.13	HSCR&D Public Health Agency	European Innovation Partnership on Active & Healthcare Ageing (EIPAHA) - What's in it for Northern Ireland	4
21.02.13	UUJ	Online Course & test completed - Research Integrity	1
20.03.13	ECH Alliance	NI Connected Health Ecosystem - Riddell Hall, Queens	6
12.04.13	UUJ/ Unison	Prof Sheila Peace - Gerontology (Developing technology in Home)	4
16.04.13	NHS Nat Institute for Health Research	Introduction to Good Clinical Practice (CGP) e-learning - Ethics	4
01.05.13	UUJ	Community of Practice - Research Day - Action Research	8
18.06.13	UUJ	Action Research Course - Institute of Nursing & Health Research	24
18.09.13	ECH Alliance	Northern Ireland Ecosystem Meeting	8
20.09.14	UUJ	Research Ethics Committee	2
24.09.13	UUJ	Dr Mike Davidson - Writing to learn, Improve Your Writing Skills	3
24.09.13	UUJ	Dr Mike Davidson - Academic Integrity: Avoiding Plagiarism	1.5
26.09.13	UUJ	Paul Toombs & Dr Dave Filipovic-Carter, Effective Progress in Your 2nd Year	6
03.10.13	UUJ	Prof Davina Poroch - Buffalo University. One to one discussion about research question and methodology	2
09.10.13	NIPEC	Innovation & Commitment Transformation	6.5
16.10.13	UUJ	Research Ethics Committee	3
17.10.13	UUJ	Doctoral Innovation Programme (DIB) Session 1 Project Initiation - Est. The Scope of Project - Dr Martina Murphy	6
21.10.13	UUJ	Prof Bev Temple, University of Manitoba - Translating Research in the Field of Intellectual Disabilities & Setting the Stage	2

05.11.13	UUJ	Research Ethics (IRAS) & Research Governance - Dr L Hanna-Trainor	2
21.11.13	UUJ	DIP Session 2 - Project Planning Implementation & Control - Dr Martina Murphy	2
29.11.13	UUJ	Essentials of Qualitative Analysis - Prof Brian Taylor	3
06.12.13	ECH Alliance	Northern Ireland Ecosystem Meeting	4
16.12.13	Ethics Committee	Developing Understanding Research Ethics Through Being Student Rep on UUJ Ethics Committee	3
14.02.14	Ethics Committee	Developing Understanding Research Ethics Through Being Student Rep on UUJ Ethics Committee	3
12.02.14	UUJ	Appraising Research Quality	3
15.02.14	Ethics Committee	Developing Understanding Research Ethics Through Being Student Rep on UUJ Ethics Committee	3
10.03.14	University of Aberdeen	ITTS Inverness Conference Lesson Learned Northern Peripheries Counties Remote Monitoring	9
25.03.14	UUJ	Connected Health Conference for Obesity & Diabetes Prevention - Dr Bond & Prof Black	4
26.03.14	UUJ	Questionnaire Design Dr Mike Davidson	3
09.04.14	University of Edinburgh hosted by UUJ	Dr Hilary Pinnock + Prof Brian McKinstry, COPD Telehealth Seminar	1.5
		SUBTOTAL as at 09:04:14	**131.5**
30.04.14	Bosch USA Leadership	Utilizing Telehealth to Reduce Readmissions - Webinar	1
03-05:06:14	Fonty's University Eindhoven	Action Research Course	25.5
12:06:14	SET	Presentation to the Minister Poots on Optimisation of RTM	1.5
20:06:14	ECH Alliance	Telehealth Eco System Workshop	4
01:07:14	UUJ On-line Training	Research Integrity and Ethics Score 260/280 Weighted Total 92.9%	2.5
13:07:14	UUJ On-line Training	Blackboard Orientation score 19/20	0.5
24:07:14	Epigeum on-line	Intellectual Property (scored 20/25)	3
24-25:07:14	Epigeum on-line	Getting Published in the Arts (scored 8/10)	3

25:07:14	Epigeum on-line	Research Methods Literature Review (scored 12/15)	3
25:07:14	Epigeum on-line	Research Methods Social Sciences (scored 15/16)	3
25:07:14	Epigeum on-line	Research Methods in the Sciences (scored 13/15)	2.5
26:07:14	Epigeum on-line	Project Management (scored 10/11)	3
		TOTAL:	**184**
04:09:14	UUJ	Effective Researcher: The End is in Sight	6.5
05:09:14	ECH Alliance	Ecosystem Participatory Debate hosted by UUJ examining the topic of creating evidence for connected health technologies	3
10:09:14	UUJ	Ethics Committee	
11:09:14	CCH	Clinical Workshop - Telemonitoring	3
23:09:14	UUJ	Writing in the 3rd Year of Your PhD (for 3rd year PhD Researchers): Planning	6
24:09:14	UUJ	Preparing for your Viva	6
25:09:14	C-TRIC	6th Annual Translational Medicine (TMED6) Conference - 'Personalising Health and Care' - Presentation of a Paper on an INR/ U-Tell Research Project along with what is needed for the future is a formula for successful implementation of RTM & Conference Attendance	5
29:09:14	UUJ	Ethics Committee Training	6
2:10:14	ECH Alliance	Connected Health Ecosystem	8
08:10:14	NICON	Northern Ireland Confederation for Health & Social Care (NICON) Celebrating Success - Planning for the Future eHealth	13
09:10:14	NICON	Northern Ireland Confederation for Health & Social Care (NICON) Celebrating Success - Planning for the Future eHealth	7
14:10:14	Health Research Authority	Ethics	4
		Further Subtotal	**251.5**
30:10:14	UUJ	Managing Chronic Illness Group - getting started in research	4
01:12:14	ECH Alliance	Ecosystem	4
09:12:14	UU	Managing Chronic Illness Research Centre	3.5
23:01:15	University of Oulu	GASEL Workshop Sendai - skype connection	3

10:04:15	PHA	PPI Standards and Neurological Conditions	4
22 & 23 :04:15	NICON	A call to action - People, Place & Partnership - HPSS Conference	12
03:04:15	UU	Ethics Committee	2.5
		Further Subtotal	**284.5**
02:06:15	Queens University	Advances in telecare: new solutions for carers and older people	3
15:06:15	UU	Qualitative study 1:1 interview (with Iseult Wilson)	5.5
16:06:15	ECH Alliance	Ecosystem Also gave a 5-minute presentation on innovation in health and social care using technology commissioned through pre-commercial procurement - to develop new technologies to solve service problems	4
18:06:15	Derry City Council C-TRIC, CTEIP Event	Gave a 30-minute presentation on innovation in health and social care using technology commissioned through pre-commercial procurement - to develop new technologies to solve service problems	1
22:06:15	Queens University	NICRN Primary Care CMG Meeting	1.5
03:04:15	UU	Ethics Committee	2.5
10:08:15	UU	Ethics Committee	2.5
		Further Subtotal	**304.5**
7&8:10:15	ABPI	2015 Clinical Innovation Conference	9
10:11:15	UU	Cochrane Literature Review Prof Martin	3
25:11:15	InnovateUK	Dallas Programme Report Workshop	3
25:11:15	UU	Introduction to SPSS	6
08:12:15	ECH Alliance	Ecosystem Also gave a 20-minute presentation on innovation in technology commissioned through pre-commercial procurement - MAGIC Project	6
19, 20 & 21:02:16	UU	Thesis Bootcamp Dr Peta Freestone	24
22 & 23:08:16	UU	Statistics Summer School (SPSS)	12
21:09:16	UU	Honest Broker Service Workshop	2
09:11:16	Westminster Health Forum	Policy Forum for Ireland (Dublin)	4.5
10:11:16	NICRN	Working with Industry - Partnership Clinical Research (Allan McGaw MD, PhD & Karen McIntyre)	3
As at 16:11:16		**Further Subtotal**	**377**

01:12:16	ECH Alliance	Presentation at inaugural North/ South Ecosystem: 7.35minuets presentation to international audience: Optimisation of Care: Providers, Patients and Enablement using Technology. (Published online post event)	5
16:12:16	UU	NVivo (introductory)	6
10:01:17	UU	NVivo (advanced)	6
		Further Subtotal up to Seminar 2	**394**
22:03:17	UU	Writing for Publication	2
04:05:17	Primary Care CMG	Participated in the Northern Ireland Primary Care Ethics Committee	2
18 & 19:05:17	NICON	2-day conference - main topic transformation, e-health technology and digital future	16
22:05:17	UU	Person Centred Practice - Dr Tanya McCance	3
27:11:17 to 30:11:17	European Alliance for Personalised Medicine	Personalised Medicine and Healthcare for an immediate future	24
01:12:17	BSO & INI	Chaired and delivered a conference on remote technologies for stroke rehabilitation.	7
16:02:18	UU	Hugh Kearness Successful Research - The Seven Secrets	2.5
04:02:18	UU	Thesis Producer	5.5
17:04:18	NICON	NHS confederation conference on transforming and delivering care with much focus upon eHealth	10
18:04:18	NICON	Day 2 NHS confederation	6
19:04:18	UU	SPSS Training Paul Slater	3
20:04:18	NICRN	Northern Ireland Clinical Research Network -research governance & ethics training day	6
23:11:18	EU	Presentation on Technology in Healthcare Vienne Austria & conference attendance	
		RESEARCH STUDY FORMS NO LONGER USED BY UU DOCTORAL COLLEGE	
22:03:19	EU	Presentation on Technology in Healthcare Cluj Napoka Romania & conference attendance	8
23:05:19	UU	Cancer Care Research Group - Person-based Approach	5
04:06:19	UU	Advanced NVivo	7
07:06:19	Kuopio University Stroke Conference	Presentation on Technology in Healthcare Kuopio Finland & (3-day) conference attendance	8

21:08:19	UU	Thesis Editing	3
11 & 12:09:19	C-TRIC	10th Annual Translational Medicine (TMED10) Conference - Disruptive Innovation in Healthcare 'Personalising Health and Care' - Poster Presentation - Acceptance of telemonitoring for people with long term conditions (*unable to attend and so Dr PJ McCullagh represented)*	
23:09:19	AAL	Presentation on Technology in Healthcare Arhus Denmark & AAL conference (3day) attendance	8
01:10:19	UU	First Steps in Teaching and Learning in Higher Education Award	5
12 & 13:10:19	UU	First Steps in Teaching and Learning in Higher Education Award	10
19:11:19	QSR International	Transcription: More than just words Webinar	1
		TOTAL hours as at 19:11:19	**536**

full working days (8hrs/ day)	**67.0**
working weeks (5 days/ week)	**13.4**

APPENDIX 12 RECORD OF STUDY OUTPUTS

10.38 10th Annual Translational (TMED10) Conference – Disruptive Innovation in Healthcare 'Personalising Health and Care' – Poster Presentation – Acceptance of telemonitoring for people with long term conditions

Acceptance of telemonitoring for people with long term conditions

Julie Ann Walkden [1], W George Kernohan [2], Paul J McCullagh [3]

[1] Deputy Commissioning Lead Belfast & Regional Stroke Network Coordinator at Health & Social Care Board, Belfast, UK, [email: Julie-Ann.Walkden@hscni.net]
[2] Institute of Nursing and Health Research, Ulster University, Shore Road, Newtownabbey, BT370QB, UK
[3] School of Computing, Ulster University, Shore Road, Newtownabbey, BT370QB, UK

Background

Remote Vital Sign Telemonitoring (RVT) has been difficult to introduce into mainstream health services due to a lack of convincing evidence. A significant whole system demonstrator trial was undertaken in England and Wales, but findings were equivocal and depended on the metric of interest (re-admission, value for money). In Scotland a large study, of people living with Chronic Obstructive Pulmonary Disease (COPD), reported mainly negative findings. In 2011, the Public Health Agency contracted a consortium to provide a telemonitoring service across Northern Ireland. Management was undertaken of (up to) 1000 patients with long term conditions. McDowell (2015) assessed the service for 150 patients in the South Eastern Trust, reporting: ***"In selected patients with COPD, telemonitoring was effective in improving health-related quality of life and anxiety, but was not a cost-effective intervention".*** McElnay (2016) engaged with 23 patients and carers in focus groups and concluded that patients and carers **"... were unanimously positive about telemonitoring, with the main benefit being the reassurance".** Home-based patient monitoring has largely failed to show intended savings to healthcare budgets, yet this technology continues to gain popularity, evidence by the 'quantified-self' movement. In Northern Ireland the regional contract for RVT was not renewed in 2018. Before being discontinued, we collected views of patients and carers, to obtain a perspective of how RVT is perceived by intended users.

Material and Methods

To better understand the benefits and risks of telemonitoring, a survey was issued to patients and their informal care-givers. Questionnaire data from 97 older service users and 49 carers were analysed. The cohorts comprised people living with Diabetes, Hypertension, post-Stroke, heart failure, COPD, Bronchiectasis and those requiring anticoagulation. 274 pseudo-anonymised questionnaires were sent to South Eastern Health & Social Care Trust (SET) RVT service users (01-Sept-15). Where an informal carer plays a role in RVT, they were also invited to provide feedback from their perspective. Descriptive, exploratory and explanatory analyses of data obtained from these questionnaires was undertaken, using IBM-SPSS (version 25). COPD and Bronchiectasis were classified as 'Respiratory'; the service received by a participant whether they had COPD or Bronchiectasis or both, was the same. A classification of Chest, Heart and Stroke (CHS) was comprised participants who reported Stroke, Chronic Heart Failure (CHF) and Hypertension (essentially circulatory system conditions).

Condition	Mean Rating (standard deviation)	Number, N
Diabetes	3.0 (0.85)	15
Stroke	1.50 (0.71)	2
Coronary Heart Failure	3.17 (1.17)	6
COPD	3.49 (0.68)	59
Renal	4.00	1
Hypertension	3.17 (0.49)	7
Weight Management	3.17 (0.75)	6
Maternity	3.00 (1.00)	3
Bronchiectasis	3.78 (0.44)	9
International Normalized Ratio (INR)	3.67 (0.49)	18
Dementia	1.0	1

Results

In considering empowerment, the statement to be considered was: (RVT) *has helped me manage my own condition and become involved in my healthcare*. The Table (left) enumerates responses rating (4 being 'strongly agree' and 1 being 'strongly disagree').

Statistical analysis showed that the respondents were supportive of the technology. Responses showed that they liked the technology because it provided control for self-management, and allowed them to continue with their lives without major disruption. These views were independent of the specific technology used and not associated with the user's long-term conditions. There were no reported adverse incidents.

Overall:

- classification of 'Respiratory' had mean rating of 3.50 (0.68), N=60.
- classification of 'Chest, Heart and Stroke' (CHS) had mean rating of 3.50 (0.63) , N=64.

Discussion and Conclusion

RVT was introduced primarily to reduce acute admission and has yet to show economic benefit. Our findings confirm that acceptance of the technology is more about empowerment. There is consensus between participants believing there is a benefit to RVT service users from their own self-management and proactive involvement; indeed, one respondent wrote, ***"...because my oxygen levels can drop very quickly and suddenly I can keep a check on my levels with oxymeter which keeps me from panicking. I can adjust my oxygen accordingly."*** The ease of use of technology was reported by both service users and carers. The qualitative rating expressed by the majority of both carer and patient participants was that the technology was intrinsically simple. When considering the potential increased use of technology in the future one carer respondent warned the increased use of the internet would be detrimental and one carer shared that 'technical issues' experienced would need to be overcome. It was suggested by one concerned carer respondent that, ***"Idea is good but many older people do not have the technical capability and its presence and attendant stress in how to use it correctly i.e. use of the internet could make some people opt out because of this."*** However, the majority of RVT users were over 65-years and reported that they found RVT a simple and helpful solution, so this concern may not be widespread.

Bengoa (2016) reported that when telemonitoring is used effectively, it can make a ***"valuable contribution to the quality of services.... enabling patients to live independent lives for longer, and engaging patients in their own health and well-being".*** RVT has yet to show intended savings to healthcare budgets, but this work confirms general acceptance by the intended user population. The main challenge is to address effective delivery by the health system. In conclusion, our survey indicated that the services available in South Eastern Health & Social Care Trust provided empowerment for both patients and carers. We found that self-management of chronic disease was adopted by most patients and the technology improved their sense of control. Our findings were not technology-dependent and not condition-specific.

Ethical approval was obtained by Ulster University (Project: 15/0065). The Proportionate Review Sub-Committee of the Health Research Authority, NRES Committee South Central – Oxford C (July 15) gave permission for the research to be undertaken (IRAS project 155990). SET Research Governance was attained on 11-Aug-15 REC 15/SC/0424 (Trust ref SET/15/17).

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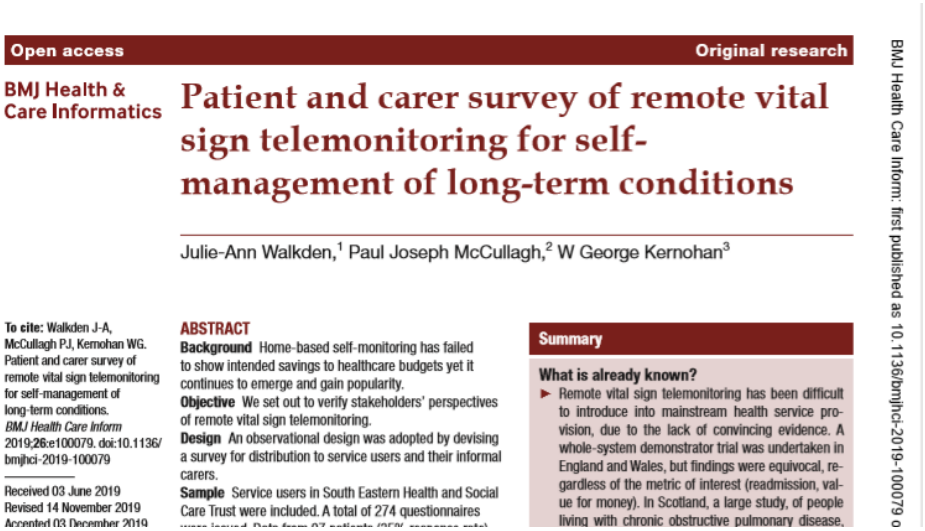
10.39 Publication - British Medical Journal Health & Care Informatic: Patient and carer survey of remote vital sign telemonitoring for self-management of long-term conditions



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BMJ Health & Care Informatics

Patient and carer survey of remote vital sign telemonitoring for self-management of long-term conditions

Julie-Ann Walkden,[1] Paul Joseph McCullagh,[2] W George Kernohan[3]

To cite: Walkden J-A, McCullagh PJ, Kernohan WG. Patient and carer survey of remote vital sign telemonitoring for self-management of long-term conditions. *BMJ Health Care Inform* 2019;**26**:e100079. doi:10.1136/bmjhci-2019-100079

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ABSTRACT

Background Home-based self-monitoring has failed to show intended savings to healthcare budgets yet it continues to emerge and gain popularity.

Objective We set out to verify stakeholders' perspectives of remote vital sign telemonitoring.

Design An observational design was adopted by devising a survey for distribution to service users and their informal carers.

Sample Service users in South Eastern Health and Social Care Trust were included. A total of 274 questionnaires

Summary

What is already known?

- Remote vital sign telemonitoring has been difficult to introduce into mainstream health service provision, due to the lack of convincing evidence. A whole-system demonstrator trial was undertaken in England and Wales, but findings were equivocal, regardless of the metric of interest (readmission, value for money). In Scotland, a large study, of people living with chronic obstructive pulmonary disease,

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[1]Health and Social Care Board, Belfast, UK
[2]School of Computing, Ulster University, Jordanstown, UK
[3]School of Nursing, Ulster University, Jordanstown, UK

Correspondence to
Dr Paul Joseph McCullagh; pj.mccullagh@ulster.ac.uk

ABSTRACT

Background Home-based self-monitoring has failed to show intended savings to healthcare budgets yet it continues to emerge and gain popularity.

Objective We set out to verify stakeholders' perspectives of remote vital sign telemonitoring.

Design An observational design was adopted by devising a survey for distribution to service users and their informal carers.

Sample Service users in South Eastern Health and Social Care Trust were included. A total of 274 questionnaires were issued. Data from 97 patients (35% response rate) and 49 carers were analysed. Of these, 81 patients and 48 of their carers experienced a monitoring service known as TF3 and 16 patients and 1 carer experienced a service known as U-Tell. The cohorts comprised people living with a number of long-term conditions: diabetes, hypertension after stroke, chronic heart failure, chronic obstructive pulmonary disorder, bronchiectasis and those requiring anticoagulation using warfarin.

Results Analysis showed that respondents were supportive of the technology with 90.7% of patients agreeing or strongly agreeing with the statement: *the remote monitoring system assisted me in managing my health on a day-to-day basis*. The patients liked the technology largely because it provided empowerment and control for self-management and allowed them to continue with their lives without major disruption. These views were independent of the technology used and not associated with the patient's long-term conditions, gender or age. There were no reported adverse incidents.

Conclusion As self-monitoring becomes more relevant to healthcare delivery, the technology will be accepted by many in the population with long-term conditions.

Summary

What is already known?

- Remote vital sign telemonitoring has been difficult to introduce into mainstream health service provision, due to the lack of convincing evidence. A whole-system demonstrator trial was undertaken in England and Wales, but findings were equivocal, regardless of the metric of interest (readmission, value for money). In Scotland, a large study, of people living with chronic obstructive pulmonary disease, reported mainly negative findings with regards to readmission (which increased). In Northern Ireland, a large regional trial of telemonitoring was introduced in 2011 but discontinued when the regional contract was not renewed in 2018. However, a previous study indicated that patients largely approved of the telemonitoring.

What does this paper add?

- We collected detailed feedback from 97 patients and 49 carers in South Eastern Health and Social Care Trust. We found that self-monitoring of long-term conditions was readily accepted by most patients and the technology provided empowerment for both patients and carers. Our findings were not technology dependent and not condition specific. The participation rate was 35%. However, a weakness of our approach is that the respondents may have been more supportive of the intervention than those who did not respond.
- Many patients with long-term conditions and their carers will support the introduction of RVT for self-management. Even if the uptake rate of RVT is commensurate with the survey response rate (ie, 35%), it can lead to a disruptive approach to managing long-term conditions: patients tend to benefit from the support provided.

INTRODUCTION

Managing long-term conditions provides significant pressures within most healthcare systems. The WHO reported that circa 38 million deaths per year were due to non-communicable diseases; their Global Action Plan 2013–2020[1] aimed to reduce such deaths by 25% by 2025. One approach to enhanced management has been to adopt telehealth, in particular the application of remote vital sign telemonitoring (RVT) which avails of advances in near patient testing, computer technology and communications.

Reviews have synthesised the findings of RVT studies for self-management, professional practice and support of carers. Hitherto findings have been largely negative.[2–4] However McClean *et al* suggested that RVT provided an opportunity for patient education, improved adherence of medication and a positive effect on a patient's quality of life.[4] In England and Wales, the whole-system

demonstrator (WSD) programme attempted to integrate telehealth into practice. Steventon and Bardsley[5] examined hospital utilisation via emergency admissions and mortality. Findings suggested a 20% reduction of emergency admissions and a statistically significant difference with deaths, with 4.6% of participants in the WSD intervention arm versus 8.3% of control participants. However, the review did not offer explanation as to why or how the intervention improved the outcome based on the metrics considered. A cost-effectiveness study[6] of the WSD programme did not make the case for telehealth. The study suggested that cost burden was borne by community services, whereas cost benefit was realised by secondary care and suggested a rebalance. Pinnock *et al*[7] examined the effectiveness of telemonitoring as defined by the admission rates when compared with usual care for patients with chronic obstructive pulmonary disease (COPD). The study did not show effectiveness and hypothesised that earlier positive findings could have been due to the enhancement of underpinning care provision rather than telehealth. A description of the understanding of their condition and appreciation of the intervention by participants, arguably demonstrated empowerment. However, Hanlon *et al*[8] caution that existing findings could be outdated due to technology advances and the nature of meta-analysis.

In 2011 in Northern Ireland, the Public Health Agency contracted a consortium known as TF3, comprising Tunstall Healthcare, Fold Telecare and S3 Group to provide telemonitoring across the region.[9] This service was monitored by specialist nurses and allied health professionals. Management was undertaken of (up to) 1000 patients (in all trusts) with diabetes, COPD, chronic heart failure (CHF) and hypertension in post-stroke. Sensing devices were used by patients (assisted as appropriate by carers) to capture relevant vital signs, and a home hub transferred the data to a monitoring service. Two types of monitoring were provided: (1) track and trend, data were recorded by the monitoring service, but clinical care was undertaken by the patient's own care team and (2) triage, the patient was monitored by the TF3 clinical triage team.

In the South Eastern Health and Social Care Trust (SET), one of five Trusts in Northern Ireland, where this research study was undertaken, an additional home telemonitoring project called U-Tell was trialled.[10] This comprised a Roche CoaguChek device and web portal, which enabled patients who administered oral anticoagulation medication to undertake testing of capillary blood at home and transmit their international normalised ratio (INR) readings to the nurses at Ulster Hospital's haematology department. This reduced the need to attend outpatients for a venous sample of blood to be taken and tested in the laboratory.

The objectives of this study were the following: (1) to survey and evaluate patients and carers to obtain stakeholder perspectives and (2) to understand user perceptions for acceptance of RVT.

METHODS

An observational design was used involving patient and carer surveys. As part of a mixed-methods study, the quantitative survey data were synthesised with qualitative data derived from clinical practitioners, commissioning and operational managers. The qualitative data were collected through semistructured interviews and the quantitative data through questionnaires posted to the target cohort. The questionnaires permitted a respondent to add unstructured qualitative data/narrative.

The patient population actively interacting with RVT was included. This contained seven disease subgroups and two RVT technologies with three service deployment models. By the inclusion of the entire SET RVT case load, it was assumed that the findings would be less likely to be skewed or inadvertently unrepresentative of participants' views. Users consisted of patients experiencing combinations of service reflecting medical conditions, including heart conditions, diabetes, respiratory issues, weight control, warfarin anticoagulation therapy and hypertension/high blood pressure in poststroke patients. The differing conditions meant that practitioners selected RVT devices to meet particular clinical observation needs.

In advance of the formal study, patients and carer questionnaires were prototyped and modified by the lead researcher to enable further enquiry and tracking of service perception over time. The questions focused on benefits, risks, care, application of technology and service user recommendations to practitioners. Advice was received and enacted following feedback from an independent review of the Patient and Client Council in Northern Ireland.

The proposal was scrutinised through peer review at Ulster University (Project No: 15/0065). The Proportionate Review Sub-Committee of the Health Research Authority, National Research Ethics Service Committee South Central—Oxford C (Integrated Research Application System (IRAS) project ID 155990, 15 July 2015) gave a favourable opinion. SET Research Governance was obtained on 11 August 2015 (REC 15/SC/0424 Trust ref SET/15/17). There were no serious risks associated with participation or data collection.

Participant information sheets and prepaid return envelopes were posted with the questionnaires (1 September 2015). This comprised 274 questionnaires. Where an informal carer played a role in RVT, they were also invited to provide data from their perspective. Completed questionnaires were returned to the Safe and Effective Care team, compiled and made available to the researcher. A unique alphanumeric code on each questionnaire enabled anonymisation. The file containing participant study identification codes and personal details was kept secure in a password-controlled computer system. Paper copies of the surveys were kept in a secure location. Confidentiality was respected but was not guaranteed, for example, if an adult safeguarding issue was identified. Any disclosure of poor practice would have followed normal management and research governance protocols. During

Table 1 Mean age profile of respondents by reported condition: in most cases, RVT was used with older people: maternity services and weight management engaged younger users

Condition	Mean age (SD)	Monitoring
Diabetes	70.2 (10.9)	TF3: Home hub (a device to collect data and send it to a remote computer), blood glucose, BP
COPD (respiratory)	71.2 (8.8)	TF3: Home hub, temperature, BP, SpO2
Bronchiectasis (respiratory)	69.7 (4.6)	TF3: Home hub, temperature, BP, SpO2
Stroke	67.5 (14.8)	TF3: Home hub, BP
Chronic heart failure	81.7 (6.2)	TF3: Home hub, BP, weight, 3-lead ECG
Hypertension	72.0 (10.3)	TF3: Home hub, BP
Dementia	78.0	Reported by respondents but **not** managed in TF3 service
Renal disease	69.0	Reported by respondents but **not** managed in TF3 service
Weight management	56.2 (24.1)	TF3: Home hub, weight
Maternity	44.3 (15.0)	TF3: Home hub, weight
INR	65.4 (11.9)	CoaguChek and web portal Reported by two TF3 respondents but **not** managed through TF3 service. 16 INR patients were monitored by SET through U-Tell

bp, blood pressure; COPD, chronic obstructive pulmonary disease; INR, international normalised ratio; RVT, remote vital sign telemonitoring; SET, South Eastern Health and Social Care Trust; SpO2, oxygen saturation.

the analysis no such issues were recorded; no individual patient's personal information was accessed or identified.

This study considers the analysis of the quantitative data provided by both patients and carers. Data were transferred into SPSS V.25. Once the data were validated, hypothesis testing was undertaken and independent t-tests were calculated.

RESULTS

The RVT service was designed to support care for patients with long-term conditions. TF3 was used to monitor diabetes, respiratory conditions, hypertension or CHF, U-Tell for INR/warfarin management. A total of 242 questionnaires were issued to patients (and carers) with the TF3 system; 81 (33.5%) patient and 48 carer questionnaires were returned. In addition, 32 questionnaires were issued to patients (and carers) with the U-Tell system; 16 patients (50%) and 1 carer questionnaires were returned. There were 97 patient respondents, 83.5% of whom used the regionally commissioned TF3 service. There was an approximate gender balance of patients (49 males and 39 females, 9 did not respond). The mean age of patients was 68.8 years (69.5 years for TF3 and 64 years for U-Tell); refer to table 1.

COPD and bronchiectasis were classified as 'respiratory'; the service received by a patient whether they had COPD or bronchiectasis or both was the same. TF3 reported the readings via Bluetooth (wireless connection) from peripheral devices to the practitioners through a Home hub, whereas U-Tell used a web-based interface which relied on self-reporting of data from the peripheral device.

Table 2 Reliability of each of the empowerment questions within the questionnaire

The remote monitoring system ...	Scale mean	Scale variance	Corrected item: total correlation	Cronbach's alpha (range 0–1)
Assisted me in managing my health on a day-to-day basis	21.43	10.158	0.722	0.904
Reduced the number of health professional visits	21.61	9.241	0.828	0.891
Prevented or reduced need to attend outpatient appointments	21.78	9.055	0.715	0.906
Has helped me manage my own condition and become involved in healthcare	21.63	9.783	0.699	0.905
Has given peace of mind	21.51	10.405	0.678	0.908
Has reduced number of GP visits	21.58	9.308	0.817	0.893
Has prevented the need to attend emergency department and/or GP out-of-hours service	21.72	8.843	0.767	0.899

GP, general practitioner.

Table 3 Responses to the question: 'Has helped me manage my own condition and become involved in my healthcare'

Condition	Mean rating (SD)	Condition incidence reported by patients
Diabetes	3.0 (0.85)	15
COPD	3.49 (0.68)	59
Bronchiectasis	3.78 (0.44)	9
Stroke	1.5	2
Chronic heart failure	3.17 (1.17)	6
Hypertension	3.17 (0.49)	7
Dementia	1	1
Renal	4	1
Weight management	3.17 (0.75)	6
Maternity	3.00 (1.00)	3
INR	3.67 (0.49)	18

COPD, chronic obstructive pulmonary disease; INR, international normalised ratio.

To determine if there was any perceived patient benefit, seven questions were posed; table 2 shows mean, variance and correlation as determined by SPSS. The Cronbach's alpha statistic of over 0.70 for each question shows that the responses are consistent and may be regarded as reliable.

The question: 'Has helped me manage my own condition and become involved in my healthcare' is indicative of empowerment. Table 3 enumerates responses rating (4 being the high rating attributed to the value statement, 'strongly agree' and 1 being the low rating attributed to the value statement, 'strongly disagree').

There were some inaccuracies in the demographic data, as well as the existence of comorbidity, so that the total number of conditions recorded exceeded the number of participants. A factor to consider was that some patients disclosed conditions for which they were not supported through RVT. Ninety-seven participants recorded 127 conditions, refer to table 3. While the care options for the conditions of dementia and renal were available in other trusts, they were not used in SET. Furthermore, the weight management service and maternity service in SET was a single service managed by a dietitian. Some patients received RVT to manage two or more long-term conditions and hence reported comorbidities. To prevent skewing of results, each participant's rating for a question was included once. Where there were differences in opinion between patient groups, there may be a risk of comorbidity skewing findings.

Table 3 considers if the patient opinions varied according to their condition when responding to the question: 'Has helped me manage my own condition and become involved in my healthcare'. The lowest rating of 1 was recorded by one participant, who documented a dual diagnosis including dementia; this syndrome was not supported by RVT so their rating would also be allocated against the condition for which they were prescribed RVT. Equally, one participant recorded a renal diagnosis and a rating of 4. Again, RVT for renal was not supported and so it is recognised that the rating was also attributed to the condition for which they were prescribed RVT. Such dual attribution of rating demonstrated a potential skewing of findings when mean rating is calculated against a diagnostic variable rather than against a technology, a gender or simple participant count. This is because there were more conditions recorded than patients and where comorbidity exists, there may be bias with the mean rating. Consideration of the mean rating by condition was of interest as it was used to gauge if there was a generalisable difference between the experience of people who were monitored for different conditions. No significant difference was found. There were circumstances where the number of patients reporting a condition was low . For example, two patients recorded a diagnosis of stroke where the mean rating for two participants was 1.50. These patients were referred by the stroke specialist nurse for the monitoring of their blood pressure and so equally their rating would be reflected in the mean rating for hypertension, a condition that was recorded seven times. The low rating by patients with stroke was consistent with qualitative data provided by the stroke practitioner in a separate data collection exercise. Eighteen patients reported that they had taken warfarin; but only 16 patients were managed through the U-Tell system. The mean rating was 3.67.

The distribution of responses versus score for the question: 'Has helped me manage my own condition and become involved in my healthcare' is shown in figure 1. For 93 valid responses, the mean value was 3.52 with a SD of 0.636.

Responses given by carers were consistent with the opinions expressed by patients. The carers' mean score of 3.72 attributed to 'improving the level of care received' and 'has given peace of mind' demonstrates carer support for RVT. The lowest mean score was 3.41 which related to perceived benefit of *future use of internet-based technology*.

DISCUSSION

RVT interventions have been introduced in the UK primarily to reduce acute admissions and potentially to show economic benefit. By contrast, patient-reported and carer-reported benefit suggest the approach is more about empowerment and enhanced self-management.

An initial survey of 100 patients, undertaken in 2014 by the TF3, had shown that 95% of patients agreed that the service assisted them with better self-management. In view of such potential benefits, McElnay *et al*[11] were commissioned by the Public Health Agency to review the regional TF3 service. Twenty-three service users and carers engaged in focus group activity across Northern Ireland; the authors concluded that patients and carers

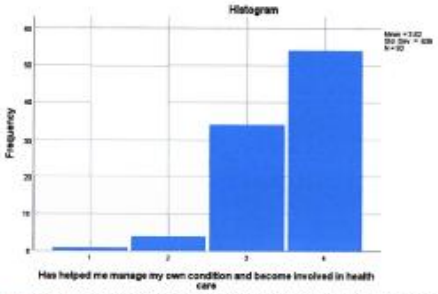

Figure 1 Histogram to demonstrate frequency of responses versus score for patient responses to the question: 'Has helped me manage my own condition and become involved in my healthcare'.

were reassured by and approved of telemonitoring. McDowell *et al*[12] reported a randomised controlled trial for SET TF3 triage service for 150 patients with COPD. In total, 84% of participants agreed that it enabled them to feel more in control of their health on a day-to-day basis; however as with other UK studies, economic benefit was not found.

Our study recruited 97 patients (35% patients with long-term conditions) and 49 carers. In broad agreement with,[11 12] we conclude that there is benefit to RVT patients from their own self-management and proactive involvement; indeed, one respondent wrote, "... because my oxygen levels can drop very quickly and suddenly, I can keep a check on my levels with oxymeter which keeps me from panicking. I can adjust my oxygen accordingly." The ease of use of technology was reported by both patients and carers. However, there was some negative feedback that urges caution. When considering the future use of technology, one carer felt the increased use of the internet would be detrimental and one carer indicated that reliability issues would need to be overcome. One carer suggested that the, "Idea is good, but many older people do not have the technical capability [*or know*] how to use it correctly." However, the majority of RVT patients were over 65 years, reporting they found RVT a simple and helpful solution, so this concern was not representative. These statements highlight key acceptance issues of data privacy, need for enhanced reliability of instrumentation and usability appropriate to cohort. These three issues will remain core to the future acceptance of RVT.

CONCLUSIONS

A total of 97 patients who used RVT technologies and 49 of their informal carers responded to questionnaires. They provided feedback on how the solutions supported self-care, management and empowerment. There was support across the long-term conditions and across the different types of technology. No significant differences of opinion were found between different technologies or where different peripheral devices were used. Patient and carer participants were supportive of the use of technology. Patients gave a score of 3.5 (4 strongly agree, 3 agree) to the question: 'Has helped me manage my own condition and become involved in my healthcare'. We interpret this as a proxy for patient empowerment.

In addition to the quantitative analysis, qualitative feedback from participants indicated: ability to live more freely, being in control of their condition, being less anxious and given peace of mind. Of note, while some apprehension was expressed by the patients when first asked by their practitioners to use RVT, the ease of use and general reliability of technology was demonstrated. A feeling of being better connected to their practitioners through technology was expressed. This was counter-intuitive, given the fear of many practitioners, at the introduction of RVT, of detachment from their patients, as articulated in one-to-one interviews.

Patients were empowered to better manage their own conditions in a home environment supported by technology connection with their healthcare practitioners. The participation rate of 35% is appropriate for this survey approach. A weakness is that the respondents may have been more supportive of the intervention than those who did not respond. However, if 35% of people with long-term conditions could successfully adopt RVT for management and the approach was adopted by their clinicians, then enhanced service delivery is possible. Indeed, as the population ages and long-term conditions become more prevalent, RVT could provide the transformation suggested by Bengoa's milestone report into Health and Social Care in Northern Ireland.[13] In page 7, the report suggested that 'to make services higher quality and sustainable, radical transformation is required'. Undoubtedly RVT has a future role if issues with user acceptance are addressed.

Twitter W George Kernohan @ProfessorPlay

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Contributors J-AW is the main author. The work forms part of her PhD research study. PJM is a supervisor of this work and has contributed to the research direction and manuscript authoring. WGK is a supervisor of this work and has contributed to the research direction and manuscript authoring.

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Competing interests None declared.

Patient consent for publication Not required.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available on reasonable request. The data have been anonymised and are available upon reasonable request and by permission of South Eastern Trust research Governance.

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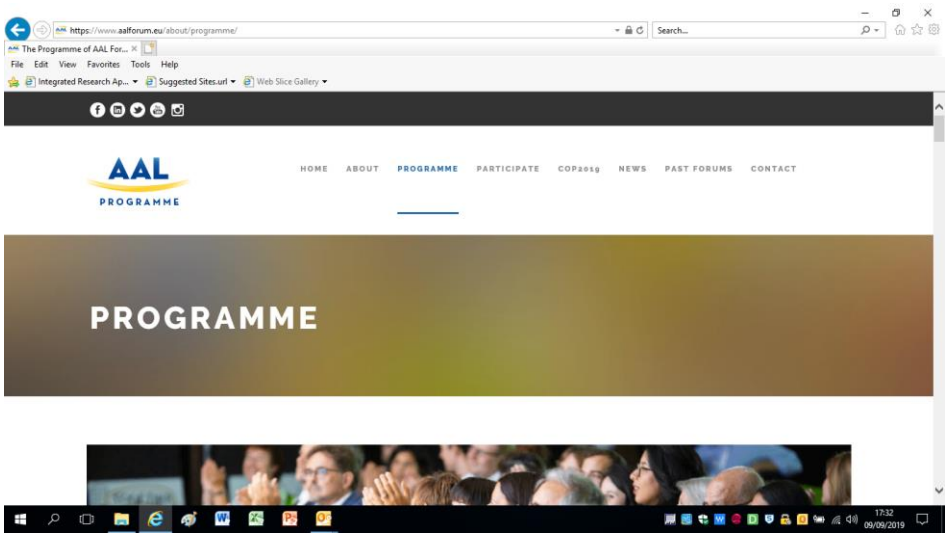
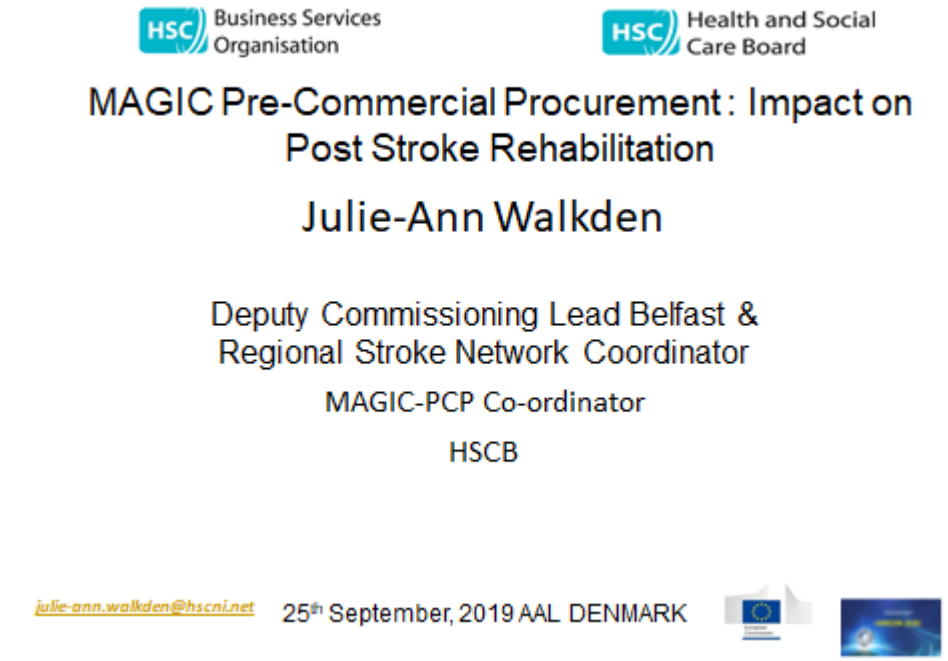
10.40 Enterprise Ireland Horizon 2020 Science/ Industry/ Society Champions of EU Research awarded by John Halligan TD, Minister of State for Training, Skills, Innovation, Research and Development

10.41 Four International Presentations made by J-A Walkden which included the concepts of co-creation with clinicians, collaboration with patients and technology empowering patients

Denmark September 2019, Finland June 2019, Romania March 2019 & Austria October 2018





KUOPIO STROKE SYMPOSIUM | JUNE 5–7, 2019

Perjantai, 7.6. / Friday June 7 (in Finnish except the three first talks)
Digitaaliset sovellukset AVH-kuntoutuksessa - *VetreaNeuronin tukema*
Puheenjohtaja/Chair: Kauko Pitkänen, VetreaNeuron, Kuopio

09:00-9:45	**The impact of health environment on post-stroke recovery** Julie Bernhardt, The Florey Institute of Neuroscience and Mental Health, Melbourne, Australia
09:45-10:15	**Virtual reality and gaming in stroke rehabilitation** Jane Burridge, Professor of Restorative Neuroscience, School of Health Sciences, Faculty of Environmental and Life Sciences, University of Southampton
10:15-10:45	***Kahvitauko ja näyttely / Coffee and exhibition***
10:45-11:15	**MAGIC project** Julie-Ann Walkden, Business Services Organisation (BSO), Belfast, Ireland

3 (5) Updated 30.4.2019

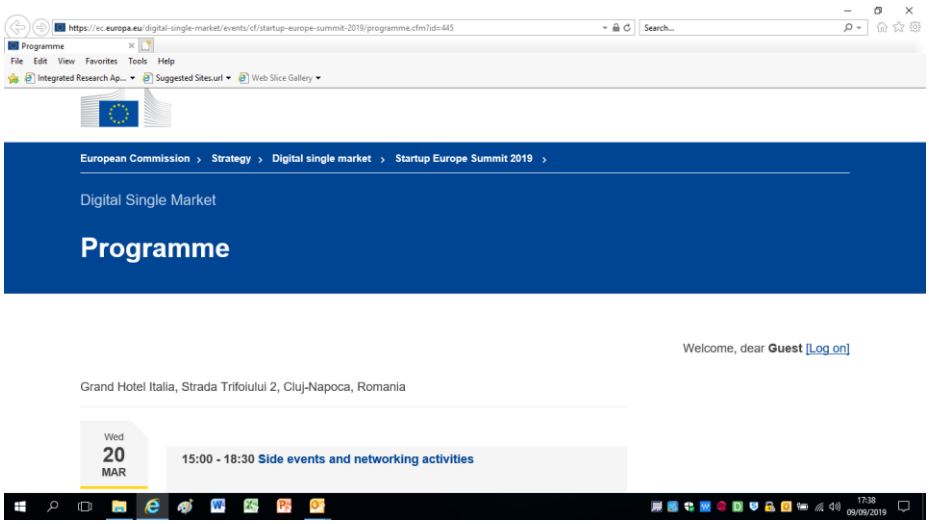
HSC Business Services Organisation | HSC Health and Social Care Board | HSC Belfast Health and Social Care Trust

MAGIC Pre-Commercial Procurement: Impact on Post Stroke Rehabilitation

Julie-Ann Walkden
Deputy Commissioning Lead Belfast & Regional Stroke Network Coordinator
MAGIC-PCP Co-ordinator
HSCB
julie-ann.walkden@hscni.net

Nicola Moran
Clinical Physiotherapist Specialist in Stroke Belfast Trust
Nicola.moran@belfasttrust.hscni.net

7th June, 2019 KUOPIO


https://ec.europa.eu/digital-single-market/events/cf/startup-europe-summit-2019/programme.cfm?id=445
Programme
File Edit View Favorites Tools Help
European Commission › Strategy › Digital single market › Startup Europe Summit 2019 ›
Digital Single Market
Programme
Welcome, dear Guest [Log on]
Grand Hotel Italia, Strada Trifoiului 2, Cluj-Napoca, Romania
Wed
20
MAR
15:00 - 18:30 Side events and networking activities


HSC Business Services Organisation
MAGIC Pre-Commercial Procurement : Impact on the market
Julie-Ann Walkden
Small Business Research Initiative Executive Business Services Organisation
Belfast
MAGIC-PCP Co-ordinator
22nd March 2019
julie-ann.walkden@hscni.net
EUROPEAN COMMISSION
DG Communications Networks, Startup Europe Summit 2019

Federal Ministry Republic of Austria Digital and Economic Affairs
Federal Ministry Republic of Austria Transport, Innovation and Technology
Federal Ministry Republic of Austria Sustainability and Tourism
e u 2018 · a t

Programme
ECOVATION 2018

Innovation and Sustainability
in Public Procurement
26th and 27th November 2018

IÖB naBe ecoinnovation

HSC Business Services Organisation

Innovation Procurement in Health and Active Ageing – Our Experience!

Julie-Ann Walkden

Small Business Research Initiative Executive
Business Services Organisation
Belfast
MAGIC-PCP Co-ordinator

27th November 2018

julie-ann.walkden@hscni.net

EUROPEAN COMMISSION
DG Communications Networks, Content and Technology Sustainable and Secure Society - **Health and Well-being**

magic

- Mobile Assistance for Groups & Individuals within the Community – Stroke Rehabilitation

- Horizon 2020 - PHC-27 PCP call – "Self-Management of Health & Disease & Patient Empowerment Supported by ICT"

http://magic-pcp.eu

This Project has received funding from the *European Union's Horizon 2020 Research and Innovation Programme* under grant agreement No 687228

European Commission

HSC Business Services Organisation

magic

Mobile Assistance for Groups Individuals within the Community - STROKE REHABILITATION cod. 687228 - H2020-PHC-2015 – http://magic-pcp.eu/

What is MAGIC?

MAGIC – Mobile Assistance for Groups & Individuals in the Community.

MAGIC is a European wide Pre-Commercial Procurement (PCP) focused upon creating innovative technology;

Transforming services for people post stroke to improve physical function and personal independence

Buyers Group

HSC Business Services Organisation | HSC Health and Social Care Board | HSC Public Health Agency | UHA | A.S.L. TO3 | U

Project support

Northern Ireland | DCU

Observer states

Oxalidatus | LUXINNOVATION | Agencia de Qualitat i Avaluació Sanitàries de Catalunya

HSC Business Services Organisation

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Mobile Assistance for Groups Individuals within the Community - STROKE REHABILITATION

http://magic-pco.eu/

What impact does MAGIC aim to achieve?

Buyers Group

HSC Business Services Organisation | HSC Health and Social Care Board | HSC Public Health Agency | UHA | A.S.L. TO3

Project support

DCU

Observer states

HSC Business Services Organisation

magic

Mobile Assistance for Groups Individuals within the Community - STROKE REHABILITATION

http://magic-pco.eu/

How will MAGIC achieve this?

Buyers Group

HSC Business Services Organisation | HSC Health and Social Care Board | HSC Public Health Agency | UHA | A.S.L. TO3

Project support

DCU

Observer states

APPENDIX 13 NON-PEER REVIEWED

10.42 None Peer-Reviewed Reports from Literature Review

In 2016 the BBC reported upon the comments of England's Chief Nurse, raising public alternatives to acute care. Whilst the linkages between expert opinion and advice were tenuous, they were plausible and the scope for comment could be extended to Remote Vital Sign Telemonitoring. The report was relevant as it encouraged care at home and by inference that should enable care to be delivered at home as an alternative

> "… means changing outdated models of care so that patients don't fall into cracks between different parts of the system and ensuring that we provide care based around their needs, and not those of NHS organisations,"

a sentiment that is not only echoed in local Northern Ireland strategic policy, Bengoa (2016), but will be evident in the narrative of the SET practitioners opinions.

The science reporter for the BBC, Gallagher (2017) reported how the smartphone 'orders' diabetes treatment. The report highlighted the findings of a trial whereby mice received implantable technology utilising optogenetic cells designed to respond to red LED light, controlled by a smartphone to generate drugs e.g. insulin. There is little scope beyond extending the boundaries of RVT and the results indicate the possibilities of monitoring to truly explore and afford liberation to patients in the future through personalised RVT and smartphones.