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An exploration of ehealth and digital literacy in pharmacy practice

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A thesis submitted in partial fulfilment of the requirements of Robert Gordon University for the degree of Doctor of Philosophy

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'A rationalist is simply someone for whom it is more important to learn than to be proved right; someone who is willing to learn from others – not by simply taking over another's opinions but by gladly allowing others to criticise his ideas and by criticising the ideas of others'

Karl Popper, philosopher
(1902-1994)

ABSTRACT

The aim of this research programme was to explore ehealth technology in pharmacy practice in Scotland and, by doing so, contribute original knowledge to this area. Strategists worldwide believe technology has the potential to promote quality, safety and efficiency in healthcare. This has been reflected in national ehealth policies designed to support collaborative working between medical and non-medical healthcare practitioners and, more recently, the whole health and social care team.

A meta-narrative systematic review was conducted to explore and contextualise research related to healthcare professionals' views of the adoption of ehealth technologies to support shared care. Findings indicate the importance of organisational development and training for core and optional ehealth services with pharmacists particularly under-represented in ehealth research.

Socio-technical systems theory and the computer supported cooperative working framework were adopted to explore healthcare practitioners' perceptions of ehealth in relation to integrated care. Findings from the review indicate ehealth research continues to focus on doctors and nurses. No ehealth application was perceived to be an unqualified success with the socio-technical gap still evident.

Multiple case studies were conducted to develop explanatory theory around the digital literacy experiences, education and training related needs of pharmacy staff in the NHS Grampian area. Digital literacy levels were self-reported as basic with mixed views on the need for formal education and training. Findings indicate organisational and social factors may act as restraining forces against implementation of technology in pharmacy and associated digital literacy training.

A final theory testing, systematic review was conducted into digital literacy training experiences of pharmacy staff applying Kirkpatrick's four level model. It found a lack of evidence of specific, measurable digital literacy levels but indications that suggest digital literacy should be included in pharmacy education at all levels and career stages.

This research provides novel insight into ehealth and digital literacy in pharmacy practice. Combined ehealth, education and pharmacy research has been demonstrated to be an under-researched area therefore these findings contribute original knowledge.

Keywords: pharmacy practice, ehealth, digital literacy, systematic review, case study, shared care, integrated care

Acknowledgements

Where to begin when there are so many to mention? I was asked if I would consider doing a PhD six years ago during the interview for my current research post, so the first thank you must go to Dr Scott Cunningham for planting the possibility. The inspiration for my study grew from the enthusiasm of the Chief Pharmacist for Scotland, Professor Bill Scott, for the Chronic Medication Service (CMS). It was after his talk at RGU that I broached the idea of a PhD tracking the implementation of CMS with my then line manager, Dr Dorothy McCaig, who tried to put me off. I know she'll be pleased that I've survived the journey, and she was right; everyone should be challenged at the start to consider what they are taking on and why they want to do a PhD. I will always be grateful to Professor Derek Stewart and Professor Alison Strath for guiding, encouraging and supervising me throughout the journey but more on them later.

The funding for my research post and PhD was provided by NHS Education for Scotland to whom I am most grateful. I am also grateful to the School of Pharmacy & Life Sciences at RGU for the opportunity as a member of staff to do a part-time PhD and for their continued support.

My first attempts at writing the research proposal were not very good at all, indeed Dr Stuart Cruickshank, who had only come in to use the office kettle, did a quick peer review then told me it was '*a load of techno-babble.'* He was right too. Many colleagues have been helpful along the way with either personal support or expert opinion or both. I would particularly thank Ranjit Barry, Alyson Brown, Sheila Wilson, Dr Barbara McKenzie, Dr Ruth Edwards, Andrea MacMillan, Dr Rachel Knott, Dr Anita Weidmann, Dr Andrew Lamb, Professor Don Cairns, Sarah Buchan, Dr Vibhu Paudyal, Dr Arthur Stewart and, lastly, Brian Addison, who agreed to take on an advisory role. A colleague who played a significant unofficial role in my PhD, and is sorely missed by many following his untimely death, is Dr Yashodharan Kumarasamy. I can but thank Yash for his kindness, calmness and breadth of knowledge and wish he was still with us.

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pharmacies enough for the privilege of spending time with them, thank you all for sharing your stories. I am full of admiration for the work you do.
This PhD would not have been possible without Professor Derek Stewart and Professor Alison Strath, so thank you just doesn't seem enough. Alison has been supportive throughout the four years and proved to be a trusted and friendly Supervisor, always looking after my best interests and waving that magic wand when needed, despite our footballing differences, so I could focus on getting the job done. It is difficult to imagine a better Principal Supervisor than Derek. He was generous in sharing his expertise, his experience, his time, always available, always reliable and able to see simple ways to cut through complexity when the task at times seemed overwhelming. Derek's attention to detail, organisation and forward planning combined with approachability and openness to new ideas has made this PhD achievable and, hopefully, the best it can be. The legacy of having a little voice in my head, asking, '*what would Derek say?*' is a small price to pay. He would also want me to say it was fun (which it was).
In writing this before the *viva voce*, it seems presumptuous to say thank you to the examination team but I must express my appreciation for your considerable commitment of time in reviewing my thesis and in giving me the opportunity to defend it, many thanks in advance.
Finally, I am looking forward to catching up with family and friends who I have neglected even more than usual these last few months. Special mention must go to my three sons, my mum, Audrey and my other closest friends, who have helped me through some very tough times.

'Our prime purpose in this life is to help others.
And if you can't help them, at least don't hurt them'
Dalai Lama

Dedicated to those I have loved and lost and those who have stood by me

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Most especially to
my amazing sons,
Andrew, Calum and Rory,
of whom I am
immensely proud

External outputs

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1. **MacLure K**, Stewart D, McHattie L, Strath A (2011) A systematic review of the impact of technology on shared care: why not ask your Pharmacist? Royal Pharmaceutical Society conference (London, poster presentation) *International Journal of Pharmacy Practice*;19(S2):98-99

2. **MacLure K**, Stewart D (2011) So, what have the Romans (or digital technology) ever done for us? Exploring non-medical prescribers' technology training experiences. *Non-Medical Prescribing conference* (Robert Gordon University, Aberdeen, workshop)

3. **MacLure K,** Stewart D, Strath A (2013) Exploring practitioners' perceptions of ehealth in relation to integrated care. *PROSPERO2013:CRD42013003844.* Available from: http://www.crd.york.ac.uk/PROSPERO_REBRANDING/display_record.asp?ID=CRD42013003844

4. **MacLure K**, Stewart D, Strath A (2013) A systematic review of perceptions of eHealth and shared care. *European Association of Hospital Pharmacists conference* (Paris, poster)

5. **MacLure K**, Stewart D, Strath A (2013) Pharmacy in the north east of Scotland: lessons in digital literacy. *Higher Education Academy STEM conference* (Birmingham, oral)

6. **MacLure K**, Stewart D, Strath A (2013) Community pharmacy in Grampian: a case for lessons in digital literacy? *Health Services Research and Pharmacy Practice conference* (Preston, poster)

7. **MacLure K**, Stewart D, Strath A, Kumarasamy Y (2013) Pharmacy staff's digital literacy training experiences and needs: a systematic review protocol. *PROSPERO 2013:CRD42013005503* Available from: http://www.crd.york.ac.uk/PROSPERO/display_record.asp?ID=CRD42013005503

8. **MacLure K**, Stewart D, Strath A (2013) Pharmacy practice in the North East of Scotland: a case study of digital literacy. Royal Pharmaceutical Society conference (Birmingham, poster presentation) *International Journal of Pharmacy Practice;*21(S2):68-69

9. **MacLure K**, Stewart D, Strath A (2013) Pharmacy practice in Grampian: a case study of digital literacy. *Health Informatics Scotland conference* (Edinburgh, poster with oral presentation)

10. Paudyal V, **MacLure K**, Stewart D (2013) Developing a systematic review protocol: an insight into processes, methods and guidelines. *European Society of Clinical Pharmacy conference* (Prague, workshop)

11. **MacLure K**, Stewart D, Strath A (2013) Pharmacy practice in the North East of Scotland: a case study of digital literacy. *European Society of Clinical Pharmacy conference* (Prague, poster)

12. **MacLure K**, Stewart D, Strath A (2014) A systematic review of medical and non-medical practitioners' views of the impact of ehealth on shared care. *European Journal of Hospital Pharmacy*;21:54–62

13. **MacLure K**, Stewart D, Strath A (April 2014). Mind the gap: multi-disciplinary team perceptions of ehealth in relation to integrated care. *Health Services Research and Pharmacy Practice conference* (Aberdeen, oral)

Forthcoming publications with additional papers and abstracts in preparation:

- **MacLure K**, Strath A, Stewart D (2014). A systematic review exploring healthcare practitioners' perceptions of ehealth in relation to integrated care (under review)

- **MacLure K**, Strath A, Stewart D (2014). A systematic review of the digital literacy training experiences and needs of pharmacy staff (under review)

FOREWORD

My most frequently spoken, almost confessional, introductory words to anyone at work these last five and a half years as a non-medical prescribing research assistant have been, *'I'm not a pharmacist!'* Nevertheless, this thesis describes my pharmacy practice based doctoral research, conducted part time over four years, from the perspective of my computing and information technology comfort zone.

Borne out of a long held curiosity about how people learn to use technology and, some would say an addiction to lifelong learning, the opportunity to embark on a PhD was a privilege for which I will always be grateful. Even as a late starter, I somehow managed to be the first in my family to complete a degree, with first class honours, to which a Masters with distinction was soon added. With the next generation fast gaining ground educationally, it was important for me personally, and for academic career development, to complete this doctoral level thesis.

The peaks and troughs reflective of all project work were personally challenging but who can really complain about being let loose with the opportunities that research presents? Nearly thirty years after taking up my first lectureship in computing, I've continued to gain valuable teaching experience from sharing my own learning experiences of research governance, project management, qualitative research and systematic review methods with undergraduate, post graduate and fellow doctoral students. A role I look forward to continuing as part of my research post.

This thesis provides comprehensive coverage of the inspiration for, and all stages of, the research conducted part time over four years in four phases. It includes the full project life cycle from background, aims and objectives, research philosophy through to details of each of the four phases before drawing the threads of the story back together in the discussion of the overall research contribution, conclusions and plans for future research.

Chapter 1 sets the scene. It describes the general background to healthcare and pharmacy practice in Scotland, the political, professional and technological influences on the evolution of the research programme, before setting out the aims and objectives of each of the four phases.

Chapter 2 explores the philosophical and methodological underpinnings of research. It describes the options, choices and influences, the range of approaches and strategies of inquiry, the scientific community's and researcher's worldview, and the methods appropriate to enable and facilitate the research design in answering the research questions.

Chapter 3 (Phase I) explores medical and non-medical practitioners' views of ehealth and shared care through a systematic review. A meta-narrative approach was adopted with the results intended to contextualise, inform and focus the design of subsequent research phases.

Chapter 4 (Phase II) explores healthcare practitioners' perceptions of ehealth supported integrated care. A systematic review was conducted using socio-technical systems theory and the computer supported cooperative working framework.

Chapter 5 (Phase III) builds explanatory theory of how pharmacy staff use, and learn to use, technology. Multiple case studies were conducted to explain the digital literacy experiences, education and training related needs of pharmacy staff in the local health board area using aspects of education theory and change management theory.

Chapter 6 (Phase IV) explores the digital literacy training experiences and needs of pharmacy staff. A systematic review was conducted as a form of theory testing using Kirkpatrick's four level model of training evaluation as an analytical framework.

Chapter 7 pulls the threads of the story together for discussion of the overall research aims and objectives, key findings, strengths and limitations. The original research contribution is discussed in terms of potential pathways to impact, conclusions and outlines further work which is already underway or planned.

Abbreviations

AACP	American Association of Colleges of Pharmacy
ACPE	Accreditation Council for Pharmacy Education
AHP	Allied Health Professional
AMIA	American Medical Informatics Association
AMRC	Academy of Medical Royal Colleges
AMS	Acute Medication Service
AQHR	American Quality in Health Research
ASHP	American Society of Health-Systems Pharmacists
BCS	British Computer Society
CASP	Critical Appraisal Skills Programme
CD	Controlled Drug
CHI	Community Health Index
CIAP	Clinical Information Access Program
CMS	Chronic Medication Service
CP	Community Pharmacy
CPD	Continuing Professional Development
CPOE	Computerised Physician Order Entry
CPPE	Centre for Postgraduate Pharmacy Education
CPS	Community Pharmacy Scotland
CPWS	Centre for Pharmacy Workforce Studies
CRD	Centre for Reviews and Dissemination
CSCW	Computer Supported Cooperative Working
DA	Dispensing Assistant
DARE	Database of Reviews of Effectiveness
DCRS	Detailed Care Record System
DPA	Data Protection Act 1998
EBM	Evidence Based Medicine
ECDL	European Computer Driving Licence
ECIS	European Community Information Society

ECS	Emergency Care Summary
EDIS	Emergency Department Information System
eDS	electronic Discharge System
eHealth	electronic Health
eMessage	electronic Message
ePharmacy	electronic Pharmacy
ePMS	electronic Pharmacy Message Store
EPOC	Effective Practice and Organisation of Care
ePrescribing	electronic Prescribing
EPSRC	Engineering and Physical Sciences Research Council
ETP	Electronic Transfer of Prescriptions
GPhC	General Pharmaceutical Council
GRADE	Grading of Recommendations, Assessments, Developments and Evaluation
HCI	Human Computer Interaction
HEPMA	Hospital Electronic Prescribing and Medicines Administration
ICT	Information and Communication Technology
iDL	instant Discharge Letter
IMIA	International Medical Informatics Association
IOM	Institute of Medicine
ISD	Information Services Division
IT	Information Technology
JBI	Joanna-Briggs Institute
KIS	Key Information Summary
KSF	Knowledge Skills Framework
MAS	Minor Ailment Service
MCA	Medicines Counter Assistant
MDS	Monitored Dosage System
MPharm	Master of Pharmacy degree
MR	Medicines Reconciliation
MRC	Medicines Research Council
N3	National Network for the NHS
NES	NHS Education for Scotland
NHS	National Health Service

NMP	Non-Medical Prescriber
NPA	National Pharmacy Association
NRES	National Research Ethics Service
NRT	Nicotine Replacement Therapy
NSS	National Services Scotland
OECD	Organisation for Economic Cooperation and Development
ORDIT	Organisational Requirements for the Determination of IT
OTC	Over The Counter
PCR	Pharmacy Care Record
PICOS	Population Intervention Comparator Outcome Study Design
PIS	Patient Information System
PMS	Patient (or Pharmacy) Management System
PSD	Practitioner Services Division
PT	Pharmacy Technician
QOF	Quality Outcomes Framework
RCGP	Royal College of General Practitioners
RCUK	Research Councils UK
RGU	Robert Gordon University, Aberdeen
RPS	Royal Pharmaceutical Society
Rx	Prescription
SCR	Summary Care Record
SIMD	Scottish Index of Multiple Deprivation
STS	Socio-Technical Systems
UK	United Kingdom
UNESCO	United Nations Educational Scientific and Cultural Organisation
UPN	Unique Prescription Number
WHO	World Health Organisation

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CHAPTER 1 Introduction to the thesis and the research area

'What peculiar privilege has this little agitation of the brain which we call thought, that we must thus make it the model of the whole universe? Our partiality in our own favour does indeed present it on all occasions; but sound philosophy ought carefully to guard against so natural an illusion'

David Hume, philosopher, historian and economist (1711-1776)

Introduction to the chapter

This chapter sets the scene. It describes the research contribution and thesis structure, the general background to healthcare and pharmacy practice in Scotland, the political, professional and technological influences on the evolution of this research programme, before setting out the aims and objectives of each of the four phases.

Research contribution and thesis structure

From the outset, the aim of this research programme has been to explore ehealth and digital literacy in pharmacy practice in Scotland and, by doing so, contribute original knowledge to this area. My original contributions to knowledge are:

Phase I

- Evidence of medical and non-medical practitioners' views of the impact of ehealth on shared care remains limited, with pharmacists particularly under-represented in ehealth research
- Organisational development and training for core and optional ehealth services remain key in keeping people at the heart of integrated ehealth strategies across the UK

Phase II

- Healthcare practitioners do not perceive any ehealth application to be an unqualified success in supporting integrated care
- Ehealth research continues to focus on doctors and nurses despite the multi-disciplinary nature of increasingly integrated health and social care
- The social-technical gap is still evident within ehealth supported integrated care

Phase III

- Pharmacy staff in the NHS Grampian area perceive their own digital literacy to be at a basic level
- With few exceptions, pharmacy staff in the NHS Grampian area, work with minimum levels of technology and are trained to use those technologies informally by the pharmacist
- Organisational and social factors may act as restraining forces against technology in pharmacy and digital literacy training

Phase IV

- Although pharmacy staff are reliant on IT in their daily practice, there is a lack of evidence of their specific and measurable digital literacy levels, training experience and needs
- Digital literacy training should be formally recognised and incorporated in pharmacy training for all staff at all levels and all career stages

This thesis is presented in the traditional complex format with four main phases of research, each with original findings. An overall thesis wraparound '*IMRaD*' (introduction, methods, results and discussion) contains an IMRaD for each phase of the research before the final discussion of all findings and conclusions.

Healthcare in Scotland

Healthcare is a politically devolved matter within the United Kingdom (UK), with policy development and health service responsibility assumed by the parliament of each home nation (Centre for Parliamentary Studies 2011). Scotland has an estimated population of 5,295,403 (Audit Scotland 2012) with their healthcare provided by National Health Service (NHS) Scotland which aims to, *'deliver greater equality and improved health for all in Scotland'*(NHS Health Scotland 2012a). Scotland's population is concentrated in the central belt around the capital city, Edinburgh, and most populist city, Glasgow, while large areas of the country remain sparsely populated. This range of population density necessitates a wide variation of geographical coverage by each of 14 local NHS Boards, as shown in Figure 1.1, with further NHS Board population detail in Table 1.1 and a breakdown of age structure per NHS Board provided in Figure 1.2 for added context.

Table 1.1 Census day 2011 population by NHS Board area in Scotland. Data sourced from National Records Scotland (NRS) Available from: http://gro-scotland.gov.uk/statistics/theme/population/estimates/mid-year/2012/index.html [Accessed 15 January 2014]

NHS Board area	Population	NHS Board area	Population
Ayrshire & Arran	373,508	Highland	320,990
Borders	113,806	Lanarkshire	572,214
Dumfries & Galloway	151,227	Lothian	835,083
Fife	365,058	Orkney	21,342
Forth Valley	297,540	Shetland	23,159
Grampian	569,057	Tayside	409,947
Greater Glasgow & Clyde	1,214,804	Western Isles	27, 668

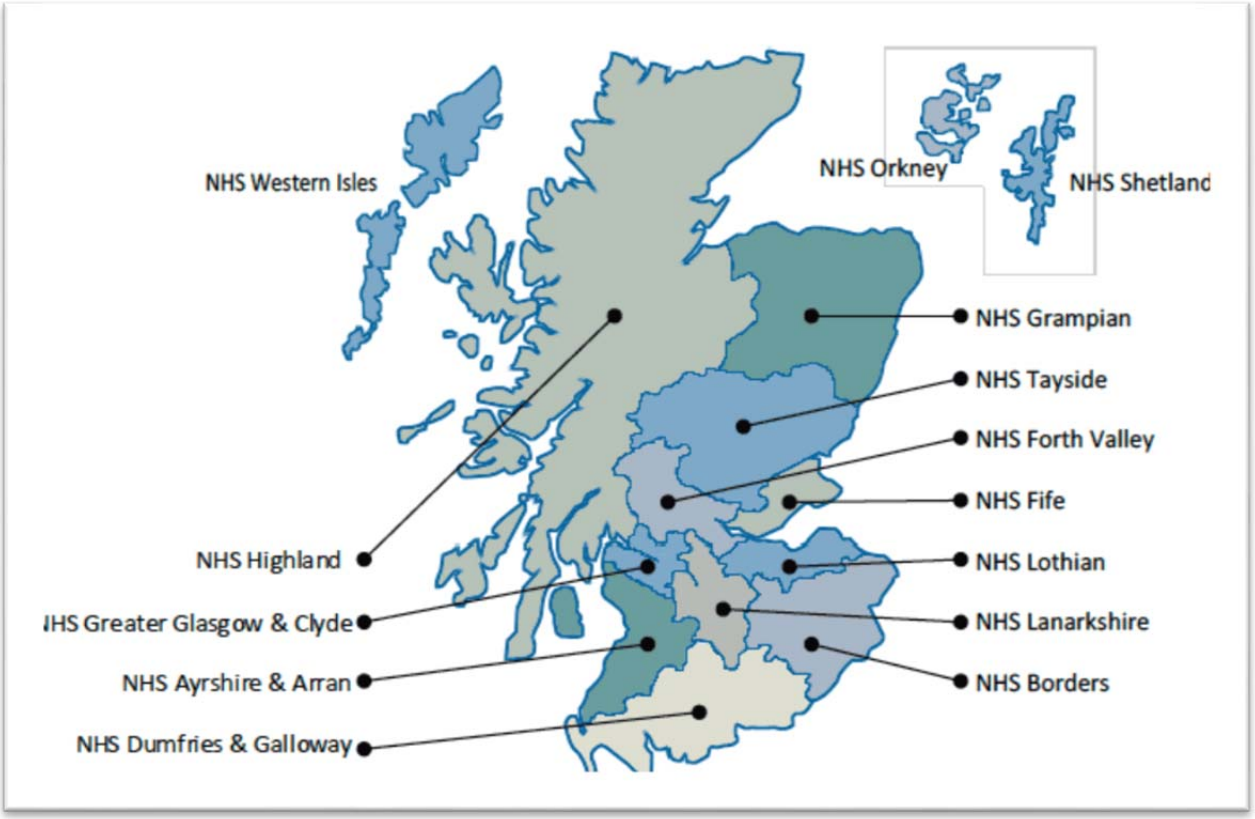

Figure 1.1 NHS Boards in Scotland. Reproduced under Open Government licence from Scottish Government website. Available from: http://www.scotland.gov.uk/Publications/2012/02/4403/2 [Accessed 15 January 2014]

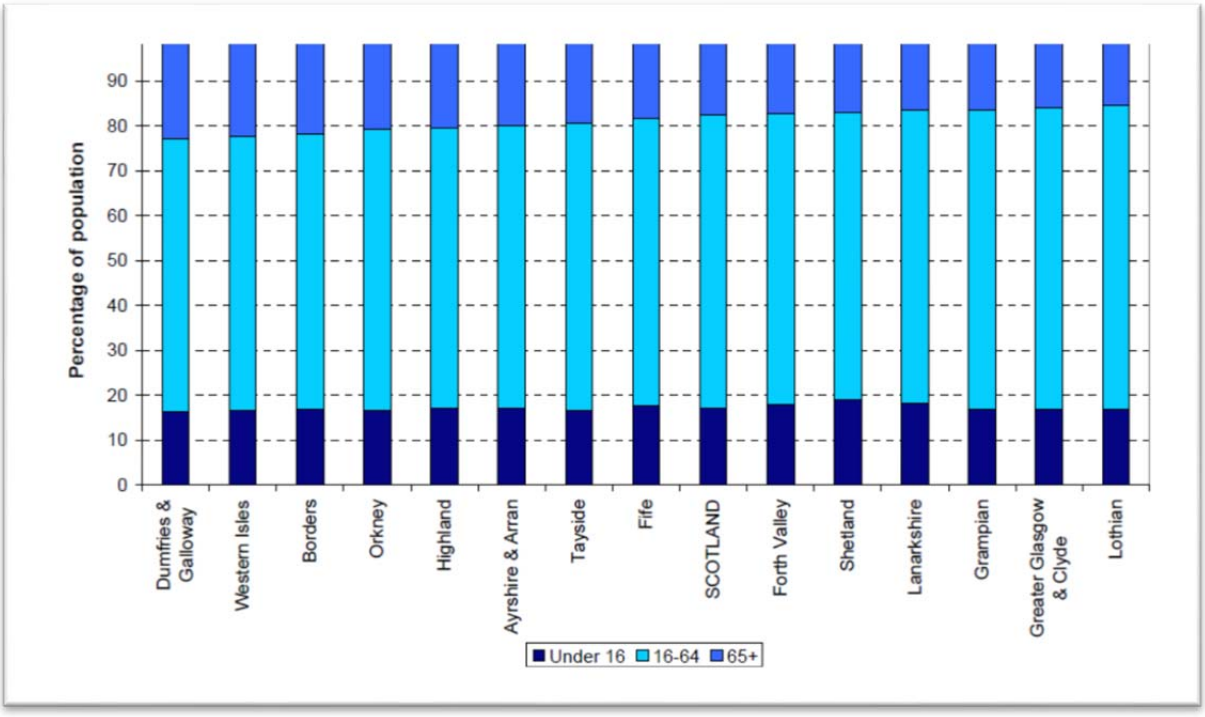

Figure 1.2 Age structure in Scotland of NHS Boards mid-2012. Reproduced under Open Government licence from National Records for Scotland *'Mid-2011 and Mid-2012 Population Estimates Scotland'* (2013). Available from: http://www.gro-scotland.gov.uk/statistics/theme/population/estimates/mid-year/2012/index.html [Accessed 15 January 2014]

The NHS Scotland Annual Report for 2012-13 (Scottish Government 2013c) focused on the, *'Route Map to the 2020 Vision for Health and Social Care'* (Figure 1.3) which included twelve priority areas designed to facilitate integrated delivery of health and social care (Figure 1.4), where possible, supporting patients at home while reducing hospital admissions and re-admissions.

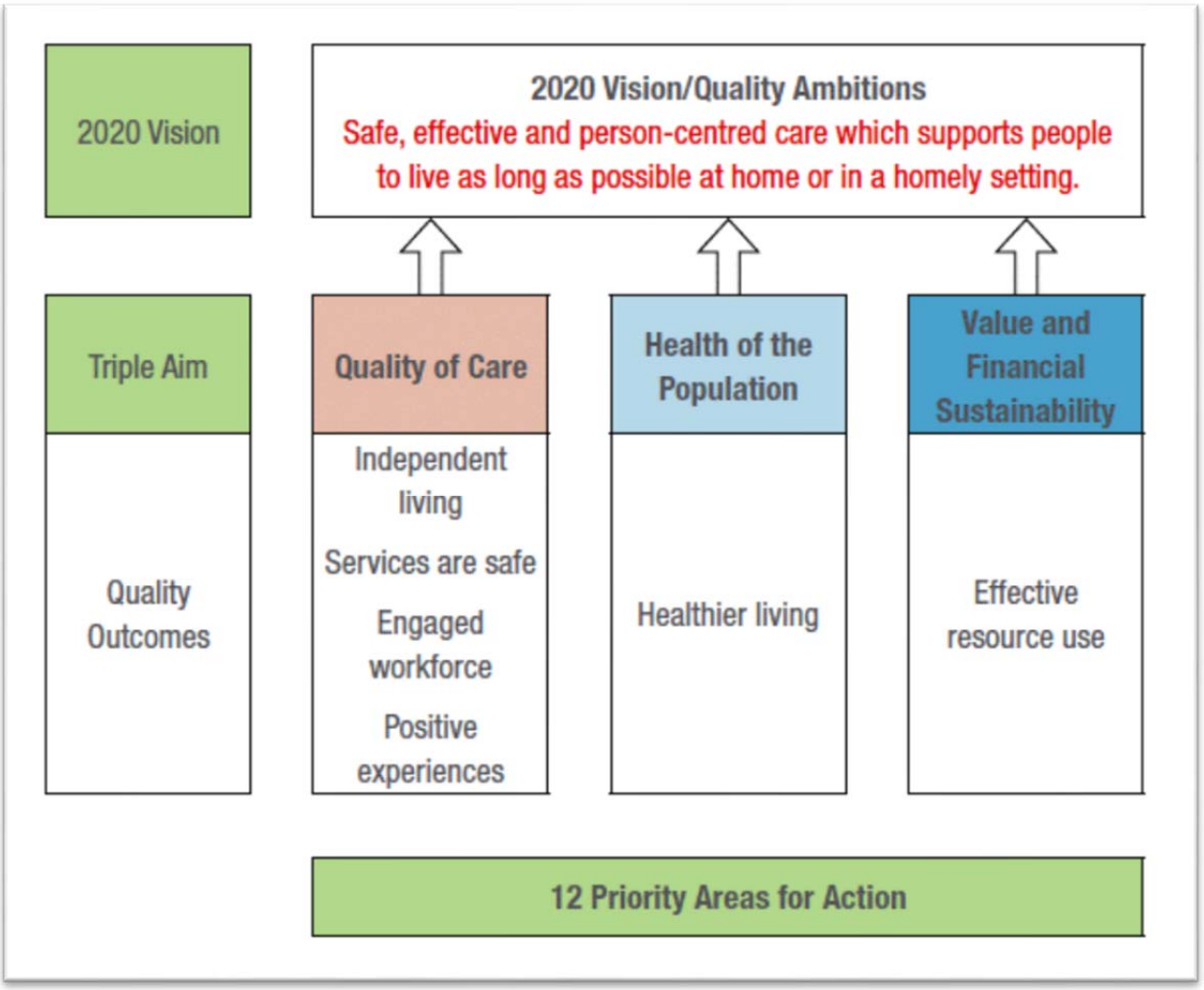

Figure 1.3 'Route Map to the 2020 Vision for Health and Social Care'. Reproduced under Open Government licence from the NHS Scotland Annual Report 2012-13 (Scottish Government 2013c)

Further improving the **quality of care** we provide with a particular focus on:

1. Increasing the role of primary care;
2. Integrating health and social care;
3. Accelerating our programme to improve safety in all healthcare environments;
4. Improving the way we deliver unscheduled and emergency care;
5. Person-centred health and care services; and
6. Improving our approach to supporting and treating people who have multiple and chronic illnesses.

Improving the **health of the population** with a particular focus on:

7. Early years;
8. Reducing health inequalities; and
9. Preventative measures on alcohol, tobacco, dental health, physical activity and early detection of cancer.

Securing the **value and financial sustainability** of the health and care services we provide by:

10. Establishing a vision for the health and social care workforce for 2020, and setting out a clear plan of actions which will have immediate effect;
11. Increasing our investment in new innovations which both increase quality of care and reduce costs, and simultaneously provide growth in the Scottish economy; and
12. Increasing efficiency and productivity through more effective use of unified approaches coupled with local solutions and decision-making where appropriate.

Sourced from: NHS Scotland Annual Report 2012-13, Scottish Government, Edinburgh 2013

Figure 1.4 Twelve priorities for further development under the *'Route Map for 2020 Vision for Health and Social Care'* (Scottish Government 2013a)

Pharmacy regulation and professional leadership in Scotland

The independent regulatory authority for pharmacists, pharmacy technicians, their education providers and courses, and pharmacy premises in Scotland, England and Wales, is the General Pharmaceutical Council (GPhC). The GPhC maintains registers of pharmacists, pharmacy technicians and pharmacy premises licenced to practice with searchable (restricted) information in the public domain. As recently as 2010, these roles were fulfilled by the Royal Pharmaceutical Society for Great Britain (RPSGB), restructured as the Royal Pharmaceutical Society (RPS), which now focuses on representing and promoting the professional body and facilitates networking through annual conferences and local practice forum events. The newly formed RPS Faculty provides a professional recognition programme to support and acknowledge a, *'pharmacist's development and progression post registration'*(RPS Faculty 2013). The Scottish Pharmacy Board is a committee elected to represent all sectors of pharmacy practice and provide advocacy services.

Pharmacy workforce in Scotland

The GPhC Annual Report 2013 (GPhC 2013) showed registrant numbers at 4,266 pharmacists and 2,030 pharmacy technicians working in 1,400 pharmacy premises (not including hospital settings) across Scotland. A demographic analysis of the pharmacy workforce in Scotland is unavailable in the GPhC report but figures for Great Britain (Centre for Pharmacy Workforce Studies 2011) indicate pharmacists are predominantly female (59.4%) with the modal age group for both sexes of 30-39 years. Pharmacy technicians are almost exclusively female (90.2%) with a modal age group of 40-49 years. The majority of pharmacists and pharmacy technicians are based in the community (71.0%; 67.4%) or hospital (21.4%; 21.2%) sector with the remainder in primary care (7.2%; 8.4%), industry (4.1%; 0.8%), academia (2.8%; 1.5%) or other (3.8%; 3.2%).

Community and hospital pharmacies

In Scotland, community and hospital pharmacies are sited in rural or urban settings with a diverse level of technology implemented, from the minimum required broadband connected computer through to advanced robotic technologies. Hospitals are managed by one of 14 NHS local Health Boards. Community pharmacies, owned and operated as small independents, medium or large independent multiples through to large chain multiples, are contracted by NHS Boards to offer a range of core services.

Community pharmacy core services

There are four core services which NHS contracted community pharmacies must provide: Public Health, Minor Ailment, Acute Medication and Chronic Medication Services (Scottish Executive 2002). The Minor Ailment Service (MAS) was implemented in 2006 to allow eligible, pharmacy registered patients to gain quicker, easier access to medicines and advice for, *'common, self-limiting conditions'* through their community pharmacy, potentially reducing GP appointments. The Acute Medication Service (AMS) followed in 2008 to provide, *'pharmaceutical care services for acute episodes of care.'* The AMS is based on the electronic transfer of prescriptions (ETP) between the GP and community pharmacist via an NHS hosted central messaging service. The Chronic Medication Service (CMS) is the final element to be introduced and is, in early

2014, soon to be fully operational. Also based around ETP, it allows, *'patients with long-term conditions to register with a community pharmacy of their choice for the provision of pharmaceutical care as part of a shared agreement between the patient, community pharmacist and General Practitioner'*(Scottish Government 2008). The pharmacist is required to implement, monitor and review the patient care plan, including an initial risk assessment within three months of registration, using the online pharmacy care record (PCR). CMS includes a, *'shared care element which allows a patient's GP to produce a 24 or 48 week serial prescription'* for dispensing by the pharmacist at appropriate intervals. The Annual Report from the Chief Executive for NHS Scotland 2012-13 notes that, despite delays in implementation, *'over 200,000 items have been dispensed through CMS'*(Scottish Government 2013c). Three of the four core services (MAS, AMS, CMS) in community pharmacy are reliant on information technology (IT) reflecting the growing trend toward technology supported health service delivery or ehealth.

Way ahead for the pharmacy workforce in Scotland

The way ahead for the pharmacy workforce is a central issue in the recent *'Review of NHS Pharmaceutical Care of Patients in the Community in Scotland'* (Wilson & Barber 2013). It recommended, *'developing and using the skills of the whole pharmacy team'* to inform and support the *'Prescription for Excellence'* (Scottish Government 2013e) with person-centred, pharmaceutical care to promote patient safety through personal development of pharmacy staff underpinned by technology, also described as ehealth. *'Prescription for Excellence'*(Scottish Government 2013e) has been welcomed by Community Pharmacy Scotland (CPS 2013) who were,

> *'encouraged that the Review is keen to promote closer working between health professionals, particularly GP surgeries and Pharmacies. We would welcome the opportunity for more, and cross-disciplinary, training opportunities for community pharmacy owners, their pharmacists and their staff.'*

eHealth definitions

Electronic health, or ehealth, is defined by the World Health Organisation (WHO) as, *'the combined use of information and communications technologies for health'* and further refined by the European Commission Information Society (ECIS) to include, *'tools and services for health'*(WHO 2011a; ECIS 2011). It is viewed as a key facilitator in helping medical practitioners, such as physicians or dentists, and non-medical practitioners, such as nurses and pharmacists, to work in partnership by improving communications (Robertson et al 2010; Goodwin et al 2011). eHealth applications, such as telemedicine, telecare, electronic health records, electronic prescribing and electronic discharge summaries, are forms of computer supported cooperative working (CSCW; Fitzpatrick & Ellingse 2012) designed to facilitate shared or integrated care (May et al 2005a; Mair et al 2007; Liddell et al 2008; Clark et al 2008; Gagnon et al 2009; Ludwick & Doucette 2009; Legare et al 2010; Dobrev et al 2010; Ahmed 2013).

International and national policies and strategies for ehealth

Health strategists worldwide promote the adoption of ehealth to support the provision of healthcare (WHO 2011b & 2012; European Commission 2011; OECD 2012). Global healthcare needs are changing (White et al 2013). Healthcare practitioners are challenged to meet that need effectively and efficiently by changing their approach to providing safe, effective care (WHO 2006; Meyer et al 2009; Ministry of Health, BC 2013; Scottish Government 2011d). Demographic trends in the developed world indicate ageing populations who expect to live well, independently and for longer, supported by local healthcare (WHO 2011c; Scottish Government 2013b). Providing healthcare for increasing numbers of people with obesity or long term conditions, such as cardiovascular disease, cancer and chronic obstructive pulmonary disease, places an additional burden on healthcare services which are already financially constrained (OECD 2012; Morgan & Astolfi 2013). Managing patients with combinations of conditions and treatments, multiple or co-morbidity and polypharmacy, is complex and logistically challenging (Guthrie et al 2012; Barnett et al 2012; NHS Scotland 2012). Health strategists worldwide believe new technologies have a role to play in enabling healthcare practitioners to work together in providing patient care (WHO 2006 & 2011c; Darzi 2008; British Computer Society 2011; Naylor 2013; Christie Commission 2011).

Shared care

Shared care, described as cooperative, seamless or collaborative working between healthcare professionals, has long been viewed as both beneficial to patients and a more efficient use of health professionals' skills (Department of Health 1989; Hepler & Strand 1990; Nolan 1995). Research into ehealth and shared care has focused on the medical practitioners perspective either of the adoption of technology (Greenhalgh et al 2005; May et al 2005a & 2006; Rahimi & Vimarlund 2007; Liddell et al 2008; Clark et al 2008; Gagnon et al 2009) or specific ehealth applications (May et al 2005b; Mair et al 2007; Greenhalgh et al 2009 & 2010b; Ludwick & Doucette 2009; McGowan et al 2009; Robertson et al 2010; Dobrev et al 2009). More patient-centred studies have investigated the impact of ehealth on quality and safety of care (Car et al 2008; Black et al 2011) or confidentiality (Greenhalgh et al 2010c).

Integrated care

More recently, policy and strategy documents have tended towards the term '*integrated'* care. The European Commission piloted the 2008-2012 '*CommonWell services for Integrated eCare'* project (European Commission 2012) based in four sites across Europe. The UK has seen similar activity in preparation for the introduction of the *'Health and Social Care Bill*' in England (Department of Health 2013) and *'Integration of Adult Health and Social Care'* in Scotland (Scottish Government 2013b). The Royal College of General Practitioners (RCGP) launched an *'Integration of Care Consultation Paper'*(RCGP 2011) which was followed in 2013 by the Academy of Medical Royal Colleges *'i-care: Information, Communication and Technology in the NHS'*(AMRC 2013) In a joint statement issued by RPS and RCGP, the role of IT and training for continuity of collaborative healthcare was further emphasised (RCGP & RPS 2011). Integrated care for the benefit of patients has, according to Kodner and Spreeuwenberg (2002), the potential to arise from the integration of,

> *'a coherent set of methods and models on the funding, administrative, organisational, service delivery and clinical levels designed to create connectivity, alignment and collaboration within and between the cure and care sectors'*(Kodner & Spreeuwenberg 2002)

Their patient-centric definition involves cooperative working within and between multi-disciplinary healthcare teams to meet the needs of often vulnerable groups with ongoing and complex care needs, more recently described as, *'services that are planned and delivered seamlessly from the perspective of the patient'* (Scottish Government 2013b).

Adoption of ehealth to support healthcare

The WHO Global Observatory for eHealth tracks and benchmarks the ehealth policies of its 114 member states. In urging the adoption of, *'appropriate eHealth services*,' WHO's stated mission is to offer, *'strategic information and guidance on effective practices and standards in eHealth'*(WHO 2011c). Support through research is a major focus of the European Commission's eHealth Action Plan 2012-2020 (European Commission 2011) with current ehealth research funding streams aligned to promoting and developing the ehealth strategies of member states. In the United Kingdom, Lord Darzi's influential *'High Quality Care For All – NHS Next Stage Review'* (Darzi 2008) was welcomed beyond England's borders. In the report, he promoted greater use of technology in providing care closer to the patient's home; for patient, practitioner and cost benefits. Lord Darzi noted that, *'wealth and technology have changed the nature of our society's outlook and expectations.'* His observation that, *'improved technology is enabling patients that would once have been hospitalised to live fulfilling lives in the community, supported by their family doctor and multi-professional community teams,'* added support for the role of ehealth enabled pharmacy practice (Darzi 2008).

Strategic principles for IT in pharmacy

The *'Healthcare Quality Strategy for Scotland'* prioritises both workplace skills and job satisfaction in seeking to ensure that, *'everyone working in and with NHS Scotland is confident that they will be supported to do what they came in to the NHS to do, and that they are valued for doing that'*(Scottish Government 2010b). Following the joint statement issued by the RPS and RCGP (RPS & RCGP 2011), RPS published a set of IT strategic principles (RPS 2011), as listed in brief in Table 1.2, which stated that pharmacy IT systems should,

'support and develop pharmacy practice, enhance the pharmaceutical care of patients and should be aligned in a way that encourages future development of pharmacy services'(RPS 2011).

Table 1.2 Royal Pharmaceutical Society IT Strategic Principles (RPS 2011)

RPS Information Technology Strategic Principles	
Patient Care	▪ Pharmacy IT systems should provide for a robust and efficient system for the electronic transfer of prescriptions ▪ Pharmacists should have secure and responsible access to the electronic patient record ▪ Pharmacy IT systems should be developed with improving the care of patients as a priority ▪ Pharmacy IT system developments should enhance medicines safety ▪ Pharmacy IT systems should be adequately resourced in order to secure the future development of the pharmacy profession in the delivery of pharmaceutical care ▪ Pharmacy IT systems should not only produce an effective, efficient and safe dispensing and labelling record system but also provide for a sound clinical system that can be evidence based ▪ New developments in IT should support electronic prescribing by pharmacists
Education, Learning and Research	▪ IT should be used and developed to support the education and training of pharmacists ▪ Pharmacy education should ensure a basic standard of IT literacy which supports the development of pharmacy with further training supported and facilitated by pharmacy IT systems ▪ Pharmacy IT system developments should provide for the recording of evidence and research to support pharmacy practice
Bureaucracy, Accessibility and Extensibility	▪ IT developments should in principle be used to decrease the bureaucratic burdens and workforce pressures on pharmacists ▪ Pharmacists should have full access to the internet and web-based information systems in their daily practice ▪ Electronic automated processes and robotic dispensing systems should be used to improve medicines safety and reduce pharmacists' workload enabling more time for the delivery of pharmaceutical care in the pharmacy setting ▪ Interoperability should be a key 'built in' objective in the development of IT systems ▪ Pharmacy IT system developments should be responsive to the needs of the user and include a future proofing process to ensure the future needs of the user and the pharmacy profession are recognised and enabled
Information Governance	▪ Proper information governance is fundamental to the development of any pharmacy IT system and information process and patient information should be stored in a safe and secure manner to ensure patient confidentiality

ePharmacy Programme in Scotland

The Scottish Government ehealth policy features an epharmacy programme designed to, *'support the future delivery of the new community pharmacy contract and improve communications across the healthcare team'*(Scottish Government 2011a). As previously described, there are four core services which NHS contracted community pharmacies in Scotland are required to provide:

Public Health, Minor Ailment (MAS), Acute Medication (AMS) and Chronic Medication Services (CMS), with all except the first reliant on IT (Scottish Executive 2002 & 2005; CMS Advisory Group 2009).

A variety of computerised pharmacy management systems are implemented across community and hospital pharmacies aimed primarily at processing prescriptions (Scottish Government 2008b). Central to the national community pharmacy IT infrastructure (Figure 1.5) is the ePharmacy Message Store (ePMS). Connected via the secure national NHS network, called N3, patient data identified by their CHI (Community Health Index) number and unique prescription number (UPN) can be stored, matched and retrieved by pharmacies, GP practices and NHS National Services Scotland (NSS). The printed prescription (GP10) given to the patient by the prescriber, usually their GP, features a UPN barcode which, when scanned in the pharmacy, pulls the data from ePMS to populate the screen as an electronic transfer of prescription (ETP) on the pharmacy management system. There are varying levels of interface integration for the core services, pharmacy management system, medicines information and stock control in community pharmacy.

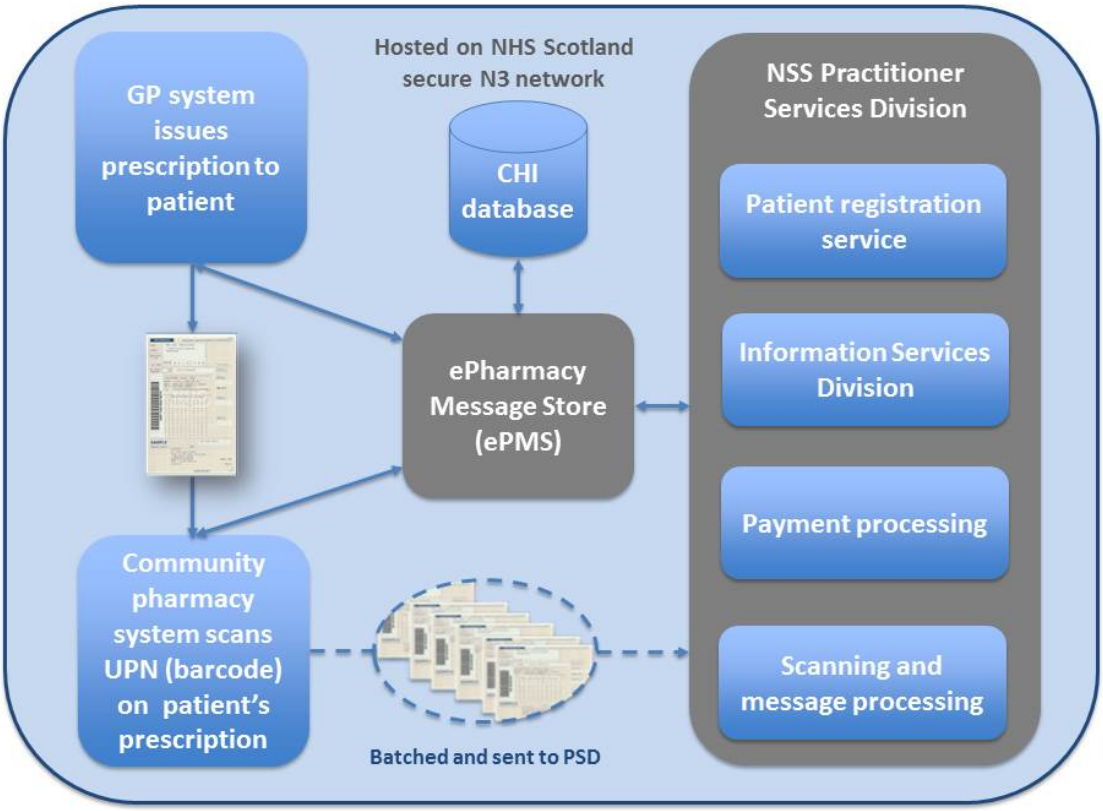

Figure 1.5 Adapted from ePharmacy Programme infrastructure (Scottish Government 2009a). Available from: http://www.scotland.gov.uk/Publications/2010/01/07144120/13

The recent *'Prescription for Excellence'* report (Scottish Government 2013e) found that in secondary care,

> *'Hospital Electronic Prescribing and Medicines Administration (HEPMA) and related electronic decision support has only been implemented in a very small number of acute hospitals, and in those cases not to its full potential.'*

A complex array of prescription formats are utilised in hospitals for out-patients, day patients, discharge and ward specific instructions, and for patients who are waiting to collect their dispensed medicines, being admitted to hospital without their regular medications, for collection by a ward, van delivery, or to be posted and more.

More generic IT systems may also be utilised in both community and hospital pharmacies such as management information systems or office applications for administrative purposes. A range of pharmacy specific support options for core services and continuing professional development (CPD) are available but these rarely focus on aspects of digital literacy, or how to use technology (RPS 2012; NES 2012).

The future for pharmacy in health and social care in Scotland

The future for Scottish pharmacy is focused on workforce development and integrated health and social care supported by technology. The Scottish Government recently announced a set of common values, agreed through consultation and consensus, for all health and social care staff. Published in the report *'Everyone Matters: 2020 Workforce Vision'* (Scottish Government 2013d), they include the commitment to:

- care and compassion
- dignity and respect
- openness, honesty and responsibility
- quality
- teamwork

The report also included a vision statement for all health and social care staff which stated that,

> *'We will respond to the needs of the people we care for, adapt to new, improved ways of working, and work seamlessly with colleagues and partner organisations. We will continue to modernise the way we work and* ***embrace technology****. We will do this in a way that lives up to our core values. Together, we will create a great place to work and deliver a high quality healthcare service which is among the best in the world'*(Scottish Government 2013d).

The call to *'embrace technology'* is aligned to the *'Second eHealth Strategy 2011-2017'*(Scottish Government 2011a) which included six key IT aims associated with both the *'Healthcare Quality Strategy for NHS Scotland'*(Scottish Government 2010b) and the McClelland *'Review of ICT infrastructure in the Public Sector'*(McClelland 2011):

- Improve safety for people taking medicines
- Maximise efficient working practices, minimise wasteful variation, bring savings and value for money
- Person-centred ehealth strategy
- Care integration and support for people with long term conditions
- Clinical portal (or electronic windows to information)
- ePharmacy programme

The *'NHS Scotland Annual Report for 2012-13'*(Scottish Government 2013c) noted the *'revolutionising'* impact of the ePharmacy Programme on Scottish healthcare with electronic transfer of prescriptions (ETP) currently enabled between 600 GP practices and 1000 community pharmacies, representing 60.3% and 71.4% respectively (ISD 2014). The vision outlined in *'A Prescription for Excellence'*(Scottish Government 2013e) presents further opportunities and challenges for the pharmacy profession in Scotland as their technology supported role continues to expand and integrate with other health and social care professionals (Figure 1.6).

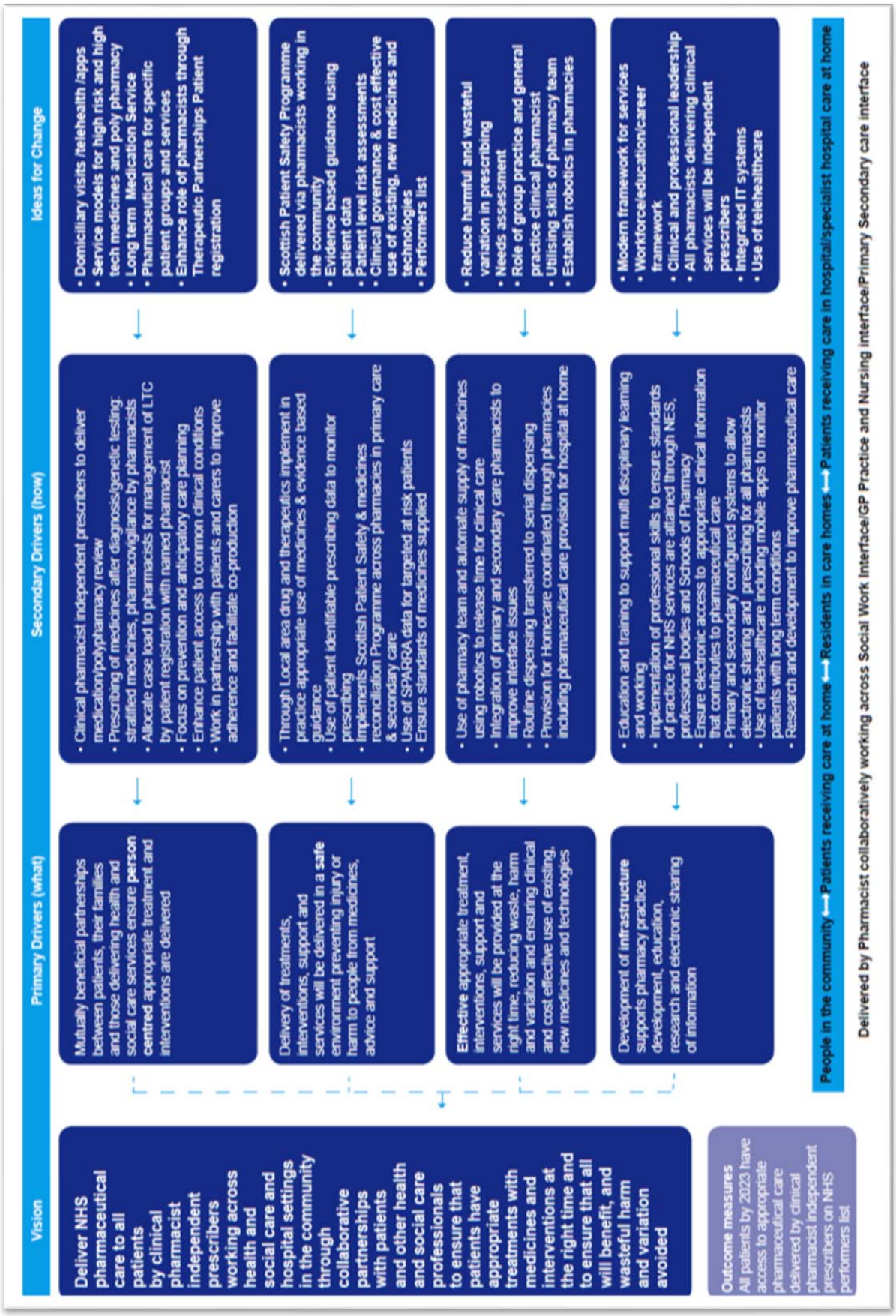

Figure 1.6 Vision for future NHS pharmaceutical care of patients in Scotland. Reproduced from *'Prescription for Excellence: a Vision and Action Plan'* under the Open Government Licence (Scottish Government 2013e)

Digital literacy in health and social care

The Scottish Government and NHS Scotland *envisage, 'making more and better use of technology and facilities to increase access to services and improve efficiency'* also promising to ensure that everyone working within the health and social care sector, *'is supported to make the best use of new technology'* (Scottish Government 2013a; NHS Health Scotland 2013). The *'RPS Strategic Principles for IT'* note that, *'pharmacy education should ensure a basic standard of IT literacy which supports the development of pharmacy'*(RPS 2011).
The abilities of pharmacy staff in using IT at home and at work, also known as digital literacy or digital competence or eskills, will vary depending on their personal experience and related education and training. The British Computer Society (BCS) defines digital literacy as,

> *'being able to make use of technologies to participate in and contribute to modern social, cultural, political and economic life'*(BCS 2013)

In 2006, digital competence was identified by the European Parliament as one of eight key skills for lifelong learning along with a recommendation for, *'better identification of occupational needs'*(European Parliament 2006). The European Commission Information Society promotes and tracks citizen and member states digital engagement (ECIS 2012). As part of the ECIS research programme, the sixth pillar out of seven in the *'Digital Agenda for Europe'* builds on that recommendation by focusing on digital literacy, skills and inclusion for lifelong learning (ECIS 2012). Within the UK, the Scottish Government plus advisory and professional bodies have developed a range of strategic principles, national competency frameworks for training, core skills and digital literacies for the general public and recently more specific targets for the health sector (BCS 2013; e-Skills UK 2011; NHS Elite 2013).

Overall aim of the research

This research thesis is entitled *'Exploring ehealth and digital literacy in pharmacy practice.'* The research was conducted in four phases over four years (part time) and, as previously described, evolved as the changing political and technological landscape affected the role of pharmacy in delivering collaborative healthcare.

Influencing factors in the evolution of the research

The overarching aim has remained the same but the focus has evolved. Primary influences have been political, strategic and technical developments, described earlier in this chapter, impacting on the social, patient-centred context within which pharmacy staff practice and this research is set (Figure 1.7). This research has evolved from:

- international and national policies and strategies for ehealth supported healthcare
- the extended role of the pharmacist and pharmacy staff in providing shared or integrated care for patients in collaboration and communication with other healthcare practitioners
- epharmacy systems implementation in pharmacy in Scotland
- findings from each preceding phase of the research

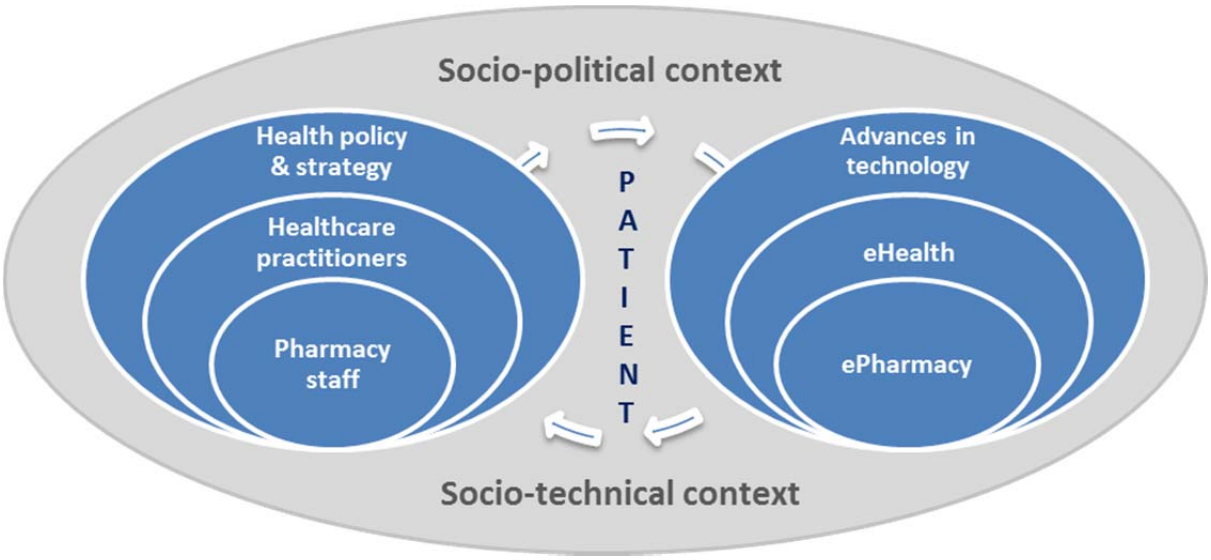

Figure 1.7 Nested diagram of factors influencing pharmacy practice and the research direction

Initial research plan

The initial aim of the research, back in 2010, had been to provide original data detailing cardiovascular patients, community pharmacists and general practitioners' experiences of the technology underpinning the soon to be introduced epharmacy Chronic Medication Service (CMS) in Scotland. In April 2007, the Chief Pharmaceutical Officer of the Scottish Government, Professor

Scott, described CMS as, *'the jewel in the crown'*(Bellingham 2007) of the phased implementation of epharmacy, and a key element of the overall ehealth programme. The epharmacy programme aimed to,

> *'support the future delivery of the new community pharmacy contract and improve communications across the healthcare team,'*

through the development of IT applications (Scottish Government 2008b; CMS Advisory Group 2009). Outcomes of the research had the potential to inform and support the CMS aim of improving,

> *'patient care through a systematic approach to the pharmaceutical care of patients with long term conditions,'*

to promote partnership in primary care and, more broadly, to influence the information, education and training provided for users of future NHS delivered epharmacy and ehealth developments. These themes are evident throughout the research conducted in the following four phases described in Chapters 3, 4, 5 and 6. However, delays and limitations with the implementation and scope of CMS meant the timing was no longer aligned with the schedule of the research programme. Working within the same context and research framework the focus of the research was broadened to explore ehealth amongst all healthcare professionals before narrowing the focus back to pharmacy practice.

Aims and Objectives

The overall aim of the research was to explore ehealth technology in pharmacy practice and by doing so contribute original knowledge to this area.

The objective of each phase within the overall aim was:

- Phase I: to explore healthcare practitioners views of ehealth in relation to shared care
- Phase II: to explore healthcare practitioners perceptions of ehealth in relation to integrated care

- Phase III: to explain the information technology education and training needs of pharmacy staff
- Phase IV: to explore digital literacy training experiences and needs of pharmacy staff.

The titles, aims, objectives and outcomes for each of the four linked phases of research are captured in Figure 1.8.

Summary of this chapter

This chapter sets the scene for the programme of research. The context of healthcare and pharmacy practice in Scotland was described alongside national and international policies and strategies for ehealth technology supported shared or integrated care.

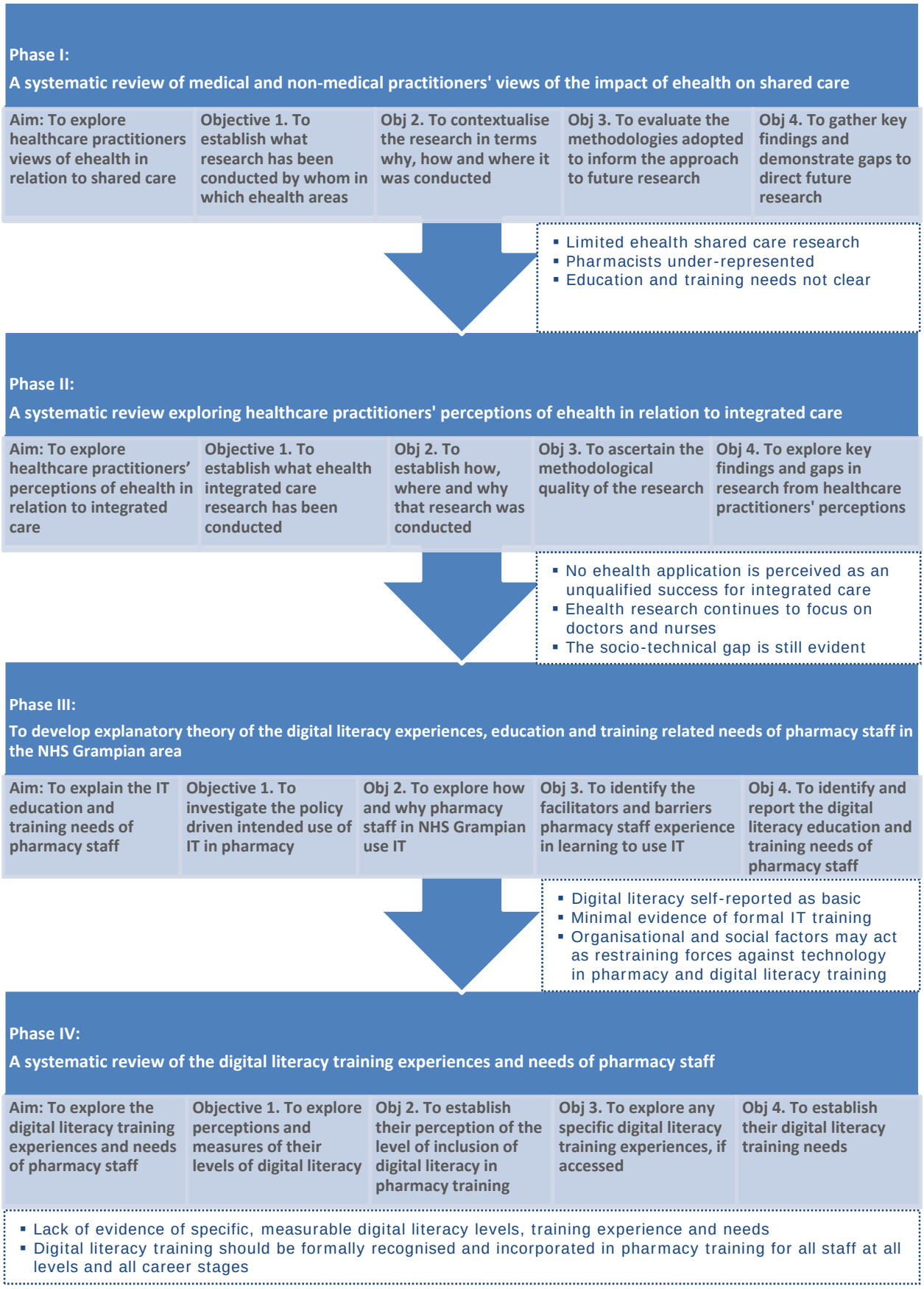

Figure 1.8 The evolving research project: titles, aims and objectives, outcomes

CHAPTER 2 Methodology & Philosophy

> *'If we knew what it was we were doing, it would not be called research, would it?'*
>
> Albert Einstein, physicist
> (1879-1955)

Introduction to the chapter

This chapter considers the philosophical underpinnings of research before positioning and articulating the research design of this study. The research design comprised two contextualising systematic reviews followed by a case study which prompted an additional systematic review. This chapter is mainly focused on the case study methodology with additional detail for the systematic reviews contained in Chapters 3, 4 and 6.

Philosophy of research

Each researcher brings to their research their own philosophical assumptions, defined as the, *'fundamental nature of knowledge, reality, and existence'*(Oxford Dictionaries). Their research philosophy will be associated with research paradigms, worldviews and research methodologies, all of which underpin selection of the most appropriate research design.

Elements of research paradigms

In his essay on *'The Nature of Normal Science,'* Kuhn (1962) suggested that a paradigm, *'is an accepted model or pattern'* shared by the scientific research community of the day but also, *'an object for further articulation and specification under new or more stringent conditions.'* Kuhn (1962) believed no facts were paradigm free or theory independent. Research paradigms, also known as theoretical perspectives (Bowling 2009) or interpretive frameworks (Cresswell 2009), are broadly held to have three elements of ontology, epistemology and methodology, defined by Healy and Perry (2000) as (Table 2.1):

Table 2.1 Elements of research paradigms and their definitions based on Healy & Perry (2000)

Elements of Research Paradigms	Definition
ontology	*is the "reality" that researchers investigate*
epistemology	*is the relationship between reality and the researcher*
methodology	*is the technique used by the researcher to investigate that reality*

Cresswell (2009) added a fourth element, *'axiology,'* to make explicit the role of values held by the researcher and the implications for the design and conduct of research (Table 2.2):

Table 2.2 Four elements of a research paradigm. Reproduced from Cresswell (2009)

Assumption	Questions	Characteristics	Implications for Practice (Examples)
Ontological	What is the nature of reality?	Reality is multiple as seen through many views	Researcher reports different perspectives as themes develop in findings
Epistemological	What counts as knowledge? How are knowledge claims justified? What is the relationship between the researcher and that being researched?	Subjective evidence from participants: researcher attempts to lessen distance between himself or herself and that being researched	Researcher relies on quotes as evidence from the participant: collaborates, spends time in field with participants, and becomes an 'insider'
Axiological	What is the role of values?	Researcher acknowledges that research is value-laden and that biases are present	Researcher openly discusses values that shape the narrative and includes his or her own interpretation in conjunction with the interpretation of participants
Methodological	What is the process of research? What is the language of research?	Researcher uses inductive logic, studies the topic within its context, and uses an emerging design	Researcher works with particulars (details) before generalisations, describes in detail the context of the study, and continually revises questions from experiences in the field

Categorisation of research paradigms

These three (or four) elements of a research paradigm are associated with four categories of research philosophies (Healy & Perry 2000 based on Lincoln & Guba 1994):

- Positivism
- Critical theory
- Constructivism
- Realism

Alternative interpretive frameworks based on philosophical assumptions (Table 2.3) were developed to reflect societal changes impacting on the research community's accepted paradigms and practice. Once again based on the research of Lincoln et al (2011), endorsed and adapted by Cresswell (2013), the interconnectedness of paradigm, worldview and research design, which together form the research philosophy, is more clearly demonstrated.

Table 2.3 Interpretive framework and associated philosophical assumptions and implications for research practice.
Reproduced from Cresswell (2009) adapted to include aspects from Denzin et al (2012), Healy & Perry (2000) and Ritchie et al (2014)

Interpretive Frameworks (research paradigms)	Ontological Beliefs (the nature of reality)	Epistemological Beliefs (how reality is known)	Axiological Beliefs (role of values)	Methodological Beliefs (approach to inquiry)	Common Methodologies
Postpositivism / Realism	A single reality exists beyond ourselves, 'out there.' Researcher may not be able to understand it or get to it because of lack of absolutes	Reality can only be approximated. Bit it is constructed through research and statistics. Interaction with research subjects is kept to a minimum. Validity comes from peers, not participants	Researchers' biases need to be controlled and not expressed in a study	Use of scientific method and writing. Object of reason is to create new knowledge. Method is important. Deductive methods are important, such as testing of theories, specifying important variables, making comparisons among groups	Experiments/ surveys: verification of hypotheses, chiefly quantitative methods
Social constructivism / Interpretivism	Multiple realities are constructed through lived experiences and interactions with others	Reality is co-constructed between the researcher and the researched and shaped by individual experiences	Individual values are honoured, and are negotiated among individuals	More of a literary style of writing is used. Use of an inductive method of emergent ideas through methods such as interviewing, observing, and analysis of texts	Hermeneutical/ dialectical: researcher is a "passionate participant" within the world being investigated
Transformative / Postmodern / Participatory	Participation between researcher and communities/ individuals being studied. Often a subjective-objective reality emerges	Co-created findings with multiple ways of knowing	Respect for indigenous values; values need to be problematised and interrogated	Use of collaborative processes of research; political participation encouraged; questioning of methods; highlighting issues and concerns	Participatory: action research, soft systems methodology
Pragmatism	Reality is what is useful, is practical, and "works"	Reality is known through using many tools of research that reflect both deductive (objective) evidence and inductive (subjective) evidence	Values are discussed because of the way that knowledge reflects both the researchers' and the participants' views	The research process involves both quantitative and qualitative approaches to data collection and analysis	Case studies/ convergent interviewing: triangulation, interpretation of research issues by qualitative and by some quantitative methods such as structural equation modelling
Critical theory, Race, Feminist, Queer, Disabilities	Reality is based on power and identity struggles. Privilege or oppression based on race or ethnicity, class, gender, mental abilities, sexual preferences	Reality is known through the study of social structures, freedom and oppression, power, and control. Reality can be changed through research	Diversity of values is emphasised within the standpoint of various communities	Start with assumptions of power and identity struggles, document them, and call for action and change	Dialogic/ dialectical: researcher is a "transformative intellectual" who changes the social world within which participants live

Linking paradigm, methodology, method and research design

Cresswell (2009) emphasised the relationship of research paradigm, with its elements and categories, to the research methodology (termed '*strategies of inquiry'*) and research methods, collectively forming the overall research design (Figure 2.1). Methodology is, *'a way of thinking about and studying social phenomena'* while methods are, *'the techniques and procedures for gathering and analysing data'*(Corbin & Strauss 2008). The research paradigm adopted is based on the philosophical worldview of the researchers and the nature of the research to be conducted, closely interrelated to choice of research design, methodology and methods.

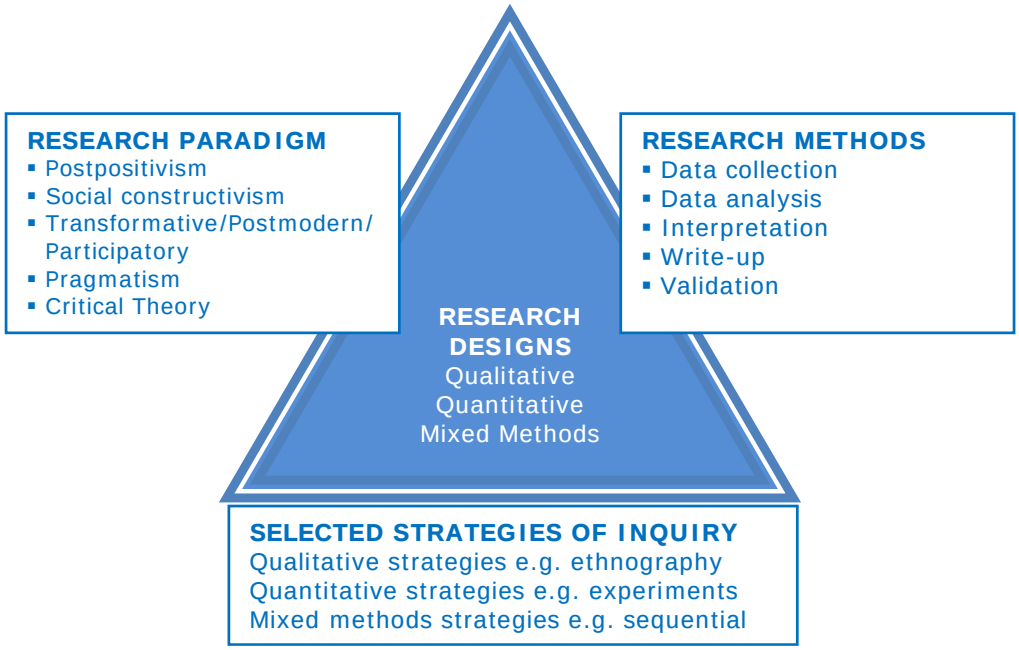

Figure 2.1 Adapted from *'A Framework for Design'* by Cresswell (2009)

Worldview or *weltanschauung*

Weltanschauung, literally translated from German as '*worldview*,' is a term used to bring focus to the multiple perspectives of all involved in any given situation, for example the research context, which includes the researcher (Churchman 1968; Checkland 1999). The concept of *weltanschauung* was adopted by Checkland (1999) to bring focus to the viewpoints, or worldviews, of every stakeholder involved in a purposeful activity, a system, or for,

> *'understanding phenomena not as so many disconnected parts but, rather, as interconnected elements'*(Thomas 2012)

This paradigmatic stance of the researcher was termed '*reflexivity'* by Cresswell (2013) who urged,

> *'that researchers reflect about how their biases, values and personal background, such as gender, history, culture, and socio-economic status, shape their interpretations formed during the study'*(Cresswell 2013)

Types of research designs

Research designs are categorised as quantitative or qualitative which are increasingly combined as mixed methods (Mertens & Hesse-Biber 2013). The characteristics of qualitative and quantitative research designs, as summarised by Spencer et al (2003), are founded in their associated research paradigm (Table 2.4).

Table 2.4 Characteristics of qualitative and quantitative research designs. Reproduced from Spencer et al (2003)

Quantitative	Qualitative
scientific	naturalistic
positivist	interpretivist/hermeneutic
realist	idealist/relativist/constructivist
objectivist/materialist	subjectivist
foundational (realist)	fallibilistic/anti-foundational
experimental	ethnographic

Quantitative research is viewed as scientific, experiment based with the philosophical assumption that an objective reality can be known and expressed in statistical form. Common approaches include laboratory based experiments, randomised control trials and surveys. The focus is on reproducibility of results from large sample sizes for generalisability and theory testing across populations.

In contrast, qualitative research is viewed as '*naturalistic'* or ethnographic, seeking to explore and explain lived experience or the socially constructed

realities, with the philosophical assumption that multiple worldviews are essentially subjective and open to interpretation. Common approaches include narrative study, phenomenology, grounded theory, ethnography and case study (Cresswell 2009). The focus is on depth rather than breadth with smaller sample sizes for explanatory, exploratory and theory building designs but with reduced potential for the generalisability or transferability of results.

Although mixed methods are subject to, *'competing epistemological, theoretical and methodological paradigms'*(Mertens & Hesse-Biber 2013), it has been suggested that this approach offers a, *'fuller understanding of the evaluation problem'*(Greene 1997). Common approaches are sequential application of quantitative followed by qualitative approaches, for example a survey with a large sample size to inform selection of indepth case studies with a small subset from the sample, or concurrent or transformative variations (Cresswell 2009).

A comprehensive comparison by Spencer et al (2003), based on the seminal text by Lincoln and Guba (1981), provided a more explicit positioning of quantitative and qualitative research design with associated philosophical assumptions (Table 2.5).

Table 2.5 Paradigms for scientific and naturalistic research.
Adapted from Spencer et al (2003) based on Lincoln and Guba (1981)

Comparator	Paradigm	
	Scientific	Naturalistic
Preferred techniques	**Quantitative**	**Qualitative**
Assumptions about reality	Singular, convergent, fragmentable (variables)	Multiple, divergent, inter-related
Assumptions about the inquirer–subject relationship	Independent	Inter-related
Assumptions about the nature of truth statements	Generalisations, nomothetic (law-like) statements, focus on similarities	Working hypotheses, idiographic (understanding particular events), focus on differences
Quality criterion	Rigor	Grounded
Knowledge types	Propositional	Propositional and tacit (statements through language plus intuitions, apprehensions)
Stance	Reductionist (limited conditions for control)	Expansionist (holistic/complex)
Purpose	Verification	Discovery
Instrument	Paper and pencil or physical device	Inquirer (often)
Timing of specification of data collection and analysis rules	Before inquiry	During and after inquiry
Design	Pre-ordinate	Emergent
Style	Intervention	Selection (sift through naturally occurring events)
Setting	Laboratory	Nature (natural)
Treatment	Stable (standardised)	Variable
Analytic units	Variables	Patterns
Contextual elements	Control	Invited interference (welcome rather than attempt to control)

Quality of evidence

In addition to philosophical assumptions, there are different expectations of evidence produced from the different methodologies. The hierarchy of evidence (Figure 2.2) considers the credibility and applicability of findings from different approaches. Quantitative randomised control trials rank second only to systematic reviews of literature or meta-analyses of data from primary studies, while findings from qualitative research are lowly ranked due to the smaller sample sizes and inherent bias (Bowling 2009) of researching subjective areas of, for example, participant's views or experiences. Nevertheless, quality is an expectation of all approaches.

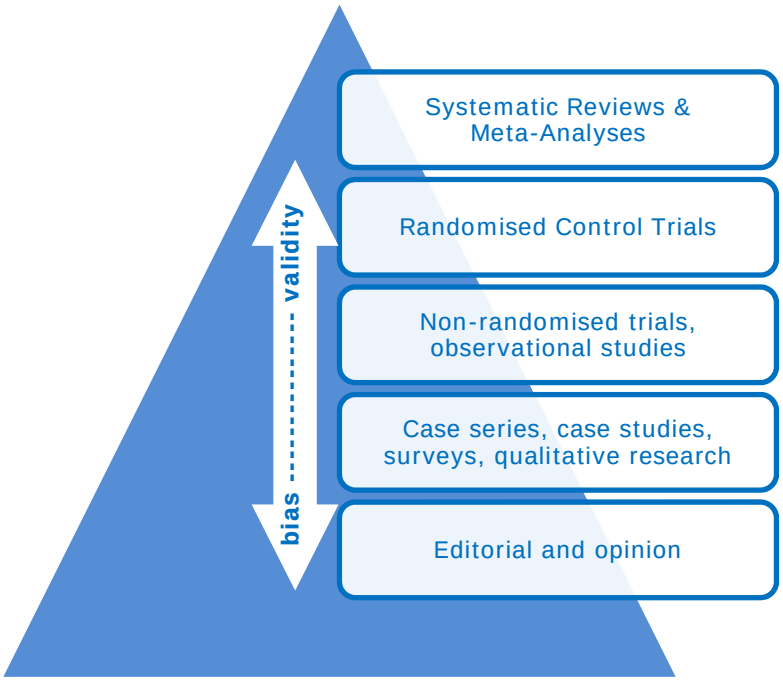

Figure 2.2 Hierarchy of evidence relating research design to measures of quality.
Based on Guyatt GH et al (2000) Users' Guides to the Medical Literature: XXV. Evidence-Based Medicine: Principles for Applying the Users' Guides to Patient Care. *JAMA.* 2000;284(10):1290-1296

The similarities, commonalities and differences between quantitative and qualitative research, as depicted in Figure 2.3, are based on values and norms, the research paradigms commonly held, including the comparative quality criteria terminology. Triangulation, or the collation of three or more methods, is considered applicable and beneficial to enhance the validity of findings from all research designs (Bowling 2009). Research findings may also be subject to the '*Observer Effect*,' also known as the '*Hawthorne Effect*,' in which, *'the very fact of being observed changes that which is being observed'*(Bowling 2009).

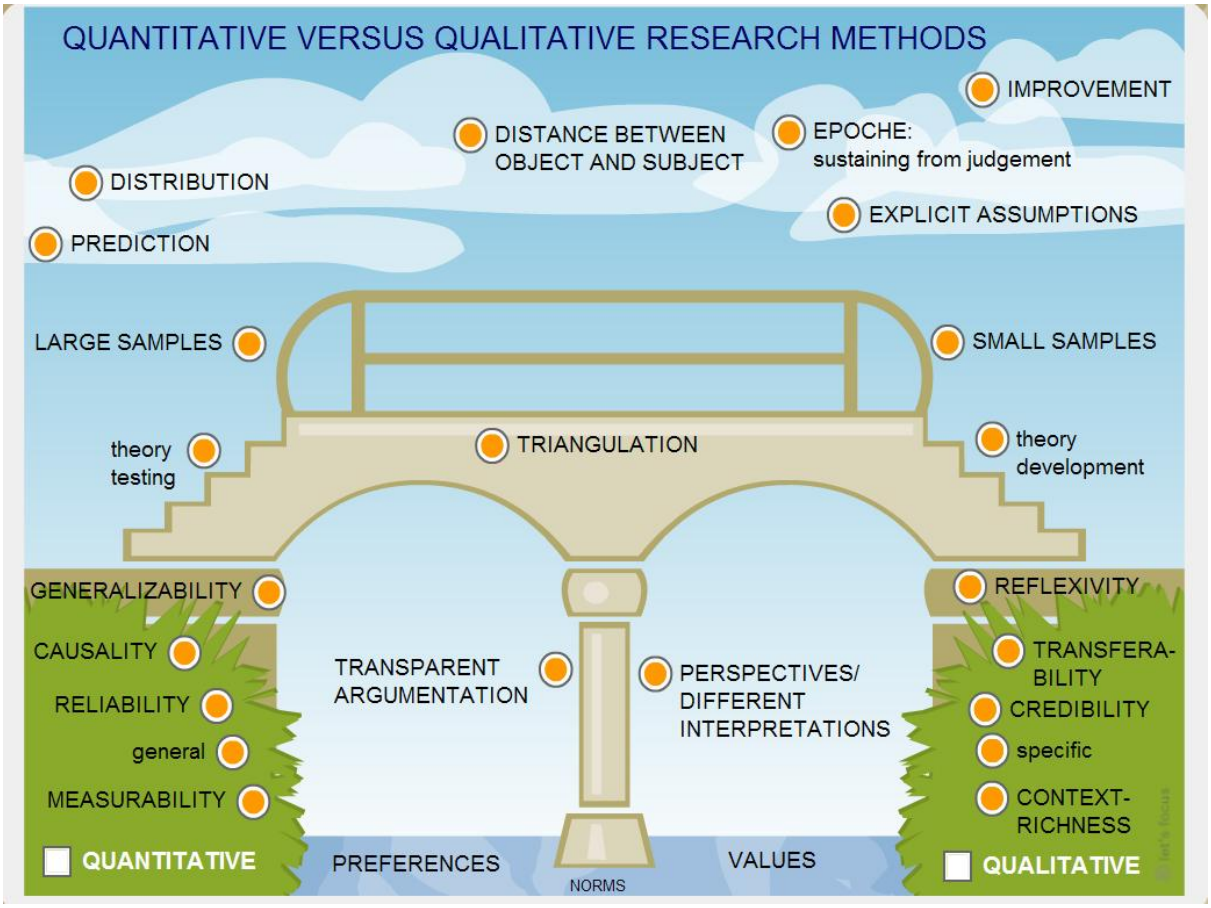

Figure 2.3 Key differences and common points between quantitative and qualitative research methods. Reproduced from results of discussions at the proceedings of the Knowledge Communications Workshop _ 5th edition. Qualitative Research Methods, October 24th 2005. Developed using software from let's focus (en.lets-focus.com). Available from http://www.knowledge-communication.org/coursesandevents.html

Bias and error

Bowling (2009) defined many forms of potential bias and error (Table 2.6) which can threaten the robustness of both quantitative and qualitative research processes and, therefore, the research findings.

Table 2.6 Types of bias and error. Selectively reproduced from Bowling (2009)

Type of bias or error	Description
Acquiescence response set	Refers to the fact that respondents will more frequently endorse a statement than disagree with its opposite form, a form of *'yes-saying'*
Assumption (conceptual) bias	This is an error arising from the faulty logic of the investigator, which can lead to faulty conceptualisation of the research problem, faulty interpretations and conclusions
Bias in handling outliers	Can arise from a failure to discard an unusual value occurring in a small sample, or the exclusion of unusual values which should be included
Design bias	Derives from faulty design of methods, sampling, analysis which can lead to differences between the observed and true values
Evaluation apprehension	Anxiety amongst participants may lead to people giving responses which they think are expected by the investigator
Interviewer bias	The interviewer may subconsciously, or consciously, bias respondents to answer in a certain way: by appearing to hold certain values, prompting social desirability bias, or by asking leading questions
Measurement decay	Refers to any changes in the measurement process over time
Mood bias	People in low spirits may underestimate their health status, level of functioning, support requirements, biasing study results
Non-response bias	Non-response, and withdrawal from longitudinal studies, reduces effective sample size resulting in loss of precision. Differences between responders and non-responders reduces generalisability
Observer bias	Difference between the true situation and that recorded by the observer owing to perceptual influences and observer variation
Publication bias	Results which do not achieve statistical significance, or are based on low response rates, face difficulty in finding a publisher. Submitting, or selecting for publication, only studies with positive results is a form of publication bias
Reactive effects	Hawthorne or Observer effect describes people changing their observed behaviour due to the research process
Recall (memory) bias	Selective memories in recalling past events
Reporting bias	Failure of the respondent to reveal full information
Response style bias	A person may respond in a patterned, automatic manner based on initial answers to attitudinal statements e.g. strongly agree, without reading the question or scale. This is countered by varying positive/negative statements
Sampling bias	Non-representative selection of participants from a population
Systematic error	Errors or biases inherent in a study which are perpetuated and confound the results

Reliability and validity

Bowling (2009) also defined many forms of reliability and validity in approaches to health services research. Reliability, that is, *'the reproducibility and consistency of the instrument'*, for example of a survey or questionnaire design and scale construction such as Likert scale or response categorisation, can be assessed by application of, *'test-retest, inter-rater reliability and internal consistency'* checks for repeatability of the results obtained and freedom from random errors (Bowling 2009). Reliability impacts on validity which Bowling (2009) defined as, *'an assessment of whether the instrument measures what it aims to measure.'* Tests for validity include face, content, criterion (concurrent, predictive), construct (convergent, discriminant), sensitivity and specificity which range from testing the relevance and comprehensiveness of the content to the ability of the instrument to, *'measure the underlying concept it purports to measure'*(Bowling 2009).

Trustworthiness

The classic text from Guba and Lincoln (1986) proposed four constructs for trustworthiness of qualitative research: credibility (truth value), transferability (applicability), dependability (consistency) and confirmability (neutrality). More recently, Spencer et al (2003) offered four guiding principles for assessing qualitative research evidence (Table 2.7) to ensure it is contributory, defensible, rigorous and credible.

Table 2.7 Guiding principles for assessing qualitative research evidence from Spencer et al (2003)

Four Guiding Principles	Description
Contributory	*'in advancing wider knowledge or understanding'*
Defensible in design	*'by providing a research strategy which can address the evaluation questions posed'*
Rigorous in conduct	*'through the systematic and transparent collection, analysis and interpretation of qualitative data'*
Credible in claim	*'through offering well-founded and plausible arguments about the significance of the data generated'*

Systematic reviews of the literature

Archibald Cochrane, a pivotal figure in the foundation of The Cochrane Collaboration, noted,

> *'evidence-based health care is the conscientious use of current best evidence in making decisions about the care of individual patients or the delivery of health services. Current best evidence is up-to-date information from relevant, valid research about the effects of different forms of health care'*(Cochrane 1972)

Reviews of the literature are conducted,

> *'to provide a key source of evidence-based information to support and develop practice as well as to support professional development – for example, by helping to identify new and emerging developments and gaps in knowledge'*(Petticrew and Roberts 2006)

Literature reviews are,

> *'a method of making sense of large bodies of information, and a means of contributing to the answers to questions about what works and what does not – and many other types of question too. They are a method of mapping out areas of uncertainty, and identifying where little or no relevant research has been done, but where new studies are needed'*(Petticrew and Roberts 2006).

A literature review of cumulative published and unpublished studies, conducted in a rigorous, reproducible manner following a pre-determined protocol, is termed a systematic review. In defining and describing systematic reviews, the Centre for Reviews and Dissemination (2009) advised that,

> *'Systematic reviews aim to identify, evaluate and summarise the findings of all relevant individual studies, thereby making the available evidence more accessible to decision makers. When appropriate, combining the results of several studies gives a more reliable and precise estimate of an*

> *intervention's effectiveness than one study alone. Systematic reviews adhere to a strict scientific design based on explicit, pre-specified and reproducible methods'*(Centre for Reviews and Dissemination 2009)

As systematic reviews, *'aim to minimize bias by using explicit, systematic methods'*(Higgins & Green 2009), a review protocol is developed, and often published, which sets out the methods to be used,

> *'including decisions about the review question, inclusion criteria, search strategy, study selection, data extraction, quality assessment, data synthesis and plans for dissemination'*(Higgins & Green 2009)

A range of standard tools and checklists are available to promote best practice at all stages of the systematic review including those provided by The Cochrane Collaboration, the Critical Appraisal Skills Programme (CASP), the Campbell Collaboration, the Joanna-Briggs Institute (JBI), the Centre for Reviews and Dissemination (CRD) and American Quality in Health Research (AQHR). Systematic reviews were conducted in this study to establish prior research in the ehealth area and gaps in the literature (Chapter 3), to inform the primary research (Chapter 4) and to follow up findings from the case study (Chapter 6).

Selecting a research design for primary research studies

Cresswell (2009) simplified the choice of research design to a matrix (Table 2.8) including quantitative, qualitative and mixed methods approaches. He recommended the researcher apply three criteria taking into consideration:

- Criterion 1: *'the research problem under investigation'*
- Criterion 2: *'the personal experience and training of the researcher'*
- Criterion 3: *'the audience for the report'*

Table 2.8 Four alternative combinations of knowledge claims, strategies of inquiry and methods. Reproduced from Cresswell (2009)

Research Approach	Knowledge Claims	Strategy of Inquiry	Methods
Quantitative	Postpositivist assumptions	Experimental design	Measuring attitudes, rating behaviours
Qualitative	Constructivist assumptions	Ethnographic design	Field observations
Qualitative	Emancipatory assumptions	Narrative design	Open-ended interviewing
Mixed methods	Pragmatic assumptions	Mixed methods design	Closed-ended measures, open-ended observations

Applying Cresswell's criteria to position this research study

Criterion 1: research problem under investigation

The overall aim of this research developed from an initial broad ehealth and collaborative healthcare focus to explore ehealth and digital literacy in pharmacy practice through the views and experiences of pharmacy staff. This study was set within the context of health services research which the Medical Research Council defines as,

> *'the identification of the health care needs of communities and the study of the provision, effectiveness and use of health services'*(Bowling 2009)

It evolved naturally from attending a seminar in 2008, held at Robert Gordon University in Aberdeen, led by the Chief Pharmacist for Scotland on the much vaunted introduction of the Chronic Medication Service. It raised within the researcher, an ex-Lecturer in Computing, Community Education tutor and Procedures Analyst recently turned pharmacy practice researcher, a curiosity about how pharmacy staff at all levels and stages use, and learn to use, technology. Initial scoping searches determined this to be an under-researched area with the potential for original findings to inform pharmacy education, policy and practice. As the research evolved, in became clear that the data to be collected and analysed interpretatively and inductively were in multiple forms and from multiple perspectives, including aspects which were:

- social, ethical (pharmacy practice)
- technical (ehealth)
- educational (digital literacy)
- personal (pharmacy staff)
- political, legal (health policy and strategy)

The terms of the research questions (explore; views; experiences; pharmacy staff) lie outwith the positivist (quantitative) paradigm other than to describe participant demographics. This mainly qualitatively based research assumed the epistemological stance, or theoretical lens, reflective of pragmatism in which,

> *'reality is known through using many tools of research that reflect both deductive (objective) evidence and inductive (subjective) evidence*'(Cresswell 2009)

Criterion 2: personal experience and training of the researcher

The personal experience and training of the researcher is varied. Originally from a *'hard'* scientific background in computing and computing education, systems and procedures analysis (reductionist/positivist) her training and experience broadened to consider philosophy, more naturalistic human computer interaction and understanding complexity through *'soft'* systems thinking (expansionist/holistic). This shift in paradigm from an ontological perspective of a single known reality towards multiple, socially constructed realities, levelled out at a pragmatist's approach to research, that, '*reality is what is useful, is practical and "works"'*(Cresswell 2009), approach to research. The researcher's experience in pharmacy practice research to date has been largely qualitatively based, gathering participants' views and experiences through focus groups, interviews, open-ended questions in surveys analysed interpretatively and thematically. Axiologically, for researcher reflexivity,

> *'values are discussed because of the way that knowledge reflects both the researchers' and the participants' views'*(Cresswell 2009)

Although interpretive, which some would consider subjective, the researcher has always strived to respect and honour the privilege of representing the

participant's voice (Oliver et al 2005). Prior experience lends a systematic approach adopted to engender rigor in the process to ensure quality of evidence grounded in, and inducted from, empirical data. Although the researcher has been trained in medical statistics, there is a limited amount of quantitative data relevant to answering the research questions in this study. Therefore, a multiple qualitative research design was deemed appropriate to answer the research questions.

Criterion 3: audience for the report

There is a broad audience to whom the original findings were reported either collectively or as discrete units of research. The collective form of this thesis was presented for examination at *viva voce* to a panel of examiners and, following incorporation of their comments, published online in electronic form. Summary reports were sent to study participants. The units of research were submitted in the form of original research articles for peer review by journals in the subject areas of pharmacy practice, pharmacy and higher education, health services research, health policy and technology and health informatics. Abstracts were also accepted by scientific committees for inclusion in conference proceedings covering the listed specialist themes as workshops, oral and poster presentations.

Applying Yin's conditions to inform research design

Yin (2009) also offered a matrix (Table 2.9) to assist the researcher in deciding *when* to use each method. The focus was on the context of the research and moved from methodology to method. Again, there were three accompanying conditions (criteria), differing from Cresswell (2013) on two and three. Condition one is open to the semantic convenience of the researcher in choosing from (who/what/how/why/where) but, in considering condition two, this research study does not require control over any behavioural events nor is a quantitative survey or historical treatment appropriate, leaving archival analysis or case study options. For condition three, the focus of the study is on contemporary events, which again suggests archival analysis and case study methods (Yin 2009).

Table 2.9 Relevant situations for different research methods. Reproduced from Yin (2009)

METHOD	Form of research question?	Requires control of behavioural events?	Focuses on contemporary events?
Experiment	how, why?	yes	yes
Survey	who, what, where, how many, how much?	no	yes
Archival Analysis	who, what, where, how many, how much?	no	yes/no
History	how, why?	no	no
Case Study	how, why?	no	yes

Pragmatism as a research philosophy

The research, and the researcher, sit comfortably within the interpretive framework of pragmatism. Cresswell (2009) described many forms of pragmatism (Table 2.10) all of which focus on the outcomes of the research and solutions to problems based on asking the right research questions, in the right way, at the right time.

Table 2.10 Basic forms of pragmatism. Adapted from Cresswell (2009)

Pragmatism...
▪ is not committed to any one system of philosophy and reality
▪ gives individual researchers freedom to choose methods, techniques and procedures of research that best meet their needs and purposes
▪ does not see the world as an absolute unity so look to many approaches to collecting and analysing data
▪ holds that truth is what works at the time; it is not based in a dualism between reality independent of the mind or within the mind
▪ looks to the “what” and “how” of research based on its intended consequences – where the researcher wants to go with it
▪ agrees that research always occurs in social, historical, political and other contexts
▪ believes in an external world independent of the mind as well as those lodged in the mind

Cresswell (2013) concluded that,

> *'in practice, the individual using this worldview will use multiple methods of data collection to best answer the research question, will employ multiple sources of data collection, will focus on the practical implications of the research and will emphasise the importance of conducting research that best addresses the research problem'*(Cresswell 2013)

Philosophy of ethical research

The NHS National Research Ethics Service (NRES) is charged with,

> *'facilitating and promoting ethical research that is of potential benefit to participants, science and society,'*

while also, *'protecting the rights, safety, dignity and well-being of research participants'*(NRES 2014). One concept of ethical research is Kantianism and the *'categorical imperative'* to do what is right. Shamoo and Resnik (2009) quote 18th century philosopher, Immanuel Kant, in stating that,

> *'human beings have inherent (or intrinsic) moral dignity and worth: we should not abuse, manipulate, harm, exploit, or deceive people in order to achieve specific goals'*(Shamoo and Resnik 2009)

Based on these and other philosophical theories, they suggest 12 principles for ethical conduct in research (Table 2.11) which resonate with the quality of evidence issues, covered earlier in this chapter, including trustworthiness, validity, reliability, bias and error, linked to UK based Caldicott principles (Caldicott 2013), the Data Protection Act (DPA 1998) and requirements for good research practice (MRC 2013).

Table 2.11 Twelve principles for ethical conduct in research.
Adapted from Shamoo and Resnik (2009)

Honesty	Objectivity	Openness
Confidentiality	Carefulness	Respect for colleagues
Respect for intellectual property	Respect for the law	Respect for research subjects
Stewardship	Social responsibility	Freedom

Study research design and relevant theories

As the research questions and design are largely qualitatively based, the remainder of this chapter further describes the characteristics of qualitative research design, the strategies of inquiry and research methods utilised in this study and the key theoretical frameworks.

Qualitative research

Qualitative research has been described within the pragmatic interpretive framework by Cresswell (2013) as:

- taking place in natural settings
- involving the researcher as the key instrument of data collection
- using multiple methods
- applying complex reasoning through inductive and deductive logic
- focusing on participants' perspectives, their meanings, their multiple subjective views
- situated within the context or setting of participants/sites
- involving an emergent and evolving design
- reflective and interpretive
- presenting a holistic, complex picture

Strategy of inquiry and research interest

There are a broad range of qualitative research strategies of inquiry and associated research methods. Miles and Huberman (1994) categorised these choices based on whether the research interest focused on the:

- **characteristics of language:** content analysis; discourse analysis; ethnography; symbolic interactionism
- **discovery of regularities:** ethnography; grounded theory; phenomenology; action research; critical research
- **comprehension of the meaning of text or action:** phenomenology; case study; hermeneutics
- **reflection:** phenomenology; heuristic research

Selection of qualitative research method also has implications in terms of resourcing or overheads (research staff costs, participant expenses, travel and

consumables) and whether it is appropriate in the research context to combine data collected from a variety of sources (Figure 2.4).

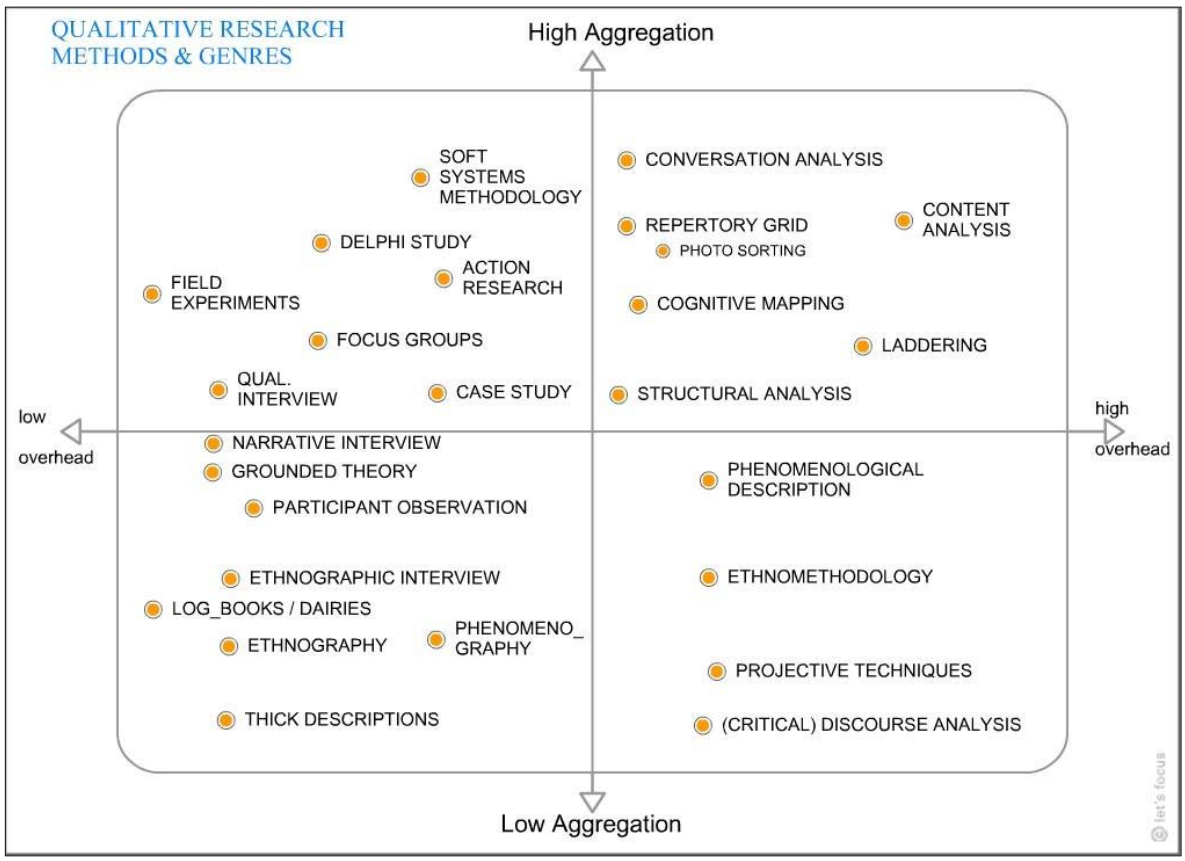

Figure 2.4 Qualitative research methods and genres. Reproduced from results of discussions at the proceedings of the Knowledge Communications Workshop _ 5th edition. Qualitative Research Methods, October 24th 2005. Developed using software from let's focus (en.lets-focus.com). Available from http://www.knowledge-communication.org/coursesandevents.html

Cresswell (2013) provided brief guides to selecting between five key qualitative approaches, recommending the researcher choose from:

- **Narrative study,** *'to examine the life experiences of a single individual when material is available and accessible and the individual is willing to share stories'*
- **Phenomenology,** *'to examine a phenomenon and the meaning it holds for individuals. Be prepared to interview the individuals, ground the study in philosophical tenets of phenomenology, follow set procedures, and end with the "essence" of the meaning'*
- **Grounded theory,** *'study to generate or develop a theory. Gather information through interviews (primarily), and use systematic procedures of*

data gathering and analysis built on procedures such as open, axial, and selective coding. Although the final report will be "scientific," it can still address sensitive and emotional issues'

- **Ethnography,** *'to study the behaviour of a culture-sharing group (or individual). Be prepared to observe and interview, and develop a description of the group and explore themes that emerge form studying human behaviours'*
- **Case study,** *'to examine a case, bounded in time or place, and look for contextual material about the setting of the case. Gather extensive material from multiple sources of information to provide an in-depth picture of the case'*

Qualitative data analysis

The combination of research interest and qualitative strategy of inquiry influence the choice of qualitative data analysis methods. Ritchie et al (2014) describe the, *'ultimate aims of analysis* [as] *description, explanation, or theory'*(Ritchie 2014). Cresswell (2013) urges researchers to,

> *'look at qualitative data analysis as following steps from the specific to the general and as involving multiple levels of analysis'*(Cresswell 2013)

The five qualitative approaches previously described and recommended by Cresswell (2012), each have *'analysis steps embedded'* which are described as:

- **Narrative research,** *'employs restorying the participants' stories using structural devices, such as plot, setting, activities, climax, and denouement'*
- **Phenomenological research,** *'uses the analysis of significant statements, the generation of meaning units, and the development of [essence description]'*
- **Grounded theory research,** *'involve[s] generating categories of information (open coding), selecting one of the categories and positioning it within a theoretical model (axial coding), and then explicating a story from the interconnection of these categories (selective coding)'*
- **Ethnography and Case study research,** *'involve[s] a detailed description of the setting or individuals, followed by analysis of the data themes or issues'*

Ritchie et al (2014) depicted the formal analysis process (Figure 2.5) of thematic framework development and summarised the, *'hallmarks of rigorous and well-founded substantive, cross-sectional qualitative data analysis'* as that it should (Ritchie et al 2014):

- Remain grounded in the data
- Allow systematic and comprehensive coverage of the data set
- Permit within and between case searches: thematic categories and patterns across different cases; linkage between phenomena within one case; linkage in phenomena between groups of cases
- Affords transparency to others

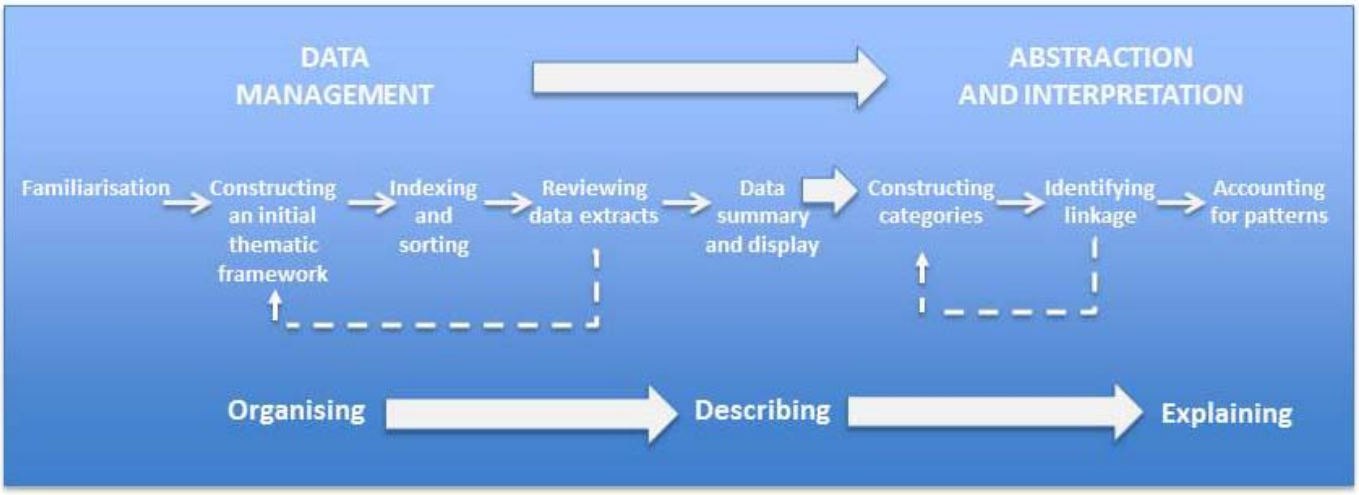

Figure 2.5 The Formal Analysis Process. Reproduced from Ritchie et al 2014

Furthermore, Ritchie et al (2014) emphasised the value of keeping an *'analytical log'* described as notes and memos. Although shown as a largely sequential process, data analysis at its best is a non-linear, reflective process (Marshall & Rossman 2011).

Research design of the current study

The remainder of this chapter covers the qualitative research design of the current study including the case study methods adopted for data collection, data analysis and key theories applied. Maxwell (2005) proposed nine arguments for a qualitative proposal which captured the style, format and elements expected of a systematic approach to qualitative research. The emphasis was on justifying the need for the research, collecting data from the appropriate sources by applying

the methods best suited to answering the research questions. Maxwell (2005) included consideration of feasibility, ethical issues and validation, to promote quality and rigor in qualitative research. Table 2.12 shows Maxwell's arguments applied to this research study, highlighting and justifying the methods applied which are detailed throughout this thesis.

Table 2.12 Maxwell's nine arguments for a qualitative proposal (2005). Reproduced from Cresswell (2013) with brief detail applied from the current study

#	Maxwells' nine arguments for a qualitative proposal (2005)	Current study, in brief
1	**We need to better understand... (the topic)**	...how pharmacy staff use, and learn to use, ehealth technologies
2	**We know little about... (the topic)**	...how healthcare professionals in general, and pharmacy staff in particular, perceive ehealth in relation to their role in delivery of patient care and their related digital literacy training needs
3	**I propose to study... (purpose)**	...what research has already been conducted into healthcare professionals' perceptions of ehealth followed by an indepth focus on the ehealth and digital literacy training experiences of pharmacy staff (see Table 2.3)
4	**The setting and participants are appropriate for this study... (data collection)**	...because we need to understand the existing international ehealth research based on all healthcare professionals to inform the focus on pharmacy staff in the local health board area (see Table 2.10)
5	**The methods I plan to use will provide the data I need to answer the research questions... (data collection)**	...because the existing body of literature is accessible through a range of means, for example, electronic databases, **systematic reviews** and **case study** methods (**document review, observation** and **interview activity** in local pharmacies), are feasible within resource and researcher skills limitations (see Table 2.8 and 2.9)
6	**Analysis will generate answers to these questions... (analysis)**	...as well-conducted **systematic reviews**, based on published protocols, are recognised for producing highly ranked evidence, while **thematic analysis** and **framework analysis** are appropriate for comprehending textual and activity based data from **case studies** (see Figures 2.2 and 2.5)
7	**The findings will be validated by... (validation)**	...application of quality criteria throughout including triangulation of methods, involvement of a second researcher, where appropriate, and peer review (see Tables 2.6 and 2.7)
8	**The study poses no serious ethical problems... (ethics)**	...as highest standards of practice will be maintained and participation is by fully informed consent and minimally disruptive of daily practice (see Table 2.11)
9	**Preliminary results support the practicability and value of the study... (pilot project)**	...as scoping searches have shown the paucity of prior research, data collection tools have been piloted and the findings have potential academic, societal and economic impact (see Table 2.7 and RCUK 2013)

Case studies design

The case study approach has been described as a, *'wrapper for different methods'*(Thomas 2012) or a means with which, *'to explain present circumstances…*[through]*…indepth description of social phenomenon'*(Yin 2009). It has also been suggested that it is, *'not a methodological choice but a choice of what is to be studied'*(Stake 2005), given its focus on the specific rather than the general. Thomas (2012) proposed the definition,

> *'Case studies are analyses of persons, events, periods, projects, policies, institutions or other systems which are studied holistically by one or more methods. The case that is the subject of the inquiry will be an instance of a class of phenomena that provides an analytical frame – an object – within which the study is conducted and which the case illuminates and explicates'*(Thomas 2012)

Methodology texts support the case study approach where research seeks to understand a phenomenon in depth through empirically gathered data. Different categories of case study (Table 2.13), collated by Thomas (2012), have developed based on the subject, purpose, approach and process but the focus remains on the research question. The subject of the current study (Chapter 5) was a multiple sequential, local knowledge, explanatory case with a theory building approach.

Table 2.13 Categorisation of types of case study. Reproduced from Thomas (2012)

Subject	Purpose	Approach	Process
▪ Special or outlier case ▪ Key case ▪ Local knowledge case	▪ Intrinsic ▪ Instrumental ▪ Evaluative ▪ Explanatory ▪ Exploratory	▪ Testing theory ▪ Building theory ▪ Illustrative ▪ Descriptive ▪ Interpretive ▪ Experimental	▪ Single ▪ Multiple ▪ Nested ▪ Parallel ▪ Sequential ▪ Retrospective ▪ Snapshot ▪ Diachronic

Theory building from case studies

Eisenhardt and Graebner (2007) collated opportunities and challenges for theory building from cases, offering methods for strengthening the validity and credibility of data collection and theory development to, *'convey rigor, creativity,*

open-mindedness of process.' In the context of case studies, building or developing theory is about creating an explanatory model which Thomas (2012) describes as:

- seeing links between ideas
- noticing where patterns exist
- abstracting ideas from your data and offering explanations
- connecting your own findings with those of others
- having insights
- thinking critically about your own ideas and those of others

Explanatory theory *'describes the reasons why a problem exists*'(Glanz & Rimer 2005). For Eisenhardt and Graebner (2007), the central notion of theory building from cases is inductive development from the data; that theory should be emergent from the empirical evidence based on patterns and constructs within and across cases with their logical arguments clearly expressed. In his treatise on the use and abuse of case studies, Flyvbjerg (2006) celebrated Walton's (1992) assertion that, *'case studies are likely to produce the best theory.'*

Misunderstandings about case studies

Flyvbjerg's article challenged and countered conventional wisdom about the limitations of case study research (Table 2.14). In brief, Flyvbjerg argued that context-dependent knowledge gained from case studies (Flyvbjerg 2006):

- is valuable
- can be generalisable
- is useful for theory building (and more)
- carries no greater bias than other research methods, and
- problems summarising from case studies are more often due to the, *'properties of the reality studied'* and process rather than outcomes

Table 2.14 'Five Misunderstandings about Case-Study Research' based on Flyvbjerg (2006)

Misunderstandings about case study research	#	Flyvbjerg's counter argument
General, theoretical (context-independent) knowledge is more valuable than concrete, practical (context-dependent) knowledge	**1**	Predictive theories and universals cannot be found in the study of human affairs. Concrete, context-dependent knowledge is, therefore, more valuable than the vain search for predictive theories and universals
One cannot generalise on the basis of an individual case, therefore, the case study cannot contribute to scientific development	**2**	One can often generalise on the basis of a single case, and the case study may be central to scientific development via generalisation as supplement or alternative to other methods. But formal generalisation is overvalued as a source of scientific development, whereas "the force of example" is underestimated
The case study is most useful for generating hypotheses; that is, in the first stage of a total research process, whereas other methods are more suitable for hypotheses testing and theory building	**3**	The case study is useful for both generating and testing hypotheses but it is not limited to these research activities alone
The case study contains a bias toward verification, that is, a tendency to confirm the researcher's preconceived notions	**4**	The case study contains no greater bias toward verification of the researcher's preconceived notions than other methods of inquiry. On the contrary, experience indicates that the case study contains a greater bias toward falsification of preconceived notions than toward verification
It is often difficult to summarise and develop general propositions and theories on the basis of specific case studies	**5**	It is correct that summarising case studies is often difficult, especially as concerns case process. It is less correct as regards case outcomes. The problems in summarising case studies, however, are due more often to the properties of the reality studied than to the case study as a research method. Often it is not desirable to summarise and generalise case studies. Good studies should be read as narratives in their entirety

Sampling for case studies

Multiple case studies based on theoretical sampling are recommended to provide a wealth and richness of empirical data from which to identify patterns, constructs and relationships between and across cases for emergent inductive development of theory. In describing theoretical sampling, Eisenhardt and Graebner (2007) stated that it,

> *'simply means that cases are selected because they are particularly suitable for illuminating and extending relationships and logic among constructs'*(Eisenhardt & Graebner 2007)

Quality of evidence in case studies

More general factors affecting quality of evidence were discussed earlier in this chapter. Thinking specifically about case studies, where theoretical sampling across all selection strata has been possible, it is considered by Eisenhardt and Graebner (2007), Stake (2005) and Yin (2009) to be testable, generalisable and more robust because consideration has been given to validity, replication, elaboration and alternative explanations. Thomas (2012) is in broad agreement with Eisenhardt and Graebner (2007) but they differ on matters of sampling for reliability and generalisability, or transferability. Thomas (2012) believes that although it is possible to, *'compare these cases for what they show'* they, *'will never form a sample from which you can generalise,'* a view also espoused by Bowling (2009). Tests of the quality of design particularly pertinent to case study methods, which counter issues raised by Flyvbjerg (2006), are offered by Yin (2009) around validity and reliability (Table 2.15) while Bowling (2009) identifies potential resource based limitations of the case study approach (cost, time, researcher skills).

Table 2.15 Tests of case study design quality. Reproduced from Yin (2009)

Test	Description
Construct validity	identifying correct operational measures for the concepts being studied
Internal validity (explanatory and causal studies only)	seeking to establish a causal relationship, whereby certain conditions are believed to lead to other conditions, as distinguished from spurious relationships
External validity	defining the domain to which a study's findings can be generalised
Reliability	demonstrating that the operations of a study – such as the data collection procedures – can be repeated, with the same results

Document review in case studies

Policy and strategy documents are valuable sources of information about socially constructed practices (Bowling 2009). Important considerations associated with document retrieval are the availability, accessibility and authenticity while analysis requires careful consideration of interpretation of terminology and balanced representation (Bowling 2009). Limitations are potential publication and reporting biases (Table 2.7).

Observational activity in case studies

Bowling (2009) describes observational activity, when undertaken as part of a qualitative case study, as structured or unstructured, non-quantitative and ethnographic in form. The researcher plans in advance what they will record and how. For example, field notes jotted down at the time and transcribed, that is written up, immediately following the observations might note behaviours, activities, interactions, comments and impressions, seen or heard, in either a participative or independent, non-participative capacity. Overt, consented observational activity takes place in the natural setting of the context of the research,

> *'for understanding more than what people say about (complex) situations, and can help to comprehend these complex situations more fully'*(Bowling 2009)

Bowling cites Merriam's (1998) observational checklist as a guide for what to record during observations (Table 2.16). While observation reduces the opportunity for social desirability bias from participant's self-reported attitudes and behaviours, it may be limited by observer bias, the reactive effect of the observer's presence, also known as the Hawthorne (Observer) Effect. This effect can be reduced by the researcher spending time with the participants before starting to record observations, putting them at ease and appearing non-judgemental (Bowling 2009). Ethical issues of (non)disclosure are also possible where private information is potentially observed or overheard (Shamoo 2009; Cresswell 2013).

Interview activity in case studies

Thomas (2012) describes interviews as:

- structured, unstructured and semi-structured
- group or one-to-one
- face-to-face or telephone

Table 2.16 Checklist for observations based on Merriam (1998) reproduced from Bowling (2009)

Recording aspect	Description
The setting	What is the physical environment like? What is the context? What kinds of behaviour are promoted or prevented?
The participants	Describe who is in the setting, how many people and their roles. What brings them together and who is allowed there?
Activities and interactions	What is going on? Is there a definable sequence of activities? How do people relate to the activity and relate to, and interact with, each other?
Frequency and duration	When did the situation being observed begin? How long does it last? Is it recurring and, if so, how often, or is it unique? How typical of such situations is it?
Subtle factors	Informal and unplanned activities; symbol and connotative meanings of words; non-verbal communications (e.g. dress, space); unreactive indicators such as physical clues; what does not happen but should?

These may involve audio, video or handwritten recording by a facilitator, scribe or the researcher to be transcribed verbatim or selectively summarised in a naturalised (with intonations, pauses, etc) or de-naturalised way (Oliver et al 2005). Technology also provides the opportunity for internet supported interviews with or without video imaging (Ritchie et al 2014). Yin (2009) adds *'guided conversations'* which he regards as, *'essential sources of case study information.'* He goes on to differentiate between Level 1 (*the verbal line of inquiry*) and Level 2 (*mental line of enquiry*) questions. These challenge the researcher to keep in mind the overall aim of the case study but to ask the participant questions in a friendly, non-threatening, semi-structured way using open-ended, non-leading but probing and clarifying questions (Yin 2009; Ritchie et al 2014). A 'walk along interview' offers another alternative in which the researcher accompanies the participant in the activity of research in situ focusing on the participant's narrative of their experience (Ritchie et al 2014).

The interview cycle is described in six stages by Ritchie et al (2014) (Table 2.17). Interviews and transcribing are both skilled and time consuming activities subject to limitations of interviewer error and bias, participant social desirability and recollection bias, transcription errors and (un)intentional misinterpretation of meaning (Table 2.15).

Table 2.17 Stages of the interview. Reproduced from Ritchie et al (2014)

Stages of the interview	Description
1. Arrival and introductions	▪ establish an initial rapport ▪ 'host' the interaction by taking responsibility for making it friendly and positive
2. Introducing the research	▪ seeking informed consent: aims, objectives, voluntary, confidential ▪ scope of the interview: but the participant is in control of what they disclose ▪ no right or wrong answers, hearing their perspective in their own words
3. Beginning the interview	▪ contextual background information: for reference in interview and to set the tone
4. During the interview	▪ breadth and depth of coverage
5. Ending the interview	▪ give some advance notice ▪ end on a positive note: suggestions and recommendations
6. After the interview	▪ Thanks for participation: value of their contribution ▪ How the information will be treated and used ▪ Be prepared to stay to help the change of mode back to the everyday ▪ Listen out for 'doorstep data'

Thematic and framework analysis in case studies

Thematic analysis is a matrix-based approach to data management developed to aid the researcher in systematically sorting, categorising and interpreting qualitative textual data (Bowling 2009). It is described by Ritchie et al (2014) as the process of,

> *'…discovering, interpreting and reporting patterns and clusters of meaning within the data. Working systematically through the texts the researcher identifies topics which are progressively integrated into higher-order key themes, the importance of which is their ability to address the overall research question'*(Ritchie et al 2014)

Three key issues for thematic analysis were identified by Silverman (2013) as:

- How to select the material to present?
- How to give due weight to the specific context within which the material was generated?
- How best to prioritize participants' orientations in presenting an interpretive account?

To assist in the process, Ritchie et al (2014) recommended five key steps for data management in thematic analysis (Table 2.18). In its simplest most superficial form, the thematic analysis matrix is a table populated with extracts from the data under themes which act as headings for the columns.

Table 2.18 Five key steps in data management for thematic analysis.
Based on Ritchie et al (2014)

Key step	Descriptive question
1 Familiarisation	What are people saying that is relevant to the research question?
2 Constructing an initial thematic framework	Under what set of headings can people's views, experiences or behaviour be organised?
3 Indexing and sorting	What parts of the data are *'about the same thing'* and belong together?
4 Reviewing data extracts	What other ways of organising the data are possible that might produce more coherent groupings?
5 Data summary and display	What, in essence, is each person saying about a particular theme?

Framework is a variation of thematic analysis which,

> *'allows the analyst to move back and forth between different levels of abstraction without losing sight of the raw data and facilitates both cross-case and within-case analyses'*(Bowling 2009)

Each study starts on a separate framework (matrix), with themes and sub-themes as column headings, and participants (cases) as rows. The illustrative extracts of data are added, or coded, to a cell under the appropriate heading attributed to the case. In qualitative framework analysis,

> *'a single item is permitted to be coded in more than one category in order to permit cross-referencing and the generation of several hypotheses'*(Bowling 2009)

The flexibility of framework analysis is in the potential for creating individual matrices per case, per participant or per theme. Limitations of thematic and framework approaches are described by Gale et al (2013) as:

- the spread sheet appearance which, *'increases the temptation for those without in-depth understanding of qualitative research to attempt to quantify qualitative data'*
- its *'time consuming and resource-intensive'* nature
- its *'high training component to successfully using the method in a new multi-disciplinary team'*

Key theories adopted for this study

This chapter started with discussion of philosophical underpinnings of research design taking account of worldviews, the reflexive researcher, and the place of research paradigms and the interpretative or theoretical frameworks. The key theoretical frameworks for this study, based on the research question and pragmatic research design, are listed here with further detail in the relevant chapters:

- Chapter 4: Socio-Technical Systems (STS) theory and Computer Supported Cooperative Working (CSCW)
- Chapter 5: Explanatory theory development, educational and change management theories
- Chapter 6: Kirkpatrick's Four Level Model for Evaluating training
- Chapter 7: educational and philosophical theories, Force Field theory

Summary of this chapter

This chapter described and linked research paradigms, methodologies, methods and research designs. It covered aspects of quality of evidence within quantitative, qualitative and mixed methods approaches before focusing on the methods adopted for the current research.

CHAPTER 3 (Phase I) A systematic review of healthcare practitioners' views of ehealth supported shared care

'In nothing do men more nearly approach the gods than in doing good to their fellow men'

Cicero, philosopher
and political theorist
(106 BC–43 BC)

Introduction to the chapter

This chapter explores medical and non-medical practitioners' views of ehealth and shared care through a systematic review. A meta-narrative approach was adopted with the results intended to contextualise, inform and focus the design of subsequent research phases.

Background

Shared care, described as cooperative working between healthcare professionals, has long been viewed as both beneficial to patients and a more efficient use of professionals' skills (Department of Health 1989; Nolan 1995; Hepler & Strand 1990; Crown 1999; Clinical Resource Audit Group 1999; Scottish Executive 2002; Scottish Executive 2005). Health strategists in the UK and worldwide promote the adoption of ehealth to support shared care, where technology facilitates medical and non-medical practitioners, such as nurses and pharmacists, working in partnership (Darzi 2008; Centre for Workforce Intelligence 2011; Scottish Government 2011a; Department of Health 2011; European Commission 2011; World Health Organisation 2011a). As previously described in Chapter 1, electronic health, or ehealth, is defined by the World Health Organisation as, *'the combined use of information and communications technologies for health'*(WHO 2011b). This has been further refined by the European Commission Information Society to include, *'tools and services for health*'(ECIS 2011).

eHealth studies to date have focused on the medical practitioners' perspective of the adoption of technology (Greenhalgh et al 2005; May 2005a; May 2006; Rahimi & Vimarland 2007; Liddell et al 2008; Clark et al 2008; Boddy et al 2009; Gagnon 2009) or specific ehealth applications, such as telehealth (May 2005b; Mair et al 2007) or electronic records (Greenhalgh et al 2009; Greenhalgh et al 2010a; Ludwick & Doucette 2009; McGowan et al 2009; Robertson et al 2010; Dobrev et al 2009; Dobrev et al 2010). More patient-centred studies have investigated the impact of ehealth on quality and safety of care (Car et al 2008; Black et al 2011) or confidentiality (Greenhalgh et al 2010b).

Problem statement

Non-medical practitioners play an increasingly accepted role in shared care (Bond 2000; Strath 2001; Latter et al 2005; Smalley 2006; George et al 2006;

Tonna et al 2007; Blenkinsopp et al 2007 & 2008; Stewart et al 2008 & 2009 & 2010; Hobson et al 2010; Royal Pharmaceutical Society & Royal College of General Practitioners 2011) and yet their views of the impact of ehealth on shared care remain largely unknown. This systematic review was conducted to explore and report research related to medical and non-medical practitioners' views of the impact of ehealth on shared care.

Objective

To explore and report the context, methodologies, findings and gaps in research which has been conducted around healthcare practitioners perceptions of ehealth in relation to shared care.

Review question

The overarching review question was, *'What research has been conducted around healthcare practitioners' views of ehealth supported shared care?'* Sub-questions to be addressed were:

- What ehealth related shared care research has been conducted by whom in which areas of ehealth?
- Why, how and where did they conduct their research?
- What was the methodological type and quality of the research?
- What were the key findings and gaps in research from healthcare practitioners' views of ehealth in relation to shared care?

Methods & Design

A protocol was developed following best practice (Ackers et al 2009) and a systematic review conducted using a meta-narrative approach (Greenhalgh et al 2005). This approach is designed to draw out each storyline before pulling them together in an *'over-arching narrative'* to *'highlight similarities and differences in the findings from different traditions'*(Greenhalgh 2008). Five principles of pragmatism, pluralism, historicity, contestation and peer review (Figure 3.1) are applied across six phases of planning, search, mapping, appraisal, synthesis and recommendation.

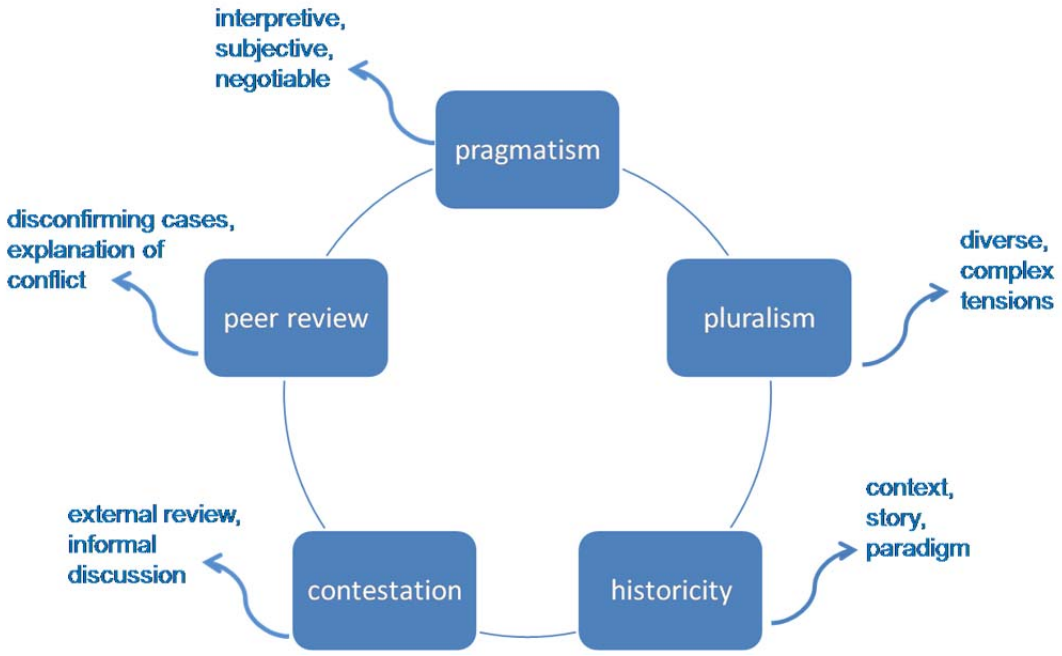

Figure 3.1 Five principles of a meta-narrative review

In application, principles of pragmatism and pluralism challenged the multi-disciplinary review team members (KM: IT, Systems Practice, Innovation & Design; DS: pharmacy practice and education; AS: pharmacy practice, epharmacy and policy development) to value both their, and the storylines, diversity. Historicity drew out the context and placement of each storyline situating it within a research tradition while contestation valued disconfirming or seemingly deviant cases to help explain perceived conflicts. Periodic peer review by external advisors (YK: medical practice, clinical pharmacology, public health; LR: general medical practice, public health, ehealth, policy development) brought rigour and robustness through questioning motives and justification for inclusion, exclusion and interpretation of individual storylines and the subsequent recommendations.

The planning phase of the meta-narrative review involved selecting research team members from varied backgrounds, meetings, informal discussion and agreement on staged outputs and, in contrast to Cochrane Reviews, openness to revising the protocol (Higgins & Green 2009). The search phase involved rigorous, intuitively driven tracking down of relevant research activity as a basis for the mapping phase where influences, stakeholders and storylines were

correlated. Data extraction and critical appraisal tools (CASP 2011; Boynton & Greenhalgh 2004; Mays & Pope 2000; Katrak et al 2004) were applied before narrating the over-arching story in which similarities and differences were synthesised to provide recommendations. Ethical review was not required for this study.

Eligibility criteria

The review included medical and non-medical practitioners who provide ehealth supported shared care for a multi-perspective view. Articles which focused solely on searching the internet for health or medicines information or exchange of emails, with or without attachments, were excluded as these were not considered to be purposefully developed ehealth tools or services (WHO 2011b; European Commission Information Society 2011). Only readily accessible, full articles published in English language from 1st January 2005 to 28th February 2011 were included. The date limits were based on the need for currency of the technology reported and publication of the key text (Greenhalgh et al 2004b). Due to the paucity of articles retrieved, no studies were excluded on the basis of design or quality.

Information sources and search strategy

Each of the databases selected (Table 3.1; ASLIB, EBSCO Host, Cochrane Library including DARE and EPOC, Informa Healthcare, PsycNet, Sciverse Scopus, Zetoc) showed multiple results on the preliminary scoping search term (health* AND technolog*) providing worldwide coverage of health technology research. This also guided the refinement of the search terms through team negotiation to identify published, peer reviewed articles maintaining the review focus on shared care. Grey literature, in the form of policy documents, consultations and reports, were sourced from government and NHS websites, and experts in the field, to provide context throughout this review.

Table 3.1 Electronic database sources

Research database	Description of coverage
ASLIB	Collection of British and Irish theses (1970 onwards)
EBSCO Host	Searched the Allied and Complementary Medicines Database (AMED), Business Source Premier, Cumulative Index to Nursing and Allied Health Literature (CINAHL), International Pharmaceutical Abstracts (IPA), Library, Information Science & Technology Abstracts (LISTA) and the US National Library of Medicine's database, MEDLINE
Cochrane Library (including DARE and EPOC)	Comprehensive database of systematic reviews of evidence for healthcare decision making including DARE (Database of Reviews of Effectiveness) and Effective Practice and Organisation of Care (EPOC) group
Informa healthcare	Access to pharmaceutical and medical books and journals
PsycNet	Access to the American Psychological Association articles
Sciverse Scopus	A comprehensive science-specific database of research literature including ScienceDirect and Scopus
Zetoc	Electronic table of contents of current journals and conference proceedings

Study selection

An incremental search string (Table 3.2) was applied with results and exceptions recorded, for each research database at each level of refinement, using an adapted PRISMA Flow Diagram (Moher et al 2009). Titles were independently screened by two researchers (KM, DS) with abstracts followed by full papers reviewed where any doubt remained. Consensus on final inclusions was negotiated.

Table 3.2 Incrementally applied search string

Level	Search string (applied incrementally using Boolean AND from January 1, 2005 to February 28, 2011)
1	(eHealth OR ePharmacy OR e-Health OR e-Pharmacy OR ehealth OR epharmacy OR e-health OR e-pharmacy OR "electronic health")
2	(technolog* OR comput* OR informati* OR electronic OR communicat*)
3	("shared care" OR partnership OR collaborati* OR interprofessional OR inter-professional OR (GP AND pharmacist) OR (doctor AND pharmacist) OR (GP AND patient) OR (doctor AND patient) OR (pharmacist AND patient))
4	(perce* OR view* OR perspective*)

Data extraction, appraisal and analysis

Data from the selected studies were tabulated mapping *'5 Ws & H'* (Who, What, Why, Where, When & How) to corresponding PICOS terms (Who/Population,

What/Intervention, Why/Comparator, Where, When, How/Study design, Author notes/Outcome). Variables extracted included participants, elements, aims, geographical and practice settings, timelines and backgrounds, methods and response rates along with definitions of ehealth and authors' conclusions. Critical appraisal tools geared to each study design type (CASP 2011; Boynton & Greenhalgh 2004; Mays & Pope 2000) were applied independently by two researchers (KM, DS). Reviewer notes were added to complete the mapping and appraisal overview. The overall quality of evidence was assessed and risk of publication and selective reporting bias considered.

Data synthesis

Meta-narrative review approach which, *'treats conflicting findings as higher order data'*(Greenhalgh et al 2005), was followed in comparing commonalities while contesting differences in the findings of the included studies.

Results

Study selection

Screening reduced the initial 327 papers identified to 12 (Figure 3.2). Reasons for excluding papers were their focus on internet searching or email exchange or that they did not focus on the views of healthcare professionals working collaboratively supported by ehealth. Ten papers were selected for inclusion from the electronic database searches with a further two added through reference tracking (Table 3.3).

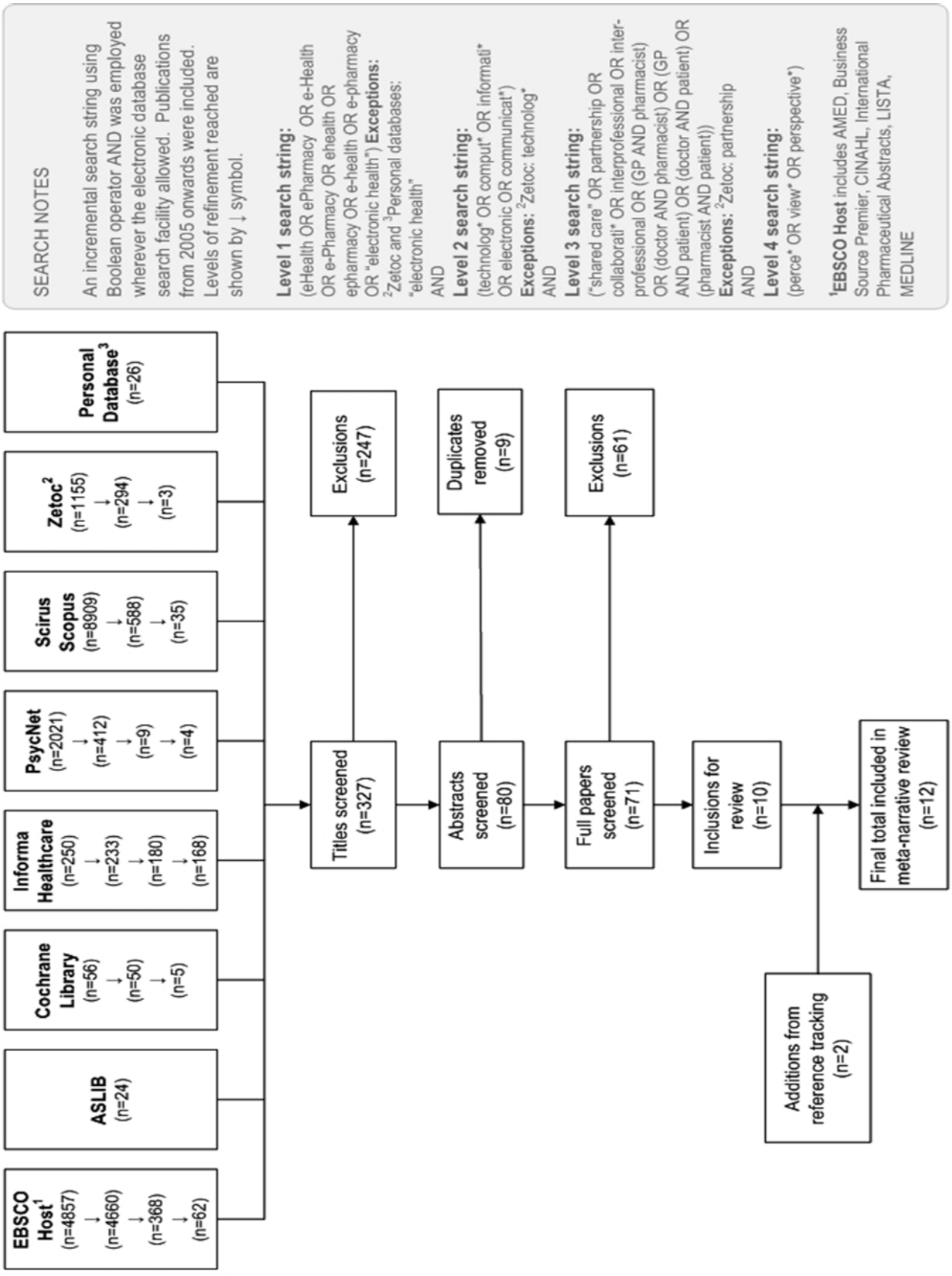

Figure 3.2 Search Phase results presented as an adapted PRISMA Flow Diagram (Moher et al 2009)

Table 3.3 Papers selected for review

Reference	Article Title in full
Richards et al (2005)	Remote working: survey of attitudes to ehealth of doctors and nurses in rural general practices in the United Kingdom
Pagliari et al (2005)	Adoption and perception of electronic clinical communications in Scotland Informatics in Primary Care
Granlien & Simonsen (2007)	Challenges for IT-supported shared care: a qualitative analyses of two shared care initiatives for diabetes treatment in Denmark
Chronaki et al (2007)	Evaluation of Shared EHR Services in Primary Healthcare Centers and their Rural Community Offices: the Twister Story
Ludwick & Doucette (2009)	Adopting electronic medical records in primary care: Lessons learned from health information systems implementation experience in seven countries
Boddy et al (2009)	The influence of context and process when implementing e-health
Greenhalgh et al (2009)	Tensions and paradoxes in electronic patient record research: a systematic literature review using the meta-narrative method
Melby & Helleso (2010)	Electronic exchange of discharge summaries between hospital and municipal care from health personnel's perspectives
Ahmad et al (2010)	Perspectives of Family Physicians on Computer-assisted Health-risk Assessments
Greenhalgh et al (2010b)	Adoption and non-adoption of a shared electronic summary record in England: a mixed-method case study
Robertson et al (2010)	Implementation and adoption of nationwide electronic health records in secondary care in England: qualitative analysis of interim results from a prospective national evaluation
Ekeland et al (2010)	Effectiveness of telemedicine: A systematic review of reviews

Study characteristics and results

The mapping and appraisal overview (Table 3.4) included three reviews (systematic, meta-narrative, realist), four qualitative, two mixed methods and three quantitative (questionnaire based) studies. The primary research studies used combinations of questionnaires, case study, group and individual interviews, observation and extraction of data from records to collect data which were then analysed using thematic, interpretive, analytic induction/constant comparative and statistical analysis methods. Practice settings were rural or urban featuring primary care, secondary care or both. Geographical settings ranged from single country, including Canada, USA, Denmark, Sweden, Australia, New Zealand, Crete, Norway, England, Scotland, to Europe and worldwide. The focus was on electronic records (7), telemedicine (2) or general ehealth

implementation (3) from the perspective of doctors, nurses, IT developers, policy makers, managers and one hospital pharmacist.

Definitions of ehealth and shared care

Ehealth definitions were highlighted in this review (Table 3.4) as they have yet to find consensus (Eysenbach et al 2001; Oh et al 2005). Of the twelve articles reviewed, five gave an explicit or implicit definition of ehealth similar to WHO (WHO 2011b) and ECIS (ECIS 2011; Boddy et al 2009; Ludwick & Doucette 2009; Chronaki et al 2007; Ahmad et al 2010; Ekeland et al 2010). One provided a list of functionality and resource requirements (Richards et al 2005) while six defined a specific ehealth application but not ehealth (Greenhalgh et al 2009; Robertson et al 2010; Pagliari et al 2005; Granlien & Simonsen 2007; Melby & Helleso 2010; Greenhalgh et al 2010b). Although shared care is the basis for inclusion only one included a definition,

> *'establishing coherent treatment of the patient through close coordination and cooperation across care sector boundaries'*(Granlien & Simonsen 2007),

while Melby & Helleso et al (2010) offered *'integrated'* or *'seamless'* care as alternative terms.

Table 3.4 Systematic Review: Mapping & Appraisal phase results

Article/ Aspect	WHO	WHAT	WHY	WHERE		WHEN	HOW	Summary of author conclusions plus review notes
	Actors, Population	**Elements, Intervention (definition of eHealth)**	**Aim, Comparator**	**Geographical setting**	**Practice setting**	**Timeline, Background**	**Study design, method (response rate)**	**Storyline, Outcome**
Richards et al (2005)	Nurses, Doctors	Remote working with telemedicine (not explicitly defined but to have access to ISDN line, scanner, digital camera, video conferencing)	Health professionals attitude to eHealth	Scotland	Remote, rural GP practice	2002; references NHS and DoH strategic programmes	Postal questionnaire to GPs (n=154; all) and nurses (n=67; 1 per practice) in inducement (remote) practices; (87%); Quantitative analysis	Recognition of potential benefits but low uptake of telemedicine by isolated practices. Respondents (37%) rated themselves as experienced computer users. Barriers: cost, workload, lack of training, technical support, patient privacy, impact on consultation. EHealth rated more positively for education than clinical practice. **Notes:** purpose clear; sampling not fully justified; questionnaire not tested for validity, reliability, piloted; unjustified and inconsistent comparison of GPs/nurses.
Pagliari et al (2005)	Primary and Secondary care representat-ives	Uptake of eHealth facilities: eResults, eReferral, eDischarge, eOutpatient booking (not explicitly defined but to include list above)	Perceptions of users in primary and secondary care	Scotland	All	2002-3; Electronic Clinical Communications Implementation (ECCI) programme; references NHS and DoH strategic programmes	Delphi devised 15 month prospective survey (against 37 measures) + retrospective questionnaire (47%); Quantitative analysis	Implementation and uptake of eHealth alternatives to paper based clinical information exchange (does not include EHRs). Benefits: convenience, ease of use, time-saving, audit trail. Barriers: data entry duplication, technological difficulties, time, training and resources. **Notes:** question justification of sampling; 'representatives' not defined; 'significant' increase claimed in results not demonstrated in graph.

Article/ Aspect	WHO	WHAT	WHY	WHERE		WHEN	HOW	Summary of author conclusions plus review notes
	Actors, Population	**Elements, Intervention (definition of eHealth)**	**Aim, Comparator**	**Geograph-ical setting**	**Practice setting**	**Timeline, Background**	**Study design, method (response rate)**	**Storyline, Outcome**
Granlien & Simonsen (2007)	Physicians, nurses, GPs, IT developers	Web -based shared electronic diabetes patient record (not explicitly defined - focus on IT supported shared care)	Why it is so difficult in primary care to implement IT supported shared care	Denmark	Primary and Secondary care	2005; diabetes treatment IT supported shared care initiatives; references Danish diabetes, IT and shared care strategies	Two case studies – one in primary care, one secondary care (21 interviews, 35 hours of observation); grounded theory	Three main challenges impeding IT supported shared care: poor integration between secondary and GP IT systems; incompatibility with GP work ethic and practice; discrepancy in identified need for shared care. **Notes:** not clear if coding of themes was by one individual; limited evidence of results validation; diabetes evidence not referenced; limitations and bias not discussed.
Chronaki et al (2007)	Health professionals and patients	EHRs also known in study as eRural (the use of ICT in healthcare)	Attitudes and perceptions to eHealth	Crete	Remote healthcare facilities	2007; Twister project with strategy of fast track deployment and continuous training and evaluation	Questionnaire (Health professionals 29/30; Patients 324; Quantitative analysis	EHRs welcomed by all; health professionals (44%) have significant computing experience; patients have low rate (19%) of internet access; rural-urban divide; need for 'systematic educational and awareness raising'. Barriers to adoption of EHR: heavy workload, limited secretarial support, shortage of medical personnel, using EHR is time consuming. **Notes:** question validity of questionnaire esp. used with patients who are unaware/not users of the Internet; patient sampling power not stated; very limited reference list.

Article/ Aspect	WHO	WHAT	WHY	WHERE		WHEN	HOW	Summary of author conclusions plus review notes
	Actors, Population	**Elements, Intervention (definition of eHealth)**	**Aim, Comparator**	**Geograph-ical setting**	**Practice setting**	**Timeline, Background**	**Study design, method (response rate)**	**Storyline, Outcome**
Ludwick & Doucette (2009)	General practitioners	EMR as service provider system (not explicit but computerised health information system (HIS))	To understand factors and influencers affecting implement ation outcomes	Canada, USA, Denmark, Sweden, Australia, New Zealand, UK	General practice/ primary care	Conducted Nov'08 to Jan'09 on materials published 2000-2007; increasing demand placed on healthcare systems	Systematic review of 86 articles	Summarised as already known: HIS can help mitigate service demand, adoption is hampered by clinician concerns (privacy, patient safety, quality of care, decline in efficiency post-implementation), physicians are not proactive in adopting HIS (high costs, risks of liability, data security). Summarised as new findings: HIS do not affect efficiency, quality of care or safety; quality of implementation process is key, mitigated with training, bar coding systems, pilots, shared terminology, strong IT management matching usability, computing skills, system fit to organisational culture. Suggests using STS. **Notes:** search string not provided; no inclusion/ exclusion criteria; no tools; no results tables; single reviewer.
Boddy et al (2009)	Policymakers, senior Health Board management; clinicians, suppliers with experience of ehealth: management, communication, computerised decision support and information systems	(the application of ICT across the whole range of functions which may affect the health of citizens and patients)	Influence of context and process	Scotland	Not clear	Not stated; part of HAVEN project; no policy document references	Semi-structured interviews (18); coding of transcripts	External (policy/strategy, technology, health system) and internal (working practices, organisational culture, role, finance) contexts. Increasingly IT literate population; professional differences over patient data security. Ambiguity of cost effectiveness – national funding, regional autonomy to prioritise. IT inter-regional incompatibility; can draw on experience of information systems in other sectors. Five issues to be managed: embedding into workflow; meet local needs and costs within national systems; support or adapt cultural values; involve users in redesigning working processes.

Article/ Aspect	WHO	WHAT	WHY	WHERE		WHEN	HOW	Summary of author conclusions plus review notes
	Actors, Population	**Elements, Intervention (definition of eHealth)**	**Aim, Comparator**	**Geograph -ical setting**	**Practice setting**	**Timeline, Background**	**Study design, method (response rate)**	**Storyline, Outcome**
Greenhalgh et al (2009)	EPR stakeholders	EPRs (not explicit on eHealth but sets out to track definitions of EPR thru the review)	Making sense of and contextuali -ing EPR in philosophical and research traditions	Unlimited	Health organisat -ions	Started 2007; policy document promises of technologic al utopia, extensive heterogene ous research literature on EPRs	Systematic review of 118 articles using meta-narrative – the unfolding of current disagreement (tensions and paradoxes) within a discipline	Questions definition, scalability, transferability of EPR systems emphasising the ongoing need for human contextualising of data. Findings suggest EPRs may offer efficiencies in audit, research, billing but primary clinical work may be adversely affected. Tensions noted in the EPR, the EPR user, organisational context, clinical work, process of change, implementation success, complexity, scale. **Notes:** clear consistent methodology throughout; heavy emphasis on research philosophy (positivist, interpretivist, critical, Actor-Network Theory, conventional, participatory) and research traditions (HCI, EBM, ethnomethodology; workplace redesign, safety-critical systems).
Melby & Helleso (2010)	Healthcare providers (nurses, physicians) and project managers	EPR inc. eMessages; (not explicit but ICT as a tool for integrated care between hospital and municipal care services)	Implications of electronic discharge summary for shared care; Experience of healthcare staff with introduction of e-messages	Norway	Municipal care and associated hospital	Seamless or coordinated care in a health IT strategy (2004) aimed at rise in chronic diseases; conducted 2006	26 group/ individual semi-structured interviews (49 inc.34 municipality, 13 hospital care plus 2 project managers); Thematic analysis	Changes in work processes; increased legibility; better prepared for receiving patients despite unaltered and sometimes inaccurate content with relevance related to perspective but no significant increase in integration of care; importance of point-of-care technologies; increased professional networks promoting integrated care. **Notes:** convenience sample but no demographic breakdown of roles; ICT the catalyst/facilitator for shared care and increased organisational awareness.

Article/ Aspect	WHO	WHAT	WHY	WHERE		WHEN	HOW	Summary of author conclusions plus review notes
	Actors, Population	**Elements, Intervention (definition of eHealth)**	**Aim, Comparator**	**Geograph -ical setting**	**Practice setting**	**Timeline, Background**	**Study design, method (response rate)**	**Storyline, Outcome**
Ahmad et al (2010)	Physicians	Computer-assisted health risk assessment (interactive computer applications transforming medical practice and empowering health consumers)	To inform future eHealth design by understand-ing physicians' perspectives of a related system	Canada	Urban, multi-doctor, hospital affiliated family practice clinic	2005; follow on from a related RCT; no policy references	Semi-structured interviews (10); Analytic induction and constant comparative analysis	Three emergent themes (with subthemes): perceived benefits (opening discussion of psychosocial risk, general facilitation), perceived concerns or challenges (generating new risk information, patient readiness, visit length), feasibility (general acceptance, visit fit, resources to implement). **Notes:** clear methodology fully explained; useful tool in relation to psychosocial health risks discussion at periodic health exams and follow up rather than all visits.
Greenhalgh et al (2010b)	Policy makers, managers, clinicians (including doctors, nurses, hospital pharmacist), software suppliers	Electronic Summary Care Record (SCR on shared, limited, secure access national database – medication, allergies, ADRs plus diagnoses, end of life care); clear definition of SCR as an element of eHealth	Evaluate adoption and non-adoption – usability, use, functionality, impact – to explain variation of adoption and use *'What hopes and dreams did different stakeholders have about it?'*	England	3 primary care out-of-hours and walk-in centres	2007-2010	Mixed method, multilevel case study; Quantitative (416325 primary care OOH records); Qualitative data (140 interviews); observation to study the process of STS change; Quantitative analysis plus Thematic, Interpretive analysis	Implementation complex and technically challenging. Subtle, contingent benefits where accessed – individual clinician is main factor in level of use and coping with inaccurate/incomplete data, inadequate server – supports better quality care, clinician confidence, prevention of medication errors but no evidence of improved safety. Risk to patient privacy. Expect complex interdependencies and tensions (clinical, technical, political, commercial) high implementation workload when on a national level. Impact of change agents and causal influences. **Notes:** large scale, comprehensive study; methodology fully explained; clear questions, challenging answers seek to explain in context; draws STS network out to identify actors in 5 sub-networks (design, implementation, governance, frontline user, evaluation).

Article/ Aspect	WHO	WHAT	WHY	WHERE		WHEN	HOW	Summary of author conclusions plus review notes
	Actors, Population	**Elements, Intervention (definition of eHealth)**	**Aim, Comparator**	**Geograph-ical setting**	**Practice setting**	**Timeline, Background**	**Study design, method (response rate)**	**Storyline, Outcome**
Robertson et al (2010)	Hospital managers, implementat-ion team and IT staff, doctors, nurses, AHPs, admin staff, patients, carers	EHRs; (not explicit on eHealth but EHR defined as a digital, longitudinal record of a patient's health and healthcare that can be shared by different healthcare providers)	To identify insights and experiences by exploring individuals expectations experiences and opinions	England	5 NHS secondary care trusts – early implement-ation sites	Feb 2009 – Feb 2010; part of HAVEN project	Mixed method (interviews, observation, quantitative data) longitudinal, multisite, socio-technical case study; Thematic analysis – socio-technical coding matrix	Three main themes termed dimensions: organisational, social or human, technical – each further refined into sub themes. Concludes with four policy recommendations related to: delays and frustrations caused by top-down, centrally driven policy approach; need to permit greater local choice and flexibility of systems and delivery; recognise need for realistic timescale; immediate need to clarify type and scale of EHRs. **Notes:** demographic breakdown of purposive sample provided; timeline of NPfIT and key publications; interim findings; notes socio-technical character of issues raised.
Ekeland et al (2010)	Patients, health professionals, care givers	All e-health with focus on telemedicine (not explicitly defined)	Impacts and costs of tele-medicine services	Europe		Conducted between Feb'09 and Jul'09 for articles published 2005-2009; part of MethoTelem ed project	Systematic review of 80 articles using realist review principles	Summarised as what was already known: evidence regarding the effectiveness of telemedicine is patchy, quality of research is poor. Summarised as new findings: evidence base of robust knowledge is growing but new knowledge needed, further research required in economic analyses, patient perspectives of effectiveness. **Notes:** search strategy not available but otherwise comprehensive, practical review of reviews.

Critical Appraisal

A critical appraisal of each of the study design types – systematic reviews, qualitative, quantitative (questionnaire based) and mixed methods – is detailed in Tables 3.5-3.8.

Quality of Evidence

The review team applied a modified form of the GRADE tool (Grading of Recommendations, Assessments, Developments and Evaluation; GRADE 2011). Without access to GRADEpro software, this was done manually and added to the critical appraisal findings (Tables 3.5 - 3.8). The *'quality of evidence'* was based initially on the study design but adjusted for rigour of application to a rating of *'high'*, *'moderate'*, *'low'* or *'very low'*. A further rating, termed '*magnitude of effect*' was added based on applicability of the review article findings to the current research.

Table 3.5 Critical Appraisal Tool for reviewing reviews from Critical Appraisal Skills Programme (CASP) Public Health Resource Unit (CASP 2011)

Quality checklist for reviewing reviews	**Ludwick & Doucette (2009)**	**Greenhalgh et al (2009)**	**Ekeland et al (2010)**
Clearly focused question **- population,** **- intervention** **- outcome**	Y Primary care in 7 countries EMR Lessons from implementation	Y - EPR Tensions and paradoxes	Y - Telemedicine effectiveness
Right type of study **- address the question, appropriate study design**	**Not clear -** inclusion/exclusion criteria and search terms not stated, included studies not listed	Y	Y
Answering 'Y' to the two screening questions above is an indication to proceed with remaining eight questions			
Finding relevant studies	Conducted in 2008 on articles published between 2000-2007 in Canada, USA, UK, NZ, Australia, Denmark, Sweden. No search terms given but 6 databases, author tracking, broad website searching	Y	Conducted between Feb'09 and Jul'09 for articles published 2005-2009 in comprehensive range of databases
Quality assessment	N	Y	Y
Combining studies justified	N – included studies not listed, results not displayed, variation not discussed	Y	Y
Results	Brief selective, narrative concluding with these assertions: Summarised as already known: health information systems can help mitigate service demand, which is due to increase further, adoption is hampered by clinician concerns (privacy, patient safety, quality of care, decline in efficiency post-implementation), physicians are not proactive in adopting HIS (high costs, risks of liability, data security). Summarised as new findings: HIS do not affect efficiency, quality of care or safety, quality of implementation process is key, risks mitigated with training, bar coding systems, pilots, shared terminology, strong IT management matching usability, computing skills, system fit to organisational culture.	Implementation was complex and technically challenging. Subtle, contingent benefits where accessed – individual clinician is main factor is level of use and coping with inaccurate/ incomplete data, inadequate server – supports better quality care, clinician confidence, prevention of medication errors but no evidence of improved safety. Risk to patient privacy. Expect complex interdependencies and tensions (clinical, technical, political, commercial) high implementation workload when on a national level. Impact of change agents and causal influences.	Summarised as what was already known: evidence regarding the effectiveness of telemedicine is patchy, quality of research is poor. Summarised as new findings: evidence base of robust knowledge is growing but new knowledge needed, further research required in economic analyses, patient perspectives of effectiveness.
Precision	Not stated	Not stated	Not stated
Applicable locally	Can't tell	Y	Y

Perspective of outcomes	Can't tell	Y	Y
Evidence for policy or practice change	N – report methodology is not explicit, content is inadequate	Y	Y
Additional comments	Lack of clarity of method and results.	Pragmatic, well presented meta-narrative review. Discusses philosophical positions (positivist, interpretivist, critical, recursive) and identifies relevant research traditions (human computer interaction, evidence based medicine, symbolic interactionism and ethnomethodology, workplace redesign, safety critical systems research).	A pragmatic, well presented and comprehensive realist review
GRADE (2011) **Quality of evidence (magnitude of effect)**	+ + (low)	+ + + (moderate)	+ + + (moderate)

Table 3.6 Critical Appraisal Tool for qualitative studies from Critical Appraisal Skills Programme (CASP) Public Health Resource Unit (CASP 2011)

Quality checklist for Qualitative studies	**Granlien & Simonsen (2007)**	**Boddy et al (2009)**	**Melby & Helleso (2010)**	**Ahmad et al (2010)**
Clear statement of aims **- goal, importance, relevance**	Y	Y	Y	Y
Methodology **- appropriate**	Y	Y	Y	Y
Answering 'Y' to the two screening questions above is an indication to proceed with remaining eight questions				
Design **- appropriate, justified**	Y but alternatives not explained	Y - in the context of the larger HAVEN project of which it is part	Y but alternatives not explained	Y – in the context of a related RCT
Sampling, recruitment **- appropriate, explained**	Y	N - 18 purposively recruited but demographic breakdown not provided	Y but demographic breakdown not provided	Y
Data collection **- justified, explained**	Y	Y	Y	Y
Reflexivity **- role of researcher**	Y	Y	Y	Y
Ethics statement	N	Y	Mentions obtaining consent	Y
Data analysis **- rigor, method, bias**	Y	Y	Y	Y
Findings **- explicit, discussed, relate back to question**	Y	Y	Y	Y
Value **- contribution to existing knowledge, further research areas, use of findings**	Three main challenges impeding IT supported shared care: poor integration between secondary and GP IT systems; incompatibility with GP work ethic; discrepancy in identified need for shared care	Confirms ehealth projects, like general information systems, similarly affected by contextual factors. External (policy/strategy, technology, health system) and internal (working practices, organisational culture, role, finance) contexts. Increasingly IT literate population; professional differences over patient data security. Ambiguity of cost effectiveness – national funding, regional autonomy to prioritise. IT inter-regional incompatibility	Changes in work processes; increased legibility; better prepared for receiving patients despite unaltered and sometimes inaccurate content with relevance related to perspective but no significant increase in integration of care; importance of point-of-care technologies; increased professional networks promoting integrated care.	Three emergent themes: perceived benefits (opening discussion of psychosocial risk, general facilitation), perceived concerns or challenges (generating new risk information, patient readiness, visit length), feasibility (general acceptance, visit fit, resources to implement) but does not relate these back to

				future eHealth design.
Additional comments	States, *'not found any studies concerning the users roles in adopting technological infrastructures supporting shared care'*	Part of the HAVEN project.		Although published in 2010, data collection took place in 2005 partially explaining the high proportion of dated references.
GRADE (2011) **Quality of evidence (magnitude of effect)**	++ (low)	+ (low)	++ (low)	+ (low)

Table 3.7 Critical Appraisal Tool for mixed methodology case studies and other in-depth complex designs. Based on Mays N, Roberts E, Popay J (2001)

Quality checklist for mixed methodology studies	**Greenhalgh et al (2010b)**	**Robertson et al (2010)**
Question **- clear, terms defined**	Y	Y
Design **- appropriate**	Y	Y
Funding	UK NIHR	UK NIHR
Resource system **- source of innovation**	National Programme for IT (NPfIT) in England	NPfIT NHS Care Records Service in England
Innovation	Summary Care Records (SCR)	Electronic Health Records (EHR)
Context **- well described**	Y	Y
User system **- user of innovation**	Authorised clinicians providing emergency and unscheduled care	Authorised healthcare providers and patients
Dissemination mechanism	Part of Connecting for Health Evaluation Programme	Core element of NPfIT
Implementation mechanism	SCR is drawn from patients' GP held electronic record which can be viewed by patients registered with HealthSpace	Local and national rollout in progress
Sampling **- conceptual, generalisation**	Y	Y
Data collection **- systematic, auditable**	Y	Y
Data analysis **- systematic, rigorous, conflict handling**	Y	Y
Results	Implementation was complex and technically challenging. Subtle, contingent benefits where accessed – individual clinician is main factor is level of use and coping with inaccurate/incomplete data, inadequate server – supports better quality care, clinician confidence, prevention of medication errors but no evidence of improved safety. Risk to patient privacy. Expect complex interdependencies and tensions (clinical, technical, political, commercial) high implementation workload when on a national level. Impact of change agents and causal influences.	Three main themes termed dimensions: organisational, social or human, technical – each further refined into sub themes. Concludes with four policy recommendations related to: delays and frustrations caused by top-down, centrally driven policy approach; need to permit greater local choice and flexibility of systems and delivery; recognise need for realistic timescale; immediate need to clarify type and scale of EHRs.
Conclusions	Y	Y
Reflexivity	Y	Y
Ethics	Y	Y

Additional comments	Comprehensive and clear with heavy emphasis on theoretical and philosophical foundations. Part of an ongoing research programme.	Part of HAVEN project. Comprehensive, practical, thorough. Seeks to inform ongoing implementation programme by learning from early adopter sites.
GRADE (2011) **Quality of evidence (magnitude of effect)**	++ (moderate)	++ (moderate)

Table 3.8 Critical Appraisal Tool for questionnaire surveys based on Boynton P, Greenhalgh T (2004)

Quality checklist for questionnaire surveys	**Richards et al (2005)**	**Pagliari et al (2005)**	**Chronaki et al (2007)**
Research question and design - **clear, appropriate**	Y	Y	Y
Sampling - **sufficient, understood**	Y	Y	Health professionals – Y Patients – not clear
Instrument - **validity, reliability, pilot**	Y	Quantitative indicators (1) – Y Qualitative instrument (2) - N	N N
Response - **rate, non-responders**	87% after 2 reminders	(1) auto generated data (2) 47% after 2 reminders	29 out of 30 health professionals 324 patients - N
Coding and analysis - **appropriate, accurate**	Y	(1) – Y (2) - not clear	Not clear N
Presentation of results - **reporting relevance**	Y	(1) – Y (2) – N uses terms such as *'most', 'main', 'some'*	N – only *'most important findings'* N – potential bias in sampling, analysis, reporting
Additional comments	Compares attitudes to eHealth between GPs and nurses in isolated Scottish practices drawing parallels with rural Australia. Although remote monitoring of patients is mentioned, only video- and teleconferencing and data exchange are fully explored.	(1) reports the uptake of eHealth in Scotland under the ECCI (Electronic Clinical Communications Implementation) programme limited to data exchange (results, email, letters, referrals). (2) reports user perceptions of ECCI	Evaluation of remote healthcare provider uptake of the HYGEIAnet in Crete for EHRs under the Twister project. Straightforward measure of uptake of EHRs, questionnaire to health professionals may be valid but basis for patient questionnaire not established, neither validated nor piloted, no limitations stated, question patient sample understanding of eHealth given low computer literacy/internet access. Very limited reference list (n=7).
GRADE (2011) **Quality of evidence (magnitude of effect)**	++ (very low)	++ (low)	+ (very low)

What ehealth shared care research has been conducted by whom?

Three ehealth research themes were identified with a shared care focus:

1. Telemedicine (Ekeland et al 2010; Richards et al 2005)
2. Generalised ehealth implementation (Boddy et al 2009; Ahmad et al 2010; Pagliari et al 2005)
3. Electronic health records (Greenhalgh et al 2009; Ludwick & Doucette 2009; Robertson et al 2010; Chronaki et al 2007; Granlien & Simonsen 2007; Melby & Helleso 2010; Greenhalgh et al 2010b)

Some feature co-authors with a long tradition, and continuing interest, in ehealth research: Pagliari et al (2005) – Morrison, Sullivan; Boddy et al (2009) – Mair; Robertson et al (2010) - Barber.

Why, how, when and where did they conduct their research?

Reasons given for conducting the research include exploring (or identifying or evaluating) the impact (or attitudes or perceptions or factors or influences or context or processes) of ehealth implementations on individuals (system users or healthcare professionals or patients) to inform (or contextualise or understand or make sense of or influence) future ehealth outcomes.

What was the methodological quality of the research?

Appropriate methodologies were adopted for all studies but, following GRADE (2011) criteria for assessment, the consistency, precision and rigour with which they were applied in some articles raised questions over the validity and robustness of some findings (Boddy et al 2009; Ludwick & Doucette 2009; Chronaki et al 2007) (Tables 3.5, 3.6, 3.8).

What were the key findings?

From the earliest (Richards et al 2005) to the most recent study (Ekeland et al 2010) included in this review, findings around the impact of technology on shared care are explicitly (Greenhalgh et al 2009; Ludwick & Doucette 2009; Robertson et al 2010; Greenhalgh et al 2010b) or implicitly (Boddy et al 2009; Chronaki et al 2007; Ekeland et al 2010; Richards et al 2005; Pagliari et al 2005; Granlien & Simonsen 2007; Melby & Helleso 2010; Ahmad et al 2010) expressed

as organisational, social or technical with additional external factors. Several expressed findings in terms of barriers or challenges and facilitators or benefits (Chronaki et al 2007; Richards et al 2005; Pagliari et al 2005; Granlien & Simonsen 2007; Ahmad et al 2010)(Figure 3.3).

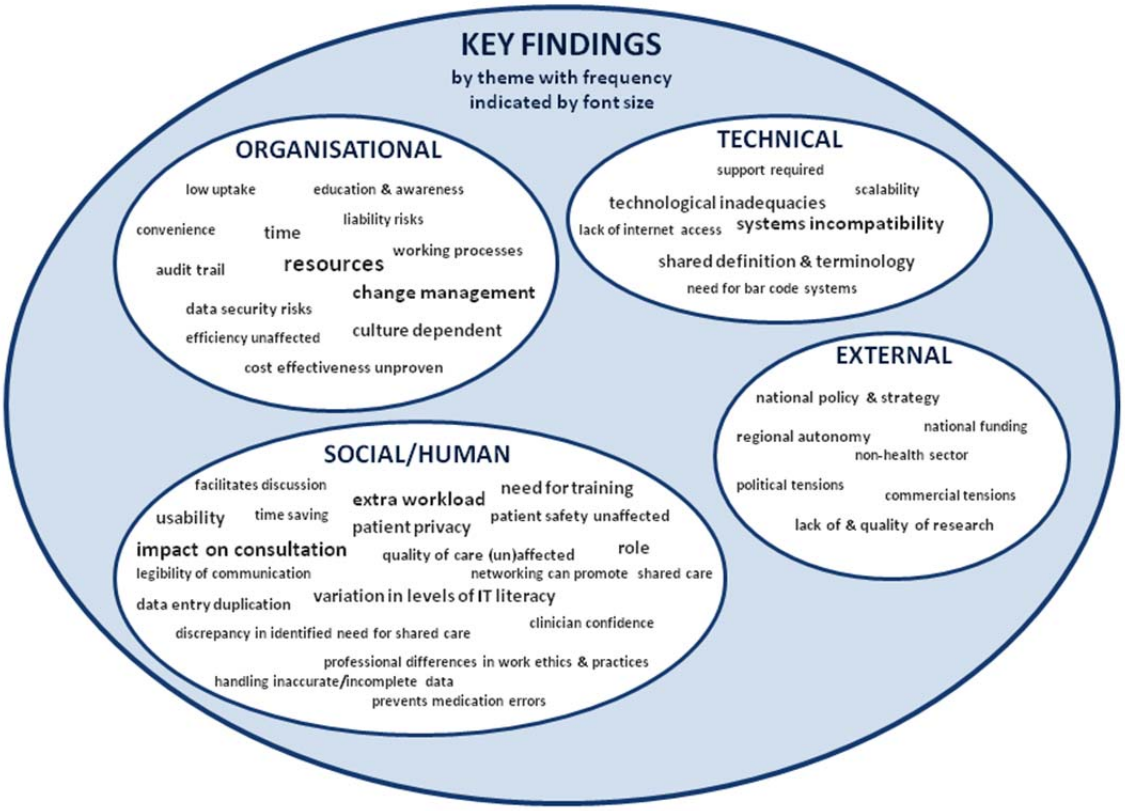

Figure 3.3 Key findings by theme with frequency indicated by font size

Social factors around the impact of ehealth on shared care

Social factors are the most frequently raised. Issues include positive and negative aspects of the impact of ehealth technologies on the patient consultation (Greenhalgh et al 2009; Ekeland et al 2010; Richards et al 2005; Greenhalgh et al 2010b; Ahmad et al 2010), the extra workload (Greenhalgh et al 2009; Chronaki et al 2007; Richards et al 2005; Greenhalgh et al 2010b; Ahmad et al 2010), need for training (Ludwick & Doucette 2009; Richards et al 2005; Pagliari et al 2005), variation in IT literacy levels (Boddy et al 2009; Ludwick & Doucette 2009; Chronaki et al 2007), usability (Greenhalgh et al 2009; Ludwick & Doucette 2009; Pagliari et al 2005), patient privacy (Ludwick &

Doucette 2009; Richards et al 2005; Greenhalgh et al 2010b), and the professional's role in ehealth supported shared care (Boddy et al 2009; Greenhalgh et al 2009; Greenhalgh et al 2010b). There is evidence of contradictory findings between articles: extra workload but time saving (Pagliari et al 2005); quality of care affected (Greenhalgh et al 2010b) but also unaffected (Ludwick & Doucette 2009); patient safety unaffected (Ludwick & Doucette 2009; Greenhalgh et al 2010b) but prevents medication errors (Greenhalgh et al 2010b). While the professional networking opportunities offered by ehealth are seen as positively promoting shared care (Melby & Helleso 2010) there is evidence of discrepancy in identifying the need for shared care (Granlien & Simonsen 2007). Concerns are expressed about ehealth facilitated roles in shared care but the confidence of medical practitioners appears raised by access to ehealth technologies (Greenhalgh et al 2010b) but with data seen as incomplete or inaccurate (Greenhalgh et al 2010b) while communication between healthcare professionals is more legible (Melby & Helleso 2010). It is not clear whether these contradictory findings are due to differences in study quality, scope, setting or other factors.

Organisational factors around the impact of ehealth on shared care

Organisational factors focus strongly on resources (Boddy et al 2009; Ludwick & Doucette 2009; Chronaki et al 2007; Richards et al 2005; Pagliari et al 2005; Ahmad et al 2010) and the time implications of using ehealth (Robertson et al 2010; Chronaki et al 2007; Pagliari et al 2005), but also the culture of the workplace (Boddy et al 2009; Greenhalgh et al 2009; Ludwick & Doucette 2009) and change management requirements for successful implementation (Greenhalgh et al 2009; Robertson et al 2010; Greenhalgh et al 2010b; Ahmad et al 2010). Efficiency (Ludwick & Doucette 2009) and cost effectiveness (Boddy et al 2009; Ekeland et al 2010) are seen as unproven with concerns raised around data security (Boddy et al 2009; Ludwick & Doucette 2009) and liability risks (Ludwick & Doucette 2009), although access to an audit trail (Greenhalgh et al 2009; Pagliari et al 2005) was viewed as a benefit of ehealth supported shared care.

Technical factors around the impact of ehealth on shared care

Few technical factors were raised, with the emphasis placed on systems incompatibility (Boddy et al 2009; Greenhalgh et al 2009; Granlien & Simonsen 2007; Greenhalgh et al 2010b), technological inadequacies (Boddy et al 2009; Pagliari et al 2005; Greenhalgh et al 2010b), and the need for shared ehealth definition and terminology (Greenhalgh et al 2009; Ludwick & Doucette 2009; Robertson et al 2010).

External factors around the impact of ehealth on shared care

External factors recognised the tensions (Greenhalgh et al 2010b) which can arise between national policies and regional autonomy when addressing local ehealth priorities (Boddy et al 2009; Robertson et al 2010).

What gaps in research were identified?

Limited research was identified which explored the impact of ehealth on non-medical practitioners' expanding role in shared care. Granlien and Simonsen (2007) had, *'not found any studies concerning the users roles in adopting technological infrastructures supporting shared care'*(Granlien & Simonsen 2007), and only one of the twelve studies included the views of a hospital pharmacist (Greenhalgh et al 2010b). Granlien and Simonsen (2007) also noted that,

> *'there is very little qualitative research exploring the practical barriers to the adoption of such systems in the primary care sector'*(Granlien & Simonsen 2007)

Pagliari et al (2005) had also reported that, *'evaluations of healthcare IT initiatives remain poorly documented'*(Pagliari et al 2005), which was more recently confirmed by Ekeland et al (2010). Greenhalgh et al (2009) make extensive recommendations for further research including exploring, *'how staff contextualize and prioritise knowledge for shared use,'* and recommending more *'technically orientated review by an interdisciplinary team' with the aim of 'telling it like it is'*(Greenhalgh et al 2009).

Discussion

This systematic review identified organisational, social, technical and external themes highlighting issues to be addressed within each. At an organisational level, the main influences are resource and time implications, culture of the workplace and change management requirements. Social concerns focused on the impact on patient consultations, extra workload, need for training suited to varying levels of IT literacy, usability, patient privacy and the practitioners' role. Technical aspects included systems incompatibility, technological inadequacies, need for shared definition and terminology, while external factors highlighted the interplay between national policy and strategy and regional autonomy. Acceptance of ehealth to support medical and non-medical practitioner provided shared care is reported but evidence of quality, safety and efficiency benefits, as well as resource and training implications, remains limited and inconclusive. Since this review was conducted, a European Commission survey based project aimed at, *'assessing the perspective of the main end users'*(Chain of Trust 2011) which did include pharmacists as well as patients, doctors and nurses, commenced. It is specific to the telehealth field and includes one question about, *'cooperation among health professionals'.* NHS Scotland has developed a Citizen eHealth Strategy, as part of its overall eHealth Strategy, aimed at helping individuals to improve their own health by engaging with ehealth services. An online survey was open to the general public as part of the development and consultation process until the end of 2011 (Scottish Government 2011b). Findings from a more recent electronic health record study in England by Sheikh et al (2011) reinforce those highlighted by this review: delays in implementation; need to focus on the staff/technology interaction; individual and organisation learning (Sheikh et al 2011). Audit Scotland's 2010 review urged both the Scottish Government and NHS boards to, *'consider the long term clinical, organisational and cost benefits'* of telehealth (Audit Scotland 2010) but, given the limited number of papers published in this area, it is still unclear what ehealth applications are perceived to have worked and how in supporting shared care of patients. However, the similarities to non-healthcare IT implementation issues (Kaplan & Salamone 2009; Greenhalgh et al 2010c; Checkland & Poulter 2006) and adoption of innovation theory (Rogers 1995) are noteworthy. Recent press releases from the Royal College of General Practitioners (2011), the Royal Pharmaceutical Society (2011) were followed by a joint statement (RCGP & RPS

2011) and the Scottish Government (2011c & 2011d) focus on joint working and integration between GPs and pharmacists, all underpinned by ehealth, which in turn resonate with the findings of the Christie Commission (2011). All point to increasing reliance on ehealth to support shared care but, as this review demonstrates, there remains a lack of quality evidence to support strategic decision-making.

Strengths and weaknesses

The main strengths of this systematic review are the methodological rigour and application of established tools by a multi-disciplinary team with independent review and input from external advisors. These strengths reduce the potential for publication and selection bias. Limitations and weaknesses are the potential bias inherent in snowballing techniques. With a limited number of quality studies identified for review, results may only be generalisable where contexts are similar.

Conclusion

Evidence of medical and non-medical practitioners' views of the impact of ehealth on shared care remains limited, with pharmacists particularly under-represented in ehealth research. Organisational development and training for core and optional ehealth services remain key in keeping people at the heart of integrated ehealth strategies across the UK (Darzi 2008; Centre for Workforce Intelligence 2011; Scottish Government 2011a; Department of Health 2011; RPS 2011; Scottish Government 2011d) Further targeted research aimed at understanding the impact of ehealth on patient consultations, and the associated resource, training and support needs of shared care providers, is required. Based on these findings, community pharmacy focused research, based in Scotland, is planned by the multi-disciplinary team adopting a mixed methods approach. The research will explore and contextualise the impact of ehealth while identifying community pharmacy staff views on resource, training and support needs.

Summary of this chapter

This chapter explored medical and non-medical practitioners' views of ehealth and shared care through a meta-narrative systematic review. This review was conducted to contextualise and inform the approach to further research. It found

limited, good quality evidence of research in this area with pharmacists particularly under-represented. Findings and gaps identified led to a second systematic review (Chapter 4), reflective of changes in health policy and strategy toward '*integrated care*', and multiple case studies in pharmacy practice (Chapter 5).

CHAPTER 4 (Phase II) A systematic review exploring practitioners' perceptions of ehealth in relation to integrated care

'Technological progress has merely provided us with more efficient means for going backwards'

Aldous Huxley, author
(1894-1963)

Introduction to the chapter

This chapter explores healthcare practitioners' perceptions of ehealth in relation to integrated care. A systematic review was conducted using socio-technical systems theory and the computer supported cooperative working framework.

Background

Global healthcare needs are changing (WHO 2012; White et al 2013). Healthcare practitioners are challenged to meet that need efficiently by changing their approach to providing safe, effective care (WHO 2006). Demographic trends in the developed world indicate ageing populations who expect to live well, independently and for longer, supported by local healthcare. Providing healthcare for increasing numbers of people with long term conditions places an additional burden on healthcare services which are already financially constrained (WHO 2011a; OECD 2012; Morgan & Astolfi 2013). Managing patients with co-morbidity and polypharmacy is complex and logistically challenging (Guthrie et al 2012; Barnett et al 2012). Health strategists worldwide believe technology has a role to play in enabling healthcare practitioners to work together in providing ehealth supported integrated care (WHO 2012; BCS 2011; Crown 1999; Darzi 2008; Meyer et al 2009). Integrated care for the benefit of patients has, according to Kodner and Spreeuwenberg (2002), the potential to arise from the integration of,

> 'a coherent set of methods and models on the funding, administrative, organisational, service delivery and clinical levels designed to create connectivity, alignment and collaboration within and between the cure and care sectors.'

Their patient-centric definition involves cooperative working within and between multi-disciplinary healthcare teams to meet the needs of often vulnerable groups with ongoing and complex care needs, more recently described as, *'services that are planned and delivered seamlessly from the perspective of the patient'*(Scottish Government 2013b) This has long been seen as both beneficial to patients and a more efficient use of practitioners' skills.(Department of Health 1989; Nolan 1995; Helper & Strand 1990; Goodwin et al 2011) eHealth applications, such as telemedicine, telecare, electronic health records, online

appointment bookings and electronic discharge summaries are forms of computer supported cooperative working (CSCW) designed to facilitate integrated care (Fitzpatrick & Ellingse 2012; Ackermen 2000; Eason 1996; Dobrev et al 2010; Ludwick & Doucette 2009; Legare et al 2010; Mair et al 2007; Clark et al 2008; Greenhalgh et al 2010c; Hor et al 2010; McGowan et al 2009; Murray et al 2010; Robertson et al 2010).

As described previously, electronic health, or ehealth, is defined by the World Health Organisation as *'the combined use of information and communications technologies for health'* and further refined by the European Commission Information Society to include *'tools and services for health'*(WHO 2011b; ECIS 2011). It is viewed as a key facilitator in helping medical practitioners, such as physicians or dentists, and non-medical practitioners, such as nurses and pharmacists, to work in partnership by improving communications (RPS & RCGP 2011; Coiera 2006).

eHealth studies to date have focused on the medical practitioners' perspective of the adoption of ehealth applications (Dobrev et al 2010; Ludwick & Doucette 2009; Legare et al 2010; Mair et al 2007; Clark et al 2008; Greenhalgh & Russell 2010a; Hor et al 2010; McGowan et al 2009; Murray et al 2010; Robertson et al 2010). Patient-centred studies have investigated the impact of ehealth on quality and safety of care or confidentiality (Liddell et al 2008; Car et al 2008; Black et al 2011). Non-medical practitioners are taking on a greater role in the healthcare team including prescribing rights (Stewart et al 2012). As reliance on ehealth grows, we need to understand the views and experiences of the multidisciplinary team taking account of social and technical factors (Latter et al 2005; Stewart et al 2011; Mumford 2006; Eason 2008; Sheehan et al 2013).

Problem statement

In summary, ehealth is now embedded in healthcare systems worldwide. There is an expectation that it will help mitigate the increasing demands on health service by facilitating integrated care. This systematic review provides a multi-perspective exploration of health practitioners' perceptions of ehealth in relation to integrated care explored through the lens of the socio-technical systems framework and computer supported cooperative working.

Objective

To explore and report findings, methodologies and gaps in research associated with healthcare practitioners perceptions of ehealth in relation to integrated care.

Review question

The overarching review question was, *'What ehealth technologies do healthcare practitioners perceive to have worked and how in promoting integrated care?'*

Sub-questions to be addressed were:

- What ehealth integrated care research has been conducted by whom and when?
- How, where and why did they conduct their research?
- What was the methodological quality of the research?
- What were the key findings and gaps in research from healthcare practitioners' perceptions of ehealth in relation to integrated care?

Methods & Theory

As described in the registered protocol (Appendix 4.1), the search phase was followed by data extraction and critical appraisal before synthesis to identify, *'What works for whom in what circumstances and in what respects?'*(Pawson et al 2005). This review draws on STS theory (Cherns 1976) to conceptualise and analyse healthcare professionals' perceptions of ehealth in relation to integrated care. Discussion of the findings is framed in terms of CSCW (Fitzpatrick & Ellingse 2012).

STS theory provides a theoretical framework for,

> *'understanding the complex way in which people at work cooperate and use tools and technology to get their collective work done'*(Trist 1981)

STS promotes equal weighting of the social and technical aspects during design (Mumford 2006). Context and interdependencies are explored by adapting Bostrom and Heinen's STS model before delving deeper by applying Cherns' nine principles of STS design (Cherns 1976; Trist 1981; Bostrom & Heinen 1977). The original STS model featured a bounded two-by-two matrix representing both

technical (task, technology) and social (organisation, people) aspects with interconnecting and crossover double-ended arrows. The principles espoused by Cherns recognise the need for joint optimisation of social and technical aspects. Based on existing models (Emery 1978; Emery & Trist 1973; Herbst 1974), Cherns developed a 9-point checklist (compatibility; minimal critical specification; sociotechnical criterion; multi-functionality; boundary location; information flow; support congruence; design and human values; incompletion), taking account of technological (deterministic) design interacting with human ingenuity to meet organisational objectives (Cherns 1976). The CSCW approach has a lengthy history of application in healthcare research with close association to human computer interaction (HCI) and participatory design (Fitzpatrick & Ellingse 2012; Ackerman 2000; Eason 1996). Key aspects of CSCW are the three C's of communication, collaboration and coordination which frame the discussion of findings (Neale et al 2004). This approach provides a theory based, evaluative framework appropriate to the inherent complexity of socio-technical healthcare environments.

Eligibility criteria

The review included articles which reported the perceptions of all healthcare practitioners in all settings providing ehealth supported integrated care as part of multi-disciplinary, collaborative teams. Articles which focused solely on searching the internet for information or email exchange were excluded as these were deemed not to be purposive ehealth applications (WHO 2011b; ECIS 2011). Only full articles published in English from 1st January 2005 to 28th February 2013 were included for currency of technology.

Information sources and search strategy

Database and search term selection were negotiated within the team based on published literature, policy documents, consultations and reports, sourced from government and National Health Service websites, and also experts in the field.

Study selection

An incremental search string (Table 4.1) was applied with results and exceptions recorded at each level of refinement using an adapted PRISMA Flow Diagram (Figure 4.1). Titles were independently screened by two researchers (KM, DS),

with abstracts followed by full papers reviewed where any doubt remained. Consensus on final inclusions was agreed across the team. Alert options were created to bring new publications to the notice of reviewers, where the database search functionality allowed.

Table 4.1 Incrementally applied search string

Level	Search string (applied incrementally using Boolean AND from 1 January 2005 to 28 February 2013)
1	(eHealth OR e-Health OR ehealth OR e-health OR "electronic health" OR "electronic healthcare")
2	("integrated care" OR "shared care" OR partnership OR collaborati* OR interprofessional OR inter-professional OR multiprofessional OR multi-professional OR multidisciplinary OR multi-disciplinary)
3	(perce* OR view* OR perspective* OR opinion OR attitude OR experience*)

Data extraction and appraisal

Data from the selected studies were tabulated mapping *'5 Ws & H'* (Who, What, Why, Where, When & How) to corresponding PICOS terms (Population, Intervention, Comparator, Outcome, Study design). Variables extracted included participants, elements, aims, geographical and practice settings, timelines and backgrounds, methods and response rates along with any ehealth application definition. A critical appraisal tool geared to qualitative study design was applied independently by two researchers (KM, DS) to each of the studies (CASP 2011). The overall quality of evidence was assessed and risk of publication and selective reporting bias considered.

Results

Study selection

Reasons for inclusion and exclusion were recorded as the study selection progressed. Of the initial 850 papers identified through the database searches 36 duplicates were removed. A further 443 papers were excluded based on title screening with 333 excluded following abstract review. In each case, it was clear that the focus did not meet the inclusion criteria, for example, due to a specific clinical, educational or economic focus rather than healthcare practitioners' perceptions of ehealth and integrated care.

Of the remaining 38 papers, 34 were excluded as they were:

- not multi-disciplinary team based (6 nurses only; 6 physicians only; 1 pharmacist; 1 case manager; 1 infection specialist; 1 radiologist) or,
- not integrated care focused (14 development of technology; 3 non-healthcare professionals perceptions; 1 cost benefit analysis)

What ehealth integrated care research has been conducted by whom and when?

One research paper based on a report identified during the search was included plus an additional paper from the lead reviewer's personal database. A total of five papers were included in the systematic review (Table 4.2).

Table 4.2 The *'when, who and what'* of the five papers included

Year	Authors	Title
2007	Aarts J, Ash J, Berg M	Extending the understanding of computerized physician order entry: Implications for professional collaboration, workflow and quality of care (Aarts et al 2007)
2010	Melby L, Helleso R	Electronic exchange of discharge summaries between hospital and municipal care from health personnel's perspectives (Melby & Helleso 2010)
2012	Shih F-J, Fan Y-W, Chui F-Ji, Wang S-S	The dilemma of "to be or not to be": developing electronically e-health & cloud computing documents for overseas transplant patients from Taiwan organ transplant health professionals' perspective (Shih et al 2012)
2013	Eason K, Waterson P	The implications of e-health system delivery strategies for integrated healthcare: Lessons from England (Eason & Waterson 2013)
2013	Callen J, Paoloni R, Li J, Stewart M, Gibson K, Georgiou A, Braithwaite J, Westbrook J	Perceptions of the Effect of Information and Communication Technology on the Quality of Care Delivered in Emergency Departments: A Cross-Site Qualitative Study (Callen et al 2013)

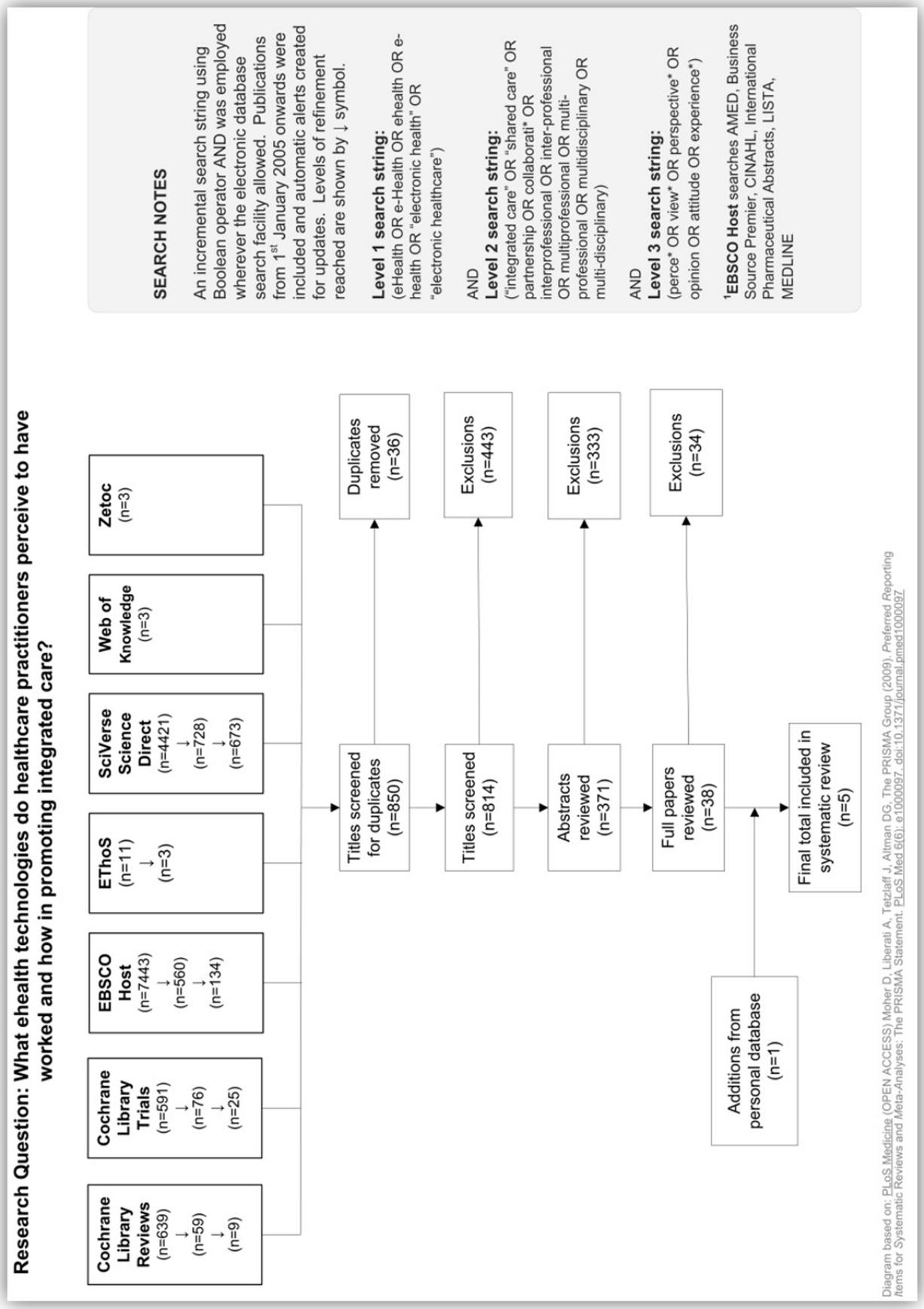

Figure 4.1 Search phase results presented as an adapted PRISMA Flow Diagram (Moher et al 2009)

Study characteristics

How, where and why did they conduct their research?

As detailed in the data extraction tool (Table 4.3), all included studies were qualitative in design (Aarts et al 2007; Melby & Helleso 2010; Shih 2012; Eason & Waterson 2013; Callen et al 2013). Data collection was predominantly interview based with two studies (Eason & Waterson 2013; Callen et al 2013) supplemented with combinations of observational fieldwork, mapping activity or focus groups. The mixed methods studies adopted either STS (Eason & Waterson 2013) or CSCW (Callen et al 2013) approaches. The three studies based only on interviews, analysed data using either key concepts (Aarts et al 2007) or a three step thematic (Melby & Helleso 2010) or content analysis (Shih et al 2012) approach. Study subjects were mainly physicians or nurses but one pharmacist also featured. One study used the collective term '*clinicians'* (Eason & Waterson 2013) and four of the five studies included the views of non-healthcare practitioners (Aarts et al 2007; Melby & Helleso 2010; Shih et al 2012; Callen et al 2013). Two studies were multi-hospital (Shih et al 2012; Callen et al 2013) based while the remainder crossed the primary-secondary care interface (Aarts et al 2007; Melby & Helleso 2010; Eason & Waterson 2013). Each study was located in a different country (Australia (Callen et al 2013); England (Eason & Waterson 2013); Norway (Melby & Helleso 2010); Taiwan (Shih et al 2012); USA (Aarts et al 2007)) and focused on a different ehealth application (Computerized Physician Order Entry (CPOE; Aarts et al 2007), Clinical & Management Information System (C&MIS; Callen et al 2013), Patient Information System (PIS; Eason & Waterson 2013), electronic Discharge Summary (eDS; Melby & Helleso 2010), Electronic Health Records (EHR) and Cloud computing (Shih et al 2012)). The context for one of the studies was ehealth supported patient documentation to facilitate cross border integrated care where high levels of overseas organ transplants were taking place (Shih et al 2012). The remainder were prompted by national ehealth strategies with growing political pressure to underpin integrated care with IT (Aarts et al 2007; Melby & Helleso 2010; Eason & Waterson 2013; Callen et al 2013).

Table 4.3 Data extracted during systematic review

	WHO	WHAT	WHY	WHERE		WHEN	HOW	Article authors' conclusions
	Population	**Intervention**	**Aim**	**Geographical and Practice setting**		**Timeline, Background**	**Study design, method**	**Storyline, Outcome**
Aarts et al (2007)	▪ physicians (11) ▪ nurses (2) ▪ pharmacist ▪ medical informatics scientist ▪ software specialist ▪ hospital manage-ment executive	Computerized Physician Order Entry (CPOE): *'process that allows a physician to enter medical orders directly and to manage the results of these orders'*	*'focus on perceptions of experts about professional collaboration, workflow and quality of care'*	Oregon, USA	Community hospitals (3), Academic medical centres (5), a VA medical centre, a health maintenance Organisation and a CPOE vendor	▪ October and November 2003 ▪ Political pressure to introduce computerized systems	▪ Qualitative ▪ 16 semi-structured interviews with 17 selected experts attending a CPOE consensus panel ▪ analysed using 6 key concepts: description and history; users and involvement; Organisational impact; workflow change; patterns of collaboration; effects on quality of care	▪ Complexity of CPOE: providers enter orders but others involved in decision making ▪ Profound impact on workflow beyond provider ▪ Quality of care is the main impetus for use but difficult to measure
Melby & Helleso (2010)	▪ health providers (nurses, physicians) ▪ project managers	Electronic discharge summary exchange	*'may promote integration of care across organisational boundaries'*	Norway	Hospital and municipal settings	▪ June 2006, October 2006, September-October 2007 ▪ Government White paper on health	▪ Convenience sample 26 group and individual semi-structured interviews with 49 informants (34 municipality, 13 hospital, 2 project management) ▪ 3 step thematic analysis	▪ No significant increase in integration of care ▪ Project a catalyst for interaction ▪ Change and duplication of working processes ▪ Increased legibility of summaries ▪ Municipality better prepared for receiving patients ▪ Information unaltered and not always accurate

	WHO	WHAT	WHY	WHERE		WHEN	HOW	Article authors' conclusions
	Population	**Intervention**	**Aim**	**Geographical and Practice setting**		**Timeline, Background**	**Study design, method**	**Storyline, Outcome**
Shih et al (2012)	▪ Transplant surgeons (20) ▪ nurses (45) ▪ ehealth ICT experts (15)	Electronic Health Records (EHR) and Cloud computing	Ehealth '*from organ transplant health professionals' perspective'*	Taiwan	Medical centres	▪ High levels of overseas organ transplants	▪ Qualitative ▪ 80 face to face interviews at 3 sites ▪ Content analysis	▪ Better and continuous care through communication and cooperation ▪ Better collaborative efforts between health professionals, IT experts ▪ Easier, secure cross border retrieval and communication of personal health documents
Eason & Waterson (2013)	▪ Clinicians (40)	e-Patient Information System including detailed care record systems (DCRS), summary care record (SCR), care pathway specific local databases, portals for multi-database access	*'PIS that effectively communicate and coordinate care across organisational boundaries'*	England	Local Health Communities (2)	▪ UK Department of Health abandonment of NPfIT ▪ NIHR funded research study EPICOg (Electronic Patient Information Crossing Organisational boundaries) in 2008-2011	▪ Qualitative socio-technical systems approach ▪ Mapping of 9 care pathways, observation of information management, interviews with 40 clinicians ▪ Socio-technical systems theory approach	▪ National strategies require tight coupling which is problematic with diverse healthcare agencies ▪ Local systems meeting locally identified needs, loose coupling, is more successful ▪ Technical strategies to permit local design of tight coupling needed to support integrated care

	WHO **Population**	WHAT **Intervention**	WHY **Aim**	WHERE **Geographical and Practice setting**		WHEN **Timeline, Background**	HOW **Study design, method**	Article authors' conclusions **Storyline, Outcome**
Callen et al (2013)	▪ Physicians (67) ▪ nurses (30)	Integrated information system (Cerner FirstNet): access to clinical and management information relating to patients (triage, history, test results, order tests, create discharge summaries)	*'perceptions of the effect of an integrated emergency department information system on the quality of care delivered'*	New South Wales, Australia	Urban emergency departments (4)	▪ October 2009 to February 2011 ▪ Government sponsored report recommend-ation	▪ Qualitative, inductive thematic approach ▪ 69 interviews, 5 focus groups, 26 hours observation ▪ analysed using Computer Supported Cooperative Work Framework (incentives, situation awareness, workflow)	▪ Better access to more complete legible information ▪ Better sharing of information between physicians and nurses ▪ Increased workload and complexity and poor fit with workflow ▪ Need for new methods of data capture

Critical appraisal & quality of evidence

What was the methodological quality of the research?

A critical appraisal tool was applied independently by two members of the review team (KM, DS) to each of the studies (CASP 2011). The review team applied a modified form of the GRADE tool (Grading of Recommendations, Assessments, Developments and Evaluation; GRADE 2011) with results added to the critical appraisal findings (Table 4.4). The *'quality of evidence'* was based initially on the study design which would rate randomised control trials and systematic reviews as '*high'* then peer reviewed papers '*moderate'* with potential adjustment for rigour of application. A further rating, termed *'magnitude of effect,'* was added based on applicability of the review article findings to the current research, indicated by one to three positive signs (+). Three of the five studies were found to be of moderate quality and with medium magnitude of effect (Melby & Helleso 2010; Eason & Waterson 2013; Callen et al 2013).

Table 4.4 Critical Appraisal Tool for reviewing qualitative studies (CASP 2011)

Quality checklist for Qualitative studies	Aarts et al (2007)	Melby & Helleso (2010)	Shih et al (2012)	Eason & Waterson (2013)	Callen et al (2013)
Clear statement of aims - goal, importance, relevance	Y	Y	Y	Y	Y
Methodology - appropriate	Y	Y	Y	Y	Y
Answering 'Y' to the two screening questions above is an indication to proceed with the remaining eight questions					
Design - appropriate, justified	Yes, a qualitative study to capture perceptions and understanding of the implications of CPOE on workflow and quality of care conducted in 2003.	Yes, a qualitative study to capture perspectives and context of electronic discharge summaries in its early stages in 2006 followed up in 2007.	Yes, a qualitative study to capture healthcare staff views of introducing Cloud-based shared e-health documents. The timeline of the study is not stated.	Yes, a qualitative study with a socio-technical approach to explore, from a user perspective, the extent to which systems coupling (tight/loose) supports integrated care. Conducted 2008-11.	Yes, a cross-sectional qualitative study to identify and describe perceptions of the effect of an integrated emergency department information system (EDIS) on quality of care between Oct'09 and Feb'11.
Sampling, recruitment - appropriate, explained	A convenience sample of 17 experts attending a consensus meeting on successful implementation of CPOE plus representatives from a community hospital. The latter may be incongruous with the stated research question which asked the *'perceptions of high-level experts.'* The range of perspectives gathered is explained	Yes, a convenience sample of 49 drawn from 34 municipality, 13 hospital and 2 project management to cover range of settings and stakeholder perspectives. Includes physicians, nurses and project management (n=2). A breakdown of health professional characteristics would have been useful.	Sampling and recruitment are not explained beyond stating that 80 participants were recruited from 3 medical centres. All had experience of caring for patients who had undergone an overseas organ transplant (OOT) in Mainland China, including transplant surgeons (n=20), nurses (n=30),	Two PCTs were purposively selected: one county-wide and one urban. Healthcare pathways mapped included integrated care provided by GP clinics, acute hospitals, a range of community services.	The 4 study sites were selected because they use the same EDIS system, Cerner FirstNet. Participants (n=97; physicians=67; nurses=30) were purposively selected to represent a variation of experience in system usage, role and seniority. Details are provided in a table.

Quality checklist for Qualitative studies	Aarts et al (2007)	Melby & Helleso (2010)	Shih et al (2012)	Eason & Waterson (2013)	Callen et al (2013)
	by the interview table.		coordinating nurses (n=15), technology experts (n=15).		
Data collection - justified, explained	Yes, 16 semi-structured interviews around 6 topics. One interview included 2 participants	Yes, 26 semi-structured interviews although some conducted as a group and some individually.	No, face-to-face interviews were conducted but no topic guide is provided.	Yes, 9 care pathways were mapped, 40 clinicians were interviewed, 4 patient information systems were categorised by the nature of their coupling (tight-loose)	Yes, detailed information is given on 69 semi-structured interviews, 5 focus groups using the same topic guide plus observational activity.
Reflexivity - role of researcher	1st/2nd authors declare involvement in CPOE consensus meeting	N	N	N	N
Ethics statement	Y	N	N	Y	Y
Data analysis - rigor, method, bias	The initial 3 items from the interview topic list as regarded as context only. The latter 3 items were treated as units of analysis using Atlas 4ti software. No further detail is provided on method of analysis or rigor. Selection and self-reporting bias covered in limitations.	A 3 step analysis with independently identified themes followed by data organisation prior to consensus on subcategories. The discussion is balanced and justified but limitations and bias are not explicitly covered.	No explanation is given beyond *'data were analyzed by qualitative content analysis.'* There is no statement of independent review or bias or limitations.	Concepts from socio-technical systems theory and ORDIT (Organisational Requirements for the Determination of IT) methodology were applied. The limitations of the study and approaches are discussed throughout the report.	Inductive thematic approach described as iterative, independent analysis by team of researchers to identify categories, codes and themes by consensus. The computer supported cooperative work (CSCW) framework was applied to the resultant themes to focus on 3 core CSCW concepts of: incentives, situation awareness and workflow. The method is designed to limit bias by using shared interviews schedules, triangulation of data gathering and independent review.

Quality checklist for Qualitative studies	Aarts et al (2007)	Melby & Helleso (2010)	Shih et al (2012)	Eason & Waterson (2013)	Callen et al (2013)
Findings - explicit, discussed, relate back to question	Yes, the authors set out to extend the understanding of CPOE and its implications for professional collaboration, workflow and quality of care. Each are addressed in the findings: ▪ the complexity of CPOE includes the collaborative decision making but single provider order entry ▪ the profound impact on workflow beyond the provider ▪ acknowledged quality of care as the impetus for use of CPOE but declares it difficult to measure. They concluded there was a need to understand CPOE in context.	Yes, the authors set out to investigate the implications of electronic discharge summary and its potential for promoting integration of care. Each are addressed in the findings which identify: ▪ changes in work processes ▪ increased legibility of discharge summaries ▪ municipality better prepared for receiving patients discharged from hospital ▪ but the information is unaltered and not always accurate. They concluded there was no significant increase in integration of care but that the project was viewed by participants as a catalyst to initiate that interaction.	The findings do relate back to the question but lack detail around the research process. The authors report 4 pros and 5 cons to adopting Cloud-based e-health documents. The pros were: ▪ enabling possible cross border collaboration ▪ better continuous care through communication ▪ better collaboration ▪ easier record retrieval. The cons were: ▪ a lack of knowledge of benefits ▪ communication issues ▪ increased workload ▪ lack of coaching and accreditation ▪ lack of systematic plans for introduction The references used as a basis for discussion are, in the main, very dated which may be limiting for a technology based study.	The findings relate back to the research questions and aims: ▪ UK national strategy required tight coupling which is problematic with diverse healthcare agencies involved ▪ Local systems are meeting locally identified needs ▪ Technical strategies to permit local design of tight coupling are needed to support integrated care in healthcare pathways They recommend choosing technical strategies that are *'in harmony with the type of organisational integration that prevails in the health service'*	Yes, the authors set out to identify and describe physician and nurse perceptions of the effect of an integrated EDIS system on quality of care. Findings are presented as 3 core themes: ▪ incentives (faster, better informed clinical decision making; access to patient specific clinical information; access to clinical databases) ▪ situation awareness (improved coordination within and outside the ED; enhanced specialty consultations; improved clinical information and documentation) ▪ workflow (IT issues; duplication of tasks; increased work and task complexity; difficulty integrating use of IT) Concluded that the system contributed to improvements in delivery of care, better decision making and specialty consultations but identified the need for new methods of data capture.

Quality checklist for Qualitative studies	Aarts et al (2007)	Melby & Helleso (2010)	Shih et al (2012)	Eason & Waterson (2013)	Callen et al (2013)
Value - contribution to existing knowledge, further research areas, use of findings	Each finding is reported as being *'consistent with theoretical insights from the sociology of medical work and the design of systems supporting collaborative working'.* The conclusion around needing to understand CPOE in context suggests one aim of the study was perhaps only partially fulfilled.	Each finding is discussed in relation to previously published studies: confirming organisational challenges are greater than the technical aspects; electronic discharge summaries have the potential to improve patient transfer and formalise timely communication; technology may promote and enable professional networking which may improve integration of care.	The lack of detail throughout, use of outdated references and unpublished observations makes it difficult to follow the development from data to results. For that same reason, the conclusions appear to be a pre-determined plan of action.	A comprehensive, detailed and well referenced study based on an extensive report which contextualises and supports further development and research into ehealth supported patient information exchange.	Findings reported are consistent with previous studies: emphasizing the importance of promoting information access; potential for increased nurse involvement thru access to lab test ordering and reporting; reinforces necessity to address concerns around role s and responsibility; need for systems developers to consider context of clinical settings; value of integrated system with single login. Need for further research to evaluate the effect of clinical information systems on clinicians' time.
GRADE Quality of evidence Magnitude of effect	(low) ++	(moderate) ++	(very low) +	(moderate) ++	(moderate) ++

What were the key findings from healthcare practitioners' perceptions of ehealth in relation to integrated care?

Applying socio-technical systems theory as a conceptual and analytical tool helped to capture the key findings. The adapted socio-technical systems model (Figure 4.2) shows the context and interconnectedness of the healthcare service and practitioners (social subsystem) who provided patient care using ehealth applications (technical subsystem). It also summarised the intentional and unintentional consequences, positive, negative and neutral perceptions of ehealth identified by healthcare practitioners.

Cherns' nine principles of socio-technical systems theory design support further exploration of the healthcare practitioners' perceptions of ehealth in relation to integrated care.

Principle 1: *Compatibility, questions whether the application meets the stated objectives.* Crossing the care interface between primary and secondary care, Aarts et al (2007) noted *'quality of care is the main impetus for use but that is difficult to measure'* with the CPOE system while Melby and Helleso (2010) found *'no significant increase in integration of care'* from the eDS. However, Melby and Helleso (2010) also suggested the *'municipality is better prepared for receiving patients'* perhaps through the *'increased legibility of summaries.'* Shih et al (2012) expected EHR and Cloud computing to offer benefits of *'better continuous care through communication and cooperation'* and *'better collaborative efforts'* based on *'easier, secure cross border'* access for overseas organ transplant patients. Eason and Waterson (2013) reported local success stories from PIS but problematic national implementations. Through Callen et al (2013), healthcare practitioners in emergency departments reported positive perceptions of C&MIS, *'enabling faster and better-informed decision making'* which they believe *'improved coordination between clinicians within and outside.'*

Principle 2: *Minimal critical specification, relates to identifying only the technical essentials leaving scope for human adaptability.* The *'profound impact on workflow'* (Aarts et al 2007) and *'increased workload and complexity and poor fit with workflow'* (Callen et al 2013) and *'change and duplication of working processes'* (Melby & Helleso 2010) suggest human ingenuity is tested to the full

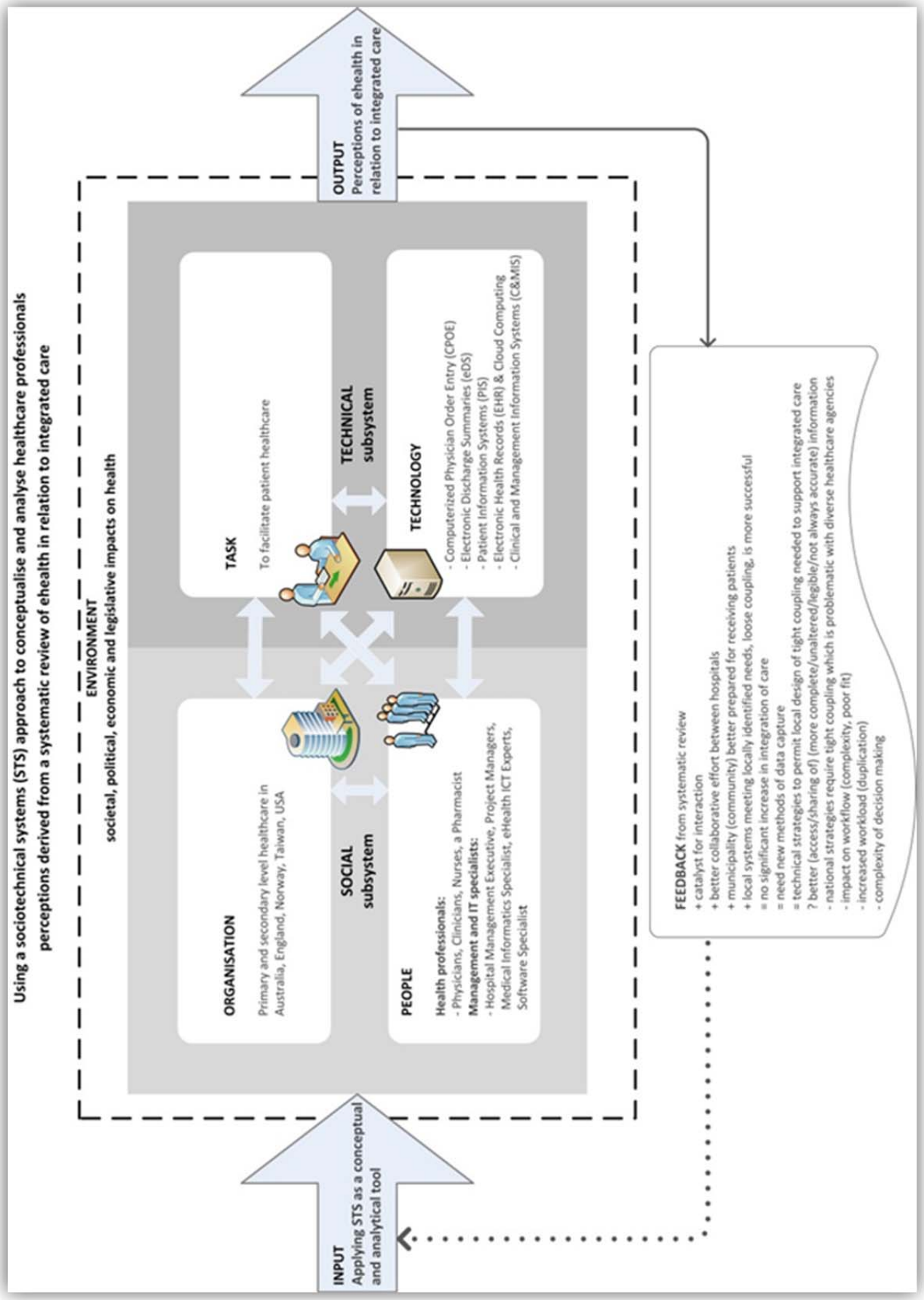

Figure 4.2 An adapted socio-technical systems theory model representing findings from the systematic review

in adopting computer supported cooperative working for integrated care in the context of CPOE, C&MIS and eDS.

Principle 3: *Socio-technical criterion, minimises variance or 'unprogrammed events' to reduce the need for human intervention.* Melby and Helleso (2010) highlighted an unintended consequence of eDS which acted *'as a catalyst for interaction'* (Melby & Helleso 2010) but the task duplication and changes in working practices, previously mentioned, point toward the lack of flexibility in systems. Eason and Waterson described this as *'tight coupling'* where national systems have not been customisable to suit local needs of the diverse agencies involved in integrated care (Eason & Waterson 2013).

Principle 4: *Multi-functionality, asks both social and technical aspects to be adaptive in recognising different ways to achieve the same outcome.* The adaptability of the health professionals in all contexts has already been highlighted. Eason and Waterson concluded that, *'technical strategies to permit local design of tight coupling are needed to support integrated care'*(Eason & Waterson 2013). In effect, national systems designed to satisfy socio-technical systems theory principles 2 and 3 (tightly coupled), overlook local needs for adaptive ehealth solutions (loosely coupled).

Principle 5: *Boundary location, may equate to 'technology, territory or time' in identifying functional responsibility.* The ehealth applications represented by the included studies suggest clearly defined functional responsibility provided integrated care (physician orders (Aarts et al 2007); discharge summaries (Melby & Helleso 2010); transplant aftercare (Shih et al 2012); nine care pathways (Eason & Waterson 2013); emergency care (Callen 2013)). The variety, scalability and accessibility is demonstrated by the range of settings and contexts crossing local (Aarts et al 2007; Shih et al 2012; Callen et al 2013), national (Melby & Helleso 2010) and international (Shih et al 2012) healthcare interfaces.

Principle 6: *Information flow, asks that appropriate, timely information is available to the right people*. Callen et al's (2013) multi-site study based in emergency departments noted *'better access to more complete, legible*

information' and *'better sharing of information between physicians and nurses'*(Callen et al 2013). But for Melby and Helleso (2010), the *'information is unaltered and not always accurate'*(Melby & Helleso 2010) in electronic discharge summaries sent from hospital to municipal care providers. Aarts et al (2007) also found that information sharing for collaborative decision making was an unsupported but necessary precursor to CPOE.

Principle 7: *Support for congruence, looks for organisational culture and management philosophy which fits with expected work behaviours.* Buchanan & Huczynski (2010) define organisational culture as,

> *'the shared beliefs and norms which influence the way employees think, feel and act towards others inside and outside the organisation'* (Buchanan & Huczynski 2010),

which he explains further through Schein's (2004) three levels of: artefacts and creations, values and beliefs, basic assumptions. Greenhalgh et al (2004a) draw parallels with social networking theory, viewing health services organisations in terms of: fads and fashions, opinion leadership, ties, centrality, redundancy and structural holes (Greenhalgh et al 2004a). There is strong evidence in the papers reviewed of the top down, hierarchical management structure shared by health services (Aarts et al 2007; Melby & Helleso 2010; Eason & Waterson 2013; Callen et al 2013). Melby and Helleso found the *'organisational challenges are greater than the technical aspects'*(Aarts et al 2007). While Callen et al (2013) and Aarts et al (2007) stressed the need to understand the organisational and clinical context, which Eason and Waterson (2013) strived to explore through levels of systems coupling, Shih et al (2012) documented cross border political challenges affecting the care of a specific patient group. Findings from the papers reviewed are critical of the *'increased work load and complexity and poor fit with workflow'*(Callen et al 2013) and *'duplication of working processes'*(Melby & Helleso 2010), all of which impact on expected work behaviours and norms where *'quality of care is the main impetus'*(Aarts et al 2007) within the organisational culture (Schein 2004; Buchanan & Huczynski 2010; Greenhalgh et al 2004b).

Principle 8: *Design and human values, provides 'a high quality of work' or job satisfaction*. These are the core values on which STS theory was founded (Mumford 2006; Eason 2008; Buchanan & Huczynski 2010). Intended and unintended consequences reported in the findings facilitate professional networking (Melby & Helleso 2010) and collaboration (Shih et al 2012; Callen et al 2013) and recommend *'technical strategies to permit local design'*(Eason & Waterson 2013). However, concern is raised by Aarts et al (2007) that,

> *'if you focus on the subatomic task to increase patient safety you may well decrease patient safety'*(Aarts et al 2007),

countering aspects of quality of work and impacting on job satisfaction. This is also evident in Eason and Waterson's (2013) reference to Grudin's Law which suggests *'when those who benefit are not those who do the work, the system is doomed to fail,'* identifying general practitioners as key players with little to gain as the *'beneficiaries are elsewhere in the healthcare system'*(Eason & Waterson 2013). This was further evidenced by negative aspects of increased workload, duplication and complexity of work and workarounds which would be expected to impact adversely on job satisfaction of healthcare professionals (Aarts et al 2007; Melby & Helleso 2010; Shih et al 2012; Eason & Waterson 2013). These counter arguments for ehealth supported integrated care are summarised by Callen et al as, *'it must maximize benefits and decrease burdens*'(Callen et al 2013).

What gaps are identifiable to direct future research?

Principle 9: *Incompletion, recognises the need for evaluation and review for optimisation.* Based on applying Cherns (1976) final STS principle, the need for further research into ehealth supported patient information sharing and exchange is identified (Eason & Waterson 2013) and also evaluation of the effect of clinical information systems on clinicians' time and *'need for new methods of data capture*'(Callen et al 2013). Melby and Helleso (2010) highlight the increased incidence of errors in electronic discharge summaries over their handwritten equivalent as an area for further investigation. The lack of peer reviewed papers identified supports the view of reviewers that there is a need for

further research into healthcare practitioners' perceptions of ehealth in relation to integrated care.

Discussion

This systematic review aimed to identify the best evidence of health practitioners' perceptions of ehealth in relation to integrated care. The search returned only five papers for review with each based on a different ehealth application and in a different country. However, all five papers focused on the perceptions of healthcare practitioners using ehealth to support multi-disciplinary teams in providing integrated care and some commonality emerged from findings. These differences and commonalities are discussed further framed in Computer Supported Cooperative Working terms of communication, collaboration and coordination.

Communication

All studies report the potential for ehealth to support improved communication between healthcare practitioners providing integrated care (Aarts et al 2007). However, the favourable findings around quicker distributed access to more legible information (Melby & Helleso 2010; Shih et al 2012; Callen et al 2013) are countered by evidence that electronic records may be less accurate than paper-based (Melby & Helleso 2010) and less adaptable to the needs of the multidisciplinary team (Eason & Waterson 2013). Secure, wider access to patient information remains an issue for cross border communication (Shih et al 2012) and within England (Eason & Waterson 2013) but has been addressed for information flow within and between hospitals (Aarts et al 2007; Callen et al 2013) and across the primary-secondary care interface (Melby & Helleso 2010).

Collaboration

There was some evidence of collaboration in relation to ehealth supported integrated care (Aarts et al 2007; Melby & Helleso 2010; Shih et al 2012; Eason & Waterson 2013; Callen et al 2013). The complex, collaborative decision making which precedes the individual action in CPOE may be affected by evolving roles and responsibilities within the healthcare team working together with the shared main impetus of providing quality care (Aarts et al 2007). The prospect of better cross border collaboration facilitated by EHR and Cloud computing (Shih

et al 2012) contrasts with the PIS (Eason & Waterson 2013), part of the NPfIT in England, deemed an unachievable plan by the National Audit Office (National Audit Office 2011). However, there were local examples of success in specific care pathways where the *'local health community are meeting together to find ways of cooperating'* at a *'middle out level'* without national direction (Eason & Waterson 2013). Faster and better informed clinical decision making was also facilitated by access to patient specific clinical information and clinical databases for the healthcare team with inter-hospital access to C&MIS in emergency departments (Callen et al 2013). The intended benefit of eDS has seen municipal (community) health staff better prepared for receiving patients while the implementation project has been an unintended *'catalyst for interaction'* facilitating collaboration through professional networks (Melby & Helleso 2010).

Coordination

Coordination is the binding element of the triumvirate, drawing together communication and collaboration. Leaving aside the prospective study from Taiwan (Shih et al 2012), which foresees benefits but is in the initial stages of coordinating a working group, the remaining studies all note the *'profound impact on workflow'* or *'changes in working processes'*, *'workarounds'* and, *'increased work and task complexity'* which challenge task coordination and management, placing additional perceived burdens on the healthcare team (Aarts et al 2007; Melby & Helleso 2010; Eason & Waterson 2013; Callen et al 2013). And yet successful examples prevail at a local level for specific care pathways or information portals (Eason & Waterson 2013) or between and within hospital emergency departments (Aarts et al 2007; Callen et al 2013). The C&MIS study noted, *'difficulty incorporating the use of ED information systems with clinicians' work'* but post-implementation realised the benefits of, *'improved care coordination, communication, clinical documentation, and the consultation process'*(Callen et al 2013).

What ehealth technologies do healthcare practitioners perceive to have worked and how in promoting integrated care?

Aarts et al (2007) report an unmeasured success in that, *'none of the respondents who had implemented CPOE had any direct proof of improved quality of care'* but, *'according to interviewees, this integrated functionality*

improves patient outcomes'(Aarts et al 2007). A considered study of electronic discharge summaries by Melby and Helleso (2010) found, *'no significant increase in integration of care'* despite implementation unexpectedly facilitating collaboration (Melby & Helleso 2010). While Shih et al (2012) concluded there was a, *'need for better continuous care through communications'* for cross border transplant patients, the health research community must wait for their post-implementation evaluation (Shih et al 2012). Eason and Waterson (2013) were clear that the key to successful implementation lies with,

> *'technical strategies that permit local design of tight coupling needed to support integrated care in healthcare pathways'*(Eason & Waterson 2013),

which are usefully termed for this review as, *'the development of socio-technical systems capable of delivering integrated care'*(Eason & Waterson 2013). Finally, and most persuasively, Callen et al (2013) conclude that the implementation of C&MIS in emergency departments had, *'contributed to improvements in delivery of patient care'* emphasising that the, *'advantages of improved information access, communication, and coordination should not be compromised by the demands of data entry'*(Callen et al 2013).

Strengths and weaknesses

The main strengths of this systematic review are the methodological rigour, independent review by more than one researcher and application of established tools by a multi-disciplinary team. These strengths reduce the potential for publication and selection bias. Limitations and weaknesses are the potential bias introduced by the variation in database search tools with some having limited capabilities. Given the limited number and heterogeneity of studies identified for review, the authors make no claim for generalisability of findings.

Conclusion

The few yet varied studies identified in this review, found healthcare practitioners reluctant to acclaim any ehealth technology an unqualified success in supporting integrated care. Nearly a decade after Greenhalgh et al's (2004a) seminal review, based around Rogers' diffusion of innovation theory (Rogers 1995) asked, *'How can we spread and sustain innovations in health service delivery and*

Organisation?'(Greenhalgh et al 2004a), their recommendations appear unaddressed in relation to ehealth and integrated care. However, the continued trend for focusing ehealth research on doctors and nurses is evident. Based on mass within the health services workforce this representation is justifiable but, given the changing roles (Stewart et al 2011 & 2012) and multi-disciplinary nature of increasingly integrated health and social care (Scottish Government 2013b; Leichsenring 2004; Naylor et al 2013; Wilson & Barber 2013), broader representation in future research should be considered. The combination of socio-technical systems theory and computer supported cooperative working approaches proved a pragmatic analytical framework enabling this systematic review to provide further evidence of, *'the divide between what we know we must support socially and what we can support technically'* more commonly known as the social-technical gap (Ackerman 2000).

Key findings

- Healthcare practitioners do not perceive any ehealth application to be an unqualified success in supporting integrated care
- Ehealth research continues to focus on physicians and nurses despite the multi-disciplinary nature of increasingly integrated health and social care
- The social-technical gap is still evident within ehealth supported integrated care

Summary of this chapter

This chapter explored healthcare practitioners' perceptions of ehealth in relation to integrated care. This systematic review demonstrated the need for further socio-technical research engaging with all members of the integrated healthcare team.

CHAPTER 5 (Phase III) Pharmacy practice in the NHS Grampian area: a case study in digital literacy

'Measure what is measurable and make measurable what is not so'

Galileo, physicist, mathematician, astronomer, philosopher (1564-1642)

+

'There is nothing so practical as a good theory'

Kurt Lewin, social psychologist (1890-1947)

Introduction to the chapter

This chapter builds explanatory theory of how pharmacy staff use, and learn to use, technology. Multiple case studies were conducted to explore the digital literacy experiences, education and training related needs of pharmacy staff in the local health board area.

Background

As described in more detail in previous chapters, health strategists worldwide promote the adoption of ehealth to support the delivery of healthcare. There is a reasonable expectation that healthcare providers, including pharmacy staff, will have the necessary information technology (IT) skills, or digital literacy, to enable them to use ehealth technologies effectively. The routes by which pharmacy staff develop their digital literacies is not clear so forms the basis for this explanatory research.

eHealth definitions

Although the term ehealth has long been discussed (Eysenbach 2001) and has at times lacked consensus (Oh et al 2005), the World Health Organisation defines ehealth or electronic health as, *'the combined use of information and communications technologies for health'*(WHO 2011a). This has been further refined by the European Commission Information Society (ECIS) to include, '*tools and services for health*'(ECIS 2011).

Adoption of ehealth to support healthcare

The WHO Global Observatory for eHealth tracks and benchmarks the ehealth policies of its 114 member states. In urging the adoption of, *'appropriate eHealth services*,' WHO's stated mission is to offer, *'strategic information and guidance on effective practices and standards in eHealth.'*(WHO 2011) Support through research is a major focus of the European Commission's *'eHealth Action Plan 2012-2020'* (European Commission 2011) with current ehealth research funding streams aligned to promoting and developing the ehealth strategies of member states. In the UK, Lord Darzi's influential *'High Quality Care For All – NHS Next Stage Review'* (Darzi 2008), was welcomed beyond England's borders. In the report he promoted greater use of technology in providing care closer to the patient's home; for patient, practitioner and cost benefits. Lord Darzi noted

that, *'wealth and technology have changed the nature of our society's outlook and expectations.'* His observation that,

> *'improved technology is enabling patients that would once have been hospitalised to live fulfilling lives in the community, supported by their family doctor and multi-professional community teams'*(Darzi 2008),

added support for the role of ehealth enabled pharmacy practice. A joint statement issued by the Royal Pharmaceutical Society (RPS) and Royal College of General Practitioners (RCGP) on cooperative working further emphasised the need for IT and associated staff training to facilitate the role of pharmacy in primary care (RPS & RCGP 2011). This was followed by publication of the RPS Information Technology Strategic Principles (RPS 2011) which stated,

> *'pharmacy education should ensure a basic standard of IT literacy which supports the development of pharmacy'*(RPS 2011)

Digital literacy in healthcare

The '*2020 Workforce Vision'* envisages,

> '*making more and better use of technology and facilities to increase access to services and improve efficiency'*(Scottish Government 2013d),

also promising to ensure that everyone, *'is supported to make the best use of new technology.'* Pharmacy practice in all settings is already underpinned by technology and locally the drive continues to, *'use technology to improve quality, patient experience, efficiency, safe systems and information transfer'*(NHS Grampian 2013).

The abilities of pharmacy staff in using technology at home and at work, also known as digital literacy or digital competence or eskills, are dependent on their personal experience and related education and training. The British Computer Society (2013) defines digital literacy as,

> *'being able to make use of technologies to participate in and contribute to modern social, cultural, political and economic life'*(BCS 2013)

This definition is grounded on historical and conceptual definitions of digital literacies which have evolved from the traditional literacies around the three R's (reading, writing, arithmetic) to reflect an increasingly technology-based world (Lankshear & Knobel 2008).

In 2006, digital competence was identified by the European Parliament as one of eight key skills for lifelong learning along with a recommendation for, *'better identification of occupational needs'*(European Parliament 2006). The European Commission Information Society (ECIS) promotes and tracks citizen and member states digital engagement as indicators of the ways in which national governments and people do, and do not, use technology (ECIS 2012). As part of the ECIS research programme, the sixth pillar out of seven in the Digital Agenda for Europe builds on that recommendation by focusing on digital literacy, skills and inclusion for lifelong learning (European Commission 2012).

Pharmacy workforce in Great Britain

Pharmacy in Great Britain is regulated by the General Pharmaceutical Council (GPhC) with whom pharmacists, pharmacy technicians and pharmacy premises must be registered. The 2013 Annual Report (GPhC 2013) showed registrant numbers at 47 407 pharmacists (4 266 in Scotland) and 21 824 pharmacy technicians (2 030 in Scotland) working in 14 186 pharmacy premises, not including hospital settings, across the UK (1 400 in Scotland). Pharmacists were predominantly female (59.4%; CPWS Manchester 2011) with the modal age group for both sexes at 30-39 years. Pharmacy technicians were almost exclusively female (90.2%; CPWS Manchester 2012) with a modal age group of 40-49 years. The majority of pharmacists and pharmacy technicians were based in the community (71.0%; 67.4%) or hospital (21.4%; 21.2%) sector with the remainder in primary care (7.2%; 8.4%), industry (4.1%; 0.8%), academia (2.8%; 1.5%) or other (3.8%; 3.2%).

The future direction of the pharmacy workforce was a central issue in the recent *'Review of NHS Pharmaceutical Care of Patients in the Community in Scotland'* (Wilson & Barber 2013). It recommended, *'developing and using the skills of the whole pharmacy team'* informing and supporting the *'Prescription for Excellence'*(Scottish Government 2013e) in promoting technology supported, person-centred pharmaceutical care to promote patient safety through personal

development of pharmacy staff. The *'Prescription for Excellence'*(Scottish Government 2013e) was welcomed by Community Pharmacy Scotland (CPS 2013) who were,

> *'encouraged that the Review is keen to promote closer working between health professionals, particularly GP surgeries and Pharmacies. We would welcome the opportunity for more, and cross-disciplinary, training opportunities for community pharmacy owners, their pharmacists and their staff'*(CPS 2013)

Pharmacy education in Great Britain

GPhC is also, *'responsible for defining the education and training requirements for pharmacists and pharmacy technicians'* and accredits their qualifications and training providers (GPhC 2011a & 2011b). Pharmacists are required to,

> *'take responsibility for all work you do or are responsible for. Make sure that you delegate tasks only to people who are trained to do them, or who are being trained'*(GPhC 2011a)

This places the onus on the nominated responsible pharmacist to delegate effectively within the pharmacy team ensuring minimum training requirements are met and that those given the task have the knowledge and the skill set to complete it safely.

Pharmacists typically complete a four year accredited Master of Pharmacy (MPharm) course in one of 27 Schools of Pharmacy in Great Britain (two in Scotland) followed by a pre-registration competency based year in practice with a final registration examination.

Pharmacy technicians are required to provide evidence of two years relevant work experience under the supervision of a pharmacist and complete Level 3 qualifications in both knowledge and competency based pharmacy practice.

Similarly, GPhC sets the, *'standards for pharmacy support staff, including dispensing assistants and medicines counter assistants'* who also have regulated training programmes. These roles are not subject to GPhC registration and the courses for dispensing assistants and medicine counter assistants are set at

Level 2. Medicines counter assistants must complete a subset of the dispensing assistant's course (units 4, 5, 15).

There are 23 accredited providers of these Level 2 and 3 courses across Great Britain (three in Scotland) plus two national providers, including the National Pharmacy Association (NPA 2013). Course delivery modes vary but are increasingly offered online with the expectation of ring-fenced time for training within the pharmacy during working hours. Continuing professional education is provided for all levels of pharmacy staff in Scotland by NHS Education for Scotland (NES 2012) while in England, the Centre for Postgraduate Pharmacy Education (CPPE) provides training opportunities for pharmacists and pharmacy technicians (CPPE 2013). Keeping an online electronic portfolio of continuing professional development (CPD) is compulsory for GPhC registrants and subject to audit (GPhC 2011a & 2011b).

Early in 2012, the NHS announced 42% of, *'relevant staff with a signed off eKSF review'* under the Knowledge and Skills Framework (NHS KSF 2012) but it was not clear whether this indicates a gap in skills or a lack of completion of skills records. The Healthcare Quality Strategy for Scotland prioritises both workplace skills and job satisfaction in seeking to ensure that,

> *'everyone working in and with NHS Scotland is confident that they will be supported to do what they came in to the NHS to do, and that they are valued for doing that'*(NHS Scotland 2010)

Pharmacy practice in Scotland

As health is a devolved matter within the UK, responsibility for policy development and service delivery lies with the parliament of each of the home nations (Centre for Parliamentary Studies 2011). The Scottish Government ehealth policy features an epharmacy programme designed to,

> *'support the future delivery of the new community pharmacy contract and improve communications across the healthcare team'*(Scottish Government 2011a)

There are four core services which National Health Service (NHS) contracted community pharmacies in Scotland are required to provide: Public Health, Minor

Ailment (MAS), Acute Medication (AMS) and Chronic Medication Services (CMS), with all except the first reliant on IT (Scottish Executive 2002 & 2005; CMS Advisory Group 2009).

A variety of computerised pharmacy management systems (PMS) are implemented across community and hospital pharmacies aimed primarily at processing prescriptions (Scottish Government 2008b). Central to the national community pharmacy IT infrastructure (Figure 1.6) is the ePharmacy Message Store (ePMS). Connected via the NHS secure N3 network, patient data identified by their CHI (Community Health Index) number and unique prescription number (UPN) can be stored and retrieved by pharmacies, GP practices and National Services Scotland (NSS). The printed prescription (GP10) given to the patient by the prescriber, usually their GP, has a UPN barcode which, when scanned in the pharmacy, pulls the data from ePMS to populate the screen as an electronic transfer of prescription (ETP) on the pharmacy management system.

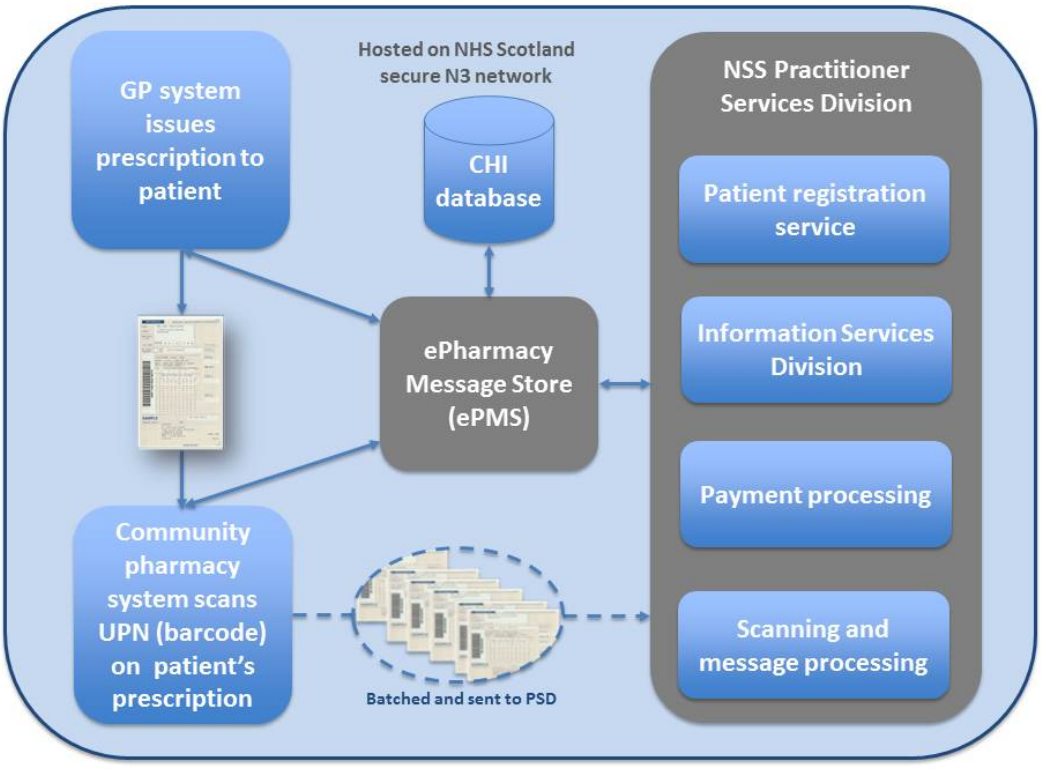

Figure 1.5 Adapted from Scottish Government ePharmacy Programme infrastructure (Scottish Government 2009a)

There are varying levels of interface integration for the core services, medicines information and stock control in community pharmacy. The recent *'Prescription for Excellence'* report (Scottish Government 2013e) found that in secondary care,

> *'Hospital Electronic Prescribing and Medications Administration (HEPMA) and related electronic decision support has only been implemented in a very small number of acute hospitals, and in those cases not to its full potential'*(Scottish Government 2013e)

A complex array of prescription formats are utilised in different hospitals for out-patients, day patients, discharge and ward specific instructions, and for patients who are waiting to collect their dispensed medicines, being admitted to hospital without their regular medications, for collection by a ward, van delivery, to be posted and more.

Generic IT systems may also be utilised in both community and hospital pharmacies such as management information systems or office applications for administrative purposes. A range of pharmacy specific support options for core services and continuing professional development (CPD) are available but these rarely focus on aspects of digital literacy.

As described earlier, it is evident that within the UK, the Scottish Government, advisory and professional bodies of both healthcare and technology (AMRC & Scottish Government 2011; Scottish Government 2011d) have developed a range of strategic principles (RPS 2011), national competency frameworks for training (BCS 2012), core skills and digital literacies for the general public (e-Skills UK 2011) with more specific targets for the health sector (BCS 2011; Skills for Health 2012; NHS Elite 2013). Their influence on pharmacy education and practice is unknown.

Research context for digital literacy in pharmacy

In summary, policy driven ehealth and information technologies underpin the delivery of healthcare in which pharmacy practice plays an integral role. Little is known about how pharmacy staff learn to use technology or their initial and ongoing digital literacy education, training experiences and needs.

Aim

The aim of this phase of the research was to develop explanatory theory of the digital literacy experiences, education and training related needs of pharmacy staff in the NHS Grampian area.

Research questions

Detailed research questions were:

1. What is the policy driven intended use of information technology in pharmacy practice in Scotland?
2. How and why do pharmacy staff in the NHS Grampian area use information technology?
3. What facilitators and barriers do pharmacy staff in the NHS Grampian area experience in learning to use information technology?
4. What are the needs of pharmacy staff in the NHS Grampian area for digital literacy education and training?

Methods

Theoretical perspectives of case study design

From a theoretical perspective, the research approach was to conduct local knowledge, explanatory research with the purpose of building theory using multiple, sequential case studies. The case studies were preceded by a review of relevant policy and strategy documents and followed by comparison of conceptual and real world models developed throughout the research. The categorisations for types of case study (Table 5.1) offered by Thomas (2012) were followed in mapping out the design.

Table 5.1 Categorisation of types of case study reproduced from Thomas (2012)

Subject	Purpose	Approach	Process
Special or outlier case	Intrinsic	Testing theory	Single
Key case	Instrumental	*Building theory	*Multiple
*Local knowledge case	Evaluative	Illustrative	• Nested
	*Explanatory	Descriptive	• Parallel
	Exploratory	Interpretive	• *Sequential
		Experimental	• Retrospective
			• Snapshot
			• Diachronic

* indicates the categorisation applied in this case study research

Subject: local knowledge case

- the research was based in the local area of NHS Grampian so it was classed as a *'local knowledge case'* with the population accessible through established networks of contacts in pharmacy practice

Purpose: explanatory

- the purpose was to explain the digital literacy experiences, education and training related needs of pharmacy staff in the local area

Approach: building theory

- the approach was to build theory, *'an explanatory model,'* around the digital literacy education and training needs of pharmacy staff

Process: multiple sequential

- the process involved conducting observation and interviews in multiple local pharmacies, one after another, at times and dates which were convenient to participants.

Multiple perspectives

As detailed in Chapter 2, case study has a long history as a methodological research approach. It has a well-established track record in health, technology and educational research where a range of contributory worldviews are to be explored (Checkland & Poulter 2006; Bowling 2009). The approach is apt for this study which involves all these research areas and seeks to understand the perspective of many stakeholders, for example, policy makers, pharmacy strategists, all levels of pharmacy staff.

Examples of case study design were cited in the systematic review in Chapter 3. Greenhalgh et al's (2010b) multi-level case study of the implementation of the electronic summary care record in England included extensive observational activity and 140 interviews. The study was designed to research complex interdependencies and tensions, causal influences and change agents to explain variation in adoption of use of a specific technology in three primary care out-of-hours and walk-in centres. Another study of electronic healthcare records, by Robertson et al (2010), adopted a socio-technical case study approach in five early implementation NHS hospital sites. Interviews and observation were again used to explore expectations, experiences and opinions from multiple perspectives. A further case study design example, selected for its focus on health, technology and education, can be found in Boulos et al (2007). Boulos et al (2007) used two detailed case studies to explore the pedagogical potential of '*Second Life'*, an online, social interaction based simulation game. The two case studies focused on virtual worlds of '*Healthinfo Island'* and '*VNEC* (Virtual

Neurological Education Centre)' developed by the US National Library of Medicines and the University of Plymouth, UK, respectively.
In each example, the case study approach brought a descriptive richness and wealth of detail evidencing the pedagogical potential on a platform where, *'medical students can gain new skills without risk of harm to patients or themselves'*(Boulos et al 2007).

Theory building from case studies

Methodology texts support the case study approach in similar contexts where research seeks to understand a phenomenon in depth through empirically gathered data. Eisenhardt and Graebner (2007) collated opportunities and challenges for theory building from cases, offering methods for strengthening the validity and credibility of data collection and theory development to, *'convey rigor, creativity, open-mindedness of process.'* In the context of case studies, building or developing theory is about (Thomas 2012):

- seeing links between ideas
- noticing where patterns exist
- abstracting ideas from your data and offering explanations
- connecting your own findings with those of others
- having insights
- thinking critically about your own ideas and those of others.

Similar views expressed by Flyvbjerg (2006) were explored in Chapter 2 but for Eisenhardt and Graebner (2007), the central notion of theory building from cases is inductive development from the data; that theory should be emergent from the empirical evidence based on patterns and constructs within and across cases with their logical arguments clearly expressed.

Theoretical sampling for generalisability

Multiple case studies based on theoretical sampling were recommended to provide a wealth and richness of empirical data from which to identify patterns, constructs and relationships between and across cases for emergent inductive development of theory. In describing theoretical sampling, Eisenhardt and Graebner (2007) stated that it,

> *'simply means that cases are selected because they are particularly suitable for illuminating and extending relationships and logic among constructs'* (Eisenhardt & Graebner 2007)

Where theoretical sampling has been possible across all strata, it was considered by Eisenhardt and Graebner (2007), Yin (2009), Flyvjberg (2006) and Walton (1992) to be testable, generalisable and more robust because consideration had been given to validity, replication, elaboration and alternative explanations. Thomas (2012) was in broad agreement but differed on matters of sampling for reliability and generalisability, or transferability, described in the classic text by Guba and Lincoln (1985) as applicability. Thomas (2012) believed that although it is possible to, *'compare these cases for what they show'* they, *'will never form a sample from which you can generalise.'* A view also espoused by Bowling (2009) but countered by Flyvbjerg (2006) who supported Walton's (1992) assertion that, 'case studies are likely to produce the best theory.'

Quality in qualitative research

However, there was general agreement that the collation of methods in a case study, using many methods and sources of data, provided a form of triangulation aiding the trustworthiness of evidence and subsequent findings (Mertens & Hesse-Biber 2013). The classic text from Guba and Lincoln (1985) offered four constructs for trustworthiness of qualitative research: credibility (truth value), transferability (applicability), dependability (consistency) and confirmability (neutrality). As explored in more detail in Chapter 2, Yin (2009) argued that four tests of quality of design should be applied to case studies (Table 5.2).

In defining triangulation, Thomas (2012) reflected on the social philosopher Foucault's, *'polyhedron of intelligibility,'* here meaning multiple perspectives and methods are required to fully understand and explain social phenomenon. In explaining that Foucault took the geometrical analogy to another level, Thomas advised that the collation of methods, for example, in this study document review, observations, interviews, development and comparison of conceptual and real world models, need not stop at three but are essential to multi-faceted case study approach to provide the triangulation which promotes trustworthiness and credibility of results.

Table 5.2 Tests of quality of design reproduced from Yin (2009)

Test	Description
Construct validity	identifying correct operational measures for the concepts being studied
Internal validity (explanatory and causal studies only)	seeking to establish a causal relationship, whereby certain conditions are believed to lead to other conditions, as distinguished from spurious relationships
External validity	defining the domain to which a study's findings can be generalised
Reliability	demonstrating that the operations of a study – such as the data collection procedures – can be repeated, with the same results

This view was reflective of the framework for assessing qualitative research evidence developed as a government sponsored review of the literature by Spencer et al (2003). Explored in Chapter 2 in more detail, but here summarised as the four guiding principles, that research should be: contributory, defensible in design, rigorous in conduct and credible in claim (Spencer et al 2003).

On that basis, where trustworthiness is demonstrated, although not necessarily generalisable, findings may be applicable in similar contexts. Thomas (2012) outlined the analytic frame which looks for, *'antecedents, behaviours and consequences'* as well as interconnectedness while encouraging reflection but he maintained it is always, *'about the particular not the general.'* Flyvbjerg (2006) argued that context-dependent knowledge gained from case studies can be generalisable, is useful for theory building and carries no greater bias than other research methods believing that '*problems summarising from case studies are more often due to the properties of the reality studied'*(Flyvbjerg 2006).

On this point of contention, Silverman (2013) offered guidance on aspects of case study design to promote generalisability: combine it with quantitative data, purposive sampling guided by time and resources, theoretical sampling, and using an analytical model which assumes generalisability (Silverman 2013).

Within that methodological, theoretical framework, the aim of this study was to develop explanatory theory inducted from empirical data from multiple cases, multiple perspectives and multiple sources using theoretical sampling.

The case study approach adopted had three elements of study design each related to the research questions (RQ):

- Element 1 (RQ 1): document review of policy and strategy publications using content analysis and the framework approach to inform a conceptual model of intended use of technology in pharmacy practice
- Element 2 (RQs 2 and 3): pharmacy visits for observation and interview of pharmacy staff during case study field work to inform a real world model of actual use of technology and facilitators and barriers to use of technology
- Element 3 (RQ 4) conceptual and real model comparison (from Elements 1 and 2) to inform explanatory theory around the digital literacy training and educational needs of pharmacy staff in the NHS Grampian area.

Although presented in this order to aid the reader, it should be noted that element 1 (document review) was conducted after element 2 (observation and interview activity) due to the timing of key publications (Wilson & Barber 2013; Scottish Government 2013e) with potential to influence the conceptual model.

Aspects of research governance applicable to all elements of the study follow, then detailed study design, data collection, data analysis and results for each of the elements are presented, followed by a collective discussion section covering findings from all 3 elements.

Research governance

Approvals and consents

The research plans passed review by the Robert Gordon University School of Pharmacy and Life Sciences Ethical Review Panel. A major amendment submitted to include hospital as well as community pharmacies was also accepted. The North of Scotland Research Ethics Service advised full NHS review was not necessary as, having reviewed the proposal and accompanying documents, they deemed it to be a service evaluation (Appendix 5.3). Permission for access to hospital pharmacies was gained from the Director of Pharmacy for NHS Grampian. Permission for access to community pharmacies and staff was gained from owners and managers. Informed, individual participant consent was gained without exception from each member of pharmacy staff prior to data collection.

Data handling and protection

All study materials were stored, processed and destroyed in accordance with the RGU School of Pharmacy and Life Sciences standard operating procedures for good research practice which references the Data Protection Act 1998 and Robert Gordon University Research Governance policies. Recruitment logs were maintained and stored on a password protected University server with access limited to the researcher. Each participating pharmacy was assigned a case number which was used for reference throughout to protect participant anonymity. Printed consent forms and data collected during observational and interview activities were labelled by case number and stored in a locked cupboard accessible only by the researcher. All data collected during observation and interview activities were transcribed verbatim and sketches scanned and also stored electronically, as previously described.

Element 1: Study design – document review

Conceptual model from review of policy and strategy documents

To address the first research question, a conceptual model (Checkland & Poulter 2006) of the *intended* use of IT in pharmacy in Scotland was developed from recent policy and strategy documents. The review team searched Scottish Government and professional pharmacy body (GPhC, RPS, CPS) databases for publications relevant to current and future use of technology in pharmacy in Scotland. The views of academic pharmacy experts at Robert Gordon University, with experience in government and pharmacy strategy and policy development, were gained to ensure currency and relevance of the selected documents and to reduce the possibility of omission of relevant documents.

The conceptual model was developed using a content analysis approach (Hseih & Shannon 2005) to identify the intended use of IT in pharmacy from the selected documents. Hseih and Shannon (2005) described three types of content analysis:

- conventional: '*coding categories are derived directly from the text data'*
- directed: '*analysis starts with a theory or relevant research findings as guidance for initial codes'*
- summative: '*involves counting and comparisons, usually of keywords or content, followed by the interpretation of the underlying context'*

In this study, conventional content analysis was conducted to identify and extract major constructs (categories), sub-themes and illustrative examples from the source documents. This was done independently by two coders (KM, DS) with (Patton 2005):

- each reading and electronically searching the documents for content relevant to pharmacy technology
- each independently noting preliminary codes (constructs, sub-themes)
- joint negotiation to reach consensus on constructs and sub-themes to be added to an analytical framework
- agreement on identification of illustrative quotes extracted from the text and added to the coding framework for analysis.

Reading familiarised and immersed the reviewers in the subject while electronic searching (using the Find option in Microsoft Word 2010 or Adobe Reader) served dual purposes of aiming to ensure (Bowling 2009):

- completeness of the search and the review: all iterations of the search terms (pharmacy, ehealth, technology, digital, ICT, IT, education and training) would be returned where hand searching may overlook instances
- accuracy of the extracted data: copy and paste is less prone to errors of omission, commission or transcription than re-typing.

Independent coding following an agreed plan by two reviewers (KM, DS) helped to (Bowling 2009):

- reduce design bias: *by applying agreed standard procedures in data handling*
- reduce information bias: *misclassification of data*
- social desirability bias: *coders acquiescing on the basis of assigning assumed values to the other coder*
- promote objectivity: *systematic processing applied independently by two coders reducing the opportunity for individual subjectivity.*

The coding framework, including data extracted as illustrative examples, was analysed for similarities and differences which were reported as conceptual models (table and figure) accompanied by narrative discussion.

Element 1: Data collection

The selection of policy and strategy documents to inform development of the conceptual model has been described elsewhere. Each document was searched for the terms: pharmacy, ehealth, technology, digital, ICT, IT, education and training. Sample text from identified paragraphs was extracted to the initial conceptual model, in the form of a table, for content analysis with iteration and refinement producing a diagrammatic conceptual model to summarise the table.

Element 1: Data analysis

A conceptual model was developed based on the content analysis of the selected policy and strategy documents using a framework approach (transcribing, familiarising, coding, developing then applying an analytical framework, mapping data to the framework, interpreting patterns across and within the constructs) from which the conceptual models of the intended use of technology in pharmacy were developed.

Element 1: Results

Research aim

The overall aim of the study was to systematically develop explanatory theory around the digital literacy experiences, education and training related needs of pharmacy staff in the NHS Grampian area. In this first element, the underlying theoretical arguments are linked to supporting empirical data collected during the content analysis of policy and strategy documents.

Conceptual model of intended use of technology in pharmacy

Publication databases of the Scottish Government, General Pharmaceutical Council, Royal Pharmaceutical Society and Community Pharmacy Scotland were searched for policy and strategy documents relevant to pharmacy technology. Four documents were identified, and confirmed as the most current and relevant by academic pharmacy experts, to inform development of a conceptual model of the intended use of technology in pharmacy (Table 5.3). Three were Scottish Government publications, one from the Royal Pharmaceutical Society, with no

publications related to pharmacy technology found on the General Pharmaceutical Council databases.

The Scottish Government's *'eHealth Strategy 2011-2017'*(Scottish Government 2011a) aligns with *'The Healthcare Quality Strategy for Scotland'*(Scottish Government 2010b) placing the, *'focus on outcomes and real benefits delivered rather than technologies'*.

Table 5.3 Documents selected to inform the development of a conceptual model of the intended use of IT in pharmacy in Scotland

Year	Authors	Title
2011	Scottish Government	eHealth Strategy 2011-2017 (Scottish Government 2011a)
2011	The Royal Pharmaceutical Society	Empowering pharmacists to improve Pharmaceutical Care and Medicines Safety through Information Technology: Information Technology Strategic Principles (RPS 2011)
2013	Wilson H, Barber N	Review of NHS Pharmaceutical Care of Patients in the Community in Scotland (Wilson & Barber 2013)
2013	Scottish Government	Prescription for Excellence: A Vision and Action Plan for the right pharmaceutical care through integrated partnerships and innovation (Scottish Government 2013e)

It emphasised convergence and compatibility of developing technologies to facilitate collaborative health and social care teams in providing integrated patient care. A briefer sub-strategy followed to drive forward the more person-centred aspects including improved information, communications, transactions and peer support grouped as three eHealth themes (Scottish Government 2012a):

- what I want to do
- what I want to know, and
- my care and my record.

Also in 2011, the Royal Pharmaceutical Society published a set of IT Strategic Principles which underlined their commitment to ensuring that,

> *'the professional requirements of pharmacists are maintained, supported and developed through the adoption and use of appropriate IT systems'* (RPS 2011)

The remit of the Wilson and Barber report (2013) was to review,

> *'how pharmaceutical care can best contribute to the ambitions set out in 'The Healthcare Quality Strategy for Scotland'* [(Scottish Government 2010b)] *that is care which is person-centred, safe and effective'(Wilson & Barber 2013)*

The progressive, forward thinking recommendations look to build on the strengths of Scotland's current pharmacy IT infrastructure and applications to make better use of workforce skills in providing safe, effective person-centred care. Similarly, *'Prescription for Excellence'*(Scottish Government 2013e) emphasised the potential benefits to be gained from technology-supported, integrated person-centred care aligned to *'A Route Map to the 2020 Vision for Health and Social care'*(Scottish Government 2013a).

Key constructs identified

The key constructs of the intended use of technology in pharmacy in Scotland, evidenced across all four documents, were (Table 5.4):

- **Patient care**
- **Education and training**
- **Information governance**
- **Implementation**

Sub-themes identified within each construct

Each construct had associated sub-themes inducted from the data:

- **Patient care:** safety, partnership, integration, resources
- **Education and training:** fit for future needs, multi-disciplinary, delivery mode
- **Information governance:** systems, staff

- **Implementation:** accessibility, interoperability, support for role development

These constructs and sub-themes were developed into conceptual models, with illustrative textual extracts from the policy and strategy documents, in fully populated table form and a summarised representation for visual impact (Table 5.4 and Figure 5.1).

Table 5.4 Conceptual model of the intended use of technology in Scottish pharmacy developed from data extracted from policy and strategy documents

Policy/ Strategy Document Constructs with subthemes	**eHealth Strategy 2011-2017** (Scottish Government 2011a)	**Empowering pharmacists to improve Pharmaceutical Care and Medicines Safety through IT: IT Strategic Principles** (RPS 2011)	**Review of NHS Pharmaceutical Care of Patients in the Community in Scotland** (Wilson & Barber 2013)	**Prescription for Excellence: A Vision and Action Plan for the right pharmaceutical care through integrated partnerships and innovation** (Scottish Government 2013e)
PATIENT CARE				
safety	▪ improve the safety of people taking medicines and their effective use	▪ pharmacy IT system developments should enhance medicines safety ▪ pharmacy IT systems should be developed with improving the care of patients as a priority	▪ growth of additional technologies to support the adherence of patients may also offer further opportunities for pharmaceutical care	▪ to optimise patient safety and to allow for appropriate monitoring of prescribing appropriateness and safety, electronic prescribing and sharing of information between primary and secondary care would need to be in place in all NHS Boards
partnership	▪ support people to communicate with the NHSS, manage their own health and wellbeing, and to become more active participants in the care and services they receive ▪ Pharmacy Care Record (PCR), to assist pharmacists in providing pharmaceutical care for patients with long term conditions in order to ensure they get the best outcomes from their medicines ▪ PCR supports community pharmacists in providing CMS through the development of an individualised pharmaceutical care plan, a copy of which is given to the patient	▪ new developments in IT should support electronic prescribing by pharmacists	▪ significant potential use of mobile devices and smart media to provide improved services to patients, e.g. for repeat prescriptions, and access to records and information, but it is important that those who cannot or choose not to access such solutions are not disadvantaged	▪ improve and enhance pharmacists' role in working in partnership with patients and carers to improve co-production and support self-management using mobile technology ▪ framework to promote and increase the use mobile technology to support people manage their medications and improve adherence

integration	▪ contribute to care integration and to support people with long term conditions ▪ telehealth and telecare, priorities will be to support home based care for managing long term conditions, delivery of care in remote and rural settings and improved ways of addressing unscheduled care ▪ ePrescribing systems are widespread in primary care, with almost all GP generated prescriptions in Scotland now coming from GP IT systems	▪ pharmacy IT systems should not only produce an effective, efficient and safe dispensing and labelling record system but also provide for a sound clinical system that can be evidence-based	▪ increasing use of new technologies to support people in their own homes, involving the health and social care sectors	▪ integration of primary and secondary care pharmacists to improve interface issues ▪ pharmacists will have a role in facilitating better integration of advice and use of medicines across sectors and disciplines
resources	▪ NHSS works efficiently and effectively, making the best possible use of available resources	▪ pharmacy IT systems should be adequately resourced in order to secure the future development of the pharmacy profession in the delivery of pharmaceutical care ▪ pharmacists should have secure and responsible access to the electronic patient record	▪ community pharmacy is already well placed to take advantage of the developments in IT, with connection to the NHS network, electronic transmission of prescriptions, electronic patient registration, and on going development of in-house systems	▪ seek to review the use of technology such as telehealthcare to enhance the patient journey
EDUCATION AND LEARNING				
fit for future needs	▪ develop a strategy for ▪ improving the professional skills of our eHealth staff	▪ pharmacy education should ensure a basic standard of IT literacy which supports the development of pharmacy with further training supported and facilitated by pharmacy IT systems	▪ designing education and training to meet the future professional and service needs	▪ review of all aspects of pharmacy workforce and associated education and training involving NES, Schools of Pharmacy, Schools of Medicine, NHS Boards and the professional and regulatory bodies to develop an integrated approach to ensure a workforce that is fit for purpose and that meets the future service needs

multi disciplinary	▪ requires multi-disciplinary working and appropriate information sharing at all levels		▪ developing and using the skills of the whole pharmacy team	▪ education and training to support multi disciplinary learning and working ▪ requires novel models for clinical practice and joint working which will create new demands on undergraduate and postgraduate education. These opportunities will be explored with NES, the professional bodies and the Schools of Pharmacy and Medical Schools in Scottish Universities
delivery mode		▪ IT should be used and developed to support the education and training of pharmacists		
INFORMATION GOVERNANCE				
systems	▪ safeguarding information ▪ confidentiality: an upgraded information assurance policy ▪ and implementation plan developed ▪ work to implement an agreed Information Assurance Strategy will be well established	▪ fundamental to the development of any pharmacy IT system or information process and patient information should be stored in a safe and secure manner to ensure patient confidentiality		▪ central to the future development of NHS pharmaceutical care is the importance of sharing of patient information between pharmacist delivering NHS services and other health and social care professionals in secure and confidential systems
staff			▪ pharmacist should be seen as a healthcare professional who, together with the rest of the pharmacy team, would be bound by the same code of confidentiality that applied elsewhere in the NHS	

IMPLEMENTATION				
accessibility	▪ improve the availability of appropriate information for healthcare workers and the tools to use and communicate that information effectively to improve quality ▪ an accurate and up-to-date electronic medication summary to be available to the appropriate healthcare workers involved in a patient's journey through the healthcare system	▪ pharmacists should have full access to the internet and web-based information systems in their daily practice	▪ The full benefits to patient care will not be realised until pharmacists are part of the NHS system of sharing information	▪ Hospital Electronic Prescribing and Medications Administration (HEPMA) and related electronic decision support has only been implemented in a very small number of acute hospitals, and in those cases not to its full potential
inter-operability	▪ ePharmacy Programme introduced the Electronic Transfer of Prescriptions (ETP) between GP practices, community pharmacies and Practitioner Services Division (PSD) ▪ continue to promote, encourage and facilitate collaboration between Boards, and to drive the convergence and standardisation of IT systems ▪ new health and social care IT strategy will have been developed in partnership with local authorities. This will have paved the way for improvements in information sharing between health and social care workers and greater integration of health and social care services	▪ interoperability should be a key 'built in' objective in the development of IT systems	▪ development of the Pharmacy Care Record, which records the pharmaceutical care needs and provision for patients, should ensure that the information contained within it can be readily shared with other systems, and that other systems can feed information into it as appropriate	▪ major technology solutions that are currently in place to support pharmaceutical care across NHS Scotland are not fully integrated at this time
support for role development	▪ Emergency Care Summary (ECS) contains patients' prescription information and information on any allergies. It is intended for use by healthcare workers in an	▪ IT developments should in principle be used to decrease the bureaucratic burdens and workforce pressures on pharmacists	▪ Scottish Government should explore the potential [for robotic systems] with the profession, including the implications for capital	▪ release capacity to deliver the clinical role, the dispensing process may benefit from better use of pharmacy technicians and be largely automated and

	emergency and OOHs, and it is now a vital part of MR (Medications Reconciliation) at the interface between primary and secondary care ▪ Health Boards will be using clinical portals (or electronic windows to information) and the priority information items agreed by clinicians will be available at the point of care ▪ ePCS and KIS will have been rolled out nationally ▪ NHS Boards will have well established programmes to replace paper with digital equivalents, along with digital dictation, voice recognition, scanning and video conferencing ▪ maximise efficient working practices, minimise wasteful variation, bring about measurable savings to ensure value for money	▪ electronic automated processes and robotic dispensing systems should be used to improve medicines safety and reduce pharmacists' workload enabling more time for the delivery of pharmaceutical care in the pharmacy setting ▪ pharmacy IT system developments should be responsive to the needs of the user and include a future proofing process to ensure the future needs of the user and the pharmacy profession are recognised and enabled	investment ▪ includes considerations of workforce, new technology, changing demographics and increasing clinical demand ▪ develop technology for decision support in prescribing and dispensing	managed by them ▪ using technology to deliver clinical care more effectively will need to be embedded into practice ▪ advances in technology, robotic dispensing and telehealth would need to be harnessed to contribute to a health service fit for the 21st century ▪ the national delivery plan for telehealth and telecare considers technology as a tool to drive improvement and to facilitate greater integration, skill mix, choice and control ▪ use of technology would allow pharmacists to effectively manage their case load of patients

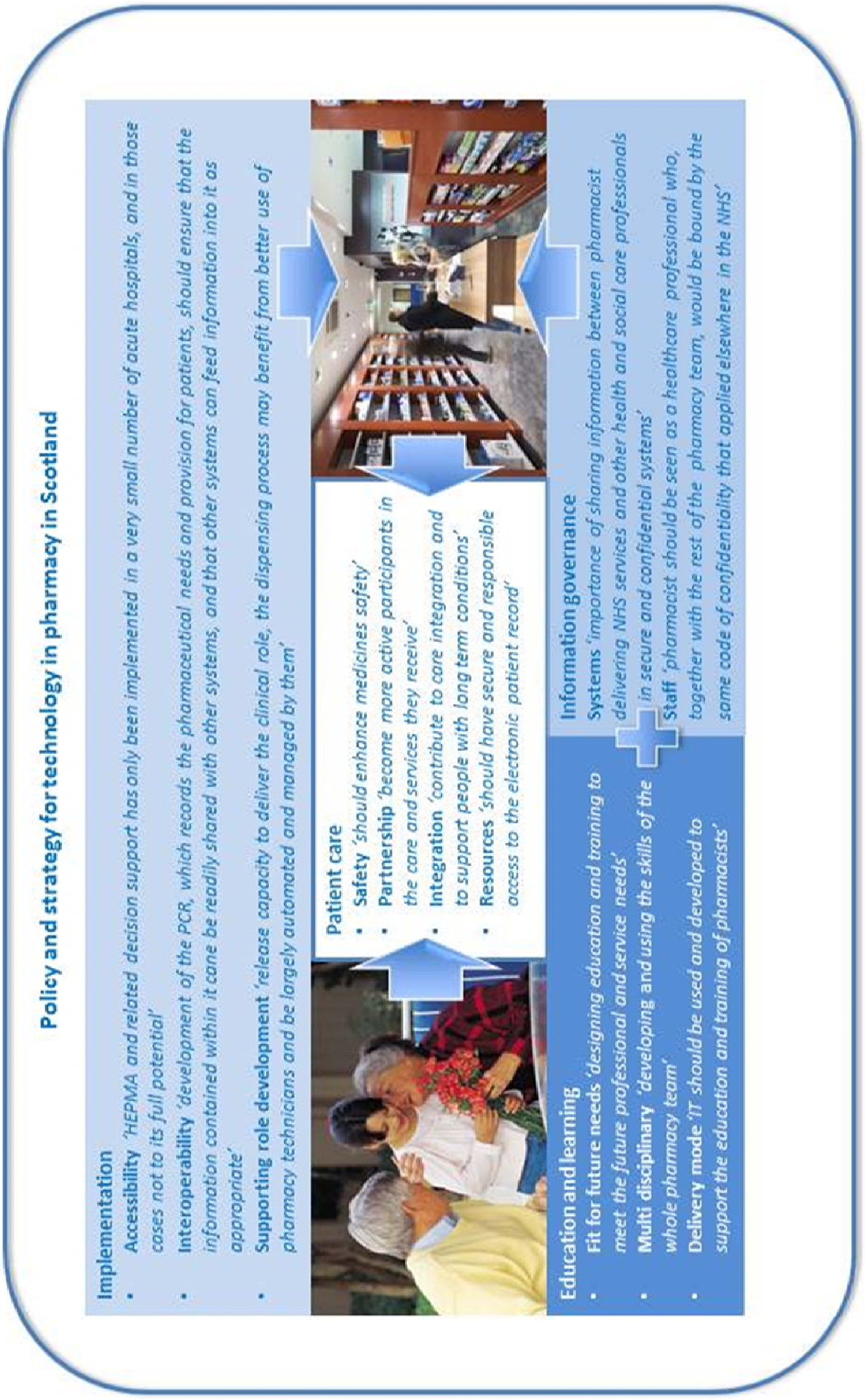

Figure 5.1 Conceptual model of intended use of technology in pharmacy based on illustrative extracts from policy and strategy documents

The conceptual models demonstrate congruence of the intended use of technology in pharmacy in Scotland at policy and strategic level. For example, the construct of *'**patient care'*** with the sub-theme of *'**safety'*** was evident across all four documents (Figure 5.2):

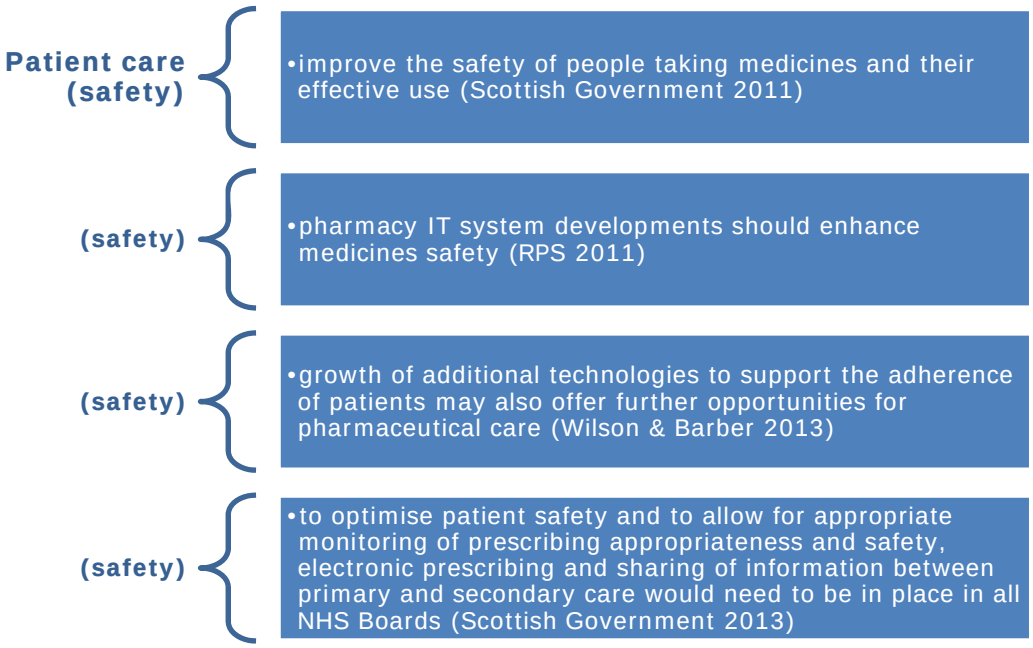

Figure 5.2 An illustrative extract from the conceptual model (Table 5.4) of construct *'patient care'*

The construct of *'**patient care'*** had three further sub-themes which evidenced technology supporting (Table 5.4):

- **'partnership'** between pharmacy staff, patients and carers with an enhanced role for pharmacy and PCR shared with the patient, improved communications with NHS Scotland and increased use of mobile technologies to promote self-management of care
- **'integration'** of health and social care across primary and secondary sectors with increased use of new technologies to support people in their own homes
- **'resources'** adequate to secure future development of the pharmacy profession to enhance the patient journey.

The second construct of, *'**education and learning'*** (Table 5.4) with a sub-theme of, *'**fit for future needs'*** was again evident across all four documents. For example (Figure 5.3):

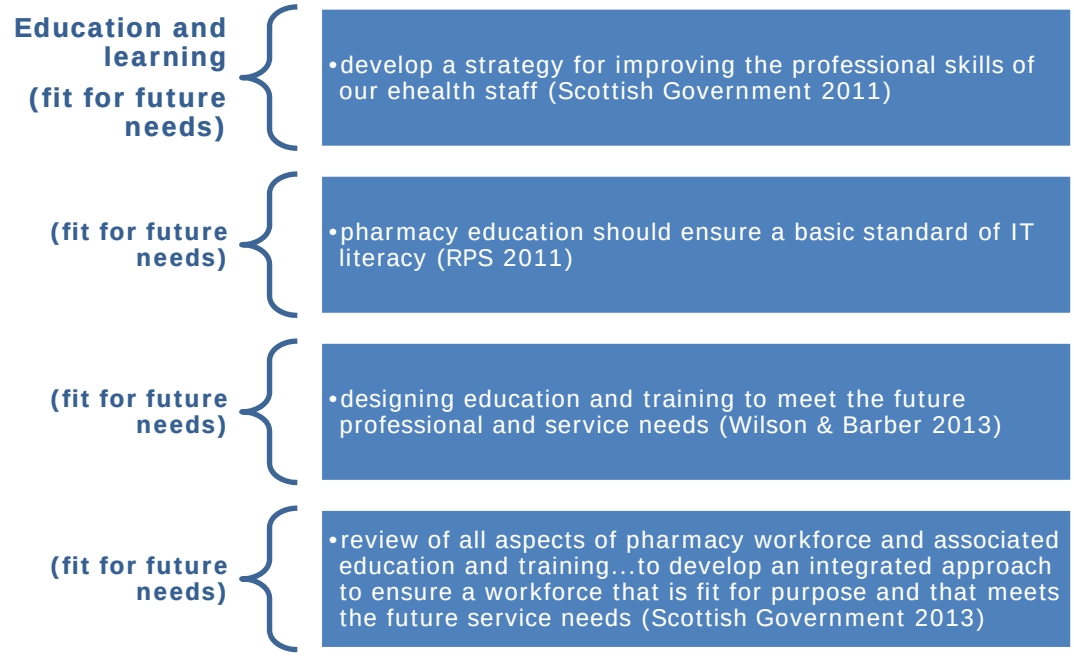

Figure 5.3 An illustrative extract from the conceptual model (Table 5.4) of construct *'education and learning'*

Further sub-themes of '**education and learning'** promoted:

- '**multi-disciplinary'** training delivered via IT to reflect working practices, with appropriate information sharing at all levels, while developing and using the skills of the whole pharmacy team
- '**delivery mode'** based on a single example, calling for IT to be used and developed to support education and training.

A third construct of '***information governance'*** (Table 5.4) featured two sub-themes namely '***systems'*** and '***staff***,' for example (Figure 5.4):

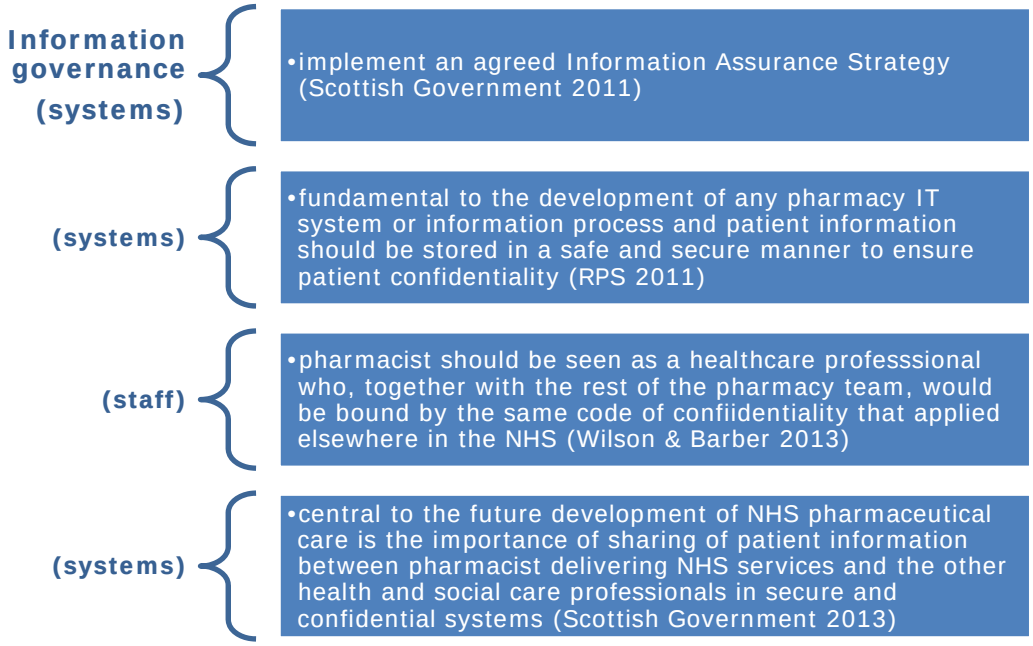

Figure 5.4 An illustrative extract from the conceptual model (Table 5.4) of construct *'information governance'*

The most heavily exampled construct across the documents was *'**implementation'*** (Table 5.4) with sub-themes of *'**accessibility**,' '**inter-operability'*** and *'**support for role development**.'* A consistent element across this construct, and all three sub-themes, was the need to facilitate sharing of information across the health and social care team to improve the patient journey by making best use of workforce skills mix, for example (Figure 5.5):

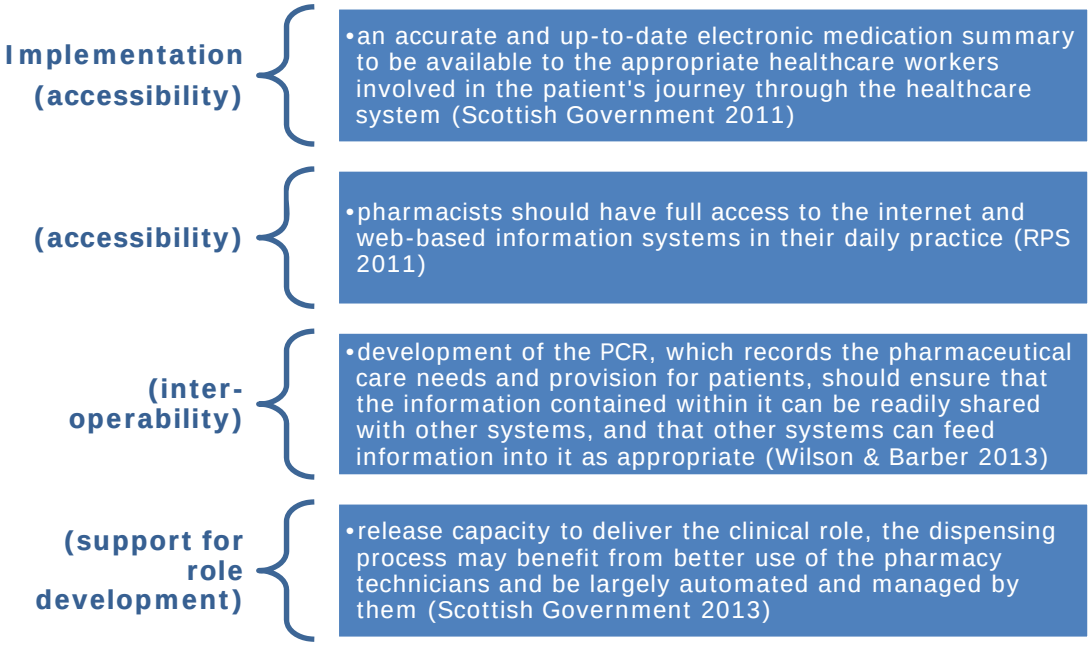

Figure 5.5 An illustrative extract from the conceptual model (Table 5.4) of construct *'implementation'*

The few gaps in mapped sub-themes evident in constructs of *'**education and learning'*** and *'**information governance**,'* may reflect the different emphasis and focus of each document. Consistent throughout the policy and strategy documents was the drive to continue to develop compatible, secure technologies which support and extend the role of pharmacy staff to deliver safe, effective person-centred care as an integral part of the multi-disciplinary health and social care team.

Applications of technology in pharmacy

A great many intended applications of technology in pharmacy were identified during the content analysis and are listed in Table 5.5.

Table 5.5 Intended applications of technology in pharmacy extracted during content analysis

Pharmacy technology	*Acute Medication Service*
	Barcode scanning
	Chronic Medication Service
	Clinical Portals
	Decision Support Systems
	Digital dictation/voice recognition
	Disease specific applications e.g. diabetes, cancer
	Electronic Patient Registration
	Electronic Prescribing
	Emergency Care Summary
	Hospital Electronic Prescribing and Medications Administration
	Internet and web-based medicines information systems
	Key Information Summary
	Minor Ailment Service
	Mobile devices and smart media
	Pharmacy Care Record
	Pharmacy Management Systems
	Robotic dispensing and labelling
	Teleheath and telecare
	Video conferencing

Content analysis of the policy and strategy documents revealed consistent evidence of the intended use of technology to support the evolving role of pharmacy in Scotland and its contribution toward improving patient care.

Key findings

Key findings inducted from data and evidenced across all constructs in the conceptual model (Table 5.4) were the clear policy and strategic intention that:

1. **Patient care:** should be supported by technology in pharmacy which is adequately resourced to support the integration of health and social care delivery promoting the role of trained pharmacy staff working in partnership with patients for their safe, effective care

2. **Education and learning:** should be designed for training the multi-disciplinary health and social care team in the appropriate, effective use of

technology, developing and using the skills of the whole pharmacy team to meet future professional and service needs

3. **Information governance:** should be fundamental to development of secure, shared patient information systems with pharmacy staff bound by the same rules of patient confidentiality as other health and social care professionals

4. **Implementation:** should improve accessibility to accurate, up-to-date patient information shared across secure, interoperable health and social care systems to facilitate greater integration, skill mix, choice and control using technology to deliver clinical care more effectively.

Element 1: Discussion

Key findings are discussed collectively later in the chapter with the results from elements 2 and 3.

Element 2: Study design – pharmacy visits

Observational and interview activities with pharmacy staff

To address research questions 2 and 3, observational and interview activities were conducted in community and hospital pharmacies. These aimed to contextualise pharmacy staff interaction with technology in pharmacy to build a real world model, noting the:

- environment
- hardware and software systems implemented
- human computer interaction during work processes
- technology related standard operating procedures
- audit processes and documentation.

Direct observation

Although time-consuming and subject to both reflexivity (Bowling 2009) and the Hawthorne Effect (Thomas 2012), as described earlier in Chapter 2, observational activity was essential to provide,

> *'insight into interactions, processes and behaviours that goes beyond the understanding conveyed in verbal accounts'*(Ritchie et al 2014)

Selective observation, focused on the use of technology to reflect the research questions, formed the basis for data collection while protecting the privacy of participants and pharmacy customers and respecting work place etiquette.

Interviews

Questions around these same areas formed the basis for individual informal, semi-structured interviews with staff, or '*guided conversations'* (Yin 2009), which explored their views and experiences of using technology and related digital literacy education and training. These were conducted as an integral part of the observational activity at times and for durations convenient to the participants during their working day. The researcher remained onsite until all participants had been interviewed and observational activity was complete.

Sampling of community and hospital pharmacies

This was a local knowledge case study designed to gather comprehensive, rich data in one geographical area with participants accessible through a network of contacts and within research resource limitations of time, budget and distance (Thomas 2012). With eight major hospitals and 131 community pharmacies (51 in Aberdeen City, 53 in Aberdeenshire, 27 in Moray) registered with NHS Grampian (NHS Grampian 2012), experts from the local health board and practising academic pharmacists with knowledge of the pharmacies in the area, were asked to assist with theoretical sampling. The basis for theory building and generalisability (or extrapolation or transferability) was strengthened by sampling from multiple rather than single case studies to reflect the theoretical position in terms of relevance to the research questions (Silverman 2013) taking into account the range of:

- urban and rural settings
- geographical variation
- technology infrastructures
- pharmacy management systems implemented

- hospital pharmacy and community pharmacy (small independent through to medium or large multiples; in the NHS Grampian area there are 23 small independents, 67 small to medium multiples, 41 national multiples)(NHS Grampian 2012)
- also considering the Scottish Index for Multiple Deprivation (Scottish Government 2012b) to add context based on societal wealth by postcode.

Recruitment of pharmacy owners/managers

The researcher was based in Robert Gordon University in Aberdeen which is one of two Schools of Pharmacy in Scotland. Many of the practising, academic pharmacists within the School are known to the local area network of pharmacy owners and managers so were able to make the initial approach and outline the project in person, by email, by text or by telephone. The researcher followed up any expressed interest by email attaching an information sheet (Appendix 5.1) and to invite written consent (Appendix 5.2). The consent included facilitating contact with the pharmacy team, to invite their informed consent to participate in the research, either directly by the researcher or through the owner or manager.

Recruitment of pharmacists, pharmacy technicians, dispensing assistants and medicines counter assistants

Where the independent contact gained consent from the owner and/or manager, the researcher arranged a preliminary visit in advance of the research activity day. This served multiple purposes of introducing the researcher to potential participants, familiarising the researcher with the pharmacy location and layout and with distribution of information sheets (Appendix 5.1) and consent forms (Appendix 5.2) in advance. It was emphasised that consent was voluntary and individual.

Place of the researcher

The researcher was introduced as having an IT background with no pharmacy experience but with an interest in human computer interaction and socio-technical systems. This was made clear in all documentation and repeated in all introductions. The researcher aimed to be an unobtrusive, self-sufficient observer taking along a stool on which to sit in the background, waiting and watching until

it was convenient for participants to answer follow up questions based on observation of their use of technology. Given their technological background and previous research experience, the researcher was well placed to conduct the observational activity and interviews.

Viable number of consents per pharmacy

The number of consents required to be viable to proceed varied with staffing levels. For example, in a small pharmacy where there may be only one pharmacist, one pharmacy technician and one medicines counter assistant (or combined roles), it would be necessary to gain consent from the full team. In a large pharmacy with multiple staff in each role, it would be possible to proceed without full participation and still achieve comprehensive data collection.
Data were collected during the consent process and pharmacy visits (observational and interview text, field notes, sketches). Consent forms included four demographic questions: sex, age band, role, pharmacy experience, with a final question,

> *'As a gauge of your current information technology experience, if you were to do a course, which of the following would be the most appropriate challenge for you?'*

followed by titles of six IT courses listed in order of difficulty (Table 5.6). The one day access for research activity, and information on number of staff and their roles, was negotiated with the owner or manager.

Table 5.6 IT course descriptions listed in order of difficulty

	Course	Description
Increasing level of difficulty	**Computing for the Terrified**	If you are new to computing then this is the course for you. This short course gives you the opportunity to explore the basics of using a computer in a friendly and relaxed environment. Overcome your fears of using a computer and learn a new subject.
	Computing for the Quietly Confident	To provide students with a firm understanding of Microsoft Office applications. Learners should finish the course with a good grasp of word processing.
	Computing for the Courageous	Learners should finish the course with a more advanced grasp of word processing, basic spreadsheets, basic databases and basic presentations.
	European Computer Driving Licence (ECDL)	Attaining a European Computer Driving Licence is the best way to ensure you have all the necessary computing qualifications of any workplace. This course covers the first steps of using a computer – IT fundamentals, the internet, email and security.
	ECDL Advanced	Enables the learner to work more effectively with IT. This unit looks at using advanced tools to save time and effort when producing word processed documents, presentations and spread sheets.
	Computing Degree or Diploma	Course content includes: Computer Architecture, Computer Operating Systems 1; Computing: Planning; Computing: Graded Unit; Information Technology: Applications Software 1, Working within a Project Team.

Source of table content: local community learning advertisements placed by Aberdeenshire Council in conjunction with Aberdeen College (now NE Scotland College)

Element 2: Data collection

Preliminary visits and consent forms

The researcher negotiated a preliminary visit to each community pharmacy with the main contact, usually the owner or manager, for introductions and orientation and also to leave a folder containing information sheets, consent forms and envelopes. This visit was timed to match the expected staff working patterns during the observation period. For operational and distance reasons, a pre-visit was not practical for the two hospital pharmacies recruited to the study or community pharmacies outwith a thirty mile radius. In those cases, the information and consent sheets had been emailed out and the folder with printed copies was circulated on the day, prior to any data collection. The pharmacy contact was emailed or phoned the day before to confirm the arrangements were still convenient. The consent form was the first element of data collection as it gathered demographic data. All consent forms were checked by the researcher as completed, signed and dated prior to further data collection.

Data collection tools - design and pilot

Data collection tools, including the consent form, were piloted in a community pharmacy outwith Grampian which also allowed the researcher some familiarisation with daily pharmacy practice. Pre-pilot, a matrix was designed to record the form of technology, type and frequency of user interaction during observation against the member of pharmacy staff but this did not prove useful or effective so was not taken forward to the full study. Therefore, post-pilot, a simple A3 clipboard with several sheets of plain, white A3 paper, coloured post it notes and standard ink pens, with Velcro to attach them to the clipboard when not in use, were adopted for data collection (Figure 5.6). This was considered less intrusive than start-stop audio recording and participants could see all that was written or sketched in the field notes, increasing transparency for member checking of data collection and therefore trustworthiness of the data. The clipboard was open to participant view at all times. Notes were non-attributable to protect participant confidentiality and anonymity.

Figure 5.6 Data collection tools: A3 clipboard with paper, pens, post its and a folding stool

Resources and location

Space is often at a premium behind the counter in pharmacy premises so it was important that the researcher carried little and was able to move from place to place within the small area to allow access to cupboards, shelves, stores, etc as

the intention was to observe normal daily activity. The researcher took her own small, fold up stool (Figure 5.6) and checked with staff at each pharmacy where it would be best to sit and offered to move when, for example, stock deliveries arrived and were being unpacked and distributed to storage locations such as shelves, fridges, controlled drugs cabinets, etc.

Observational activity

Following introductions and having ensured consents were in place, the researcher sketched (freehand, not to scale) the floor plan of each pharmacy on A3 paper held on the clipboard, annotating placement and type of all installed technologies. This quiet activity capturing the pharmacy environment required little input from the participants so allowed time for them to ask the researcher any questions, most commonly, *'so what is it you are doing exactly?'* or *'so what's it for?'* and demonstrated the intention not to disrupt their daily routine. The researcher added detail and corrected the sketch throughout the observation period. Field notes of researcher observations, for example, technology problems or workarounds, were written on sticky post it notes positioned on the top sheet of the clipboard which were then transferred and accumulated on a background sheet of A3. Follow up questions based on observations were also noted, either on the A3 paper or on post its, to remind the researcher to ask a member of pharmacy staff as and when they were available.

Interviews or guided conversations

As previously described, the interviews with participants were informal, often interrupted, guided conversations which had to fit around their normal pharmacy activities. Interview questions were based on a semi-structured interview schedule (see below) but also followed from researcher observations, for example*, 'I noticed you using x. Can you tell me more about that, please?'* which often prompted a demonstration of that technology. In keeping with the research questions, the semi-structured interview schedule included initial questions with further prompts for examples and probes for more detail from each participant, asking:

- What technologies do you use?
    - How do you use them and what for?
    - How reliable are those technologies? What do you do when the technology lets you down? How and where do you get help?
    - Are there any technology related standard operating procedures you follow, for example startup/shutdown, back ups and updates?
- How did you learn to use those technologies?
    - When and where did you learn to use those technologies?
    - Who and what helped or hindered you in learning to use those technologies?
    - How would a new member of staff learn to use those technologies?
- What technology related training was there in your pharmacy related course?
    - What technology training do you think could or should be available?
    - What technology related CPD opportunities have you been aware of?

Responses were recorded as brief bullet points or notes on post its or directly on to the A3 top sheet or floor plan sketch, depending on the context of the question and answer. Accumulated post it notes were moved to a background A3 sheet of paper on the clipboard. A box of chocolate biscuits or shortbread was left in each pharmacy staff room and a card was sent thanking each pharmacy for their participation. This was followed some months later by a Christmas card with a summary report enclosed.

Secure storage and transcription

To protect the anonymity of participants, each pharmacy was allocated a case study number with the participating pharmacy list stored securely in a separate electronic file and folder. All paper materials (consent forms, A3 and post it field notes, sketches) were stored in a locked cupboard, only accessible by the researcher, in a locked office within a university building. The field notes from the post its and A3 sheets from each pharmacy visit were transcribed by the researcher verbatim in a denaturalised (without notation of pauses, pitch, tone) form to a securely stored, word processed document as soon as possible following each pharmacy visit. The annotated sketches were scanned and stored securely with the transcriptions. The role of transcription is described by Oliver et al (2005) as, *'a powerful act of representation'* which they argued should not be

regarded as, *'a behind-the-scenes task,'* as it encompasses opportunities for the researcher to reflect on the research activity and immerse themselves in the data while, *'honouring both the research process and participant's voice.'* Oliver et al (2005) clearly articulated the importance of transcription while emphasising the potential to alter how data are conceptualised. The immediacy of the transcription activity encouraged immersion in the data to aid analysis and reflection on the research activity. The accuracy of the transcription was verified by a second researcher (DS) who was also involved in the data analysis. The researcher was encouraged to reflect on and discuss the observation and interview activity with the second researcher to help them contextualise the data prior to analysis.

Element 2: Data analysis

Both quantitative and qualitative data were collected during the recruitment of pharmacies, participant consent process and pharmacy visits:

- Pharmacy data collected were:
  - tabulated to show the pharmacy type, description, rurality, number of pharmacy staff observed/interviewed in each role, volume of dispensing, level of technology and pharmacy management system implemented
  - analysed by postcode against the Scottish Index for Multiple Deprivation (SIMD) and presented in graphical form to contribute further contextual data for each pharmacy case study
- Participant demographic data were analysed using descriptive statistics and presented in graphical form showing combinations of: pharmacy role, sex, age band, years of pharmacy experience together with self-reported level of digital literacy
- Interview data from the multi-site case studies were collated and inductively analysed using a framework approach, as previously described, looking for patterns and constructs within and across cases
- Observational data were also collated and inductively analysed using a framework approach, as previously described
- Interview and observational data were combined to develop a real world model of how technology is utilised in pharmacy.

Element 2: Results

Data collection period

Observations and interviews were conducted between August 2012 and March 2013 in 17 community and two hospital pharmacies across the NHS Grampian area. Up to a full day was allocated to conduct research in each pharmacy but the actual time taken varied with staffing levels and participant availability. The longest data collection period was six and a half hours (medium hospital) with the shortest 20 minutes in a community pharmacy staffed by one MCA.

Types of pharmacy and settings

As shown in Table 5.7, participating pharmacies ranged from small independent single or multiples (1-4 pharmacies) through large independent multiples (5-25 pharmacies), up to large multiples (>25 pharmacies) in the community sector plus two of the main hospitals in the area. Two of the community pharmacies which had expressed an initial interest in taking part in the research withdrew before the consent process due to staff illness and holidays. In addition, one date was rearranged because of a General Pharmaceutical Council inspection of premises, another because the arranged date had been omitted from the pharmacy diary.

The nearest participating pharmacy was situated 1.3 miles from the research base with the furthest 66.2 miles away. Nine of the community pharmacies were regarded as rural given their small village or town location which was some distance from the main cities in Grampian, Aberdeen and Elgin. The remaining eight community pharmacies and two hospital pharmacies were located in major conurbations designated as urban.

Table 5.7 Overview of participating pharmacy demographics

Case	Type	Description	Rural/ Urban	P	PT	DA	MCA	No. of Rx per month	High tech/ Low tech	Pharmacy Management system
1	community	large, independent, multiple	R	1	1	0	4	8 000	L	Cegidem
2	community	small, independent, multiple	U	1	0	1	1.5	5 000	L	ProScript
3	community	small, independent, multiple	U	1	1	0	2	7 000	L	ProScript
4	community	small, independent, multiple	R	1	0	1	1	4 000	L	ProScript
5	community	small, independent, multiple	R	1	1	0	2	4 500	L	Cegidem
6	community	small, independent, multiple	R	1	0	1	1.5	6 500	L	Cegidem
7	community	small, independent, multiple	R	1	0	1	1	3 000	L	Cegidem
8	community	small, independent, multiple	R	0.5	0	0	1	850	L	Cegidem
9	community	small, independent, multiple	R	0.5	0	0	1	1 350 items	L	Cegidem
10	community	large, multiple	U	1	0	0	1	11 000	L	Nexphase
11	community	small, independent, multiple	U	3	2	1	2	Info withheld	H	Positive Solutions
12	community	small, independent, multiple	U	1	1	0	0	2 500 items	L	ProScript
13	community	large, independent, multiple	R	1	1	0	2	3 500	L	Cegidem
14	community	large, multiple	R	1	1	1	2	11 000	L	ProScript
15	community	small, independent, multiple	U	1	1	0	1.5	Info withheld	H	Positive Solutions
16	community	small, independent, multiple	U	2.5	0	2	2	8 000	L	Cegidem
17	community	small, independent, multiple	U	2	2	2	2	Info withheld	H	Positive Solutions
18	hospital	medium	U	4	3	1	0	not available	L	JAC
19	hospital	large	U	1	4	5	0	>800 items per day	H	JAC

Notes: small independent multiple (1-4 pharmacies); large independent multiple (5-25 pharmacies); large multiple (>25 pharmacies); P=Pharmacist; PT=Pharmacy Technician; DA=Dispensing Assistant; MCA=Medicines Counter Assistant; Rx=prescription

Staffing and dispensing volume

The number of participating staff recorded was the number who gave informed consent and took part in the observational and interview activities, which are described in more detail elsewhere. No potential participants withheld consent or withdrew from the study. The figures given reflect the number in each role available and willing to participate on the arranged day and time, not necessarily the number employed at that pharmacy.

Although prescription and item numbers are not directly comparable, an impression of dispensing volume was gained. These ranged from approximately 850 prescriptions per month in a small, rural community pharmacy to over 800 items per day in a large, hospital pharmacy. Three community pharmacies withheld dispensing volume information and the information was not available from one of the hospitals.

Hardware and software implemented

Categorisation as a *'low tech'* pharmacy was allocated where the minimum specification necessary to operate was implemented, for example, single or multiple PCs connected to a network server with secure N3 broadband connection, barcode scanner(s), label dispenser(s), printer(s) and fax machine(s). If the pharmacy had robotic storage and dispensing capability it was categorised as *'high tech.'* Fourteen of the community pharmacies and one hospital pharmacy were categorised as *'low tech'* with three community and one hospital pharmacy deemed *'high tech.'*

A range of commercially available pharmacy management software applications were implemented. Two ran the specialist hospital pharmacy software, JAC, while the community pharmacy systems included Cegidem (8), Positive Solutions (3), ProScript (5) and Nexphase (1).

Pharmacy postcode against SIMD 2012

To add further contextual information, the postcode of each participating pharmacy was mapped to the Scottish Index for Multiple Deprivation (SIMD) which is a free to use, publicly available online tool (Scottish Government 2012b). A relative ranking between one (most deprived) and

6505 (least deprived) for each datazone across Scotland was calculated by data analysts combining,

> *'38 indicators across 7 domains, namely: income, employment, health, education, skills and training, housing, geographic access and crime. The overall index is a weighted sum of the seven domain scores. The weighting for each domain is based on the relative importance of the domain in measuring multiple deprivation, the robustness of the data and the time lag between data collection and the production of the SIMD'.*

The graph below (Figure 5.7) shows the numerically ordered, relative ranking of the 19 participating pharmacies in the NHS Grampian area contextualising the case study locations in Scotland-wide terms.

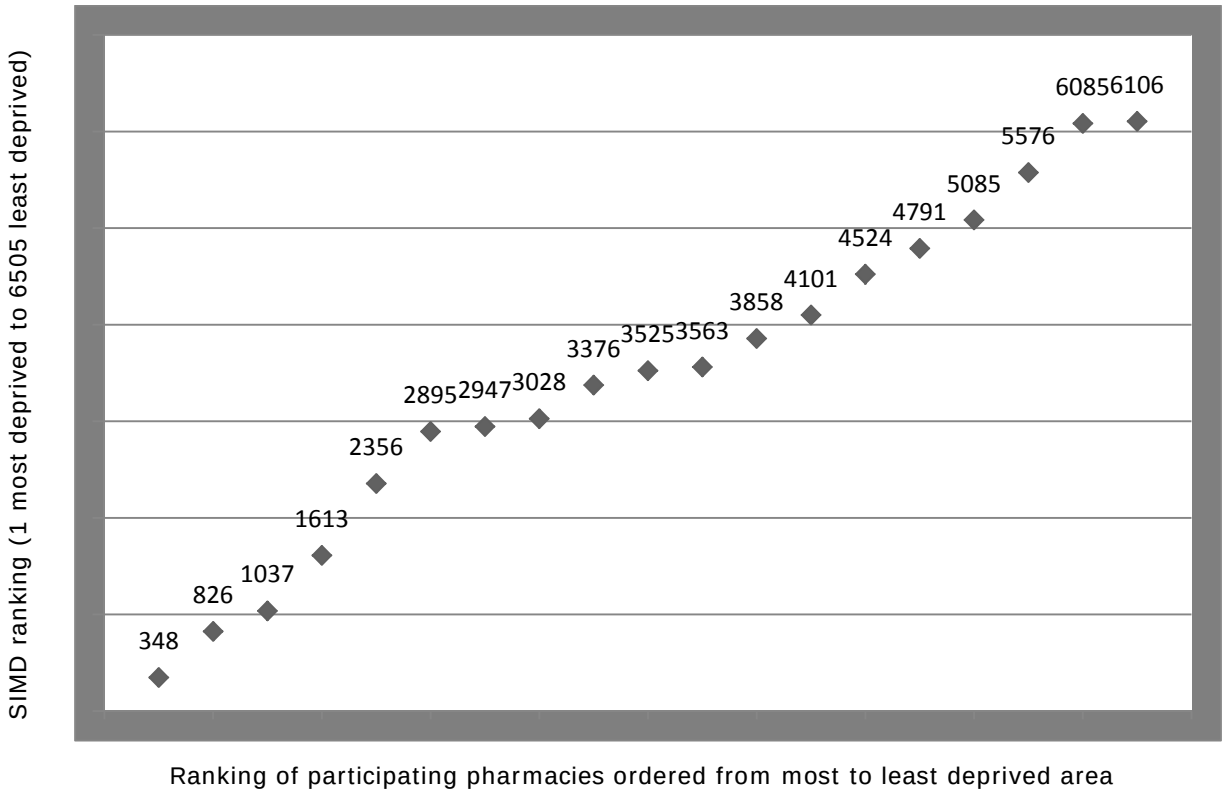

Figure 5.7 Postcodes of 19 participating pharmacies ordered and ranked on SIMD 2012

Participant demographics

Across the 19 pharmacies which took part there were 94 participants including:

- 24 pharmacists, two of whom were locums
- 2 pre-registration pharmacy graduates
- 19 pharmacy technicians
- 15 dispensing assistants, and
- 34 medicines counter assistants

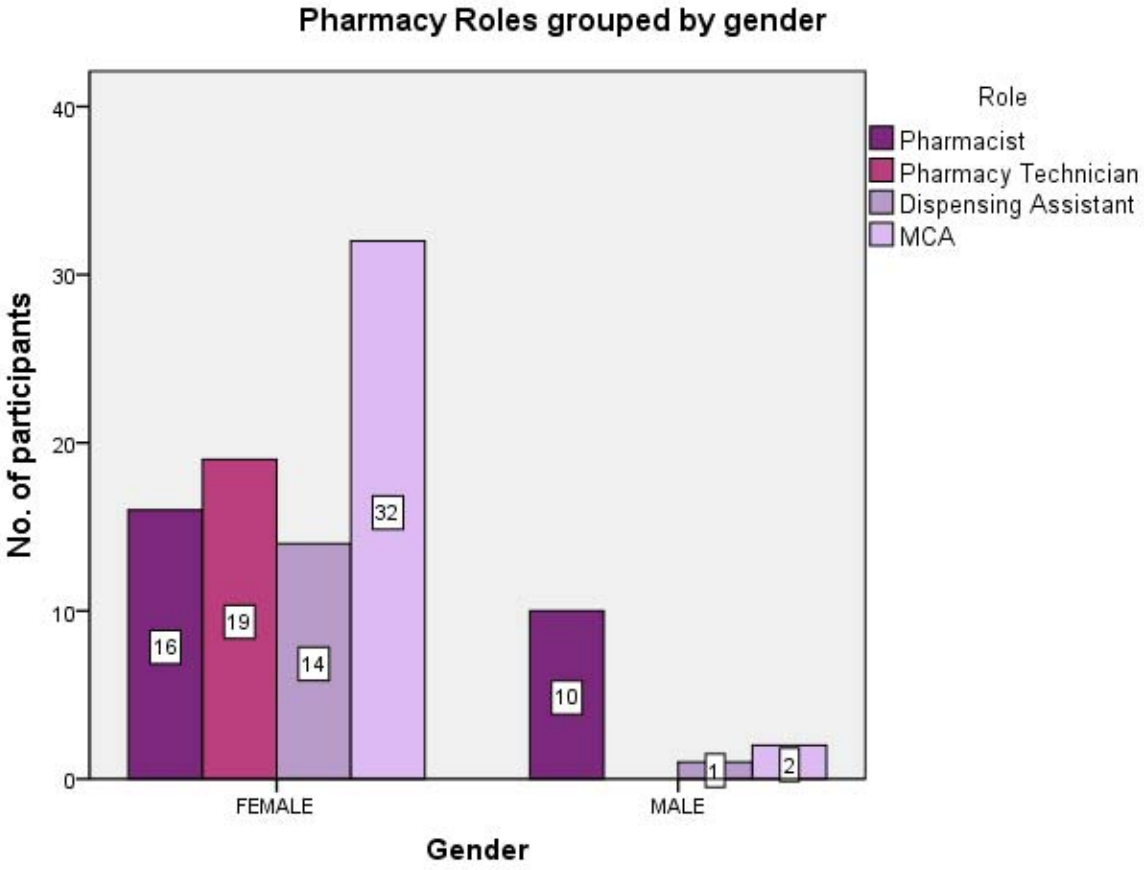

Figure 5.8 Participant roles grouped by gender

Of the 13 male participants ten were pharmacists, one was a dispensing assistant and two were medicines counter assistants (Figure 5.8).

While half the pharmacists were aged 29 or younger, other pharmacy staff groups featured a broader age range (Figure 5.9).

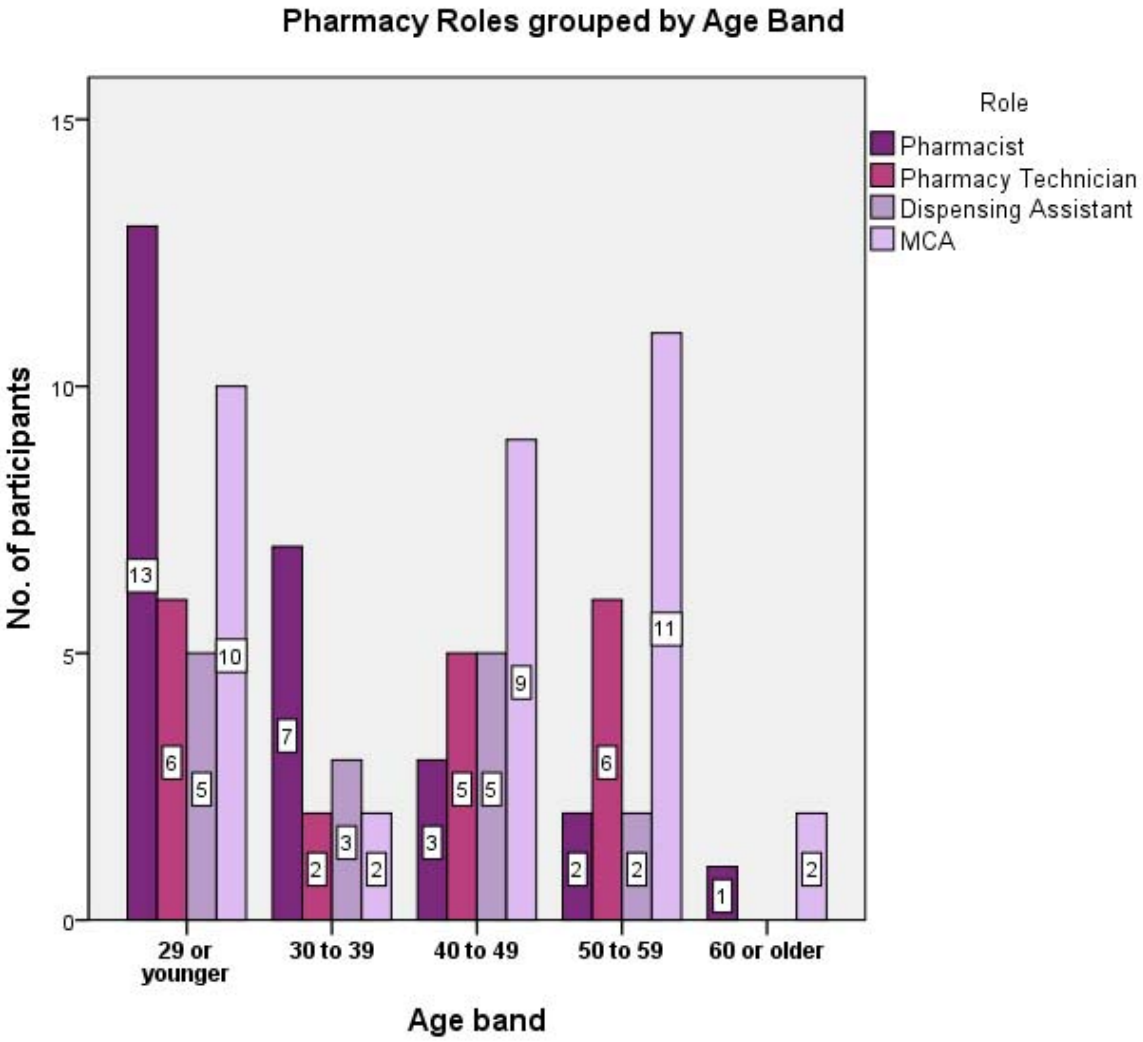

Figure 5.9 Participant roles grouped by age band

The participants' experience working in pharmacy ranged from an MCA with one month experience to 35 years, also an MCA.

The final question on the consent form asked participants,

> *'As a gauge of your current information technology experience, if you were to do a course, which of the following would be the most appropriate challenge for you?'*

and invited them to self select from six IT courses listed in order of difficulty (Table 5.6).

The most frequently self selected IT course across all pharmacy roles (Figure 5.10) was *'Computing for the Quietly Confident'* (n=39) followed by *'Computing for the Terrified'* (n=19). These two least difficult courses together accounted for the selections of nearly two-thirds of participants. The remainder selected *'European Computer Driving Licence'* (ECDL; n=14), *'Computing for the Courageous'* (n=13), *'ECDL Advanced'* (n=5) or '*Degree or Diploma'* (n=4).

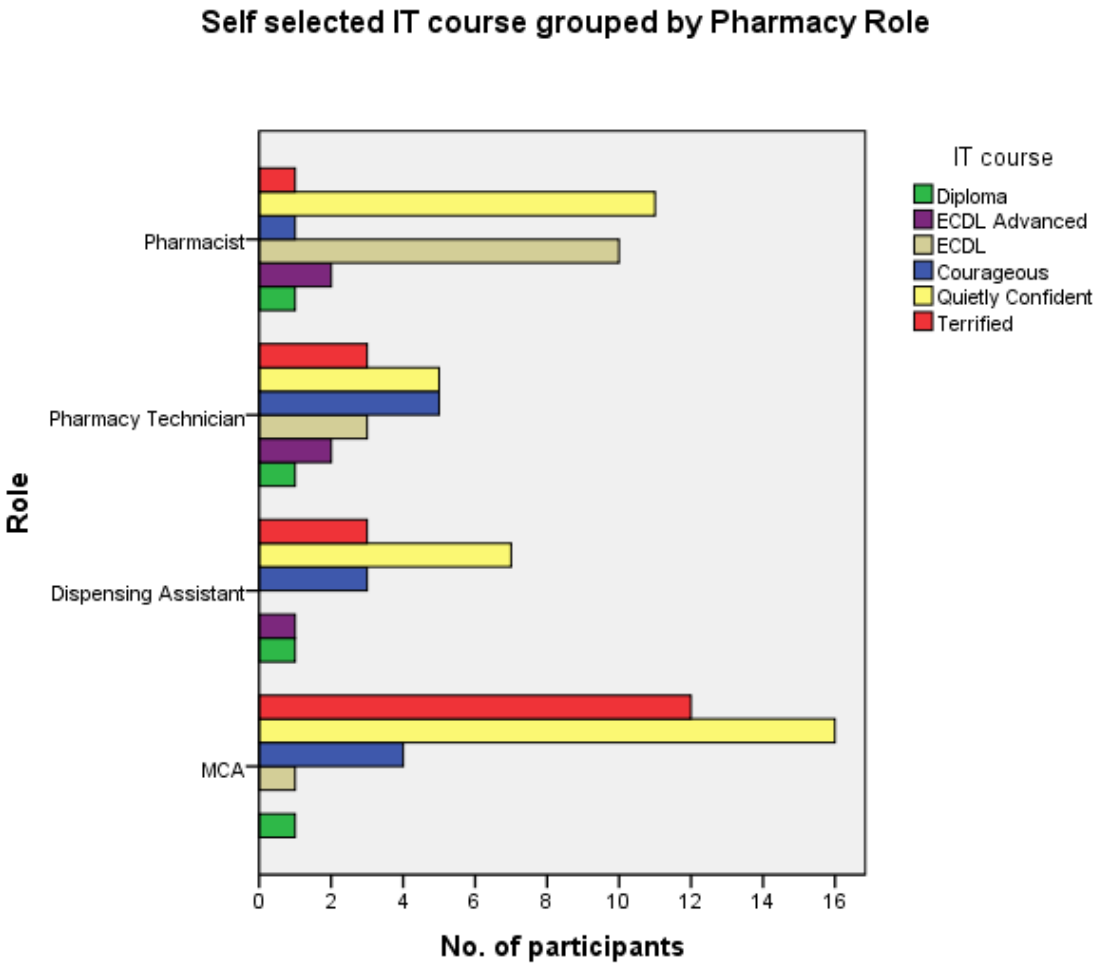

Figure 5.10 Self selected IT course by pharmacy role

Similarly, grouping self-selected IT course by age band, showed *'Computing for the Quietly Confident'* as the most frequently selected in all age bands except '50 to 59' where *'Computing for the Terrified'* was the predominant option selected. *'Computing for the Terrified'* featured as a choice for all age bands except the '60 or older.'

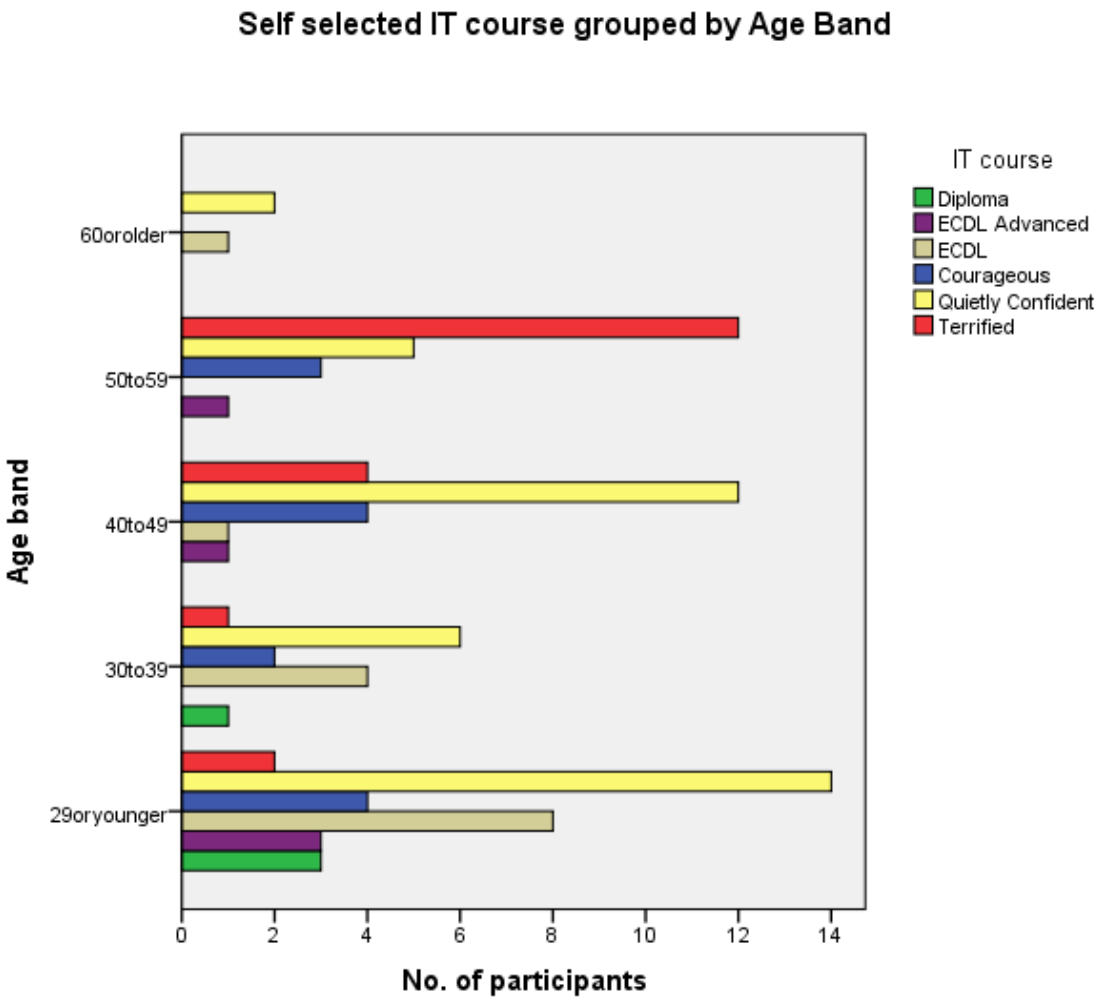

Figure 5.11 Self selected IT course by age band

Although one third of pharmacists (n=8) in the '29 or younger' age band self selected *'ECDL'* as their appropriate IT challenge, the predominance of the lower level courses, indicative of basic levels of digital literacy, was clear across all roles and age bands (Figure 5.12).

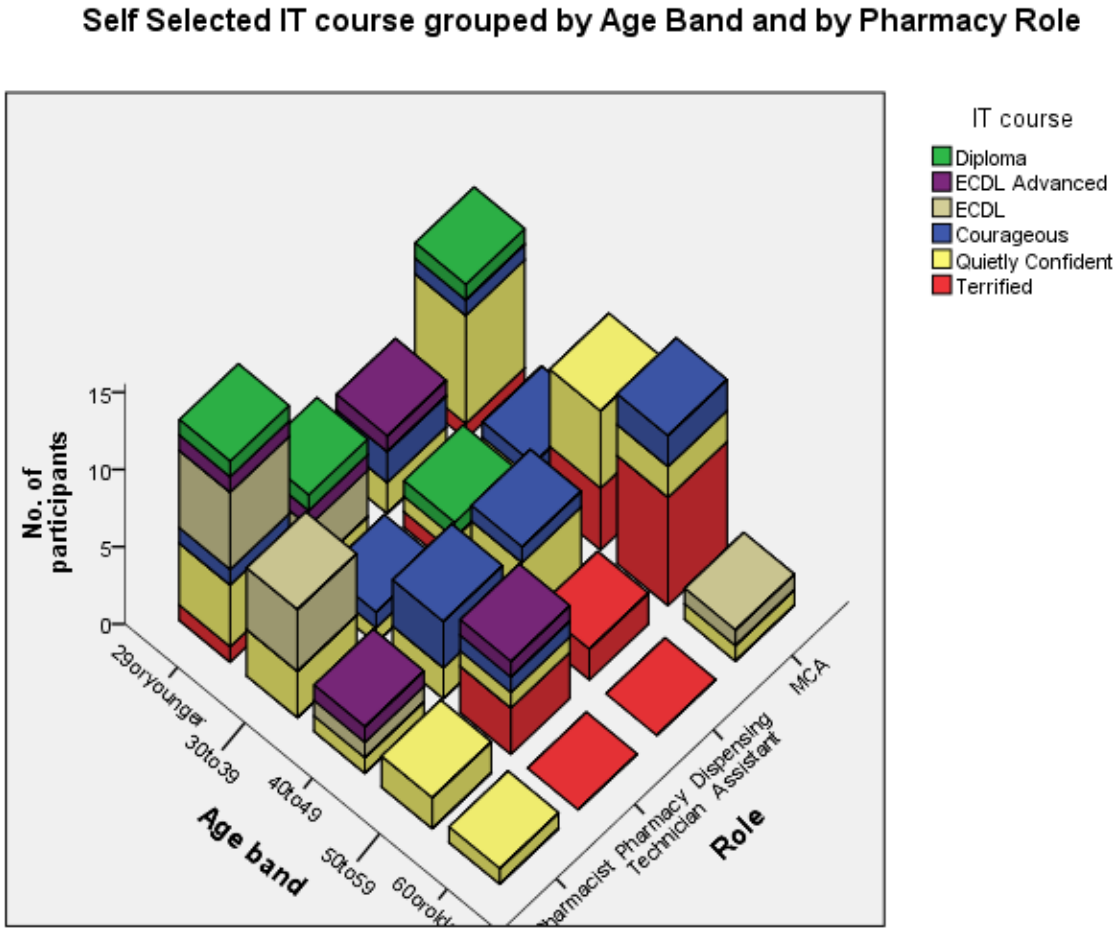

Figure 5.12 Self selected IT course by age band and pharmacy role

Interview and observational activity data

A thematic framework template was developed keeping interview and observational activity data separate for each pharmacy to facilitate within case analysis i.e. 19 interview frameworks, 19 observational frameworks. A colour coding scheme was applied and maintained for each of the 19 pharmacies to ensure contributions were attributable as different frameworks were developed for between and cross case analysis:

1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19

Provisional themes emerged inductively from the collected data and were challenged and tested as data from further pharmacy visits were added.

Five recurring themes (Figure 5.13) were agreed by two researchers (KM, DS):

- **Teamwork**
- **Training**
- **Technology**
- **Usability**
- **Processes**

The data from each of the nineteen pharmacies was collated for between and cross case analysis in new frameworks (1 interview, 1 observation) under the same five themes. Sub-themes were inducted from the data for each of the themes:

- **Teamwork**: leadership, local, communication
- **Training**: who, what, where, when, why, how
- **Technology**: hardware, CMS, MAS, PMS, MethaMeasure, extras, wishlist
- **Usability** (facilitators and barriers): accessibility, technical support, stability, functionality
- **Processes**: prescriptions, system maintenance, stock control, internet access, standard operating procedures, paper-based

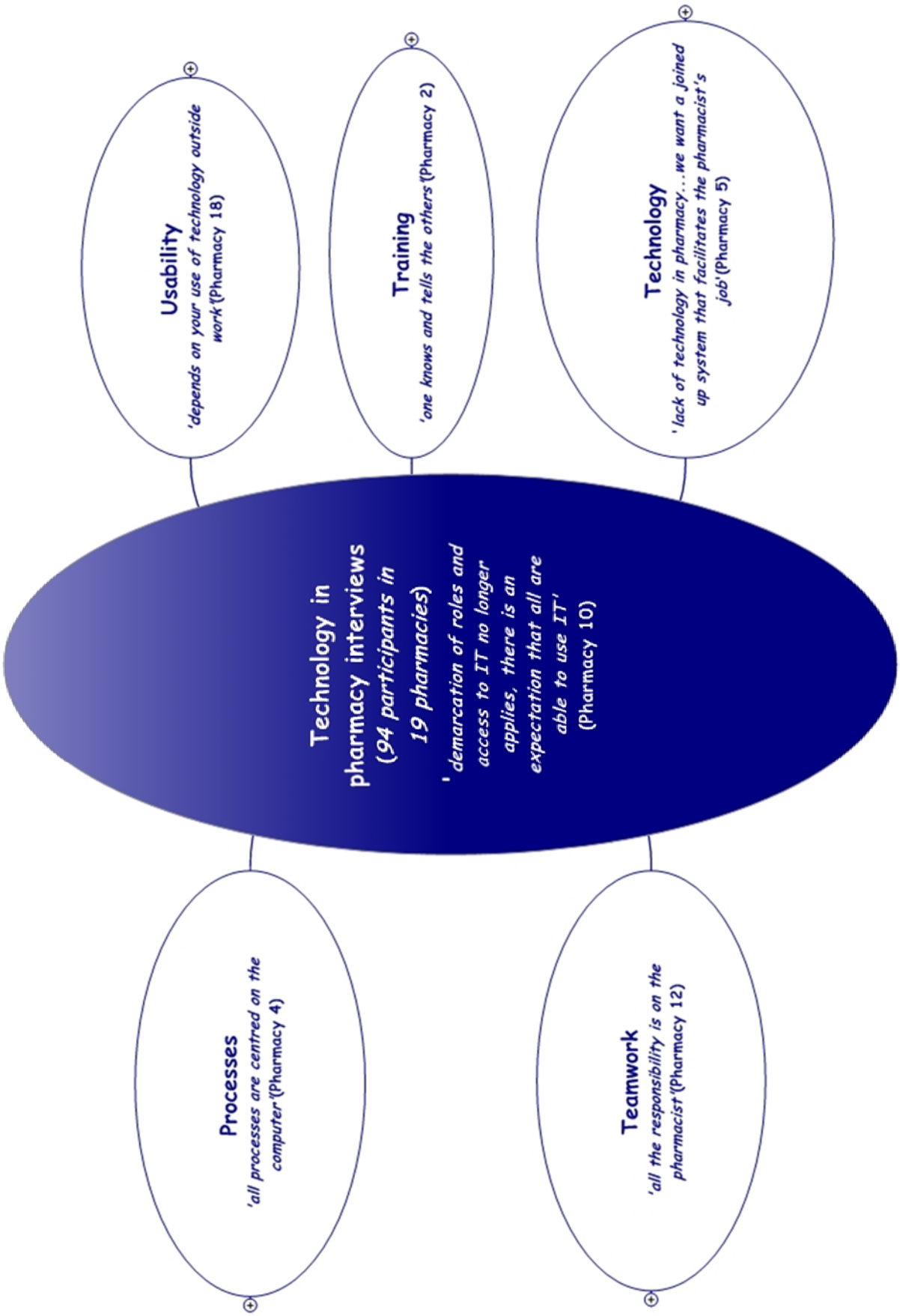

Figure 5.13 Model illustrating the five themes inducted from 94 interviews conducted in 19 pharmacies

Each of the five themes was analysed and modelled with illustrative quotes from the interviews associated to each of the sub-themes (Figures 5.14, 5.15, 5.16, 5.18, 5.19). Observational data helped to further explore each theme by adding context and testing for any differences between what was said to be done and what was actually done, to reduce the Hawthorne Effect, discussed in Chapter 2.

Teamwork: *leadership, local, communication*

During observational activity it became clear that teamwork was a key element of pharmacy practice. The pharmacy environment was often crowded, even cluttered, and is usually hectic, with staff working in close proximity and dealing with the demands of the general public all day, most days of the week. Many hours are spent standing at counters, stretching or using kick steps to reach for items to be dispensed, with irregular, infrequent and often interrupted breaks. The work was surprisingly physical involving a lot of lifting and shifting of large boxes containing the twice daily deliveries. Goods coming in had to be signed for, checked against orders, priced and placed on high or low shelves, in fridges or locked cupboards where the rest of the pharmacy team would expect to be able to find them. In hospital settings, pharmacy staff may walk long distances between wards and the dispensary carrying notes, tablet or laptop computers, notebooks and BNF.

The importance of local knowledge and communication between pharmacy and GP practices was well illustrated in interview data (Figure 5.14). Local knowledge, communication and teamwork also came to the fore in anecdotes told to the researcher. In one case, a man phoned and asked the pharmacist, '*can you make up my mum's repeat prescription'* but hung up without providing a name. The pharmacist and MCA between them took on the challenge and were able to figure it out (P8). Or customer service in recognising someone approaching and being prepared to help them, remembering their circumstances and adding value to the pharmacy visit through appropriate open, supportive questions (P8, P12, P15).

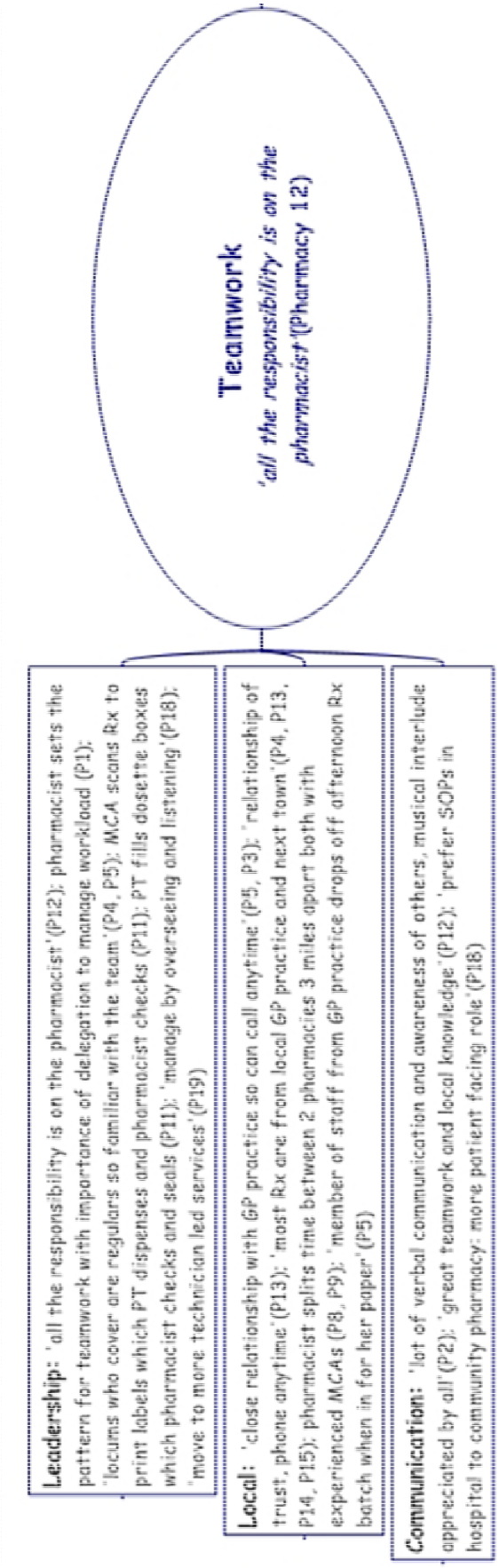

Figure 5.14 Model of 'Teamwork' theme with sub-themes and illustrative quotes

Little was said about team work during interviews but observational notes reflected team work, communication and leadership,

'an efficient team led by a very experienced pharmacist owner: quiet, polite, very busy' (P17).

Other examples noted,

'*a well-managed team in which everyone knows their role with little need for direction from the pharmacist'*(P1),

or,

'clear evidence of team work and roles; pharmacist is listening and aware of all customer interactions with the MCA, a subtle handover takes place when the MCA refers a customer on to the pharmacist with just a slight turning of the head to catch his eye'(P5).

There were contrary examples too, in which,

'*staff seem to be of limited experience'*(P6),

or,

'*no clear routine but all managed quietly, ably and as a team'*(P13),

but also concern raised about,

'*little communication between dispensing team and front of shop MCA'*(P6)

and,

'*isolation and lack of peer support for the pharmacist'*(P14),

when,

'*all the responsibility is on the pharmacist'*(P12).

Training: *who, what, where, when, why, how*

There was overwhelming evidence from pharmacy staff at all levels, ages and stages that they could not recollect IT training as part of their pharmacy education (Figure 5.14) and yet,

'*it's what you use everyday*'(P4).

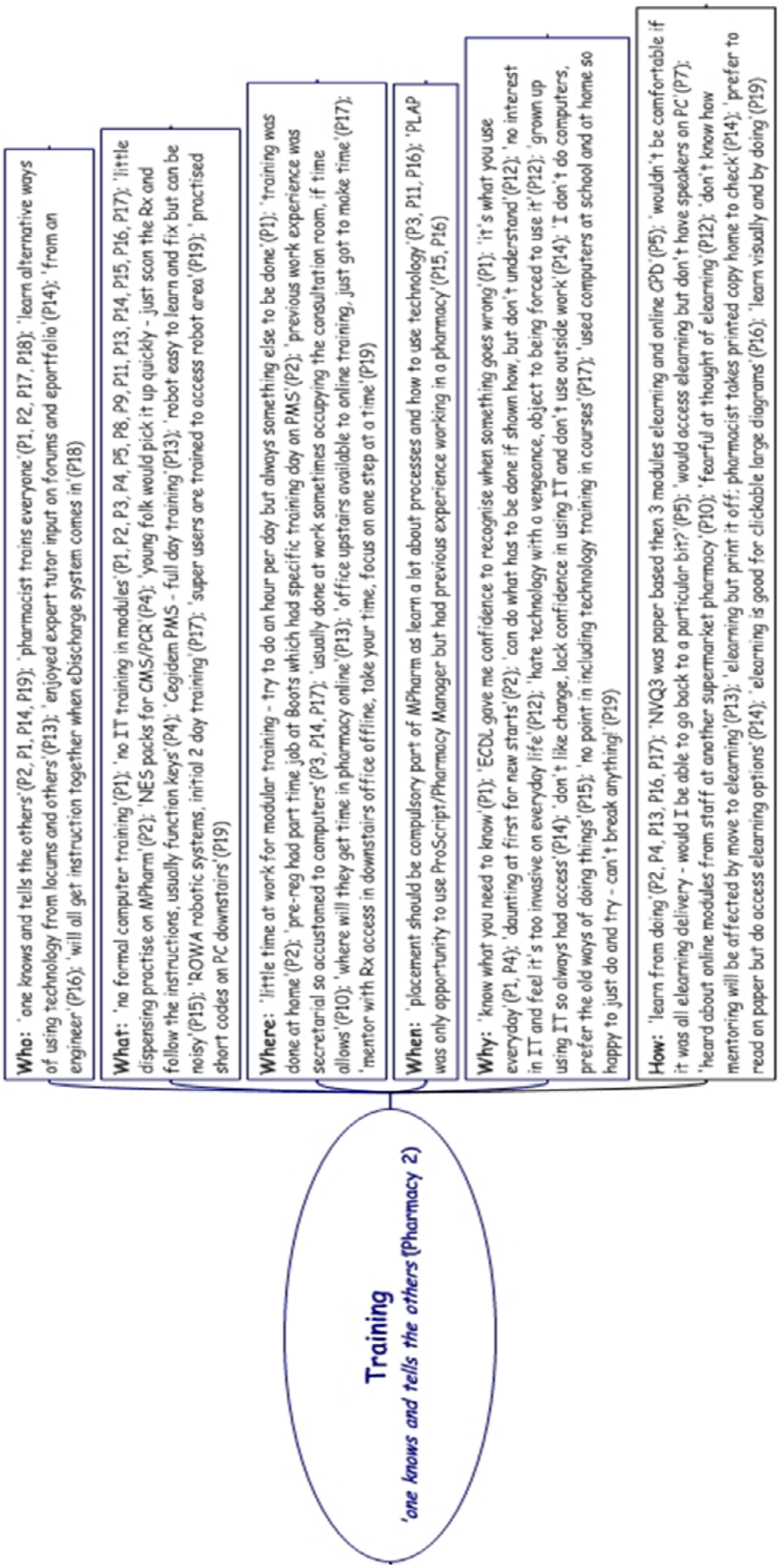

Figure 5.15 Model of 'Training' theme with sub-themes and illustrative quotes

What was less clear from interviews and observational data was whether there was a need for IT training as pharmacy staff,

> '*know what you need to know'*(P1),

while others say they,

> '*can do what has to be done if shown how, but don't understand*'(P12),

or there is,

> '*no point in including technology training in courses'*(P17).

Observational notes describe the

> '*expectation of IT skills'*(P1),

but also the,

> '*expectation that the pharmacist will hold the knowledge for all aspects of running pharmacy processes, shop premises and staff mentoring'*(P2),

which begs the question,

> '*who trains the trainer?*'(P1).

Other themes which were clearly evidenced were the lack of time and place for training within pharmacy premises during working hours,

> '*usually done at work, sometimes occupying the consultation room, if time allows'*(P10),

and mixed feelings about IT,

> '*grown up using IT so always had access'*(P14)

or,

> '*don't like change, lack confidence in using IT and don't use it outside work'*(P14).

The delivery mode of training in future was another topic raised, with some,

> '*fearful at the thought of elearning'*(P12),

while others raised the related concern,

> '*don't know how mentoring will be affected by move to elearning'*(P13).

A solution adopted in one pharmacy was to,

> '*use elearning but print it off, pharmacist takes printed copy home to check'*(P14).

Technology: ***hardware, CMS, MAS, PMS, MethaMeasure, extras, wishlist***

Pharmacy technology (Figure 5.16) observed in operation ranged from the low tech, minimum specification of a single PC server with N3 broadband connection with a barcode scanner, label dispenser, printer, fax machine and cash register, through to state-of-the-art, high tech robotic storage and dispensing facilities (Figure 5.17). Participants spoke of 3 or 4 year upgrade cycles for hardware and support packages costing around £4000 per annum. Many complained of slow N3 connections and poor performance of networked PCs and cash registers when used in combination. Most had a laptop, often kept in the consultation room, but where able to link it to the network, it was often in use for tracking prescription progress or staff training. Most pharmacies had closed circuit television monitoring in place but one admitted,

> '*the monitor behind the counter is kaput*'(P13)

and,

> '*only switched on shop floor facing monitor because of your visit'*(P13).

Monitors displaying promotional materials or relaying footage of the pharmacy robot activity were also observed in several pharmacies.

Figure 5.16 Range of technology implemented in pharmacy from low to high tech

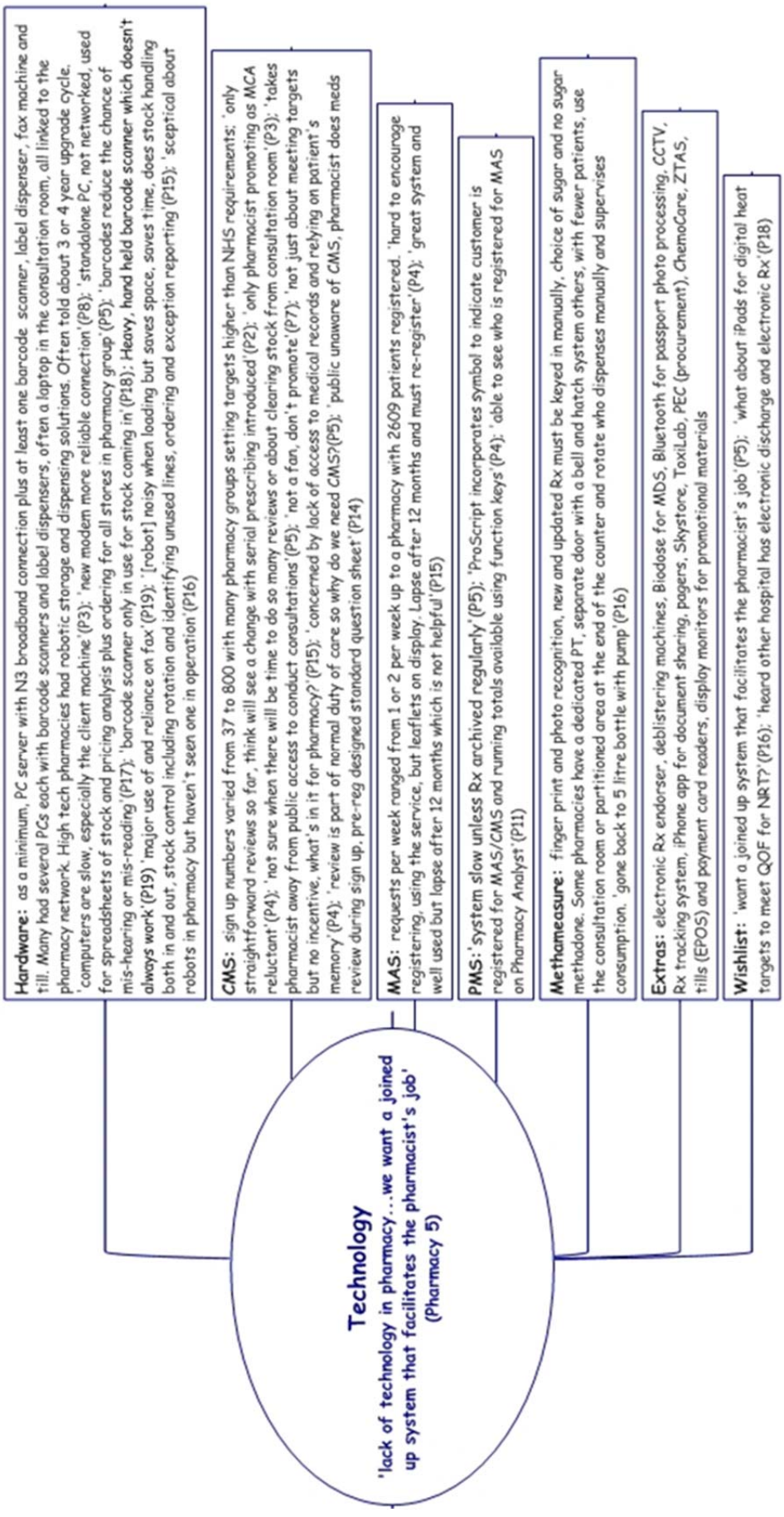

Figure 5.17 Model of 'Technology' theme with sub-themes and illustrative quotes

Barcode scanners were observed to be an essential technology in pharmacy with the ability to,

'reduce the chance of mis-hearing or mis-reading'(P19).

Some were resistant to adopting the full functionality,

'*only in use for stock coming in'*(P18)

perhaps because it is a,

'*heavy, hand held barcode scanner which doesn't always work'*(P19),

or,

'some don't scan and could be once per day or all scripts from one GP'(P11).

A creative, timesaving solution, observed in one pharmacy, involved a pharmacy technician making a V-shaped fan of prescriptions then flicking through them under a stand-mounted, barcode scanner until the full set had been read (P7). Another adopted a technique similar to counting bank notes, again, carefully positioned under the barcode scanner (P14). Some pharmacy owners see technology as the way forward and make a high investment in providing tools to make the most of staff time and effort (P11, P15, P17) from tablet de-blistering machines to electronic prescription endorsing machines or multi-compartment, medication dispensing systems capable of holding liquids, sealed with the patient's photograph and full instructions for care providers. Nevertheless, pharmacy was observed to still be a major user of fax technology with heavy reliance recorded for stock ordering and document exchange in both community and hospital settings. Paper-based systems were still the norm for controlled drug registers and public health promotions, such as smoking cessation.

The adoption of high tech robotic pharmacy solutions was the exception with some,

'*sceptical about robots in pharmacy but haven't seen one in operation'*(P16),

while others see advantages in that the robot,

> '*saves space, saves time, does stock handling both in and out, stock control including rotation and identifying unused lines, ordering and exception reporting'*(P16).

Numbers signing up for CMS continue to grow with many community pharmacy multiples setting their own targets in addition to NHS Scotland targets. As the illustrative quotes show (Figure 5.15), while MAS has a ground swell of acceptance, CMS has yet to reach full functionality and yet to be fully embedded within community pharmacy and GP practices.
Pharmacy management systems (PMS) software implemented for handling ETP, MAS, CMS and stock control were observed to vary in interface look-and-feel but with the same essential functionality. Some PMS were seen as having an 'MS Windows-like interface' which was grey and dull while others were preferred for ease of access to MAS and CMS. Even where PMS had stock control and ordering functionality, some pharmacies still send orders by fax rather than monopolise the only PC and hold up other processes.
Several pharmacies had installed MethaMeasure, a commercially available system for processing and dispensing methadone prescriptions. One pharmacy, observed as trending toward adopting greater technology, had tried the system but, '*gone back to 5 litre bottle with pump'*(P16) because of spillage problems. Where MethaMeasure was fully adopted, pharmacy staff and patients were keen to demonstrate its finger print recognition and photo identification with the only downside noted as, '*new and updated prescriptions must be keyed in manually'*(P11).
Several extra technologies (Figure 5.15) were observed including the use of Bluetooth for photo transfer, a barcode supported prescription tracking service in hospital pharmacy, use of smartphone apps for document upload and sharing, applications supporting access to laboratory test results, specialist patient care for oncology and mental health monitoring and varying cash register and payment card technologies.

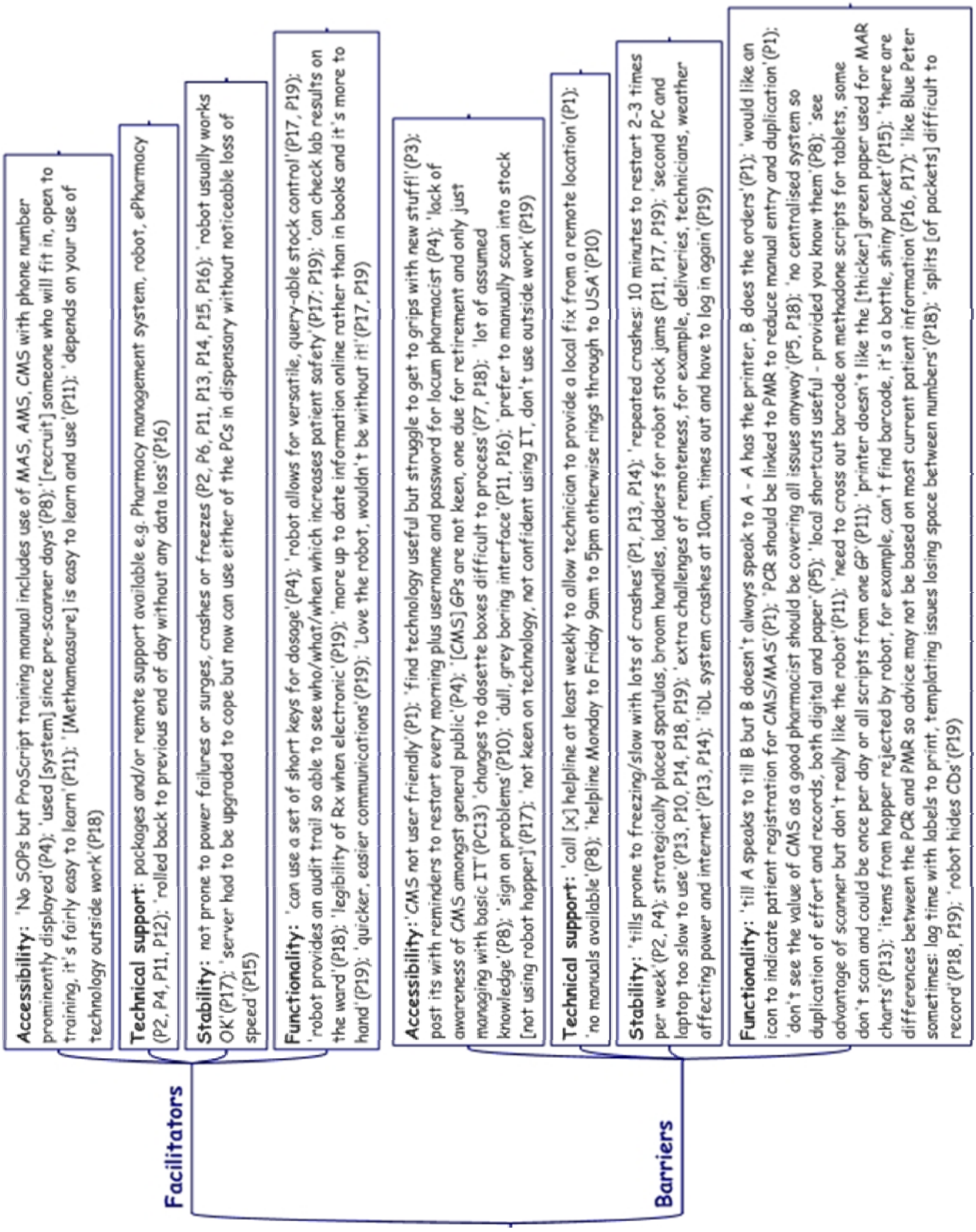

Figure 5.18 Model of 'Usability' theme with sub-themes and illustrative quotes

Wishlists were encapsulated by one pharmacist, based in a low tech, rural, community pharmacy, who asserted there was a,

> '*lack of technology in pharmacy...we want a joined up system that facilitates the pharmacist's job'*(P5).

Usability (facilitators and barriers): *accessibility, technical support, stability, functionality*

Facilitators and barriers emerged from the data within the theme of 'usability' with evidence for and against presented for each of the sub-themes (Figure 5.18).

Availability of manuals for one of the pharmacy management systems, including coverage of the core technology supported community pharmacy services in Scotland (AMS, MAS, CMS), was seen as a facilitator of usability (P4) which others raised as unavailable for their PMS (P8).

Some suggested pharmacy technology was,

> '*fairly easy to learn'*(P11),

but this was countered by evidence suggesting there is,

> *'a lot of assumed knowledge'*(P8),

with some systems viewed as lacking user friendly elements, for example, CMS (P1, P10, P11, P13, P16), processing dosette box changes (P7, P18), handling split packets (P18, P19) or expressing a preference for manual systems (P17).

Barriers to accessibility were raised in both low and high tech pharmacies where some,

> '*find technology useful but struggle to get to grips with new stuff'*(P3),

or are,

> '*not keen on technology, not confident using IT, don't use it outside work'*(P19).

Another noted that ease in using pharmacy technology,

> '*depends on your use of technology outside work'*(P18).

During observational activity, a whole pharmacy team, coincidently a CMS pilot site, spoke of their lack of confidence in using IT, with the pharmacist joking that when something goes wrong they would,

'*just pick a button'*(P12).

Technical support was viewed as readily available for epharmacy (AMS, MAS, CMS) with contact numbers on display in most community pharmacies. Support packages were in place, and regularly accessed, for pharmacy management systems, specific hardware and applications, such as BioDose MDS or MethaMeasure. Prominently placed post it notes, business cards and lists were pointed out to the researcher as key numbers phoned,

'*at least weekly to allow technician to provide a local fix from a remote location'*(P1),

but,

'*helplines are available Monday to Friday 9am to 5pm otherwise rings through to USA'*(P10).

Most reported few problems with power failures or surges (P2, P6, P11, P13, P14, P15, P16) affecting stability but many were affected by,

'*tills prone to freezing or go slows with lots of crashes'*(P1, P13, P14),

or,

'*second PC and laptop too slow to use'*(P10, P13, P14, P18, P19),

and,

'*repeated crashes with 10 minutes to restart 2 or 3 times per week'*(P2, P4).

During observation the researcher noticed a pharmacist casually, almost unconsciously as though a normal act, switch the modem off and back on without comment (P13).

Although the,

'*robot usually works OK'*(P17),

the researcher asked about strategically placed spatulas, brooms and a step ladder (P11, P17, P19). These were kept to hand for clearing jams in the hopper, delivery chutes and robot area.

One known but unexplained system failure was described as taking place each morning,

'*iDL crashes at 10am, times out and have to log back in'*(P19),

but there was acceptance of the natural consequences of the rurality of much of the north east of Scotland where,

'*extra challenges of remoteness, for example, deliveries, technicians, weather affecting power and internet'*(P13, P14).

Facilitators of usability were dominated by the functionality of robotic systems which,

'*allows for versatile, query-able stock control'*(P17, P19),

and,

'*provides an audit trail so able to see who, what and when which increases patient safety'*(P17, P19).

Although some complained that,

'*items from the hopper are rejected, for example, can't find the barcode, it's a bottle or shiny packet'*(P15),

or,

'*the robot hides CDs!*'(P19),

when items got trapped in the corner sections of the ceiling mounted conveyor belt housing, but the generally expressed feeling was,

'*I love the robot, wouldn't be without it!*'(P17, P19).

Usability was also improved by the functionality provided by the internet, allowing,

'*quicker, easier communications'*(P19)

and,

'*more up to date information online, rather than in books, and it's more to hand'*(P19),

including on ward rounds, and also the improvements provided by,

'*the legibility of electronic prescriptions'*(P19).

Other barriers to usability created by lack of functionality related to local networking issues,

'*till A speaks to till B but B doesn't always speak to A – A has the printer but B does the orders'*(P1),

or epharmacy lack of interconnectedness,

> '*PCR should be linked to PMR to reduce manual entry and duplication'*(P1),

also demonstrated by the lack of a,

> '*centralised system so duplication of effort and records, both digital and paper'*(P5).

Nevertheless, pharmacy staff displayed optimism and ingenuity acknowledging,

> '*local shortcuts are useful – provided you know them'*(P8),

while it was,

> '*like Blue Peter sometimes with lag time with labels to print, templating issues losing space between numbers'*(P18).

Processes: *prescriptions, system maintenance, stock control, internet access, standard operating procedures, paper-based*

From observational activity, and commentary from participants (Figure 5.19), it is clear that in community and hospital pharmacies,

> *'all processes are centred on the computer'*(P4)

The main focus of pharmacy dispensaries is the safe and efficient processing of prescriptions which requires stock control and standard operating procedures. The majority of prescriptions in Scotland involve electronic transfer (ETP) over an N3 internet connection on a well-maintained system but many processes remain paper-based.

As the illustrative quotes in Figure 5.19 show, there were complexities and nuances to processing prescriptions. Observation of prescription processing noted that pharmacists,

> *'conduct a five point check: patient's name, form of drug, strength, directions, quantity or drug/dose/delivery including calculation of medication on the prescription, number of tablets, number of doses, is it antibiotics?'*(P19)

Pharmacy technicians and MCAs patiently demonstrated the handling of prescriptions for ETP in community settings to the researcher. They

scanned the barcode to populate the PMS screen, conducted checks on name and address, checked the descriptive text and directions were correct before printing the labels, placed the prescription and labels in the correctly coloured basket to indicate whether the patient was waiting, collecting later or for delivery. In some pharmacies the same member of staff would also dispense, in other pharmacies a different member of the team took over before final checks were conducted by a pharmacist. Handwritten nurse practitioner prescriptions or ETPs that would not scan or paper-based hospital prescriptions were processed manually. The illustrative quotes (Figure 5.19) detail the local, colour-coding of hospital prescriptions and the keying in processes. Issues raised around technology in the prescription process were associated with duplication of effort, manual processing, inconsistency in relation to payment and claims processes and local, non-standardised requirements.

System maintenance processes were equally varied and in several cases the effect of the researcher asking, '*can you tell me about your back up system, please*,' prompted pharmacy staff to question the physical security and purpose of back ups and archives.

Stock control processes in pharmacy were generally conducted on a just-in-time basis. Storage was at a premium, return custom or regularity of customer need could not be guaranteed and the shelf life of items was hugely varied. Four main suppliers were mentioned for community pharmacy providing twice daily deliveries. The main hospital in Grampian provided centralised stock control for hospitals across the area. The level of automation of stock control in both hospital and community pharmacy was dependent on the PMS implemented, the availability of PCs and stability of the N3 connection with staff preferences also influencing processes. Pharmacy remains heavily reliant on fax technology and manual checking of stock and orders. Multiple cross checking of controlled drugs was common, sometimes in triplicate and usually handwritten, with physical measurement of liquids resulting in wastage.

The use of the internet for pharmacy processes such as checking email or medicines information or one-off customer orders was again varied. In some cases, tight filters prevented any internet access outwith the PMS so even NHS email could not be checked during the working day.

Figure 5.19 Model of 'Processes' theme with sub-themes and illustrative quotes

Other pharmacies benefited from full, open internet access but raised issues of duplication of medication alerts and frequency of notices about lost prescription pads.

Technology specific standard operating procedures were rarely documented but many reminders were noted on post its or on whiteboards. One SOP noticed by the researcher in a community pharmacy was issued by the PMS supplier for regular system activities but, in general there were,

> '*SOPs for daily, weekly, monthly tasks but none technology related'*(P1).

Paper-based processes remain prevalent in pharmacy,

> '*generating loads of paper-based records'*(P13)

and,

> '*large amounts of paperwork, such as invoices and copy orders, to be kept for seven years with storage issues and time consuming shredding'*(P14).

The duplication of effort and clear technology alternatives was a cause of frustration for some in community pharmacy,

> '*take smoking cessation, handwrite three copies of the same form – one for the patient, one for the pharmacy and one to be sent to Aberdeen for someone else to key in – all duplication of effort and handwriting again and again – why is it not part of MAS?*'(P5),

and,

> '*serial prescribing is still paper-based even when described as an online system'*(P5).

Hospital pharmacy also was seen to be largely paper-based,

> *'ward rounds, stock control, ordering, prescriptions are all manual and handwritten'*(P18),

and yet,

> '*all processes are centred on the computer'*(P4).

An expanded version of the five themes model (Figure 5.13), incorporating the many sub-themes, encapsulated the real world model of actual use of technology in pharmacy for comparison with the conceptual model (Figure 5.1) developed in Element 3.

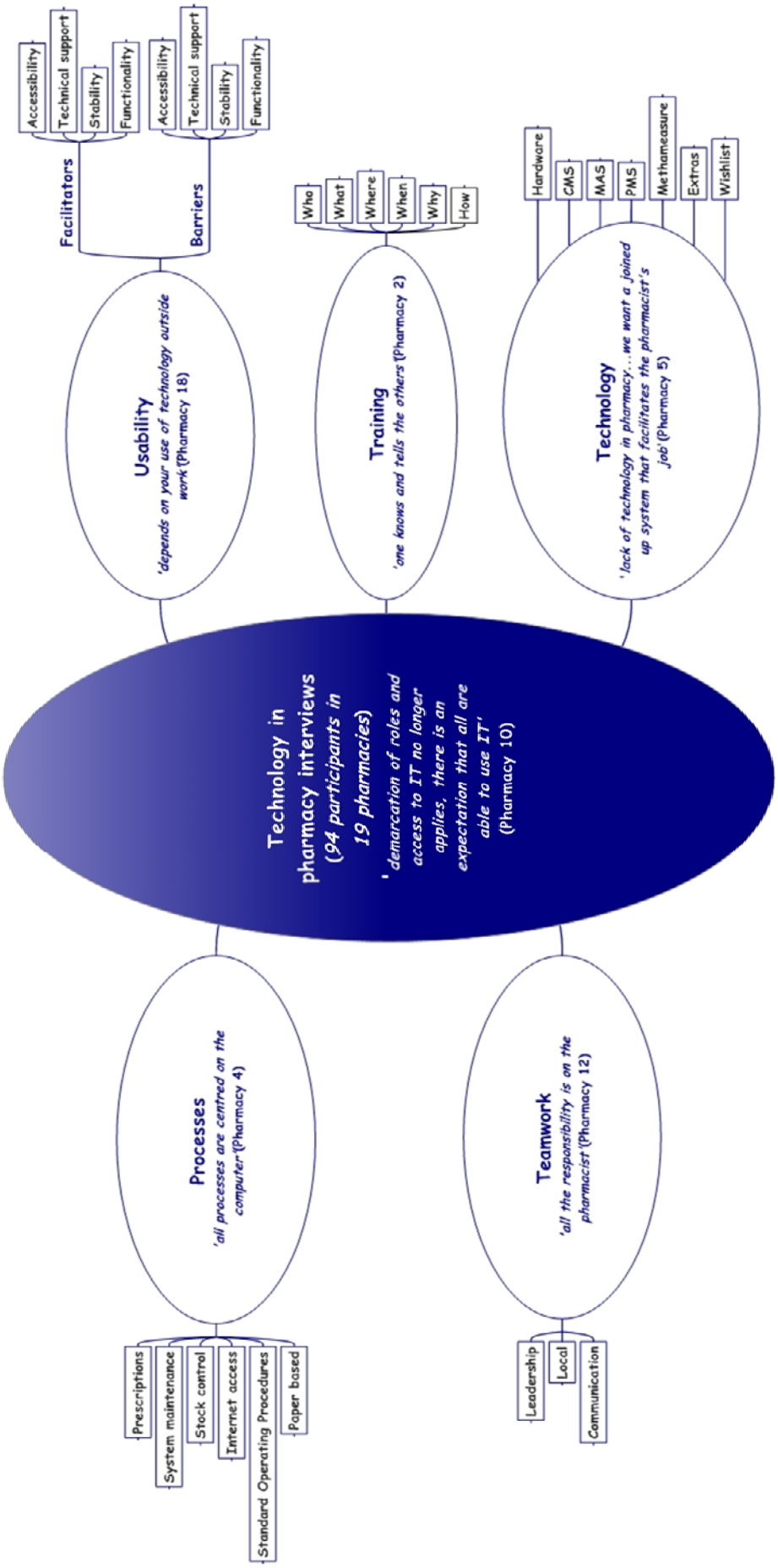

Figure 5.20 Real world model of actual use of technology in pharmacy

Element 2: Discussion

Key findings are discussed collectively with the results from elements 1 and 3 later in this chapter.

Element 3: Study design – conceptual and real world model comparison

The conceptual model (Figure 5.1) developed in element 1 to represent the intended use of technology in pharmacy and the real world model (Figure 5.20) developed in element 2 of the case study to represent the actual use of technology in pharmacy were compared in element 3.

Element 3: Data collection

The models developed in elements 1 and 2 provided the data for element 3 of the case study.

Element 3: Data analysis

Conceptual and real world models of the intended and actual use of technology in pharmacy were compared to identify similarities and differences.

Element 3: Results

The conceptual model (Figure 5.1) developed in element 1 identified four constructs (patient care, education and learning, implementation, information governance) based on policy and strategic intentions for the aspirational use of technology in pharmacy in Scotland. Themes and sub-themes inducted from the data were tabulated and mapped (Table 5.8), where possible, to themes and sub-themes inducted from the data in element 2, the real world model (Figure 5.20) of how technology was observed to be in use in pharmacy in the NHS Grampian area.

Table 5.8 Comparison of conceptual and real world models of the intended and actual use of technology in pharmacy

Conceptual model v Real World model	Patient Care Safety; Partnership; Integration; Resources	Education and Learning Fit for future needs; Multidisciplinary; Delivery mode	Implementation Accessibility; Interoperability; Supporting Role Development	Information Governance Systems; Staff
Teamwork Leadership; Local; Communication	▪ limited technology implemented to support conceptual model sub-themes, other than where robotic systems are installed ▪ lack of access to shared EHR, DSS, realtime systems, email ▪ reliance on pharmacist IT expertise, team's local knowledge and relationship with GP practices	▪ pressure on pharmacist to be the holder and mentor of IT skills	▪ some evidence of move to technician led service in hospital but not IT dependent	▪ assumed knowledge ▪ lack of understanding ▪ no evidence of SOPs
Training Who, What, Where, When, Why, How	▪ limited time and access to IT facilities in pharmacy ▪ reliance on pharmacist IT expertise to act as mentor	▪ limited evidence of formal IT training ▪ unproven expectation that age is determinant of IT experience and skills ▪ assumed knowledge ▪ evidence of informal sharing of IT skills at work ▪ resistance to and lack of access to elearning at work	▪ IT support available but full training only with initial installation of commercial packages	▪ lack of standardisation ▪ superficial knowledge of IT related information governance
Technology Hardware; CMS; MAS; PMS; MethaMeasure; Extras; Wishlist	▪ progress toward technology supporting core services but limited health care integration ▪ added value provided by commercial technologies ▪ heavy reliance on fax	▪ epharmacy manuals and telephone support available	▪ limited by investment in hardware and training ▪ change management challenges to IT acceptance ▪ limitation of N3 connection and often single phone line	▪ as above

Conceptual model v Real World model	Patient Care Safety; Partnership; Integration; Resources	Education and Learning Fit for future needs; Multidisciplinary; Delivery mode	Implementation Accessibility; Interoperability; Supporting Role Development	Information Governance Systems; Staff
Usability Accessibility; Technical Support; Stability; Functionality	▪ CMS reviews take pharmacist away from counter to consultation room, not always fully set up for purpose ▪ repetitive, duplication of non-IT processes open to error and legibility issues, also takes additional time and effort ▪ robotic systems offer additional safeguards of barcode based process, audit trail	▪ lack of formal training ▪ resistance to change ▪ pressure on pharmacist to act as mentor, limiting sources of learning and knowledge cascade effect	▪ lack of formal training ▪ lack of processor power and/or network availability ▪ issues of remoteness	▪ while there are examples of best practice, there are also cases where the technology aspect is poorly understood
Processes Prescriptions; Systems Maintenance; Stock Control; Internet Access; SOPs; Paper-based	▪ lack of joined up, complete, easy to use IT system ▪ continued reliance on fax and duplication of paper-based systems	▪ formal training to support efficient, effective processes not in place ▪ assumed knowledge	▪ unfulfilled potential of IT systems to support pharmacy staff and reduce human error	▪ as above

Patient care

There was limited evidence in the real world model of pharmacy technology to support the construct of '*patient care'* in the conceptual model. The drive to *'improve the safety of people taking medicines'* (Scottish Government 2011) is central to all pharmacy activity, however, many pharmacies remain under-resourced with minimum technology implemented so the reliance on human checking remains unsupported.

Decision Support Software was listed on pharmacy 'wish lists' for the future, meantime many endeavour to fill dosette boxes in cramped, unsuitable areas, using scissors to pop pills from blister packs with constant interruptions or are unable to access online medicines information or NHS email at work. Scotland is considered to be well-advanced in electronic prescribing but the paper prescription token is retained for the patient to present in pharmacy and for pharmacy to evidence dispensing in the payment claims process. There was little evidence of progress towards a shared, electronic health record which many consider pivotal in promoting safety in integrated patient care alongside the developing role of pharmacy. Although CMS may increase partnership between pharmacist and patients, there remains resistance from GPs and unclear procedures for normal working while the responsible pharmacist is in the consultation. Many processes, such as controlled drug registers and NRT, remain repetitive and paper-based while the reliance on fax for document exchange and stock control seems ingrained.

Education and Learning

The real world model evidenced the views of pharmacy staff that technology was not covered in their formal training at any level but some questioned whether it should be. The current form of learning observed was informal, sharing and cascading of IT skills from the pharmacist, or locum, or support engineer, or staff member moving from another pharmacy or different background, bringing new but self-limiting knowledge. The conceptual model placed the emphasis on education and learning to create a workforce '*fit for future needs'*(Wilson & Barber 2013). The RPS (2011) contention that, '*pharmacy education should ensure a basic standard of IT literacy'* aligns with the BCS call for every citizen to be,

> *'able to make use of technologies to participate in and contribute to modern social, cultural, political and economic life'*(BCS 2013)

The real world model showed resistance to technological change and also resistance to, and lack of access to, elearning at work. Demographic data supporting the real world model countered the expectation raised by participants that age, pharmacy role or pharmacy experience were determinants of IT experience while some participants suggested the use of IT outside work brought some IT skills, or confidence in using IT, into the workplace. Nevertheless, the conceptual model promoted role development for all pharmacy staff with a more clinical, patient-facing role for pharmacists reducing their availability to dispense IT skills to other pharmacy staff.

Information governance

The conceptual model places staff and systems central to the promotion of information governance in the future development of pharmacy. While patient confidentiality was clearly evidenced in the real world model there were unnecessary challenges of paper-based systems, duplication and repetition of records with secure storage and destruction implications. The real world model found few examples of technology related standard operating procedures but many examples of less than best practice on sharing of login details, inconsistency and lack of understanding of back up and update procedures.

Implementation

Sub-themes from the conceptual model aspired to '*accessibility'*, '*interoperability'* and '*support for role development'* underpinned by technology in pharmacy. There were overwhelming calls within the policy and strategy documents for '*full access to the internet and shared web-based information systems'*(RPS 2011). The real world model highlighted wide variation with resourcing and filtering issues limiting internet access while CMS provided the only form of electronic patient record access through PCR, which has yet to be linked to the PMR. A comparison of intended and actual use of technology in pharmacy (Table 5.9) demonstrated the distance to be travelled along the technology aspects of the '*2020 Route Map'*(Scottish Government 2013c) towards the aims espoused by policies for health and social care integration (Scottish Government 2013a) to be

fulfilled by an appropriately trained, resourced and supported workforce (Scottish Government 2013d).

Table 5.9 Comparison of conceptual model and real world model use of technology in pharmacy (Table 5.5 updated based on observational and interview activity)

Pharmacy technology - *what was observed to be in use in pharmacy in the NHS Grampian area?*	✓*Acute Medication Service*
	✓*Barcode scanning*
	✓*Chronic Medication Service*
	✗*Clinical Portals*
	✗*Decision Support Systems*
	✗*Digital dictation/voice recognition*
	✓*Disease specific applications e.g. diabetes, cancer*
	✓*Electronic Patient Registration*
	✓*Electronic Prescribing*
	✗*Emergency Care Summary*
	✓*Fax*
	✓*Hospital Electronic Prescribing and Medications Administration*
	✓*Internet and web-based medicines information systems*
	✗*Key Information Summary*
	✓*Minor Ailment Service*
	✓*Mobile devices and smart media*
	✓*Pharmacy Care Record*
	✓*Pharmacy Management Systems*
	✓*Robotic dispensing and labelling*
	✗*Teleheath and telecare*
	✗*Video conferencing*

Discussion of findings from Elements 1, 2 and 3

The aim of this phase of the research was to develop explanatory theory of the digital literacy experiences, education and training related needs of pharmacy staff in the NHS Grampian area. The discussion of the case study findings which follows is initially based around answering the four original research questions, including aspects of education theory and change management theory, before a final statement of explanatory theory.

What is the policy driven intended use of information technology in pharmacy practice in Scotland?

As described in element 1 and the conceptual model (Figure 5.1), the policy driven strategy for IT supported pharmacy practice in Scotland values the pharmacy team and promotes their role in *'improving the safety of people taking medicines and their effective use'* (Scottish Government 2011a). Key IT infrastructure and ehealth applications (Table 5.5) were identified for all

pharmacy settings. The intention is to facilitate and develop the patient-facing clinical role of the pharmacist and the integrated role of pharmacy in Scotland by enabling web-based communication between health and social care practitioners based on a secure, shared EHR (RPS 2011). Policy documents placed emphasis on supporting the role development of the whole pharmacy team (Scottish Government 2013e) through IT supported, multidisciplinary education and training *'to meet future professional and service needs'*(Wilson & Barber 2013).

How and why do pharmacy staff in the NHS Grampian area use information technology?

Observational and interview activity, detailed in Element 2 and captured in the real world model (Figure 5.20), provided a wealth of information on participants use and views of IT in pharmacy practice in the NHS Grampian area. Case studies described the low through to high tech infrastructures which support the core and additional services currently available in pharmacy (Table 5.9). Thematic analysis using the framework approach inducted themes of teamwork, training, technology, processes and usability. A sub-theme of teamwork explored the level of expectation placed on the pharmacist to provide leadership in all aspects of pharmacy, including IT skills mentoring and training. Further teamwork sub-themes showed the value of combining local knowledge with communication to integrate services across the community. The main focus of the processes theme was handling of prescriptions. The manual checking process would benefit from rolling out DSS plus easier access to medicines information through less tightly filtered and more stable internet access, which would in turn facilitate communication, by providing access to email at work and easing ordering of stock. The system maintenance process theme raised issues of inconsistent, and at times ill-informed, processes for system access, updates, back up procedures but also highlighted the availability of remote access and telephone support. Stock control remained heavily reliant on manual checks, paper-based processes and fax technology, even where the technology was theoretically available but hampered by reluctance to address unstable, slow systems. Pharmacy is a highly organised and SOP driven profession so the scarcity of technology-based SOPs raised questions around lack of acceptance or lack of information on best practice.

What facilitators and barriers do pharmacy staff in the NHS Grampian area experience in using information technology?

Participants' views of the facilitators and barriers to the usability of IT in pharmacy were analysed around accessibility, technical support, stability and functionality. Prior experience and use of technology outside work were noted as facilitators to usability. Although IT systems were said to be easy to learn, barriers included the level of assumed knowledge, poorly designed interfaces and resistance to both change and technology. There was a tolerance of staff continuing with manual systems, even where technology supported alternatives were in place, perhaps reflecting lack of confidence in IT skills. Technical support, while costly, was seen as readily available within normal working hours, subject to the vagaries of geographical remoteness. It was interesting to note the variation in opinion on stability of systems. Even within the same pharmacy some talked of slow systems, crashes and freezes which others either hadn't noticed or had different levels of expectation. The creativity of the pharmacy workforce in crafting workarounds may have reduced the impact of unstable systems. Functionality was rated highly where robotic solutions were installed while full internet access facilitated email communication, use of medicines information, disease specific, and Cloud-based applications. Many highlighted issues with CMS but spoke highly of MAS with few reflecting on the time required for bedding in new systems and gaining acceptance.

What are the needs of pharmacy staff in the NHS Grampian area for digital literacy education and training?

The consent forms indicated that pharmacy staff perceived their own digital literacy skills as basic. Their self-reported levels of digital literacy appeared unrelated to age, pharmacy experience or role in pharmacy indicating a need for training to support staff at all levels, ages and stages in their pharmacy career. Educational theorists would describe much of the technology-related learning evidenced as '*experiential'* and '*single-loop'*(Dewey 1933; Schon 1983; Kolb 1984). Participants described being '*able to do what they need to do - but don't understand*' and '*one knows and tells the others'* redolent of coping with technology (Turner 2013) at a surface level rather than deeper learning (Biggs & Kember 2001). While the workarounds are admirably creative '*adjustments and amendments to maintain performance'* (Buchanan & Huczynski 2010) these are

examples of '*thinking on your feet'* rather than '*reflection-in-action'*(Schon 1983) or querying and challenging the issues and assumptions to enable '*double-loop'* learning (Argyris & Schon 1978) at individual, organisational or societal level (Schon 1983). The observed organisational culture (Schein 2004) at pharmacy practice level lacks the time and resources, perhaps the recognition of need, to advance digital literacy skills within the workplace to enable more effective use of technology.

However, although participants were divided on whether it is best to learn formally, through education and training programmes, or informally, by sharing knowledge at work (Dewey 1933; Kolb 1984), government and pharmacy policy intention is to continue to increase reliance on IT in both community and hospital pharmacy with staff supported in role development, '*to ensure a workforce that is fit for purpose and that meets the future service needs'*(Scottish Government 2013e). On the basis of policy and the evidence from this research study it could reasonably be expected that digital literacy will feature in future UK pharmacy education.

Towards an explanatory theory

The conceptual model described the intended, or aspirational, use of ehealth technology in pharmacy which the Scottish Government (2011 & 2013e) and the Royal Pharmaceutical Society (2011), backed by recommendations from the Wilson & Barber (2013) report, will strive to introduce into pharmacy practice before the year 2020.

The real world model described pharmacy staff working in cohesive teams to complete tasks (processes), all of which were centred on IT. The team and each individual member, engaged in the purposeful activity of pharmacy practice (Checkland & Poulter 2006), operated under the leadership of the responsible pharmacist (GPhC 2012a) who findings from this research have identified as pivotal in cascading knowledge, including digital literacy and adoption of technology.

Adair (1973), in his action-centred leadership model, depicted these three work-based units as interconnected circles, which he described as the:

- **Team:** *'the group of people that the leader is responsible for and who must work together in order to achieve the task'*
- **Task:** *'the job that needs to be done at a particular time'*
- **Individual:** *'people who make up the team with their own personalities, motivations and skill sets'*

In terms of the leader of the pharmacy team, currently the norm is the responsible pharmacist. Optional models are changing toward experienced technician-led, and technology supported, services in hospital which may follow in community pharmacy as the pharmacist takes a more clinical, patient-facing role. Adair (1973) listed expected leadership functions of:

- task defining
- planning
- briefing
- controlling
- evaluating
- motivating
- organising
- setting an example

All are recognisable in the real world model. The focus on managing the dynamics of the group (leader, team, individuals) can influence and affect the introduction and acceptance of technology in pharmacy practice. Checkland & Poulter (1976) would add other influences to the adoption of technology (Rogers 1995), which in this case includes (Figure 5.21):

- societal needs (pharmacy service users, wider healthcare team)
- political and non-governmental agencies (Scottish Government, European Parliament, ECIS, WHO, UNESCO)
- regulatory body (GPhC)
- professional bodies (RPS, CPS, RCGP, AMRC)
- education providers (NES, Higher Education Institutes, NPA)
- economic climate, and
- technological advancements

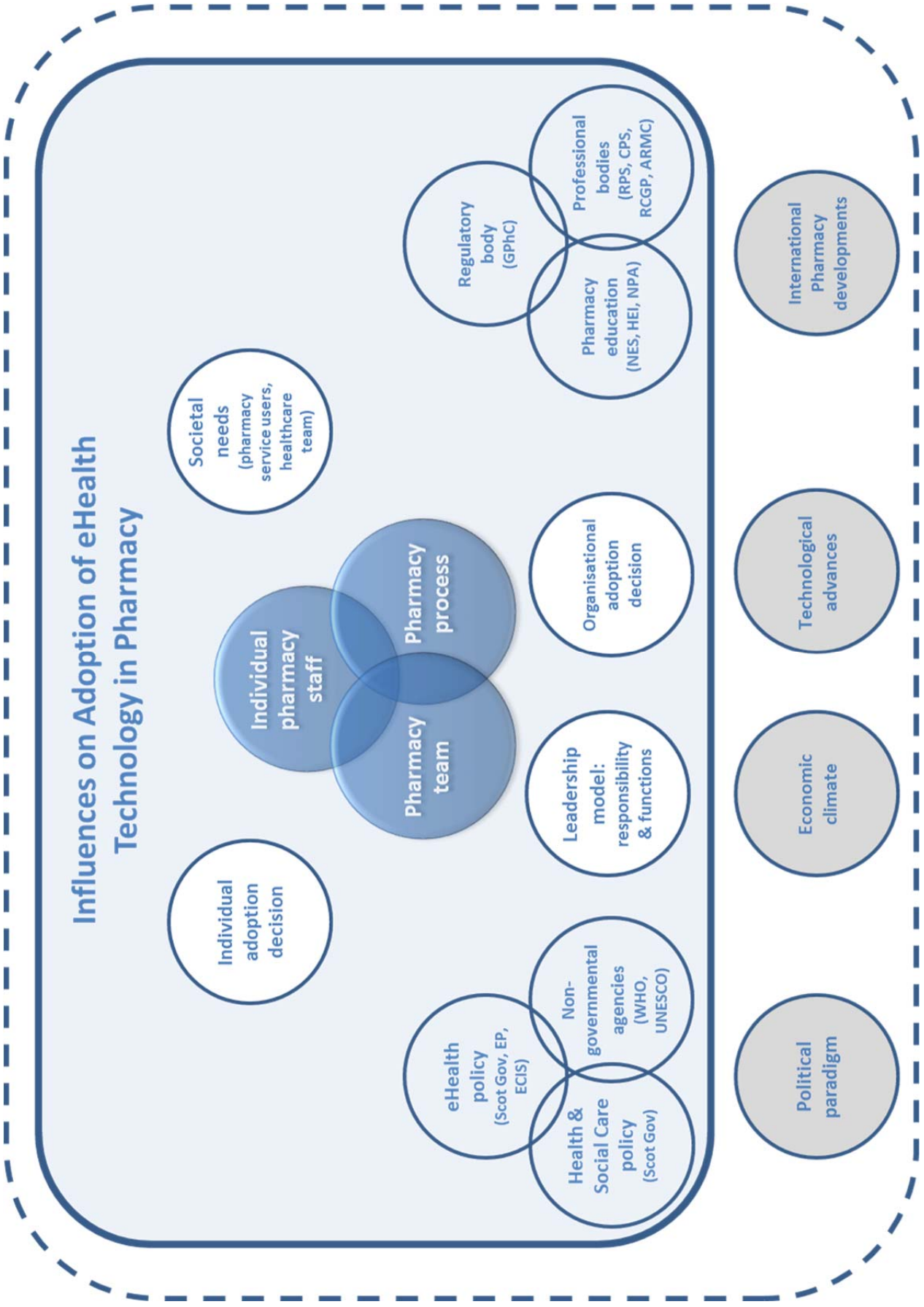

Figure 5.21 Influences on Adoption of eHealth Technology in Pharmacy

Greenhalgh et al (2005) explored the diffusion of innovation in health service organisations from several theoretical perspectives including Rogers (1995) '*Adopter Categories'* and '*Attributes of Innovation*' to account for the complexity of combining socio- and technical systems. All point to the competing forces at play which Lewin (1951) described in his Force Field theory as where,

> *'an issue is held in balance by the interaction of two opposing sets of forces – those seeking to promote change (**driving forces**) and those attempting to maintain the status quo (**restraining forces**)'*(Lewin 1951)

Driving forces for technology in pharmacy

Clear driving forces for technology in pharmacy to support healthcare, discussed in elements 1 and 3 of this chapter, have been evidenced nationally by the Scottish Government through the:

- '*eHealth Strategy'* (2011a)
- '*Better eHealth: Better Care – Citizen eHealth Survey*' (2011b)
- '*2020 Vision for Quality'* (2011d)
- '*2020 Route Map'* (2013a)
- '*Prescription for Excellence'* (2013e)
- and locally by NHS Grampian (2013).

Technology in pharmacy has been supported by the GPhC (2013), the RPS (2011) and jointly by RPS & RCGP (2011) with further backing from the '*Review of Pharmaceutical Care of Patients in the Community'* (Wilson & Barber 2013), endorsed by Community Pharmacy Scotland (2013).

Another driving force is the educational support designed for the healthcare workforce to provide the digital literacy skills needed to use technology in pharmacy through the '*2020 Workforce Vision*' (Scottish Government 2013d), NHS Knowledge & Skills Framework (NHS KSF 2012) and British Computer Society '*Preparing the NHS for an information revolution'* (BCS 2011).

Policy and strategy drivers aim to change the role of pharmacy practice, upskilling the role of each member of the pharmacy team, within the integrated health and social care team, releasing the pharmacist for a more clinical, patient-facing role (Scottish Government 2013b). The intention is to support the roles

and integration with technology which requires a digitally literate workforce. In brief, societal healthcare needs and technological advances have driven the organisational adoption decision in favour of technology (Figure 5.21).

Restraining forces for technology in pharmacy

If policy is the driver bringing technology into the pharmacy process, the main restraining forces are the pharmacy team, its leadership and the individuals within the pharmacy team. Findings from the case studies depicted a workforce who self-reported their digital literacy levels as basic. Few recalled any technology in their pharmacy education but some questioned whether it was necessary, stating a preference for work-based, experiential learning. Although there were notable exceptions, most pharmacies had the minimum level of technology implemented with unaddressed usability issues acting as barriers, or additional restraining forces. The leadership role of the pharmacist was seen to be pivotal in the team's approach to processes and training pharmacy staff (Figure 5.20). This informal, experiential, cascading learning is self-limiting and dependent on pharmacist's digital literacy and their attitude to adoption of technology. Changing roles may also lead to the pharmacist spending less time with the pharmacy team. The decisions of individuals to adopt technology were dependent on use of technology outside work but Adair (1973) and Lewin (1947) would also argue that leadership and group acceptance of technology are influential in the change management needed to counter the restraining forces.

Conditions for change

In '*Human Relations in Curriculum Change*,' Lewin (1947) outlined the conditions for change, the tensions at play in his Force Field theory (1951) and combinations of educational and organisational measures to '*change the strength of opposing forces'*(Lewin 1947). Lewin considered the power of '*social habits and group standards'* where there is resistance to change to be amenable to a three step process of '*unfreeze, change, refreeze'* applied and depicted for technology in pharmacy in Figure 5.22.

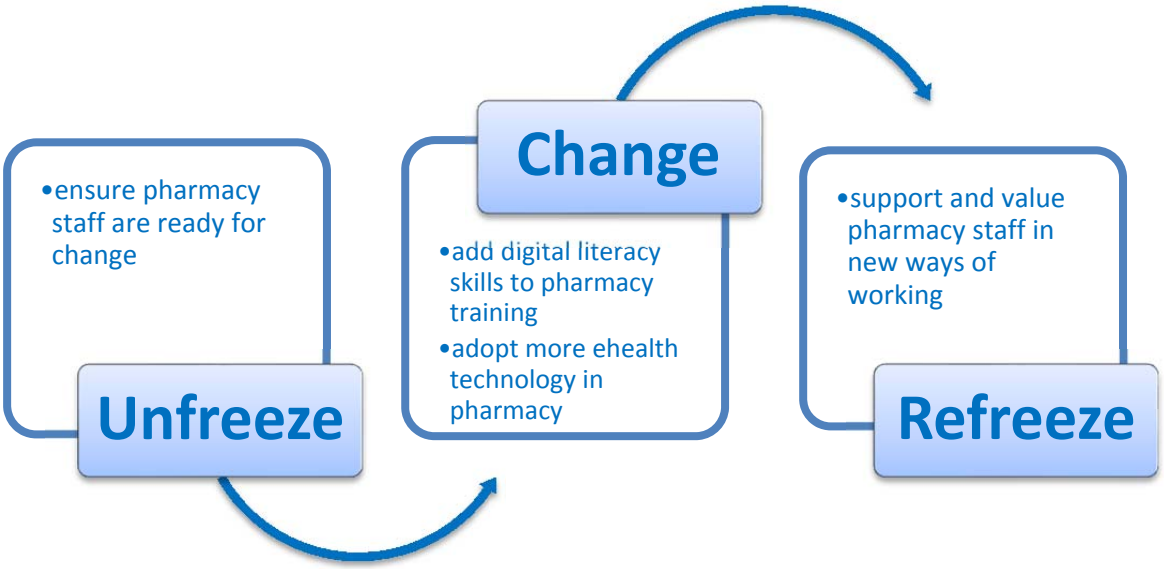

Figure 5.22 Conditions for change to bring technology into pharmacy.
Adapted from: Planning and Executing Change Effectively. Available from: http://www.web-books.com/eLibrary/NC/B0/B58/047MB58.html [Accessed 12 January 2014]

Explanatory theory

The aim of this phase of the research was to develop explanatory theory of the digital literacy experiences, education and training related needs of pharmacy staff in the NHS Grampian area. Evidence from the case studies suggests there is a policy driven intention to support changing roles in pharmacy by increasing and improving the provision of ehealth technologies and the associated education and training of pharmacy staff. With few exceptions, pharmacy staff in the NHS Grampian area, work with minimum levels of technology and are trained to use those technologies informally by the pharmacist. Digital literacy levels are self-reported as basic with mixed views on the need for related education and training. This tends to indicate organisational and social factors may act as restraining factors against the driving forces for technology in pharmacy and associated digital literacy training.

Strengths and limitations

Strengths and limitations of the case study approach are covered in Chapter 7.

Summary of this chapter

This chapter explored the digital literacy experiences, education and training related needs of pharmacy staff in the NHS Grampian area using a multiple, local knowledge, explanatory case study approach. It was conducted as three inter-related elements. Firstly, current government and pharmacy ehealth policy and strategy documents were reviewed to build a conceptual model of intended use of IT in pharmacy. Secondly, observational and interview activity took place in 19 pharmacies across NHS Grampian involving 94 participants. Findings formed the basis for real world models capturing multiple perspectives of the actual use of technology in local pharmacy. Lastly, the conceptual and real world models were compared exploring similarities and differences leading to explanatory theory of the digital literacy experiences, education and training related needs of pharmacy staff in the NHS Grampian area.

CHAPTER 6 (Phase IV) A systematic review of the digital literacy training experiences and needs of pharmacy staff

'Education is the best provision for the journey to old age'

Socrates, philosopher
(470 BC – 399 BC)

Introduction to the chapter

This chapter explores the digital literacy training experiences and needs of pharmacy staff. As a follow up to theory developed in Chapter 5, a systematic review was conducted as a form of theory testing using Kirkpatrick's four level model of training evaluation as an analytical framework.

Background

Pharmacy staff across all practice settings are increasingly reliant on information technology (IT) (Darzi 2008; Scottish Government 2011a; Department of Health 2011; Crown 1999). Pharmacists, graduate (pre-registration) pharmacists, pharmacy technicians, dispensing assistants and medicines counter assistants use widely available office, retail and management information systems alongside dedicated pharmacy management and electronic health (ehealth) applications in a range of community, hospital and other pharmacy settings. The abilities of pharmacy staff to use these applications at home and at work, also known as digital literacy or digital competence or e-skills, depends on personal experience and related education and training (GPhC 2012a & 2012b; Beetham et al 2009). The British Computer Society defines digital literacy as,

> *'being able to make use of technologies to participate in and contribute to modern social, cultural, political and economic life'*(BCS 2013)

A similar definition of digital literacy adopted in the United States (US) describes,

> *'the ability to use information and communication technologies to find, evaluate, create, and communicate information; it requires both technical and cognitive skills'*(American Library Association 2013)

Both definitions are grounded in historical and conceptual definitions of digital literacies (Lankshear & Knobel 2008).

IT facilitates the provision of core pharmacy aspects of the United Kingdom (UK) National Health Services (NHS) in collaboration with other healthcare professionals with similar examples evidenced worldwide (CMS Advisory Group 2009; McElenay 2011; Australian Government Department of Health 2013;

Ministry of Health, British Columbia 2013). In the United States, digital literacy also forms the basis for pharmacy led health literacy as a tool for improving public health and patient outcomes. (Agency for Healthcare Research and Quality 2007).

Collaborative working in health has been viewed as both beneficial to patients and a more efficient use of health professionals' skills since long before the advent of ehealth (Department of Health 2007; Nolan 1995; Hepler & Strand 1990). Health strategists worldwide promote the adoption of IT and ehealth to support patient care through collaborative working, which is tracked globally by the World Health Organisation (Darzi 2008; Scottish Government 2011b; Department of Health 2011; CMS Advisory Group 2009; McElenay 2011; Scottish Government 2012a; European Commission 2011; World Health Organisation 2011). Both the adoption of ehealth and standards of digital literacy at home and in the workplace are key but separate themes of interest at an international level (NTIA United States Department of Commerce 2013; Innovation & Business Skills Australia 2010; New Zealand Ministry of Education 2010).

United Nations Educational Scientific and Cultural Organisation (UNESCO) identifies digital literacy as both a *'life skill'* and *'gate skill'* because *'it targets all areas of contemporary existence'*, including employability (UNESCO 2011). The European Commission Information Society (ECIS) promotes and tracks citizens' and member states' digital engagement (ECIS 2012). As part of the ECIS research programme, the sixth of seven pillars in the Digital Agenda for Europe, builds on that recommendation by focusing on digital literacy, skills and inclusion for lifelong learning (European Commission Digital Agenda for Europe 2012). Similarly, the European Parliament promotes digital literacy as one of eight key skills for lifelong learning along with a recommendation for, *'better identification of occupational needs'*(European Parliament 2006). In the United States, a government initiative to create a *'digital nation'* recognises the role of digital literacy in promoting inclusion (NTIA United States Department of Commerce 2013). A government commissioned report into digital literacy in Australia concluded that, *'both citizen and worker will need to be digitally literate for the digital economy to work effectively'* while a report from New Zealand argues, *'that technology can change the nature of work faster than people can change their skills'* (Innovation & Business Skills Australia 2010; New Zealand Ministry of Education 2010).

In the UK, a joint statement on pharmacists and doctors working together, issued by the Royal Pharmaceutical Society and Royal College of General Practitioners, further emphasised the role of IT and digital literacy training for continuity of care for patients (RPS & RCGP 2011). A range of strategic principles, national competency frameworks for training, core skills and digital literacies for the general public, and recently more specific targets for the health sector, have been developed by government, advisory and professional bodies (BCS 2012; RPS 2011; Academy of Medical Royal Colleges & the Scottish Government 2011; e-Skills UK 2011; NHS KSF 2012; Skills for Health 2012; Department of Health 2004).

Pharmacy students in the UK undertake the General Pharmaceutical Council (GPhC) accredited and regulated Master of Pharmacy course (GPhC 2011a). This undergraduate university course is followed by a pre-registration year, based in practice, culminating in an end of year written examination. Training for pharmacy technicians, dispensing assistants, and medicines counter assistants is similarly accredited and regulated but undertaken as a combination of practical experience, college and open learning (GPhC 2011b). The pharmacy staff all have access to continuing professional development (CPD) opportunities (RPS 2012; NHS Education for Scotland 2012). Specific mention of the digital literacies required to facilitate pharmacy staff's collaborative healthcare role is not evident in the UK curricula for initial training or CPD. Pharmacy training programmes around the world are similar but vary in terminology and digital literacy content. The Accreditation Council for Pharmacy Education (ACPE) in the US added health informatics to its standards for pharmacist training in 2007. The focus is initially on basic computer skills, then on ability to find resources as an appropriate, relevant evidence base for practice (ACPE 2012). The most recent standards for pharmacy programme accreditation in Canada, Australia and New Zealand make explicit mention of the need to prepare students to make best, *'use of information technology in pharmacy and more widely in health care'*(Canadian Council for Accreditation of Pharmacy Programs 2012; Accreditation Standards for Pharmacy Degree Programmes in Australia and New Zealand 2012). While digital literacy may be covered to an extent in some initial training programmes, there is limited evidence that it features in CPD for existing members of pharmacy staff.

In summary, despite the increasing adoption of IT and ehealth to support the role of pharmacy staff, there is a paucity of research exploring their perceptions and experiences of digital literacy and related training. This review identifies evidence of perceived levels of digital literacy amongst pharmacy staff and their related training experiences and future needs.

Objective

To explore the digital literacy training experiences and needs of pharmacy staff.

Review question

This review asks, *'What are the digital literacy training experiences and needs of pharmacy staff?'* to summarise the best available existing evidence of pharmacy staff perceptions and measures of:

1. their levels of digital literacy
2. the inclusion of digital literacy in their pharmacy training
3. their specific digital literacy training experiences, if accessed, and
4. their digital literacy training needs

Methods & Theory

As described in the pre-registered protocol (Appendix 6.1), this systematic review followed the guidance for healthcare reviews published by the Centre for Review and Dissemination (CRD) in seeking to, *'identify, evaluate and summarise the findings of all relevant individual studies'* and to, *'demonstrate where knowledge is lacking…to guide future research'*(Ackers et al 2009). The theoretical framework for analysis adopted was Kirkpatrick's 4 level model (reaction, learning, behaviour, results) for evaluating training programmes (Kirkpatrick 1996 & 2007). Kirkpatrick likens level 1 (reaction) to a, *'measure of customer satisfaction'* with level 2 (learning) a, *'measure of knowledge acquired, skills improved or attitudes changed due to training.'* Level 3 (behaviour) measures, *'the extent to which participants change their on-the-job behavior'* while level 4 (results) look for wider impact in more organisational terms. Although Kirkpatrick's model has been criticised for over-simplification and a lack of contextual consideration, its pre-eminence as a training evaluation tool has

been acknowledged over several decades (Bates 2004; Employment Security Department 2013).

Eligibility criteria

This review considered studies that related to any aspect of digital literacy or computer skills training for any member of pharmacy staff such as, but not limited to, pharmacists, graduate (pre-registration) pharmacists, pharmacy technicians, dispensing assistants and medicines counter assistants. All pharmacy settings were included, for example, community, primary care, hospital, prison. No geographical or date restrictions were applied.

Focus of interest

This review focused on the perceptions, experiences, availability and needs of pharmacy staff in relation to digital literacy training. The qualitative component of the review considered studies which explored these foci of interest through narratives of perceptions, experiences and self-reported need for digital literacy training amongst pharmacy staff. The quantitative component of the review considered studies which measured levels of digital literacy, whether against a benchmark or not, and also evaluated the need for and availability of related training for pharmacy staff.

Types of outcome

The main outcomes of interest were summarised in tables of findings (Tables 6.2 and 6.3). Subjective outcomes from qualitative components included perceptions, experiences, needs and levels of digital literacy training described or self-reported by pharmacy staff. Objective outcomes from quantitative components included evaluation of digital literacy based on testing or self-reporting of pharmacy staff and reviews of digital literacy training curricula.

Search Strategy

The search strategy aimed to find both published and unpublished studies. A three-step search strategy was utilised in this review. An initial limited search of MEDLINE and CINAHL was undertaken followed by analysis of the text words contained in the titles and abstracts, and of the index terms used to describe the article. A second search using all identified keywords and index terms was then

undertaken across all included databases (Figure 6.1). Thirdly, the reference list of all identified reports and articles was searched for additional studies. Only studies published in English language were considered for inclusion in this review. Titles of papers returned by the search were independently screened by two reviewers (KM, DS) followed by abstracts and, where necessary, full papers. The search string, database returns and exclusions are shown in an adapted PRISMA diagram (Figure 6.1).

Assessment of methodological quality

Qualitative and quantitative papers selected for critical appraisal were assessed by two reviewers (KM, DS) independently for methodological quality before inclusion in the review using a standardised critical appraisal tool adapted to suit all study types (Mays et al 2001).

Data extraction

Qualitative and quantitative data were extracted using a bespoke data extraction tool (Table 6.3). The data extraction was performed independently by two reviewers (KM, DS) before cross-checking to minimise errors and bias. The data extracted included details of the populations, interventions, comparators, outcomes and study methods for context relevant to the review question and objectives.

Data synthesis

Qualitative and quantitative findings were further explored in narrative through Kirkpatrick's 4 level model for evaluating training programmes, by focusing on evidence of reaction, learning, behaviour and results.

Results

Study selection

Systematic application of the search strategy returned 86 published papers which, after independent screening of titles, abstracts and, where necessary, full papers, was reduced to five (Figure 6.1 and Table 6.1). There were no studies featuring pharmacy staff other than pharmacists and no unpublished studies identified.

Critical appraisal & quality of evidence

Each of the five studies was independently reviewed for quality by two of the research team (KM, DS). Details of the clarity of the research question, appropriateness of the design, description of context, population, sampling, data collection and analysis along with results, limitations and conclusions are provided in Table 6.2. It also details reasons for exclusion of one study on quality grounds while four were taken forward for data extraction.

Table 6.1 The *'when, who and what'* of the five papers included prior to Critical Appraisal

Year	Authors	Title
2004	Balen R & Jewesson P	Pharmacist Computer Skills and Needs Assessment Survey (Balen & Jewesson 2004)
2005	Bearman M, Bessell T, Gogler J & McPhee W	Educating Australian pharmacist about the use of online information in community pharmacy practice (Bearman et al 2005)
2008	Fox B, Karcher R, Flynn A & Mitchell S	Pharmacy Informatics Syllabi in Doctor of Pharmacy Programs in the US (Fox et al 2008)
2004	Gosling A & Westbrook J	Allied Health Professionals' Use of Online Evidence: a survey of 790 staff working in the Australian public hospital system (Gosling & Westbrook 2004)
2010	Gour N & Srivastava D	Knowledge of Computer Among Healthcare Professionals of India: A Key Toward e-Health (Gour & Srivastava 2010)

Study characteristics

The Data Extraction table (Table 6.3) provides summarised study characteristics and contextual information. In brief, one of the studies was a survey conducted to establish baseline computer skills of hospital pharmacists in Canada prior to an educational intervention (Balen & Jewesson 2004). Another surveyed allied health professionals, including pharmacists, in Australia about their use of electronic evidence resources (Gosling & Westbrook 2004). A further Australian study, based on community pharmacists, combined pre-intervention focus groups with a post-educational intervention evaluative survey (Bearman et al 2005). The final study used mixed methods to review informatics content, including computer and digital literacy skills, in pharmacy education by mapping syllabi returned by Schools of Pharmacy against the ACPE Standards (Fox et al 2008).

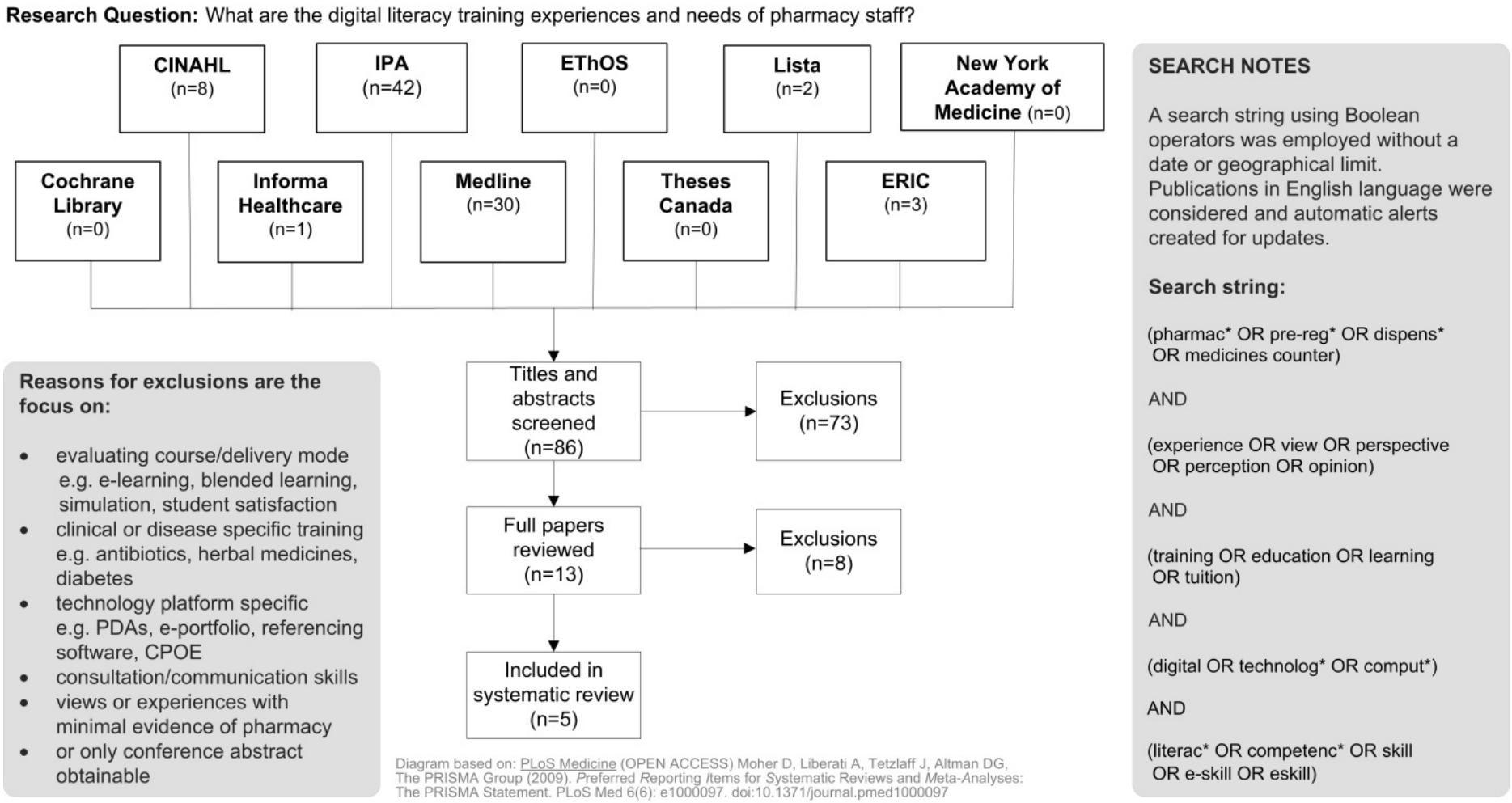

Figure 6.1 Adapted PRISMA flowchart showing search strategy and returns (Moher et al 2009)

Table 6.2 Critical Appraisal Tool adapted from Mays N, Roberts E, Popay J (2001)

Quality checklist for mixed methodology studies	**Balen & Jewesson (2004)**	**Bearman et al (2005)**	**Fox et al (2008)**	**Gosling & Westbrook (2004)**	**Gour & Srivastava (2010)**
Question **- clear, terms defined**	yes, to gain baseline data on pharmacists computer skills and training needs	yes, use of internet by community pharmacists in practice and potential for educational interventions	yes, to identify and analyse current pharmacy informatics education, current competencies, core recommendations for teaching informatics	yes, comparison of different groups of allied health professionals (AHPs) use of online evidence, training and computer skills	no, *'to enlighten the perspective of computer use among healthcare professionals and its implications'*
Design **- appropriate**	yes, survey of all pharmacists in one hospital	yes, in two phases: needs analysis focus groups; course evaluation	yes, pharmacy syllabus mapping of informatics programs against Accreditation Council for Pharmacy Education (ACPE) 2007 standards	yes, survey of AHPs with access to Clinical Information Access Program (CIAP)	mixed methods including cross sectional survey and semi-structured interviews
Context **- well described**	yes, post implementation of applied informatics program in a Canadian hospital	yes, Australian pharmacy education and practice	yes, adoption of American pharmacy education standards and Institute of Medicine inclusion of informatics as one of five core competencies	yes, introduction of online evidence system to hospitals in New South Wales, Australia	described adequately but with dated and contrived referencing
User system **- user of innovation**	hospital pharmacists	community pharmacists	pharmacy education	hospital based AHPs including pharmacists	healthcare professionals including pharmacists
Sampling **- conceptual, generalisation**	yes, all hospital pharmacists (n=106) at one hospital over two sites	not clear, both phases lack detail of recruitment/ sampling/ timing	yes, from all American Association of Colleges of Pharmacy (AACP) with pharmacy informatics programs	randomly selected hospitals representative of CIAP use (n=65); convenience sample of AHPs (n=790)	stratified sample (n=240) of 'all' healthcare professionals, identified as doctors, nurses, lab technicians, pharmacists at one hospital; 'no knowledge' of computer

Data collection **- systematic, auditable**	yes, survey instrument developed by author consensus after review of previously published surveys (84 items over 9 domains)	yes, independent facilitator, notes taken at each focus group by different scribes; course evaluation form (16 closed items; 3 open)	yes, clearly explained at each stage of the process of collection, verification for reliability and validation	yes, survey instrument developed from previous, related research findings plus US study of clinicians' use of Medline	confusion between survey and interview techniques, use of a form assessing 'knowledge of computer', overlapping scales; lacks detail of development of survey/ interview tools
Data analysis **- systematic, rigorous, conflict handling**	appropriate use of descriptive statistics and frequencies	themes not clear, qualitative data quantified, inappropriate inversion of scales; mean, SD applied to non-continuous scale	consensus reached following independent categorisation by each research team member	appropriate use of descriptive and comparative statistics	inappropriate analysis, over-analysis and over interpretation of a small, simple data set; overlap of at least two scales
Results & limitations	clear, concise with declared limitations around sample size, response rate (55%), survey instrument and self reporting	findings grounded in data but authors indicate major limitations: no baseline prior to intervention, 2 focus groups (not audio recorded), methods questioned, high drop out	findings are clearly explained and grounded in the data; limitations are explored in terms of response rate (36%), non-respondents, variable detail of syllabi and generalisability	clear and comprehensive with declared limitations of sampling recommending further validity and reliability testing	imprecise terms e.g. various, some; majority = 100%; assertions not grounded in data; parallels drawn to Nigeria and UK; speculation; major limitations but claims generalisable
Conclusions	appropriate for findings	appropriate for findings	appropriate for findings	appropriate for findings	additional findings presented in Conclusions; unjustified assertions given research context
Ethics	not covered	not covered	yes	not covered	yes, plus verbal consent
Additional comments	data collected in 2001; clearly developed and presented	data collected in 2002; specific to using the internet	data collected in 2007; clearly developed and presented	data collected in 2001-2002; clearly developed and presented	poorly developed, inconsistencies, poorly analysed/ referenced
Take forward to Data Extraction?	**Y**	**Y**	**Y**	**Y**	**N**

Table 6.3 Data Extraction of four papers reviewed

Author/Aspect	WHO	WHAT	WHY	WHERE		WHEN	HOW	Summary author conclusions
	Population	**Intervention**	**Aim**	**Geograph-ical setting**	**Practice setting**	**Timeline Back-ground**	**Study design, method**	**Storyline, Outcome**
Balen & Jewesson (2004)	hospital pharmacists	Prior to introduction of an applied informatics program	▪ To identify pharmacist baseline computer skill needs	Vancouver, Canada	1 multi-site hospital	Data collected in 2001	Survey (84 questions, 9 domains): 1.Computer experience 2.Computer anxiety 3.Computer vocabulary 4.Basic computer skills 5.Communications 6.Internet skills 7.Clinical database information retrieval 8.Access to computers 9.Anticipated needs 55% response rate (n=58)	Variety of: ▪ Access: home, work ▪ Skill levels: literate, not anxious, more training requested ▪ Use: internet searching, drug distribution systems, email, patient care systems, minimal office packages
Bearman et al (2005)	community pharmacists	Web skills education programme: introduction to the internet; finding online information; introduction to evidence based pharmacy and assessing the quality of information; using internet technologies in daily practice	Pre – ▪ to investigate internet use and education needs Post – ▪ to identify the benefits/ weaknesses of an education programme	Victoria, Australia	Community pharmacy education	Data collected in 2002	Pre: 2 focus groups (10 & 11 purposively selected) with independent facilitator, 2 hrs inc lunch and $50, scribe and whiteboards ▪ internet use in practice ▪ Thematic analysis Education intervention – ▪ 147 enrolled; 104 completed; 93 responded Post: Survey: 16 quantitative questions plus 3 likes, dislikes, 3 changes in practice ▪ 93 completed quantitative ▪ 107 free text answers ▪ inductive analysis of qualitative data	Focus group: ▪ ½ have access at work ▪ Email, search engines but not health specific ▪ Variation in: technical knowledge and skills ▪ Barriers: negative attitude, lack of time, costs, lack of familiarity/ expertise, difficulty finding information, resources ▪ Need to gain confidence, desire for education ▪ Survey: Course met expectations ▪ Average responses positive, ease of use, aims/ objectives met ▪ Significant online behaviour changes

Author/Aspect	WHO	WHAT	WHY	WHERE		WHEN	HOW	Summary author conclusions
	Population	**Intervention**	**Aim**	**Geographical setting**	**Practice setting**	**Timeline Background**	**Study design, method**	**Storyline, Outcome**
Fox et al (2008)	Contacts at Schools of Pharmacy	Defines pharmacy informatics	▪ To identify/ analyse current state ▪ to identify current competencies ▪ to develop core set of recommendations	USA	Pharmacy education	Data collected 2006; ACPE 2007 Guideline 12.1; 1 of 5 IoM core competencies; AMIA/ IMIA initiatives ASHP 2015 initiative	▪ Invitation letter followed by 2 reminder emails ▪ 32 out of 89 schools of pharmacy responded (response rate 36%) with 25 providing syllabi ▪ 4 'not being taught' ▪ 3 integrated in curriculum ▪ Syllabi reviewed against ACPE Standards 2007 ▪ Content used to develop foundational and core competencies	▪ Confusion between pharmacy informatics and drug information practice ▪ Much required to be compliant with ACPE 2007
Gosling & Westbrook (2004)	Allied health professionals	To identify awareness, use, perceived barriers to use and impact of point of care online information systems	▪ To provide baseline data for AHPs use of electronic evidence resources	Australia	Public hospital	Data collected 2001-2 1997 State policy Part of CIAP (clinical information access program) evaluation	Survey of: ▪ Quantitative study ▪ Convenience sample of 790 staff from 65 hospitals ▪ 7 professions (physiotherapists, occupational therapists, speech pathologists, dieticians, clinical psychologists, pharmacists, social workers) ▪ Pre-piloted, 25 closed questions ▪ SPSS for rates, frequency, Chi-square comparison by profession, t-tests	Concluded there was: ▪ A marked difference between professions (pharmacists highest; social workers lowest) ▪ 90% agreed potential to improve patient care ▪ Facilitators to use: computer skills and easy access ▪ Barriers to use: lack of specific training and time ▪ General computer skills training more effective than system specific training ▪ Social, organisational and professional support more important than system specific training

Pharmacy staff levels of digital literacy

In 2004, Balen and Jewesson (2004) stated there was not yet,

> *'a standard definition of computer literacy and valid dimensions of computer competency for pharmacy practice'*(Balen & Jewesson 2004)

Bearman et al (2005) found,

> *'there was little or no information regarding community pharmacists' skills and knowledge levels or how they currently employ internet technologies'*(Bearman et al 2005)

They also identified a, *'wide variety of technical knowledge and skills'*(Bearman et al 2005). Where access was available, participants most commonly used the internet at work for email and to search pharmacy-related topics, such as medicines or patient information, with a small proportion (n=4) contributing to a pharmacy message forum. They were, *'less familiar with local health-specific portals or websites.'* Lack of familiarity or expertise and difficulty finding relevant information online were noted issues.

Balen and Jewesson (2004) found pharmacists were likely to have both home and work access to computers (Balen & Jewesson 2004). Work use included information management, internet searching and email, drug distribution systems, patient care systems but minimal use of spread sheets, statistical or presentation software. They concluded hospital pharmacists were *'computer literate'* and *'not anxious'* about using IT.

Fox et al (2008) identified, *'confusion within the academy/profession between pharmacy informatics and drug information practice'* and low compliance at that time with ACPE Standards 2007 on pharmacy informatics competencies (Fox et al 2008). Three progressive levels of pharmacy informatics competency were detailed under headings of terminology, systematic approaches, benefits and constraints. Fox et al (2008) concluded that pharmacists, *'must utilize information technology and automation'* implying, but not specifying, levels of digital literacy.

In a convenience sample survey of allied health professionals (AHPs; n=790), Gosling and Westbrook (2004) found pharmacists (n=84) were the highest users

of an online evidence system (Gosling & Westbrook 2004). Two of 25 closed questions in their survey related to database searching and computer skills. Across all AHPs, nearly three quarters (74%) reported their computer skills as good, very good or excellent with pharmacists rated most able to find online information.

Digital literacy in pharmacy training

The study by Fox et al (2008) focused on searching pharmacy syllabi for elements of informatics training (Fox et al 2008). Listing several technologies in daily use by pharmacists, they cite Flynn (2005) in asserting, *'few pharmacy programs provide formal pharmacy informatics'*(Flynn 2005). However, they go on to elaborate on the role of the Institute of Medicine (IOM) who recognise, *'utilizing the tools and techniques of informatics,'* as a core competency for all clinical healthcare professionals. This is further evidenced by the initiatives around educational provision by the American (AMIA) and International Medical Informatics Associations (IMIA) whose recommendations were adopted by the American Society of Health-Systems Pharmacists (ASHP).

Balen and Jewesson (2004) noted, *'informatics is not a formal component of the core undergraduate or graduate programs'*(Balen & Jewesson 2004) at their local university, the University of British Columbia, and *'remains an uncommon component of most pharmacy and medical school curricula'* in North America. Bearman et al (2005) assert that, *'many [community pharmacists] have not been educated in internet use for professional practice'* in establishing a need for their, *'advanced web skills for pharmacists'* educational programme (Bearman et al 2005). Although Gosling and Westbrook (2004) found a, *'marked difference between professions use'* of an online evidence system, there is no clear evidence to relate this back to pharmacy or other AHP training (Gosling & Westbrook 2004).

Digital literacy training experiences

Balen and Jewesson (2004) found 79% of pharmacist who had responded to their survey, *'had received no formal computer training'*(Balen & Jewesson 2004). Following their educational intervention, Bearman et al (2005) received positive feedback from participants about improved searching skills and more effective searching while, *'almost half of the 93 respondents reported a change in*

practice'(Bearman et al 2005). While declaring informatics a new discipline for pharmacy, Fox et al (2008) emphasised the intricate link between IT and pharmacy informatics explaining, *'IT tools provide the infrastructure for information management and support pharmacy informatics'*(Fox et al 2008). In findings across all AHPs, Gosling and Westbrook (2004) identified social, organisational and professional support, along with general computer skills training, as important facilitators influencing use of technologies in pharmacy practice (Gosling & Westbrook 2004).

Digital literacy training needs

Each of the included studies indicates participants want or need more digital literacy related training. Balen and Jewesson (2004) found 77% (n=106) in need of, *'general computer skills upgrading,'* ranking medical database and internet search as priority areas (Balen & Jewesson 2004). Access to internet related education was viewed as a key area for community pharmacists by Bearman et al (2005), based on their course enrolment enquiries, while Gosling and Westbrook (2004) found,

> *'general training aimed at improving computer skills more important…than specific system-based training'*(Gosling & Westbrook 2004)

Finally, Fox et al (2008) recommend a set of foundational competencies, *'based on themes extracted from course syllabi and from personal experience'* and encouraged pharmacy educators to *'look to informatics in other disciplines, such as medicine and nursing, for guidance'*(Fox et al 2008).

In terms of Kirkpatrick's model, the pre-training survey of computer skills conducted by Balen and Jewesson (2004) evidenced elements of baseline evaluation recognised as a preliminary activity for level 2 (learning) (Kirkpatrick 2007; Balen & Jewesson 2004). Similarly, Gosling and Westbrook (2004) conducted a survey which included measures of baseline skills (level 2: learning) (Gosling & Westbrook 2004). Although computer skills were shown to be associated with the use of technology by pharmacists (level 3: behaviour), it is not clear from the findings presented whether pharmacists were included in the AHPs who received training. Bearman et al (2005) report pharmacists, *'were highly positive about the learning experience'* (level 1: reaction) with the,

'flexible delivery of the course' and online resource identification attracting most comments (Bearman et al 2005). Findings also reported, *'specific changes in practice'* (level 3: behaviour) around *'use of new websites, more effective searching, a change to regular use of specific resources.'* The emphasis in the article by Fox et al (2008) was on syllabus content: which informatics skills (level 2: learning) are taught by whom and where in pharmacy education (Fox et al 2008). Their conclusions and recommendations aspire to levels 3 (behaviour) and 4 (results) in urging pharmacy programmes,

> *'to prepare future pharmacists to approach their professional practice as drug safety experts and medication knowledge-workers who must utilize information technology and automation in order to create a safer, more effective medication-use system'*(Fox et al 2008)

Discussion

Ehealth strategies and global reports recommend collaborative working underpinned by technology for safer, more efficient and effective patient care. The evolving role of pharmacy within the healthcare team is increasingly reliant on a range of ehealth technologies and digital literacy. This review set out to summarise the best available existing evidence of pharmacy staff perceptions and measures of their levels of digital literacy, the inclusion of digital literacy in their pharmacy training, specific digital literacy training experiences, and their digital literacy training needs. While limited digital literacy research was identified in relation to pharmacists, no studies were found in relation to pharmacy staff other than pharmacists.

The findings in relation to pharmacists' levels of digital literacy were limited and inconclusive. While pharmacists were described as *'computer literate'* with self-reported computer skills ranging from *'good to excellent'* there remained a lack of determination and application of measures of digital literacy. The need for better identification of citizen and workforce skills for the digital age is a matter of increasing focus worldwide but, as this review shows, there is little evidence of its impact on pharmacy education or pharmacy practice.

Evidence around inclusion of digital literacy in pharmacy training was clearer, albeit absent for pharmacy staff other than pharmacists. Three of the four studies found little or no evidence of digital literacy training in pharmacy

programmes. While pharmacy programmes in America demonstrated a lack of compliance with the ACPE standards 2007, for the inclusion of informatics in pharmacist training, there was even less evidence of digital literacies in pharmacy programmes outside the US. While digital literacy is acknowledged as an important life long skill needed to *'make use of and contribute to modern social, political and economic life'*(BCS 2013), that is not readily evidenced in initial pharmacy staff training or continuing professional development.

The limited evidence found of digital literacy training experience was positive. Improved search skills and general computer skills, with social, organisational and professional support, were shown to facilitate the use of technologies in pharmacy. Yet, the majority of pharmacy staff had received no digital literacy training. The US leads the way in viewing digital literacy in pharmacy as a pathway to engaging the community in health literacy with the potential to improve social welfare, inclusion and individual health and well being.

All studies indicated that pharmacists want or need more digital literacy training but their recommendations lack baseline data and are not current, quantifiable, measurable or specific. A key finding of this review is the lack of digital literacy research amongst not only pharmacists but all pharmacy staff as pharmacy technicians, dispensing assistants and medicines counter assistants all use technology in daily pharmacy practice. The core competencies recommended for pharmacy informatics are founded on digital literacy so may offer a starting point for further research which should be broadened to include all pharmacy staff.

Kirkpatrick's 4 level model held the potential as an analytical framework to evaluate reaction, learning, behaviour and organisational results but was of limited use given the paucity and heterogeneity of the studies.

In launching the US 2012 Digital Government Strategy, President Obama said,

> *'I want us to ask ourselves every day, how are we using technology to make a real difference in people's lives'*(US Government 2012)

As the role of pharmacy in healthcare continues to expand there are calls for enhanced workforce skills, most recently from the UK Academy of Medical Royal Colleges (AMRC) who emphasise the need for,

> *'enhanced informatics skills in healthcare professionals so that the significant benefits that technology can enable are realised'*(AMRC 2013).

Strengths and weaknesses

It is a strength of this review that it demonstrates the lack of research conducted around digital literacy of pharmacy staff but it is also its main weakness. With so few studies on which to base the review, findings must be treated with caution. It would not be appropriate to conduct meta-analysis or synthesis based on so little evidence. Although not a weakness of this review, the survey or evaluation based studies used self-reporting which is recognised for its inherent bias. Best practise for systematic reviews was applied throughout including registration of the review protocol to promote transparency and reproducibility of process. Independent study selection, critical appraisal and data extraction were applied to reduce potential for reviewer bias.

Conclusion

In conclusion, although pharmacy staff are reliant on IT in their daily practice, there is a lack of evidence of their specific and measurable digital literacy levels, training experience and needs. As a society we acknowledge that technology is an important part of everyday life, impacting on the efficiency and effectiveness of working practices but, in pharmacy, do we take cognisance,

> *'that technology can change the nature of work faster than people can change their skills'*(New Zealand Ministry of Education 2010)

It seems pharmacy has embraced technology without recognised occupational standards, definition of baseline skills or related personal development plans. This review recommends future research should be focused on establishing what digital literacy training is needed and how it should be designed, delivered and evaluated for all pharmacy staff at all levels and career stages.

Key findings

- Evidence of current levels of digital literacy amongst pharmacy staff is not readily available
- There is limited evidence of inclusion of digital literacy in curricula for initial pharmacist training with none identified for other pharmacy staff
- Pharmacy staff training experiences and needs around digital literacy remains under-researched.

Summary of this chapter

This chapter set out to explore the digital literacy training experiences and needs of pharmacy staff, following on from the explanatory theory developed in Chapter 5, using a systematic review. Adopting Kirkpatrick's four level model of training evaluation as an analytical framework, the review found a lack of evidence of specific, measurable digital literacy levels, training experiences and needs. The review recommended that digital literacy should be formally recognised and incorporated in pharmacy training for all staff at all levels and all career stages.

CHAPTER 7 – Discussion and Conclusions

'Whenever a theory appears to you the only possible one, take this as a sign that you have neither understood the theory nor the problem which it was intended to solve'

Karl Popper, philosopher
(1902-1994)

Introduction to the chapter

This final chapter pulls the threads of the story together before concluding with a statement on the novel research contributions. It reviews the key findings in terms of the research design, quality of evidence and strengths and limitations of the methods and theories applied. Relevance to ehealth policy, pharmacy practice and education in Scotland are examined in terms of pathways to impact and plans for future research.

Review of the thesis

Aim and motivation

From the outset, the aim of this research was to explore ehealth and digital literacy in pharmacy practice in order to gain evidence which would contribute original research findings to areas of ehealth, pharmacy practice and pharmacy education. The policy driven adoption of ehealth was prompted by technological advances and ever increasing societal demands on the providers of healthcare (WHO 2011b & 2011c & 2012). Ehealth has been promoted worldwide to support process automation, communication and collaboration between healthcare practitioners as they experience changing roles and levels of responsibility (Greenhalgh et al 2005; WHO 2006; Liddell et al 2008; Legare et al 2010; European Commission 2011; OECD 2012; White et al 2013; Scottish Government 2013b & 2013d & 2013e). As these changes have implications for pharmacy practice, it is important that we understand how pharmacy staff use, and learn to use, ehealth technologies and the associated facilitators and barriers.

Research context

The early part of the thesis contextualised healthcare in Scotland and the developing ehealth supported role of pharmacy (RPS & RCGP 2011; RGCP 2011; RPS 2011; Scottish Government 2011a; Scottish Government 2009a & 2011c & 2013e). International policy and strategy documents from non-governmental agencies, such as the World Health Organisation and UNESCO (2011), and European and Scottish Government were explored along with initiatives to promote digital literacy amongst the healthcare workforce (BCS 2011; Skills for Health 2012; NHS KSF 2012; NHS Elite 2013; Scottish Government 2013d).

Research paradigm

The researcher and research design sit comfortably within the pragmatist paradigm. The relative advantages of associated methodologies and methods were explored in Chapter 2 to inform the research design of the four phases of research which followed. Factors to promote the quality of evidence and philosophy of ethical research were explored and are revisited later in this chapter.

Phase I

The first phase of the research was conducted to contextualise, inform and focus the design of the subsequent three phases. A meta-narrative systematic review of healthcare practitioners' views of ehealth and shared care found limited evidence in this area of research with pharmacy, in particular, under-represented. The papers reviewed were from three distinct research themes (telemedicine; EHR; generalised ehealth implementations) and demonstrated a broad range of methodological approaches. The terms used in the reviewed papers provided synonyms for later phases of this research study but also confirmed the current plans were appropriate to answer the overarching aim of this study. Key findings around organisational, social and technical factors were not unexpected when considered in terms of Rogers' theories of diffusion of innovation and adoption criteria (Rogers 1995) and outcomes of technology implementation in other health service organisational contexts (Greenhalgh et al 2004a). Work in this area led by Greenhalgh et al (2005) provided the seminal text for this study. Most importantly, the researcher gained experience in how to conduct a systematic review, insight into the research field and established the under-representation of pharmacy and pharmacists in ehealth research.

Phase II

Around the time of the second phase of the research, there was a noticeable shift in terminology of policy documents and strategy statements. The RPS and RCGP joint statement (RPS & RCGP 2011) was followed by moves toward what was termed 'integration' of health and social care (WHO 2012; Scottish Government 2013b; Naylor et al 2013; Wilson & Barber 2013). Therefore, a systematic review of healthcare practitioners' perceptions of ehealth in relation to integrated care was conducted using the analytical framework of socio-technical systems (STS)

theory combined with the computer supported cooperative working framework (CSCW). The review was designed to gain insight into the organisational, social and technical issues identified in phase one of the research. Different papers, but still limited in number, were identified for review, again focused on doctors and nurses, and lacking any views from the pharmacy profession. The international diversity of the papers, and breadth of technologies, extended and built on the findings of the previous review. Applying socio-technical systems theory as an analytical framework was useful in separating technical subsystems, of task and technology, from the social subsystems, of organisation and people. More detailed feedback was gained on the issues and their impact on practice. The CSCW framework added useful, thematic insight into communication, collaboration and coordination. CSCW and STS applied together proved to be a pragmatic analytical framework covering all elements of policy driven moves toward integrated health and social care and the inherent changes to ehealth supported working practices. Findings indicate healthcare practitioners do not perceive any ehealth application to be an unqualified success in supporting integrated care. The socio-technical gap described by Ackerman (2000) as, '*the divide between what we know we must support socially and what we can support technically*,' was clearly evident. In addition to confirming the dearth of pharmacy-based ehealth research, useful practical research design techniques were noted of what worked, in what context. When considered with findings from phase one, and the philosophy and methodology options identified as appropriate in Chapter 2, case studies using multiple methods were indicated as most likely to be productive in conducting pharmacy-based, primary research in phase three.

Phase III

Phase three of the research was presented in three elements and formed the bulk of the data collection and analysis behind this thesis. This was the most productive phase in terms of both personal insight and gathering a wealth of rich, descriptive, indepth, empirically-based data on how pharmacy staff use, and learn to use, ehealth technology. Where the systematic reviews had been a useful exploration of how ehealth was viewed by doctors and nurses in relation to shared and integrated care, the findings were limited in terms of both the technical and social aspects: pharmacy tasks, pharmacy technologies, pharmacy

staff and pharmacy as an organisation, were not included in any of the papers reviewed. A document review in element one of recent, relevant pharmacy technology policy and strategy refined the broad, global ehealth-based reviews of phases one and two down to the focus on pharmacy in Scotland. A conceptual model, derived through thematic analysis of the documents reviewed (Scottish Government 2011a; RPS 2011; Wilson & Barber 2013; Scottish Government 2013e), showed the clear, policy driven intention for technology supported health and social care integration. Documents reviewed indicated that pharmacy staff would be supported through education and training to take on more skilled roles and responsibilities in a computer supported cooperative working environment reliant on the communication, collaboration and coordination, described in phase two. The documents reviewed emphasised that these technical and social changes would require a digitally literate workforce, each competent and confident in using a broad range of technologies. In element two, the researcher was welcomed into 19 pharmacies across the NHS Grampian area for observational and interview activity with 94 staff from all roles, age bands and with varying lengths of pharmacy experience. Theoretical sampling had facilitated access to a breadth of pharmacy type, setting, level of technology and pharmacy management system implementation which were found, on analysis of postcode, to cover a broad range on the SIMD ranking. Framework analysis of transcribed data from observations and interviews formed the basis for a real world model of technology use in pharmacy. Findings from the final element of phase three, in which conceptual and real world models were compared and explored, using aspects of education and change management theories, provided the basis for explanatory theory. There is great disparity between conceptual and real world models in both the technical and social sub-systems with the potential for social factors to act as restraining factors against the policy-led driving forces. In returning to Grudin's law, which came to the fore in Chapter 4,

> '*when those who benefit are not those who do the work, the system is doomed to fail'* given the '*beneficiaries are elsewhere in the healthcare system'*(Eason & Waterson 2013)

Phase IV

Phase four broadened the geographical scope of the research but kept the focus on the digital literacy education and training aspects found to be so important in the policy drive for pharmacy practice development in phase three. A systematic review was conducted as an initial testing of the explanatory theory from case studies in phase three to contextualise the findings from the NHS Grampian area of Scotland in terms of pharmacy education worldwide. This review identified a third area in which there is a paucity of pharmacy research with indeed no evidence of research into pharmacy staff other than pharmacists. The lack of literature defining baseline skills or related personal development plans of pharmacy staff limited the potential of the review to test the explanatory theory. It also limited the value of applying Kirkpatrick's four level model for evaluating reaction, learning, behaviour and organisational results, the social factors. However, findings from the review were useful in identifying movement towards inclusion of pharmacy informatics in US pharmacy curricula with indications to look to informatics in other health disciplines, such as medicine and nursing where it has long been established.

Quality of evidence

The principles of ethical conduct in research (Shamoo & Resnick 2009; Table 2.11) were inculcated throughout this research study. Every attempt was made in the design and conduct of this research to minimise the potential for bias and error, as identified in Chapter 2 (Table 2.6). Controls applied to guard against the most pertinent examples are shown in Table 7.1.

Systematic reviews

Best practice for promoting quality of evidence from systematic reviews was discussed in Chapter 2 with further detail of application and adherence in each of Chapters 3, 4 and 6. Strengths and limitations were included in each chapter but further to these it should be borne in mind that these reviews were conducted by a doctoral student undergoing a professional training supported by a small supervisory team. Although search terms were tried and tested, further studies may have been identified if optimised search techniques had been applied. However, published protocols for systematic reviews are appended (Appendix 4.1 & 6.1) and external outputs (page v) have been subjected to peer review with

several accepted as conference abstracts and one, to date, as a journal publication with further papers under review or in draft. Triangulation of methods was achieved through combining systematic reviews with extensive case studies which in themselves involved multiple methods.

Table 7.1 Controls against examples of the most pertinent bias and error to this research

Type of bias or error	Description
Acquiescence response set	*Interviews were brief, focused and timed for the participant's convenience with the researcher available throughout the day.*
Design bias	*Best practice was followed and endorsed by an experienced supervisory team. Review of prior research was useful in exploring pragmatic methods and a pilot was conducted at the start of the case study phase. Triangulation was employed which would have highlighted design issues.*
Evaluation apprehension	*The researcher's approach was friendly and non-judgemental making her lack of pharmacy practice experience and interest in how people interact with technology clear.*
Interviewer bias	*The researcher declared her non-pharmacy background from the start. Open and probing questions were used throughout.*
Observer bias	*It was difficult to counter questions of Hawthorne Effect but best practice was followed (Table 2.17) and participants put at their ease in their own work environment.*
Reactive effects	*As above.*
Recall (memory) bias	*There was no pressure to remember events and the researcher was available throughout the day for recall.*
Reporting bias	*This is always possible but less likely where the above best practice has been applied and pharmacy colleagues are chatting with the researcher as a group in the workplace.*
Sampling bias	*Theoretical sampling was applied to improve potential for transferability of findings where context are similar.*

Case studies

Quality of evidence in case studies was covered generically in Chapter 2 with specifics of application covered in Chapter 5. For Lincoln and Guba (1986), quality of evidence in case studies related to achieving:

- credibility (truth value)
- transferability (applicability)
- dependability (consistency)
- confirmability (neutrality)

The researcher has been detailed in her description and recording of events, offering reflective observations and considered reflexivity throughout. All findings

were grounded in and inducted from the data gathered in each of the 19 pharmacies from 94 participants. Each had the opportunity for member checking of the sketches and notes but few took the opportunity. Participating teams have received a summary report and abstracts have been made publicly available. Generalisability, applicability and transferability were considered at length in Chapter 2. While some argue sample size is irrelevant in case studies, the extent and rigour of this research together with the external and expert advisors consulted on recruitment for theoretical sampling lend weight to any claim for transferability where there are sufficient similarities in context. This is a detailed treatise of a lengthy programme of research but its consistency is best judged by others with a fresh, independent eye. The reflexivity of the researcher has been covered throughout, initially in the confessional form of '*I'm not a pharmacist!*' which, in light of the research experience, is now prefixed by '*thank goodness*' as my appreciation of the role they and the pharmacy team play gathered pace.
In their extensive quality research framework, Spencer et al (2003) offered four guiding principles for assessing qualitative research evidence (Table 2.7). Each is now considered in light of the current research study (Table 7.2). Tests of reliability and validity are less relevant for this research which has not involved a survey instrument or scales.

Table 7.2 Application of Spencer et al's (2003) guiding principles for assessing qualitative research evidence

Four Guiding Principles	Description
Contributory	*Evidence of novel findings have been listed for each phase of research.*
Defensible in design	*Research design was based on a pragmatic research approach, best practice and a systematic review to establish what worked for whom in what context leading to further systematic reviews and case studies with multiple methods for triangulation of findings.*
Rigorous in conduct	*The conduct of this research programme has been recorded throughout this thesis in sufficient detail to be reproducible with the notable exception of the researcher's own individuality.*
Credible in claim	*The findings from each phase follow from application of a rigorous and detailed research design. Each finding is presented in measured terms in the context of policy and practice to contextualise and describe potential impact.*

Document review

The important issues raised in Chapter 2 for document review of '*availability, accessibility, authenticity*' have been seen to be addressed in Chapter 5.

Observational and interview activity

Merriam's checklist for observations (Table 2.16) and Ritchie et al's (2014) stages of the interview (Table 2.17) were consistently applied and evidenced in Chapter 5. The enduring importance of the transcription process, as described by Oliver et al (2005), was also discussed in context in Chapter 5.

Thematic and Framework analysis

The five key steps (Table 2.18) outlined by Ritchie et al (2014) were adhered to taking note of the key issues offered by Silverman (2013) in Chapter 2. Every attempt was made to demonstrate avoidance of the limitations described by Gale et al, also detailed in Chapter 2.

Key findings

Key findings from this extensive and timely research study indicate:

- pharmacy is under-researched in the areas of ehealth, shared and integrated care, and digital literacy
- socio-technical issues are evident across findings from all phases of the research
- no ehealth application is perceived by practitioners to be an unqualified success in supporting integrated care
- pharmacy staff in the NHS Grampian area self-report their own digital literacy level as basic
- there is minimal evidence of formal IT training in pharmacy education
- there is a lack of evidence of specific, measurable digital literacy levels, training experiences and needs
- digital literacy training should be formally recognised and incorporated in pharmacy training for all staff at all levels and career stages

Policy implications & relevance to practice

A timely set of recent publications from the Scottish Government lends weight to the relevance and significance of this research. The relevance of the findings to areas of ehealth research, pharmacy practice and pharmacy education have been detailed and discussed throughout the thesis. Policies for the '*2020 Vision'*, both

for health and the workforce, and the '*Prescription for Excellence'* (Scottish Government 2013a & 2013b & 2013d & 2013e) hold implications for the interpretation and application of the findings from this research. Findings also demonstrate relevance to practice in Scotland throughout but may only be transferable where contexts are similar. While relevance to pharmacy practice and education is clear, strategic action on socio-technical issues to facilitate policy implementation is required at a higher level. It is worth returning to the nested diagram of factors influencing pharmacy practice (and the research direction, Figure 1.7) and comparing it to the more detailed influences of adoption of ehealth technology in pharmacy (Figure 5.21) based on findings from Chapter 5 and asking, as Lewin (1947) did in his Force Field theory, how can we,

> '*change the strength of opposing forces'*?

bearing in mind the question raised in Chapter 6, do we take cognisance,

> *'that technology can change the nature of work faster than people can change their skills'*(New Zealand Ministry of Education 2010)

Future work

Research is already underway exploring digital literacy training experiences and needs amongst students and academic staff across the Faculty of Health and Social Care at Robert Gordon University in Aberdeen. Additional planned research questions and associated methods in this programme of research include:

- What do key pharmacy stakeholders in Scotland perceive to be the facilitators and barriers to the implementation of ehealth policy in pharmacy?
    - face-to-face or telephone interviews with key pharmacy representatives from Scottish Government, NHS agencies and local health boards, Scottish Pharmacy Board, General Pharmaceutical Council, Royal Pharmaceutical Society and Community Pharmacy Scotland

- What digital literacy education and training should be included in programmes for the initial and follow up (CPD) training of each member of pharmacy staff?
    - systematic review and mapping of tools for digital literacy skills in healthcare
    - development of a digital literacy tool using a Delphi approach and expert academic, professional and student panel

- One year on (and annually for a longitudinal study), what has changed in how pharmacy staff use, and learn to use technology, in pharmacy practice?
    - follow up face-to-face interviews and observation, tracking '*2020 Vision'* policy implementation

- What types of query are raised and with what frequency is support from the ePharmacy team called for by community pharmacy?
    - mixed methods quantitative database analysis and qualitative observations and interviews, or data logs with follow up calls, at PSD and in community pharmacies

Conclusion

It has to be said again, '*I'm not a pharmacist'* but I have relished the privilege and challenge afforded to me, as a naïve researcher in the area, to follow my curiosity and ask questions about the affect of technology on staff and processes in pharmacy practice. This programme of study has been timely, if not for tracking CMS as originally planned, then for policy and strategy changes which directly affect the future of technology supported pharmacy practice in Scotland:

- closer working between pharmacists and GPs (RPS & RCGP 2011)
- integration of health and social care (Scottish Government 2013b)
- McClelland report into ICT infrastructure (2011) followed by EPSRC (2013)
- '2020 Vision: Route Map' (Scottish Government 2013a)
- '2020 Workforce Vision' (Scottish Government 2013d)
- Wilson & Barber report (2013)
- 'Prescription for Excellence' (2013e)

Looking outside Scotland, ehealth and e-citizen plans across Europe are gathering pace (European Commission 2011 & 2012). Further afield, pharmacist education accreditation in the US has recognised pharmacy informatics since 2007 with draft plans for the next iteration currently out for consultation (ACPE 2007 & 2014). There are also indications of a shift in focus from digital literacy in pharmacy toward technology in pharmacy facilitating citizen's health literacy (AHRQ 2007). Back in Scotland, under more recent policy calls for a digitally literate pharmacy workforce, would this be considered another area in which the pharmacist will,

> *'take responsibility for all work you do or are responsible for. Make sure that you delegate tasks only to people who are trained to do them, or who are being trained'*(GPhC 2011a)'?

As a participant in the case studies shrugged and observed,

> '*all the responsibility is on the pharmacist'*(P12)

The research presented throughout this thesis demonstrates the pathways to impact identified by the Research Councils UK (2013) from:

- academic impacts (*health of academic disciplines; training highly skilled researchers; improving teaching and learning*)

to,

- economic and societal impacts (*changing organisation culture and practices; enhancing the research capacity, knowledge and skills of public, private and third sector organisations; improving health and well-being; improving social welfare, social cohesion; enhancing the effectiveness and sustainability of organisations including public services and businesses*)

This thesis describes my pharmacy practice based doctoral research, conducted part time over four years and two weeks, from the perspective of my computing

and information technology comfort zone. My original contributions to knowledge here re-stated are:

Phase I

- Evidence of medical and non-medical practitioners' views of the impact of ehealth on shared care remains limited, with pharmacists particularly under-represented in ehealth research
- Organisational development and training for core and optional ehealth services remains key in keeping people at the heart of integrated ehealth strategies across the UK

Phase II

- Healthcare practitioners do not perceive any ehealth application to be an unqualified success in supporting integrated care
- Ehealth research continues to focus on doctors and nurses despite the multi-disciplinary nature of increasingly integrated health and social care
- The social-technical gap is still evident within ehealth supported integrated care

Phase III

- Pharmacy staff in the NHS Grampian area perceive their own digital literacy to be at a basic level
- With few exceptions, pharmacy staff in the NHS Grampian area, work with minimum levels of technology and are trained to use those technologies informally by the pharmacist
- Organisational and social factors may act as restraining forces against technology in pharmacy and digital literacy training

Phase IV

- Although pharmacy staff are reliant on IT in their daily practice, there is a lack of evidence of their specific and measurable digital literacy levels, training experience and needs
- Digital literacy training should be formally recognised and incorporated in pharmacy training for all staff at all levels and all career stages

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APPENDICES

Appendix 4.1 - Systematic Review Protocol

PROSPERO International prospective register of systematic reviews

Exploring practitioners' perceptions of ehealth in relation to integrated care

Katie MacLure, Derek Stewart, Alison Strath

Citation

Katie MacLure, Derek Stewart, Alison Strath. Exploring practitioners' perceptions of ehealth in relation to integrated care. PROSPERO 2013:CRD42013003844 Available from http://www.crd.york.ac.uk/PROSPERO_REBRANDING/display_record.asp?ID=CRD42013003844

Review question(s)

Research Question: What ehealth technologies do healthcare practitioners perceive to have worked and how in promoting integrated care?

Objectives:

• To establish a narrative of the history and key researchers involved in ehealth integrated care research.

• To evaluate the appropriateness of the methodologies adopted to inform the approach in future research.

• To summarise key research findings.

• To demonstrate gaps in knowledge and direct future research.

Searches

Articles for review will be selected from a broad range of sources including electronic databases*, hand searching, snowballing from references, etc. Readily accessible peer reviewed, full articles, conference proceedings and grey literature which is published in English, will be included dating from 1st January 2005 onwards. *Electronic databases (ASLIB; EBSCO Host including AMED, Business Source Premier, CINAHL, International Pharmaceutical Abstracts, LISTA, MEDLINE; Cochrane Library (including DARE and EPOC); Informa healthcare; PsycNet; Scirus Scopus; Zetoc).

Types of study to be included

There are no restrictions on the types of study design eligible for inclusion.

Condition or domain being studied

There is an expectation that ehealth will help mitigate the increasing demands on healthcare by facilitating integrated care. As non-medical practitioners take on a greater role in the healthcare team through the award of prescribing rights and other key changes in roles and responsibilities, and the reliance on ehealth grows, we need to understand the views and experiences of the whole multidisciplinary team. This systematic review is a multi-perspective exploration of health practitioners' perceptions of ehealth in relation to integrated care.

Participants/ population

Inclusion: healthcare practitioners in all settings.

Exclusion: healthcare management and support staff.

Intervention(s), exposure(s)

Inclusion: the adoption of ehealth as a facilitator to integrated care.

Exclusion: general use of information technology, for example, internet searches or email exchange, as these are not ehealth specific.

Comparator(s)/ control

A comparator is not appropriate for this review.

Context

Global healthcare needs are changing. Healthcare practitioners are challenged to meet that need efficiently by changing their approach to providing safe, effective care. Demographic trends in the developed world indicate ageing populations who expect to live well, independently and for longer, supported by local healthcare. Providing healthcare for increasing numbers of people with obesity or long term conditions, such as cardiovascular disease, cancer and chronic obstructive pulmonary disease, places an additional burden on healthcare services which are already financially constrained. Health strategists worldwide believe technology has a role to play in enabling healthcare practitioners to work together in providing ehealth supported integrated care.

Outcome(s)

Primary outcomes

Primary outcomes from the review will describe:

• ehealth integrated care research conducted to date

• why, how, when and where that research was conducted
• the methodological quality of that research
• the key findings from healthcare practitioners' perceptions of ehealth in relation to integrated care

Secondary outcomes

None.

Data extraction, (selection and coding)

Titles will be independently screened by two reviewers (KM, DS) with abstracts followed by full articles reviewed where any doubt remains. Consensus on final inclusions will be negotiated with the third reviewer (AS). Inclusions and exclusions will be recorded following the PRISMA guidelines. A data extraction tool has been designed to capture: actors/population (Who), elements/intervention (What), aim of study (Why), geographical and practice setting (Where), timeline/background (When), study design/method (How) tracking definitions of ehealth and providing a storyline/outcome (summary of findings).

Risk of bias (quality) assessment

Critical appraisal checklists appropriate to each study design type have been identified and will be applied independently by two of the review team. The GRADE (Grading of Recommendations, Assessments, Developments and Evaluation) system will be applied independently by two review team members. The 'quality of evidence' will be based initially on the study design but adjusted for rigour of application to a rating of 'high', 'moderate', 'low' or 'very low'. A further rating, termed 'magnitude of effect,' will be added based on applicability of the review article findings to the current research. Any bias or quality issues identified in studies will be taken into account prior to synthesis.

Strategy for data synthesis

Synthesis will take the form of a composite narrative to explain the commonalities and differences identified in the included studies.

Analysis of subgroups or subsets

If appropriate, different healthcare professions, geographical and practice settings may be explored.

Dissemination plans

In addition to informing the next phase of research, the findings will form the basis for a doctoral thesis, submission to a peer reviewed journal and conference.

Contact details for further information

Katie MacLure
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k.m.maclure@rgu.ac.uk

Organisational affiliation of the review

Robert Gordon University www.rgu.ac.uk

Review team

Mrs Katie MacLure, Robert Gordon University
Professor Derek Stewart, Robert Gordon University
Professor Alison Strath, Robert Gordon University

Anticipated or actual start date

18 February 2013

Anticipated completion date

29 March 2013

Funding sources/sponsors

NHS Education for Scotland

Conflicts of interest

None known

Language

English

Country

Scotland

Subject index terms status

Subject indexing assigned by CRD

Subject index terms

Attitude of Health Personnel; Delivery of Health Care, Integrated; Humans; Telemedicine

Date of registration in PROSPERO
12 February 2013
Date of publication of this revision
22 August 2013
Stage of review at time of this submission Started Completed
Preliminary searches Yes Yes
Piloting of the study selection process Yes Yes
Formal screening of search results against eligibility criteria Yes Yes
Data extraction Yes Yes
Risk of bias (quality) assessment Yes Yes
Data analysis Yes Yes
PROSPERO
International prospective register of systematic reviews
The information in this record has been provided by the named contact for this review. CRD has accepted this information in good faith and registered the review in PROSPERO. CRD bears no responsibility or liability for the content of this registration record, any associated files or external websites.

Appendix 5.1 – Participant Information Sheet

ROBERT GORDON UNIVERSITY·ABERDEEN

RESEARCH TEAM
Katie MacLure
Derek Stewart
Alison Strath

Pharmacy services in Grampian: a case study in digital literacy

Hello from the research team -

You are being invited to take part in a research study. It is important that you understand why the research is being done and what it will involve. Thank you for taking the time to read the following information carefully. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

What is the purpose of the study? The aim of the study is to explore the information technology education and training needs of current and prospective pharmacy staff in Grampian.

Why has my pharmacy been chosen? The case study will be conducted in a range of settings: urban/rural, small independent/large multiple, community, hospital, high/low technology. Your pharmacy has been selected to represent part of that demographic range.

Do I have to take part? No. Participation in the study is voluntary and your decision to participate will not influence your relationships at work, with Robert Gordon University or the research team.

What will happen to me if I take part? To take part in the study, we ask that you complete a consent form permitting the researcher to observe how you use technology at work and to ask about your views and experiences of information technology training. It is anticipated that the researcher will be in your pharmacy for one day.

What are the possible benefits of taking part? We cannot guarantee any direct benefit to you from participation in this study, however, it is hoped that findings from this study will inform curriculum development.

Will my taking part in this study be kept confidential? There will be no personally identifiable information reported from the study, however, members of the public may be aware that the research is taking place.

Will over the counter discussions and customer information be kept confidential? Yes. The research focus is on how information technology is used in pharmacy. No customer or patient information, consultations or staff conversations will be noted or recorded. There will be no personally identifiable information reported from the study.

What will happen to the results of the research study? The main findings of the study will contribute to a doctoral thesis and may be published in a health care journal and presented at a conference. You may request a copy of the publication or report by emailing Katie MacLure on **k.m.maclure@rgu.ac.uk**.

Who is organising and funding the research? This project is organised and funded under the supervision of Robert Gordon University.

Who has reviewed the study? This study has been approved by the Ethical Review Panel of the School of Pharmacy & Life Sciences at Robert Gordon University and deemed service evaluation by NHS Grampian R&D.

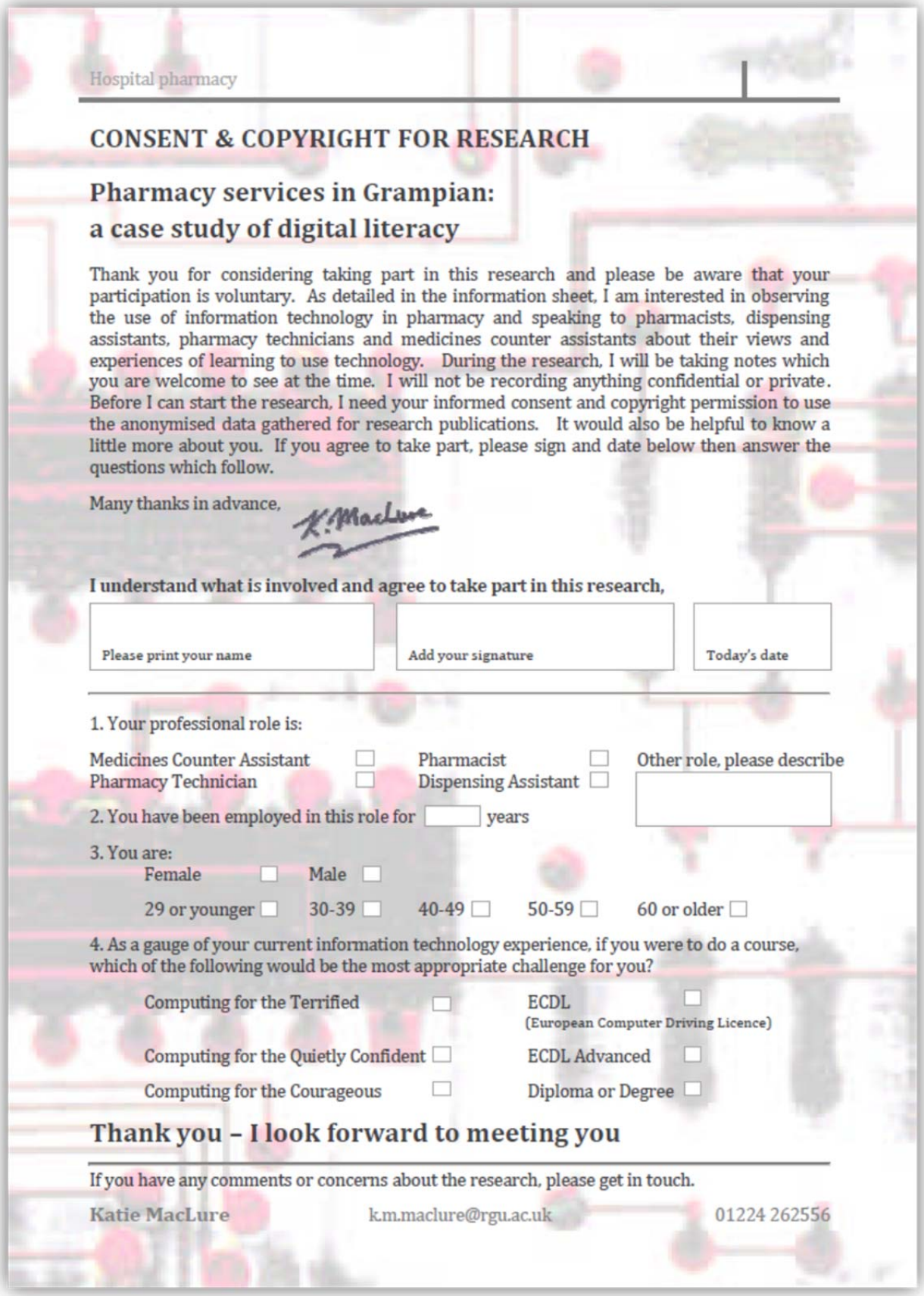
To participate in this study, please complete and return the consent and copyright form attached.

Thank you in advance

Katie MacLure

Version 2 17/01/2013

Appendix 5.2 - Participant Consent Form



Hospital pharmacy

CONSENT & COPYRIGHT FOR RESEARCH

Pharmacy services in Grampian: a case study of digital literacy

Thank you for considering taking part in this research and please be aware that your participation is voluntary. As detailed in the information sheet, I am interested in observing the use of information technology in pharmacy and speaking to pharmacists, dispensing assistants, pharmacy technicians and medicines counter assistants about their views and experiences of learning to use technology. During the research, I will be taking notes which you are welcome to see at the time. I will not be recording anything confidential or private. Before I can start the research, I need your informed consent and copyright permission to use the anonymised data gathered for research publications. It would also be helpful to know a little more about you. If you agree to take part, please sign and date below then answer the questions which follow.

Many thanks in advance, K. MacLure

I understand what is involved and agree to take part in this research,

Please print your name	Add your signature	Today's date

1. Your professional role is:

Medicines Counter Assistant ☐ Pharmacist ☐ Other role, please describe
Pharmacy Technician ☐ Dispensing Assistant ☐

2. You have been employed in this role for ____ years

3. You are:

Female ☐ Male ☐

29 or younger ☐ 30-39 ☐ 40-49 ☐ 50-59 ☐ 60 or older ☐

4. As a gauge of your current information technology experience, if you were to do a course, which of the following would be the most appropriate challenge for you?

Computing for the Terrified ☐ ECDL (European Computer Driving Licence) ☐

Computing for the Quietly Confident ☐ ECDL Advanced ☐

Computing for the Courageous ☐ Diploma or Degree ☐

Thank you – I look forward to meeting you

If you have any comments or concerns about the research, please get in touch.

Katie MacLure k.m.maclure@rgu.ac.uk 01224 262556

Appendix 5.3 – Research Ethics R&D review

Katie MacLure (aps)

From: randdpermissions grampian (NHS GRAMPIAN) <grampian.randdpermissions@nhs.net>
Sent: 16 January 2013 09:32
To: Katie MacLure (aps)
Subject: RE: Advice on approvals required, please

Hi Katie,

I have read through the documents and you will not require R&D approval as the study appears to be a service evaluation.

Regards,
Rituka

R&D Office
Foresterhill House Annexe
Foresterhill
Aberdeen
AB25 2ZB
Tel: 01224 553846
Fax: 01224 550559
www.nhsgrampian.org/r&d

From: Katie MacLure (aps) [k.m.maclure@rgu.ac.uk]
Sent: 10 January 2013 17:16
To: randdpermissions grampian (NHS GRAMPIAN)
Subject: Advice on approvals required, please

Hi Rituka & team

Nice to speak to you on the phone and I'd appreciate your advice on the following, please.

As outlined, I've been visiting community pharmacies across Grampian speaking to staff about technology in pharmacy practice. During the period of observation, I've spoken to pharmacists, pharmacy technicians, dispensing assistants and medicines counter assistants about the technologies they use and how they learn to use IT. I've attached the protocol, information sheet and consent form for you to read. As this did not involve NHS staff or premises it was not subject to NHS Ethical Review.

I am contacting you because we are considering whether or not it is practical to extend the observational activity into hospital pharmacy. From checking the website I believe this study would be considered as a service evaluation but would appreciate your guidance on whether NHS Ethical or R&D approvals would be required. Ideally, subject to gaining all necessary permissions, I would like to visit the outpatient dispensary at ARI, Cornhill Hospital and Dr. Gray's Hospital to see their technologies in use and speak to pharmacy staff.

Look forward to hearing from you and always available to provide any further details.

All the best

Katie

Katie MacLure
MSc (dist.) BSc (1st) DipSysPrac MBCS
Prescribing Research Assistant
Robert Gordon University
School of Pharmacy & Life Sciences

1

Appendix 6.1 - Systematic Review Protocol

PROSPERO International prospective register of systematic reviews

Pharmacy staff's digital literacy training experiences and needs: a systematic review protocol

Katie MacLure, Derek Stewart, Alison Strath, Yashodharan Kumarasamy

Citation

Katie MacLure, Derek Stewart, Alison Strath, Yashodharan Kumarasamy. Pharmacy staff's digital literacy training experiences and needs: a systematic review protocol. PROSPERO 2013:CRD42013005503
Available from
http://www.crd.york.ac.uk/PROSPERO_REBRANDING/display_record.asp?ID=CRD42013005503

Review question(s)

What are the digital literacy training experiences and needs of pharmacy staff? More specifically, this review seeks to summarise the best available existing evidence of pharmacy staff perceptions and measures of:
1. their levels of digital literacy;
2. the inclusion of digital literacy in their pharmacy training;
3. specific digital literacy training experiences, if accessed;
4. digital literacy training needs.

Searches

The search strategy aims to find both published and unpublished studies. A three-step search strategy will be utilised in this review. An initial limited search of MEDLINE and CINAHL will be undertaken followed by analysis of the text words contained in the title and abstract, and of the index terms used to describe the article. A second search using all identified keywords and index terms will then be undertaken across all included databases. Thirdly, the reference list of all identified reports and articles will be searched for additional studies. Only studies published in the English language will be considered for inclusion in this review. No date limit will be applied. No geographical limit will be applied. The databases to be searched for published studies during the review are:
• ASLIB
• CINAHL
• Cochrane Library (including DARE and EPOC)
• ERIC (Education Resources Information Centre)
• Informa healthcare
• IPA
• MEDLINE
• LISTA
In addition grey literature will also be searched. This will include:
• Conference Proceedings
• New York Academy of Medicine - Grey Literature Report
• Theses online (British Library EThOS, Canada Portal)

Types of study to be included

This review will not be restricted to a particular type of study. However, it is likely to focus on qualitative studies which explore and contextualise lived experience through narrative. This review will consider existing published reviews. The qualitative component of the review will consider studies that focus on qualitative data including, but not limited to, designs such as phenomenology, grounded theory, ethnography and action research. It is possible that quantitative studies may also be relevant where a survey instrument has been adopted to gauge levels of participant agreement. The quantitative component will consider studies that focus on quantitative data including, but not limited to, cross sectional or longitudinal surveys.

Condition or domain being studied

Digital literacy, training experiences and needs of pharmacy staff.

Participants/ population

This review will consider studies that relate to any aspect of digital literacy training for any member of pharmacy staff such as, but not limited to, pharmacists, graduate (pre-registration) pharmacists, pharmacy technicians, dispensing assistants and medicines counter assistants. All pharmacy settings are included, for example, community, primary care, hospital, prison. No geographical or date restrictions will be applied.

Intervention(s), exposure(s)

This review focuses on the perceptions, experiences, availability and needs of pharmacy staff in relation to digital literacy training. The qualitative component of the review will consider studies which explore these foci of interest through narratives of perceptions, experiences and self-reported need for digital literacy training amongst pharmacy staff. The quantitative component of the review will consider studies which measure levels of digital literacy, whether against a benchmark or not, and also evaluate need for and availability of related training for pharmacy staff.

Comparator(s)/ control

A comparator is not relevant to this study.

Context

Pharmacy staff across all settings are increasingly reliant on information technology (IT). Pharmacists, graduate (pre-registration) pharmacists, pharmacy technicians, dispensing assistants and medicines counter assistants use widely available office, retail and management information systems alongside dedicated pharmacy management and electronic health (ehealth) applications in a range of community, hospital and other pharmacy settings. The abilities of pharmacy staff to use these applications at home and at work, also known as digital literacy or digital competence or e-skills, depends on personal experience and related education and training. IT facilitates the provision of core pharmacy aspects of the National Health Services (NHS) in collaboration with other healthcare professionals. Collaborative working in health
has been viewed as both beneficial to patients and a more efficient use of health professionals' skills since long before the advent of ehealth. Health strategists worldwide promote the adoption of IT and ehealth to support patient care through collaborative working which is tracked globally by the World Health Organisation. Both the adoption of ehealth and standards of digital literacy at home and in the workplace are key but separate themes of interest at an international level.

Outcome(s)

Primary outcomes

The main outcomes of interest will be summarised in tables of findings. Subjective outcomes from qualitative components may include perceptions, experiences, needs and levels of digital literacy training described or self-reported by pharmacy staff against a scale. Objective outcomes from quantitative components may include evaluation of digital literacy based on testing of pharmacy staff and lists of available digital literacy training curricula.

Secondary outcomes

None

Data extraction, (selection and coding)

The search string will be applied with results and exceptions recorded using an adapted PRISMA Flow diagram. Titles of papers returned by the search will be independently screened by two reviewers (KM, DS) followed by abstracts and full papers; where necessary a third reviewer (AS) will be consulted. The data extraction will be performed independently by the primary and secondary reviewer before crosschecking to minimise errors and bias. The data extracted will include details of the populations, interventions, outcomes, study methods and context of significance to the review question and specific objectives.

Risk of bias (quality) assessment

Qualitative and quantitative papers selected for retrieval will be assessed by two reviewers independently for methodological quality before inclusion in the review using the standardised critical appraisal tools from CASP. Where there is disagreement between the primary and secondary reviewer, the problem will be resolved through discussion, or a third reviewer will be consulted where any doubt remains over inclusions.

Strategy for data synthesis

Qualitative and quantitative findings will each, where appropriate, be combined using meta-analysis or otherwise synthesised and presented in tables, with the aid of narrative and figures.

Analysis of subgroups or subsets

None planned.

Dissemination plans

The findings will inform the basis of a doctoral thesis and also be submitted in the form of a paper for a peer reviewed health education journal and education and/or pharmacy conference.

Contact details for further information

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Organisational affiliation of the review
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Review team
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Professor Alison Strath, Robert Gordon university
Dr Yashodharan Kumarasamy, Robert Gordon University

Anticipated or actual start date
26 August 2013

Anticipated completion date
31 October 2013

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NHS Education for Scotland

Conflicts of interest
None known

Language
English

Country
Scotland

Subject index terms status
Subject indexing assigned by CRD

Subject index terms
Computer Literacy; Education, Pharmacy, Continuing; Humans; Pharmacies; Pharmacists; Staff Development

Date of registration in PROSPERO
27 August 2013

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27 August 2013

Stage of review at time of this submission Started Completed
Preliminary searches No No
Piloting of the study selection process No No
Formal screening of search results against eligibility criteria No No
Data extraction No No
Risk of bias (quality) assessment No No
Data analysis No No

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The information in this record has been provided by the named contact for this review. CRD has accepted this information in good faith and registered the review in PROSPERO. CRD bears no responsibility or liability for the content of this registration record, any associated files or external websites.

'I have striven not to laugh at human actions, not to weep at them, nor to hate them, but to understand them'

Baruch Spinoza, philosopher
(1632-1677)