Development and early-stage validation of a questionnaire measuring patient acceptance of electronic patient reported outcome measures

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The candidate confirms that the work submitted is her own and that appropriate credit has been given where reference has been made to the work of others

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قال الله تعالى: **(وَقُل رَّبِّ زِدْنِي عِلْمًا (114))**

"My Lord, increase me in knowledge."

The Qur'an, *Ta-Ha* 20.114.

Abstract

Electronic patient-reported outcome measures (e-PROMs) have been introduced to improve the collection of patient feedback and to facilitate data linkage with research databases. However, before implementing e-PROMs, it is important to understand patient's feelings about and acceptance of these technologies. Until today, there has been no adequate questionnaire to understand patient acceptance of e-PROMs. So, this study aimed to study patient acceptance of e-PROMs through developing and validating a new questionnaire based on the Theory of Planned Behaviour (TPB) and additional factors including computer anxiety and patient characteristic factors.

Not only did this study apply a quantitative method to understand the factors behind patient acceptance, the development and the psychometric testing of the new questionnaire was conducted using a variety of methodological approaches. This includes: (1) developing the initial version of the questionnaire based on the available literature, (2) an expert panel review (n=5) and cognitive interviews (n=10) to measure face and content validity, and (3) conducting field-testing (n=231) to measure construct validity and internal consistency reliability. The field-testing included testing the conceptual model with cancer survivors at an outpatient oncology clinic in Leeds Teaching Hospitals NHS Trust.

Based on these study findings, the developed questionnaire shows good validity and reliability. Moreover, the conceptual model results show that patient attitudes (a TPB construct), computer anxiety and gender were significantly ($P<0.05$) associated with behavioural intention to use e-PROMs. The most influential factor is patients' attitude to computers, followed by computer anxiety then male gender. Overall, these model constructs explained around 87% of the variance in acceptance. The findings of this study strongly suggest that clinicians need to encourage their male patients to use e-PROMs and help them to reduce their computer anxiety.

Publications and Presentations Resulting From This Work

External conference posters and presentations

- **Al-Rayes S.A.**, Wyatt J.C, Twiddy M. and Clamp S. The application of Theory of Planned Behaviour (TPB) to understand the factors influencing cancer survivors' acceptance of electronic patient reported outcome measures (e-PROMs). MEIbioeng 15. Leeds, the United Kingdom September 2015. (ID no. 2001)
- **Al-Rayes S.A.**, Twiddy M. and Wyatt J.C. Factors affecting cancer survivors' acceptance of electronic patient reported outcome measures (e-PROMs). International Digital Health and Care Congress 2015. London, the United Kingdom June 2015. The King's Fund.
- **Al-Rayes S.A.**, Twiddy M., Clamp S. and Wyatt J.C. Development and Early-stage Validation of a Questionnaire Measuring Patient Acceptance of E-PROMs. European Medical Informatics Conference, Istanbul, Turkey August 31st 2014. (ID no. 150).

Papers under preparation

- **Al-Rayes S.A.**, Wyatt J.C, Twiddy M. and Clamp S. Systematic Review of the Validity, Reliability and Response rate of the Theoretically Informed Questionnaires Developed to Measure Consumer Health Information Technology Acceptance. Journal of the American Medical Informatics Association.
- **Al-Rayes S.A.**, Wyatt J.C, Twiddy M. and Clamp S. Review of Existing Theories/Models Useful for Understanding Consumer Health Information Technology Acceptance and Use. Journal of Biomedical Informatics.
- **Al-Rayes S.A.**, Wyatt J.C, Twiddy M. and Clamp S. Psychometric Properties Testing of a Questionnaire Developed to Understand E-PROM Acceptance and Use. International Journal of Medical Informatics.
- **Al-Rayes S.A.**, Wyatt J.C, Twiddy M. and Clamp S. Factors Influencing Cancer Survivor Acceptance and Use of an E-PROMs. Journal of the American Medical Informatics Association**.**

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List of Abbreviations

Abbreviation	Meaning
CHITs	Consumer Health Information Technologies
PROMs	Patient Reported Outcome Measures
e-PROMs	Electronic Patient Reported Outcome Measures
NHS	The National Health Services
IT	Information Technology
BI	Behavioural Intention
At	Attitude
SN	Subjective Norms
PBC	Perceived Behavioural Control
CA	Computer Anxiety
IR	Importance of Resources
DI	Demographic Information
TPB	Theory of Planned Behaviour
DTPB	Decomposed Theory of Planned Behaviour
IDT	Innovation Diffusion Theory
NPT	Normalisation Process Theory
NPM	Normalisation Process Model
TAM	Technology Acceptance Model
UTAUT	Unified Theory of Acceptance and Use of Technology
TRA	Theory of Reasoned Action
MM	Motivational Model
MPCU	Model of Personal Computer Utilisation
C-TAM-TPB	Combined Model of Technology Acceptance Model and Theory of Planned Behaviour
CTT	Classical Test Theory
IRT	Item Response Theory
DH	Department of Health
UK	The United Kingdom
CVR	Content Validity Ratio
CVI	Content Validity Index
MTMM	Multi-Trait/Multi-Method
AVE	Average Variance Extracted
SD	Standard Deviation

RR	Response Rate
R	Relevancy
C	Clarity
RO	Response Options
PC	Personal Computer
IE	Internet Experience
CTT	Classical Test Theory
ICC	Interclass Correlation Coefficient
CFA	Confirmatory Factor Analysis
EFA	Exploratory Factor Analysis
IRT	Item Response Theory
LTFU	Long-Term Follow-Up
HNA	Holistic Needs Assessment
SEM	Structural Equation Modelling
SPSS	Statistical Package for Social Sciences
LTHT	Leeds Teaching Hospital Trust
R&D	Research and Development
CFI	Comparative Fit Index
TLI	Tucker Lewis Index
RMSEA	Root Mean Square Error of Approximation
SRMR	Root Mean Square Residual
MLR	Maximum Likelihood Estimator

CHAPTER 1. Overview of the Thesis

1.1 Introduction

In the United Kingdom (UK), the role of patient-reported outcome measures (PROMs) has attracted growing interest from researchers in the last 10 years (Black and Jenkinson, 2009). PROMs can be defined as "*the consequences of disease and/or its treatment as reported by the patient, including perceptions of health, well-being, symptom experience, functioning, and treatment satisfaction*" (Coons et al., 2009, p420). The National Health Service (NHS) White Paper stated that PROMs would be used as a mechanism to improve the quality of care and communication between the patient and clinicians (Department of Health., 2010; Greenhalgh et al., 2012; Santana et al., 2010; Benson et al., 2013). PROMs can improve the capture and understanding of patient outcomes including physical and psychosocial difficulties (Ashley et al., 2013). The information collected using PROMs can then be used to improve services and enhance the clinical decision support processes (Rubenstein et al., 1995), to detect patient problems more promptly (Velikova et al., 2004), and generally to improve patient health status (Velikova et al., 2004; Wiklund, 2004). Clinically, the information gathered through the doctor's notes might be a good alternative to the PROMs. Yet, relevant outcome information is not collected routinely at each patient's visit. This makes the use of PROMs more desirable (Velikova et al., 2002; Taenzer et al., 2000).

PROMs are usually collected in the clinic manually, on a paper-based form. However, moving to electronic patient-reported outcome measures (e-PROMs) would have several potential advantages: (1) it could reduce missing data by ensuring that a patient cannot move to the next item without completing the current one and could minimise unanswered items by handling the undesired skip patterns, (2) it could reduce ambiguous data by making each question answered mutually exclusive (i.e. patients cannot tick more than one box at the same time), (3) it could reduce the number of errors associated with typing responses, (4) electronic results can be backed up and easy to share, (5) it can prompt alerts automatically and (6) patients can report their data even when they are at home (Gwaltney et al., 2008; Deshpande et al., 2011). Previous studies shown that compliance of electronic tools is 90% or better compared with only 11% to 20% in other studies that been using paper-based tools (Hufford and Shields, 2002; Stone et al., 2002).

Not only would the advantages to staff and researchers encourage the introduction of e-PROMs, but also the new information strategy would do so (Department of Health., 2012; Greenhalgh et al., 2010b). Using electronic instead of paper systems has become noticeable in health policy recently. In the United Kingdom, the Department of Health (DH) information strategy has a key commitment to enable better access to healthcare information by reducing the amount of paperwork in patient processes (Department of Health., 2012).

However, despite the benefits of these technologies, patients might reject them and the barriers to their introduction and use are not clear yet. Previous research, which used e-PROMs to collect feedback information from cancer survivors, researchers acknowledged that not all patients are interested in using such an internet-based system (Ashley et al., 2011a). Understanding the barriers to using an internet-based tool such as e-PROMs is important before implementing the technology. It will help clinicians to identify patients who need help/support using e-PROMs and provide them with the appropriate help for effective system use in the future. Consequently, more research is required in this area.

Although the information technology literature includes a good number of valid theoretically informed questionnaires that help us to understand information technology acceptance and use, the use of these questionnaires to assess patient perspectives less common (Holden and Karsh, 2010; Legris et al., 2003). Limited research has been conducted to develop and validate theoretically informed questionnaires in the health informatics field to understand patient acceptance and use of consumer health information technologies (CHITs) (Or and Karsh, 2009).

1.2 Thesis aim and objectives

The research aims to develop a theoretically informed questionnaire to help clinicians to measure patient acceptance of and understand the barriers to e-PROM adoption. It was conducted to achieve the following objectives:

1- Review the literature to identify existing, theoretically informed questionnaires developed to measure patient acceptance of a Consumer Health Information Technology and assess their overall quality (i.e. reliability, validity and response rate).
2- Review the different psychological theories or models that have been used to understand technology acceptance and choose the appropriate theory for the

study purpose.

3- Understand the factors associated with patient acceptance of e-PROMs from the patients' and researcher's perspective within the literature.
4- Develop and undertake initial validation of a questionnaire to measure patient acceptance of e-PROMs.
5- To undertake further validation of the developed measure in a sample of patients (cancer survivors) to assess their acceptance towards using e-PROMs in Leeds Teaching Hospitals NHS Trust.

1.3 Thesis structure

In addition to this chapter, this thesis is composed of eight chapters (Table 1.1). *Chapter 2* contains background information relating to the thesis context. Definitions for the main terms are provided including Consumer Health Information Technologies (CHITs), Patient Reported Outcome Measures (PROMs), Electronic Patient Reported Outcome Measures (e-PROMs) and patient acceptance of CHITs. Moreover, the chapter includes background details of the ways to measure patient acceptance of a CHIT, the importance of e-PROMs, the difference between e-PROMs and other CHITs and the main issues highlighted during research into e-PROM implementation.

Chapter 3 presents a literature review of the studies measuring patient acceptance of CHIT quantitatively. The questionnaires utilised in the reviewed studies are identified and their psychometric properties, including questionnaire validity and reliability, assessed. The chapter also discusses the response rate and briefly describes the association between the response rate and certain other factors (i.e. mode of distribution, questionnaire length, etc.). This study found that there is no appropriate questionnaire available to measure e-PROM acceptance and use. The identified questionnaires were either very context relevant (e.g. using none-English language) or very technology relevant, but not appropriate to be used for e-PROM acceptance and use (e.g. general questionnaire for telecare). Moreover, this chapter identifies that in the health informatics field there is still limited reporting of the conduct and documentation of the measurement studies (i.e. studies focused on the development process of the measurement/questionnaires). Indeed, full validation of the questionnaire used appears to be absent from the majority of studies. Consequently, this finding emphasises the need to focus more on the process of questionnaire development, rather than only focusing on questionnaire distribution and use.

In addition to the previous literature review, another further review is conducted to investigate the best theory to understand e-PROM acceptance and use.. This review is presented in *Chapter 4*. This chapter also includes a review of the empirical evidence to understand the factors associated with the acceptance and use from the previous e-PROM implementation studies. Based on the findings of the review, the most appropriate theory is the Theory of Planned Behaviour (TPB). This is because TPB is developed to understand human behaviour through understanding the individual behavioural intention which is a factor can be used to understand pre-implementation acceptance, it measures non-volitional behaviour similar to the behaviour within the study (i.e. the e-PROM use), appropriate to be used within none professional context, have been widely validated and tested and the model is parsimonious (i.e. it can predict the outcome of interest with fewer constructs).

Chapter 5 includes an overview of the research design and methodology to understand the process of questionnaire development and validation. This chapter facilitates an understanding of the methods used in the research sub-studies (*Chapter 6*, *Chapter 7* and *Chapter 8*).

Chapter 6 explains the questionnaire design process and includes testing of the initial questionnaire validity (including face and content validity). Face and content validity was tested through expert opinion and through conducting cognitive interviews with participants from the general public. *Chapter 7* demonstrates the process of testing the construct validity and item reliability of the new questionnaire. The study was conducted by distributing the questionnaire within a sample of cancer survivors who are likely to start to use e-PROMs in the near future. Based on these findings, it appears that the modified questionnaire has good construct validity and internal consistency reliability.

Using the data collected in *Chapter 7* and by removing the weak questionnaire items, the factors influencing cancer survivors' acceptance of e-PROMs are identified in *Chapter 8*. The results show that TPB has a good fit with the study data. However, in this study context, the only predictors of acceptance were attitude, computer anxiety and gender.

Because this thesis applied different methods to develop and validate the study questionnaire, the last chapter (*Chapter 9*) includes an overall discussion of the study methods and the empirical work. The chapter also includes a discussion of the strengths and limitations of the whole thesis and considers how these could influence

the study results. In addition, it summarises a number of recommendations for further research.

Table 1.1. Thesis objectives and the relevant chapters.

Thesis objectives	Relevant chapter	Chapter objectives
1- Review the literature to identify existing, theoretically informed questionnaires developed to measure patient acceptance of a Consumer Health Information Technology and assess their overall quality (i.e. reliability, validity and response rate).	Chapter 3	I. To review theoretically informed questionnaires developed to measure patient acceptance of CHITs. II. To understand the type of CHITs tested in each study with regards to its acceptance and use (patient-initiated or clinician-initiated CHITs). III. To investigate the extent to which the available questionnaires can be used in another context (i.e. generalisability). IV. To evaluate the quality of the questionnaires, including reliability, validity and response rate. V. To identify the main factors influencing the response rate within these contexts.
2- Review the different psychological theories or models that have been used to understand technology acceptance and choose the appropriate theory for the study purpose.	Chapter 4	I. To review the different theories/models that have been used to understand user acceptance and actual use of information technologies. II. To understand the extent to which the identified theories/models were adopted and validated. III. To choose an appropriate, well-validated, theory/model to measure patients' acceptance of e-PROMs.
3- Understand the factors associated with patient acceptance of e-PROMs from the patients' and researcher's perspective within the literature.		IV. To review the empirical studies that qualitatively or quantitatively reported the factors influencing patient acceptance and use of electronic measures to report health information. V. To check if there is a need to add more factors to the selected theory/model through mapping the empirical finding and the theoretical finding.
4- Develop and undertake initial validation of a questionnaire to measure patient acceptance of e-PROMs.	Chapter 6	I. To design and develop the first questionnaire draft to measure patient acceptance of using e-PROMs. II. To evaluate the content and face validity of the first questionnaire draft.
5- To undertake further validation of the developed measure in a sample of patients (cancer survivors) to assess their acceptance towards using e-PROMs in Leeds Teaching Hospitals NHS Trust.	Chapter 7	I. To evaluate the construct validity and internal reliability using classical test theory (CTT). II. To reduce the number of items by removing the ones that do not represent the assigned construct.
	Chapter 8	I. To investigate the correlation of the participants' characteristics (i.e. age, gender and education level) with the behavioural intention, in addition to the association measured earlier in chapter 7 between the study constructs and BI. II. To investigate the significant predictors of e-PROMs acceptance through testing the structural/conceptual model using a structural equation model. III. To determine the level of variance in behavioural intention explained by the assigned predictors.

CHAPTER 2. Background

2.1 Introduction

Consumer Health Information Technologies (CHITs) form new methods of healthcare monitoring to be used by patients. These technologies are paving the way for health services in the information age. Previous studies tested the accessibility, feasibility and effectiveness of CHITs in order to facilitate patient health monitoring and disease prevention (Lewis et al., 2005; Winkelman et al., 2005; Cross and Finkelstein, 2007). It has been found that CHITs have a good impact on the quality of care and patient health outcomes (Hailey et al., 2002; Martínez et al., 2006; Louis et al., 2003). Electronic patient-reported outcome measures (e-PROMs) form an application of CHITs.

E-PROMs, as will be defined later in this chapter, refer to the electronic reporting of the consequences of disease or its treatment by patients. They were used initially in a research context, but now are being introduced to clinical practice because analysis and administration of paper-based PROMs is difficult for large numbers of patients, taking into account the limited resources within healthcare organisations (Velikova et al., 2002). Consequently, the electronic mode can improve the collection of high-quality information in a cost effective manner (Bell and Saxon, 2011; Wu et al., 2006; Shekelle et al., 2006).

Whilst these technologies have significant potential impact, the lessons learned from previous studies, where some patients failed to engage with the technology (Lohr, 2011; Greenhalgh et al., 2010a), raise the need for a good understanding of patients' technology acceptance and actual use. Failure to do this will have significant negative impacts on patients (e.g. loss of technology benefits, including access to clinician communication and materials for decision support which have the potential to improve quality of life) and healthcare organisations (loss of organisation resources including time and money) (Or and Karsh, 2009). Although user acceptance has been studied widely in the information technology (IT) literature, Or and Karsh (2009) explained that there is a gap in studying acceptance in the patient context. They also highlighted that most of the available studies in patient contexts tested the acceptance empirically, which might lead researchers to miss some important factors. They could better be measured using one of the available theories on information technology acceptance. This would help to provide a clear image of the different factors that might influence

acceptance and then actual use. This could then help the researcher to identify different ways to change patient behaviour toward using CHITs (Or and Karsh, 2009).

This chapter explains this issue in more detail from different angles. It starts by defining the main study terms, and then explains the importance of electronic patient-reported outcome measures (e-PROMs), followed by an exploration of the concept of technology acceptance and actual use, and ends with detailing the United Kingdom population usage of the Internet.

2.2 Definitions of the main terms

Within this thesis, different terms will be used and need to be defined. These include Consumer Health Information Technologies (CHITs), Patient-Reported Outcome Measures (PROMs), Electronic Patient-Reported Outcome Measures (e-PROMs) and patient acceptance of CHITs.

Consumer Health Information Technologies (CHITs) is one of the terms used to describe the technologies or systems used by patients to make them more involved in their own health. They are also known as 'consumer health informatics systems', 'consumer health IT applications' and 'consumer health applications' (Eysenbach, 2000; Gibbons et al., 2009; Gustafson et al., 2002). Although the term CHITs had not previously been well-defined, Or and Karsh (2009) recently provided a general definition of the CHITs as being, *"computer-based systems that are designed to facilitate information access and exchange, enhance decision making, provide social and emotional support, and help behaviour changes that promote health and well-being"* (p550). One of the CHIT applications is the electronic patient-reported outcome measures (e-PROMs) that will be explained in the following section. However, before defining e-PROMs, it is useful to define the term patient-reported outcome measures (PROMs) first.

Patient-reported outcome measures (PROMs), as defined by Coons et al. (2009), are *"the consequences of disease and/or its treatment as reported by the patient, including perceptions of health, well-being, symptom experience, functioning, and treatment satisfaction"* (p420). In some literature sources, these are abbreviated as PROs rather than PROMs, but both refer to the same term. PROMs are used to enhance clinical decision processes (Rubenstein et al., 1995), detect patients' problems (Velikova et al., 2004), monitor disease stages and symptoms (Wiklund, 2004), improve communication between patients and healthcare providers (Santana et al., 2010), and, it has been

argued, are the only way to measure patients' pain (Wiklund, 2004) and generally to improve patients' health status (Velikova et al., 2004; Wiklund, 2004). In other cases, PROMs are used in clinical trials to assess the effectiveness of treatment or other therapeutic interventions (McHorney, 1997; Duncan et al., 2000; Turk et al., 2006; Greenhalgh et al., 2005; Marshall et al., 2006). E-PROMs refers to electronic capture of PROMs to optimise the benefits of collecting these measures and then improving healthcare services. More details are presented later in this chapter.

Information technology user acceptance, or patient acceptance of CHITs, is defined as an *"individual's psychological state with regard to his or her voluntary or intended use of a particular technology"* (Chau and Hu, 2001, p701).

2.3 Background

2.3.1 The importance of e-PROMs

Nowadays, healthcare assessment is not limited to whether the patient lives or dies. It is more about how well somebody is doing, and whether they have any physical or psychosocial difficulties. The introduction of PROMs aimed to facilitate continuous patient care and health monitoring which can provide patients with a good quality of life (Velikova et al., 2004; Wiklund, 2004; Benson et al., 2013). PROMs have become common practice in clinical trials and are starting to be used in clinical practice (Greenhalgh et al., 2005). Even though some doctors' notes might include some similar data, it is not usually collected which makes the use of PROMs within routine clinical practice potentially useful (Velikova et al., 2002; Taenzer et al., 2000).

Traditionally, PROMs are collected manually using validated questionnaires. However, with the increased number of patients who require long-term monitoring, analysis and administration of the clinical practice PROMs are associated with challenges that can be overcome using electronic means (e-PROMs). Moreover, e-PROMs have potential advantages over paper-based forms as they: reduce the costs of collecting data manually by more than 75% (Russell et al., 2010); increase participation as they can be completed anytime and from wherever the patient prefers (Ashley et al., 2011a); reduce missing data by ensuring that patients cannot move to the next item without completing the current one; and minimise the number of errors in typing responses (Gwaltney et al., 2008). In addition to these advantages, electronic data capture provides the ability to easily link up to other information held about the patient (e.g. patients' clinical information and research databases). Although linking data can be

complex, expensive and time consuming (Bohensky et al., 2010), the availability of registries and data repositories allow linkage between e-PROM and clinical data that is subject to high standards of security and information governance (Ashley et al., 2011a).

2.3.2 The differences between e-PROMs and other technologies used by patients

Recently, several CHITs have been developed to enhance patient-physician communication and healthcare information accessed by patients. CHITs can be classified into two main categories; patient-initiated and clinician-initiated services (Peeters et al., 2012) (Table 2.1, Table 2.2 and Figure 2.1)

Table 2.1. Relevant definitions

Terms	Definition
Patient-initiated CHITs	The information technologies that are developed to help patients to manage their health personally and to provide them with access to health-related information for both their clinical problems and overall welfare.
Clinician-initiated CHITs	The technologies driven by clinicians to monitor and manage their patients' health remotely

In patient-initiated CHITs, the real motivation behind usage is patient needs where patients can immediately realise the benefits once their requests been answered. Patients prefer these since they feel more confident in participating in their healthcare plan as it supports their decision process (Eysenbach, 2000; Lai et al., 2008). This in turn enhances their involvement in improving the quality of healthcare (Brennan and Safran, 2005).

On the other hand, clinicians are the main motivation toward using clinician-initiated CHITs. The average hospital length of stay decreased from 7.3 to 4.8 days in 1980 and then 2006, respectively (DeFrances et al., 2008) and patient numbers increased, consequently, clinicians need a better way to monitor those patients. Using CHITs allows clinicians to monitor patients remotely and support homecare services. For example, using clinician-monitoring telecare which is defined as "*an audio-visual connection between a home-dwelling client and remote healthcare professionals, using communication technologies*" (Peeters et al., 2012 , p3184). Through telecare, patients can have an online consultation with the clinician to discuss issues and find help immediately. Likewise, clinician-initiated CHITs would allow clinicians to monitor patients more closely once discharged home (e.g. replacing the traditional use of

paper-based measures with electronic measures could provide access to patients who are outside the healthcare trust) (Greenhalgh et al., 2012).

E-PROMs are considered to be clinician-initiated CHITs, and their benefits are often not as obvious to patients as in telecare, which gives them different implementation characteristics. Telecare is similar to the patient-initiated CHITs in terms of received benefits. However, with e-PROMs patients complete online questionnaires only, without any immediate communication with the clinician, which might decrease patient interest for technology adoption (Basch et al., 2007; Wilkie et al., 2003). Consequently, there is more need to understand what factors can motivate system acceptance and actual use (Table 2.2).

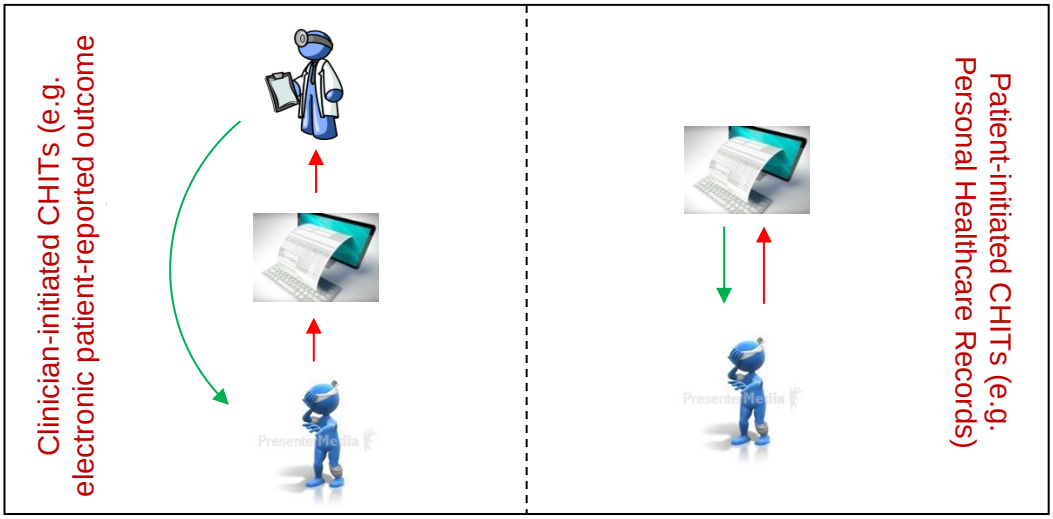

Figure 2.1. Types of consumer health information technologies

Table 2.2. Patient-initiated vs. clinician initiated CHITs

Aspect	Patient-initiated CHITs	Clinician-initiated CHITs
Motivation	Patient needs	Clinician needs
Main users	Patients and healthy people	Patients and clinicians
Decision of usage	Under patients option (Volitional)	Patients directed by clinician
Benefits	Self-monitoring and health-related information to increase health awareness	Clinician-monitoring instead of using the traditional face-to-face consultation and paper-based reporting of their needs
Usage in hospitals	Used widely in researches and clinically	Used recently in research, but not clinically
Examples	E-health and personal healthcare records	Telecare and e-PROMs

2.3.2.1 Issues with e-PROM implementation

E-PROMs have been used for a while and their use is increasing dramatically in healthcare clinics (Ashley et al., 2011a; Basch et al., 2007; Jensen et al., 2013). There is a drive to widen the adoption of e-PROMs, within clinics, but several issues should be resolved (Jones et al., 2007). Firstly, there is a need to check whether e-PROMs are equivalent to paper-based PROMs in terms of validity, (Coons et al., 2009). If the two modes are not equivalent, researchers need to compare the validity of the existing and new e-PROMs measures. Researchers have already identified that this is an issue and research is underway to understand the equivalence between e-PROMs and paper-based PROMs (MacKENZIE et al., 2011; Gwaltney et al., 2008).

Another issue is user acceptance of e-PROMs (clinicians and patients). Understanding the main barriers might help in predicting who will use e-PROMs and who won't. It could provide a guide for how to motivate patients to use e-PROMs (e.g. providing training courses for potential users or better information about their potential benefits to persuade people to use them). This might increase the chance of system success (Or and Karsh, 2009). Although some implementation studies have reported brief feedback from preliminary users on the use of e-PROMs (Basch et al., 2007; Weber et al., 1998), to date researchers have failed to examine the potential barriers to their use before introducing them. Therefore, more research should be conducted to understand these issues before actual implementation and actual use of an e-PROM.

2.3.3 The concept of acceptance

Information technology acceptance, as defined earlier is the *"individual's psychological state with regard to his or her voluntary or intended use of a particular technology"* (Chau and Hu, 2001, p701). Lack of CHIT acceptance and use is a concern for patients as those ones who reject the technology will not realise its benefits (Or et al., 2011). Moreover, it is also a significant concern for healthcare organisations as patient rejection means a loss of returns on the organisation's investment (Or et al., 2011). In fact, it has been shown that user acceptance is an important factor determining the success or failure of any information technology (Davis, 1993). Consequently, researchers have a significant interest in understanding why people accept information technology. More specifically, measuring and understanding acceptance within the CHIT context is important to provide the clinician, IT developers and decision makers with a guide to encourage the actual use of the system and to provide patients with software that fulfils their needs (Or and Karsh, 2009).

Technology acceptance is an individual behaviour. In psychology and sociology, the individual behaviour is the product of a multitude of interrelated factors (McQueen and Knussen, 2006). Due to the complexity of these factors and how these underpin specific behaviours, a concise summary of what is known about them and explanation of how they actually interact is impossible (United Kingdom Parliamentary Archives., 2011). But, these can be characterised broadly as the following: individual feelings and thoughts, social interaction, genetics and social identity (interaction within and between groups) (United Kingdom Parliamentary Archives., 2011). Therefore, there are many socio-psychological theories and models developed to help understanding behaviours through testing different sets of factors (Fishbein and Ajzen, 1975; Bandura, 1986; Ajzen, 1985; Taylor and Todd, 1995b; Deci and Ryan, 1985). Thus, the technology by itself is not the only barrier that could hinder acceptance and use of CHITs.

Although the study of technology acceptance and actual use is important, the consumer health information technology field, in general, showed a lack of literature on understanding the main drivers and the barriers to technology use. In 2008, an evidence report sponsored by the United States Agency for Healthcare Research and Quality to investigate the drivers of the successful use of CHITs among the elderly concluded with the following: "*in most cases our evidence for usability, barriers, and drivers came from studies where these issues were not a key part of the study design, but rather qualitative evidence that accompanied an outcomes study*" (Jimison et al., 2008, p54). Consequently, and since that call, the study of patient technology acceptance and actual use has become a priority.

To measure overall information technology success, acceptance should be measured during the different implementation stages (i.e. before and after technology implementation) (Figure 2.2) (Venkatesh et al., 2003; Hu et al., 1999). This is because the factors influencing pre-implementation and post-implementation early acceptance could have different influencing strengths when measured after the continuing use of a specific technology (Peek et al., 2014). For example, social influences and ease of use have a stronger influence over acceptance in the early stages, but become weaker with increased experience and when measuring the continuing use of a technology (Venkatesh et al., 2003). For example, it has been found that Health Space in the UK showed a good usage level in its early implementation stage, but users did not continue using the system which affected the overall system success (Greenhalgh et al., 2010a). Consequently, measuring pre-implementation could provide an insight into how to motivate patients to maximise the use of CHITs and measurement post-implementation could help to improve or maintain their use.

Although measurement of acceptance before system implementation does not include any evidence of use, it has been shown to help increase the chance of system success and to save the healthcare organisation time and money (Davis and Venkatesh, 2004). Moreover, pre-implementation acceptance testing may strongly influence the future use of the technology and the level of satisfaction that the user feels when using it (Sweeney and Soutar, 2001; Tzeng, 2010). So, as there are time differences between the implementation stages, longitudinal research to understand CHITs acceptance and use is needed to determine the overall technology success – and pre-implementation acceptance testing is the first step.

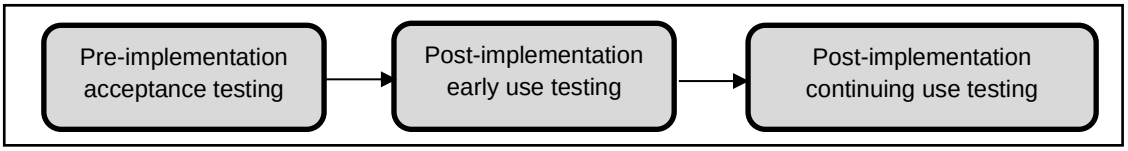

Figure 2.2. Testing stags through IT implementation

2.3.4 Methods for measuring acceptance

In the information technology literature, acceptance and its main predictors have been addressed empirically and theoretically (Or and Karsh, 2009). However, the use of a theoretical approach has more advantages compared with an empirical approach. First, theoretical approaches provide a better understanding of the different types of factors involved, including: individual factors (i.e. attitude, demographic factors), technology factors (i.e. ease of use and usefulness) and organisational/environmental factors (i.e. availability of resources) (Chau and Hu, 2002; Hu et al., 1999). It has been shown that due to the lack of a theoretical framework, most of the studies in healthcare focused on individual factors and neglected some important factors (e.g. ease of use and usefulness) (Or and Karsh, 2009). This narrow focus may be insufficient to guide CHIT implementation (Karsh and Holden, 2007). Second, they help a researcher to compare the findings between different studies (Peek et al., 2014). Third, if the researcher conducted a quantitative study, the use of a theoretically informed questionnaire would positively influence the questionnaire validity and the reliability, as DeVellis (2011) explained:

> "*the more researchers know about the phenomena in which they are interested, the abstract relationships that exist among hypothetical constructs, and quantitative tools available to them, the better equipped they are to develop reliable, valid and usable scales.*" (p9).

Even with these advantages, few studies in the health informatics field have adopted a theoretically informed approach to measure technology acceptance within the patient context. This led researchers to focus more on studying the influence of individual factors over acceptance and actual use and neglect the factors that are relevant to technological and environmental contexts (Or and Karsh, 2009; Peek et al., 2014). Thus, use of the theoretical approach to measure patient acceptance of CHITs should be more emphasised (Or and Karsh, 2009).

However, it is important to note that the use of a theoretical approach by itself will not succeed unless the researcher is cautious about two things. First, the researcher needs to be careful in selecting the appropriate theory (Venkatesh et al., 2003). Second, Streiner and Norman (2008) believe that the global behavioural theories convey far more information if they have a component of specific empirical findings and vice versa. This is because the empirical findings can reflect the factors that might influence acceptance within the context (Holden and Karsh, 2010; Legris et al., 2003). So, the researcher needs to inform the selected theory with factors from the empirical evidence within the study context. Especially because, to date, there is no available theory developed specifically to understand patient acceptance of CHITs.

2.3.4.1 The use of theoretical approach

There are different behavioural theories in the psycho-social and information technology literature that can be used to facilitate our understanding of patient acceptance and actual use (e.g. the Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology (UTAUT), the Theory of Reasoned Action (TRA), and the Theory of Planned Behaviour (TPB)) (Peek et al., 2014; Venkatesh et al., 2003). The majority of these theories explain an individual's behaviour, such as use or rejection of the technology, through the influence of behavioural intention (BI) and other self-reported factors (e.g. subjective norms, ease of use and attitude). However, it has been shown in some literature that BI is the strongest and the most proximate predictor of behaviour (Ajzen, 1991; Shih and Fang, 2004; Yousafzai et al., 2010; Taylor and Todd, 1995a; Daim et al., 2013). A meta-analysis of 51 studies of the technology acceptance model showed that BI can explain between 25% and 70% of the actual behaviour variance (Schepers and Wetzels, 2007).

Behavioural intention is defined as the *"behavioural plans that...enable attainment of a behavioural goal"* (Ajzen, 1996). Based on this definition, subjective measurement of BI was used in different studies to assess pre-implementation technology acceptance as it related to an individual's plan to use or reject the technology (Or et al., 2011;

Venkatesh et al., 2003; Shroff et al., 2011; Agarwal et al., 2013; Tzeng, 2010; Foy et al., 2007). In fact, it has been assumed that "*when someone forms an intention to act, he or she will be free to act without limitation*" (Lai et al., 2008, p219), even though BI is not the only factor predicting acceptance. However, as discussed earlier, measurement of pre-implementation acceptance should be associated with measurement of post-implementation acceptance and continuing use to judge overall system success. Thus, measurement of the individual plan to use the technology, BI, works as a proxy which might lead then to the actual behaviour (i.e. future use of the information technology), Even when there is no perfect relationship between BI and actual use. In this case, BI mediates the effects of individual beliefs and perceptions on behaviour (Marinos and Askoxylakis, 2013; Venkatesh et al., 2003). A systematic review conducted by Turner et al. (2010) concluded that BI is likely to be directly associated with actual use, but the user's beliefs (i.e. ease of use and usefulness) are less likely to be directly associated with actual use.

To measure the pre-implementation acceptance using BI, this must be operationalised by asking people what they plan to do, as behavioural intention cannot be measured directly (Or and Karsh, 2009). On the other hand, to measure the post-implementation use (early or continuous) of an information technology, behaviour can be assessed objectively through, for example, system logs, or subjectively using self-reported measures of behaviour (Turner et al., 2010). Within the information technology literature, the association between the BI and the subjective or objective form of actual use is viewed differently. A study measured the association of self-reported factors including BI on the two forms of actual use reporting (Straub et al., 1995). The results showed that self-reported factors have an association with the subjective measure of actual use, but showed a weaker relationship with the objective measure of actual use. Within information technology studies, the majority of studies measured the subjective form of actual use, rather than actual system use (Legris et al., 2003). This could be because measurement of the subjective form is easier than the objective form of actual use. Consequently, it is important to acknowledge that the influence of pre-implementation acceptance over actual use will be weaker than self-reported behaviour (Turner et al., 2010). The strong association between BI and the self-reported behaviour compared with the objective measure of behaviour was reported also in the psychology literature. Self-reported measures may overestimate the association between BI and behaviour because of social desirability or memory bias (Kiesler, 1971; Hessing et al., 1988; Randall and Wolff, 1994; Webb and Sheeran, 2006). Armitage

and Conner (2001) found that BI has a stronger association with self-reported behaviour (r = .56) than the objective measure of behaviour (r_+ = 45).

2.3.5 Internet usage in the United Kingdom

As e-PROMs require use of the Internet, it is important to understand a little about Internet usage within the United Kingdom's population. Use of the Internet in the UK has increased dramatically every year (Office for National Statistics., 2014a). In 2014, around 44.6 million (87%) of UK adults had used the Internet (Office for National Statistics., 2014a). Moreover, it has been shown that people use the Internet while on the move, with an increase of 17 percentage points from 2011 to 2013. This actually points out the importance of being online in future generations (Dutton et al., 2013). Consequently, a move to e-PROMs is expected to increase in popularity and might offer benefits to a higher portion of the UK population.

The national figures show that there are no significant gender differences with regards to Internet use in the UK (Table 2.3) (Office for National Statistics., 2014a). However, when comparing age groups, the use of the Internet decreased when moving from younger adults aged 16-24 (99%) to older adults aged 75+ (37%), as shown in Table 2.3 (Office for National Statistics., 2014a). Thus, it can be expected that the UK's older people might have greater resistance toward using e-PROMs and most of the patients fall into the older category.

When looking at the most common device used to access the Internet in the UK, younger Internet users aged 16-24 and 25-34 prefer to use mobile phones rather than other devices. However, this was the opposite for older people aged 55-64 and 65+ who prefer computers, laptops and tablet computers rather than mobile phones (Ofcom, 2014). These figures highlight the need to offer access using appropriate electronic devices to facilitate the use of e-PROMs. If older people do not prefer using mobile phones, a researcher can expect higher rejection levels if they develop a mobile-based e-PROM.

In 2014, over 50% of UK Internet users accessed the Internet for sending/receiving e-mail, Internet banking and online shopping (Office for National Statistics., 2014b). Moreover, in 2013, over 70% of Internet users accessed the Internet to seek health related information (Office for National Statistics., 2013) (Figure 2.3). It appears that UK users are using services that might require personal and sensitive information about themselves. So, it appears that accessing the Internet and providing sensitive information is not a concern for the UK population. Consequently, and from all the

above, rejection of e-PROMs could be due to other reasons, rather than an inability to access the Internet.

Table 2.3. Internet use in the UK in 2014 (Office for National Statistics., 2014a).

	Categories	% in 2014 Q1
Gender	**Males**	89.3
	Females	85.3
Age group	16-24	99.2
	25-34	98.9
	35-44	97.8
	45-54	94.3
	55-64	87.5
	65-74	70.6
	75+	37.1

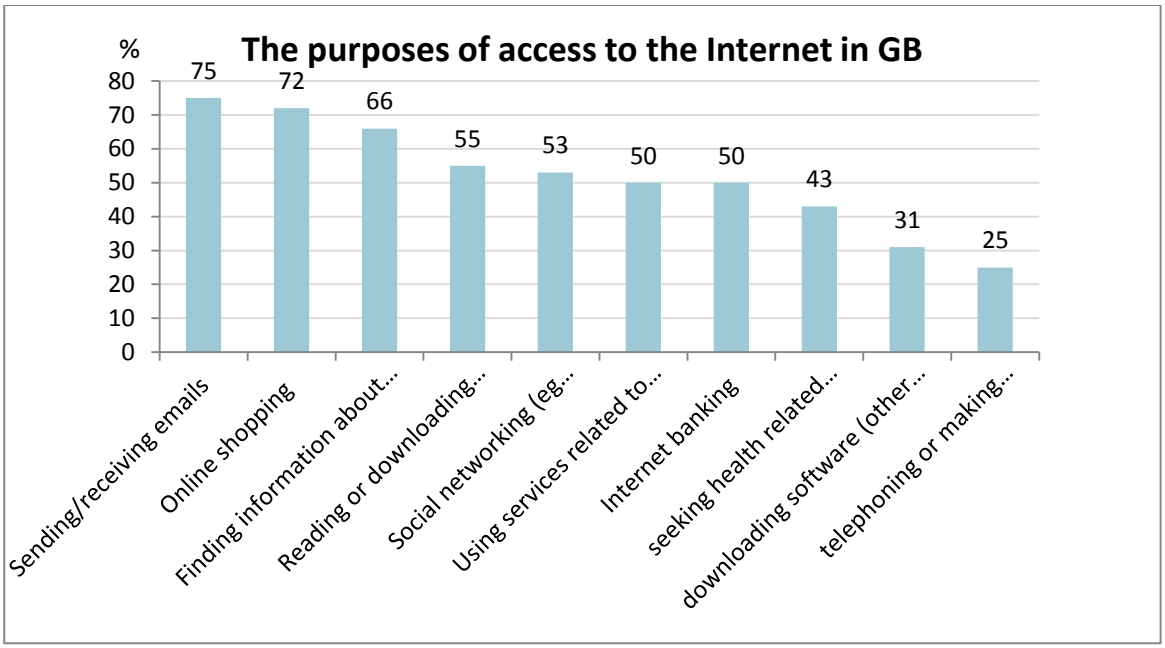

Figure 2.3. The percentage of the common purposes for using the Internet in 2013 (Office for National Statistics., 2013).

2.4 Conclusion

Electronic patient-reported outcome measures (e-PROMs) were introduced to improve healthcare delivery (Russell et al., 2010). They have advantages over the traditional paper method of capturing PROMs (Russell et al., 2010). However, from previous research, it appears that not all patients are interested in using electronic modes to report information about their health and the reasons for this are not clear yet (Ashley et al., 2011a). Consequently, it could be difficult for clinicians to encourage patients to

use these e-PROMs, which increases the need to study the factors behind the acceptance of e-PROMs. An understanding of e-PROM acceptance would, then, help to optimise system use and overall success. Although health informatics literature has some detail about CHIT acceptance and use, to date no study has aimed to understand patient acceptance of e-PROMs. Consequently, the current study will address this gap in knowledge by investigating the factors influencing patient acceptance of e-PROMs.

Information technology acceptance can be measured theoretically and empirically. However, the theoretical approach has advantages over the empirical approach (i.e. it can offer a way to compare the results of different studies). Even with these advantages, few studies used this approach within the health informatics literature. The current study will fill another literature gap by using a theoretical approach rather than studying e-PROM acceptance empirically.

Different theories make up the psycho-social literature that can be used to study information technology acceptance and actual use (i.e. the technology acceptance model (TAM), the Theory of Reasoned Action (TRA), etc.). These theories establish that behavioural intention and other user beliefs could predict the behaviour (i.e. to use or reject the technology). Although the evidence of success is to use or reject the technology, this chapter discussed the fact that technology acceptance can be measured before implementation using the construct “behavioural intention”. An understanding of pre-implementation acceptance might provide a good chance to increase future use of the system once it is implemented. However, measurement of this alone is not enough to show technology success and there is still a considerable need to study the factors influencing post-implementation (early and continuing use) of this information technology. To measure acceptance in these different implementation stages, a longitudinal study is needed where pre-implementation acceptance is the first step.

Accordingly, the current study aims to provide empirical evidence of the factors influencing acceptance of e-PROMs based on a theoretical framework. However, only the pre-implementation acceptance, measured by BI, was tested. This is because within the current study context, the e-PROM was in the early stages of implementation and large-scale use of clinical e-PROM has not occurred yet. So, this obstructed the measurement of actual e-PROMs use. However, further research is greatly needed to link the study findings on BI with actual e-PROM use to provide a better understanding of the expected barriers to overall system success.

2.5 Summary

1- E-PROMs are defined as clinician-initiated consumer health information technologies (CHITs) where clinicians are behind the introduction of the system and patients may not immediately realise the benefits of this system.

2- The literature shows that even with the potential advantages of e-PROMs, patients often still do not engage with the system; this might increase the chance of e-PROM failure.

3- An understanding of the factors influencing the acceptance and use of e-PROMs would help clinicians to motivate patients and optimise the system for future use, but to date no study has aimed to measure the factors influencing e-PROM acceptance.

4- The information technology literature shows that technology acceptance can be measured theoretically and empirically.

5- The use of a theoretical approach to understand acceptance helps to ensure coverage of all influential factors, compare different study findings, and improve the validity and reliability of the questionnaires.

6- Few studies within the CHIT literature have applied a theoretical approach to understand acceptance, which has led previous acceptance research to focus on understanding the influence of user factors and neglect other important factors relevant to technology and the organisational context.

7- Different theories within the information technology and psycho-social literature can be used. These theories explain behavioural intention (BI) and how BI and other self-reported factors can influence actual behaviour (i.e. use or reject the system).

8- Although acceptance and actual use should be measured after implementation of the system, measurement of pre-implementation acceptance (i.e. an individual's plan to use or reject the technology) before the technology implementation would facilitate technology use and help in designing information technology that fulfils patient needs.

9- Pre-implementation acceptance was measured using the construct BI from the information technology and psycho-social theories. In this case, acceptance can be used as proxy to predict actual use of the technology.

10- However, before using a theoretical approach, the researcher needs to be precise in selecting the appropriate theory. Moreover, he/she needs to justify the selected theory with empirical findings, which will provide additional factors to the ones provided by the selected theory.

CHAPTER 3. A Review of the Theoretically Informed Questionnaires Used to Assess Acceptance and the Use of Consumer Health Information Technologies

3.1 Introduction

The acceptance and use of technologies are affected by different factors. These include factors relating to patient characteristics, the technology and the environment. Or and Karsh (2009) and Peek et al. (2014) conducted two systematic reviews to investigate these factors. These indicated that researchers focused more on the factors relevant to patient characteristics, rather than technology or environment. Or and Karsh (2009) imputed this limitation to the lack of adoption of well-known theories to justify the factors behind acceptance and use in most of the reviewed studies. Indeed, the psycho-social and the information technology literature contains several theories which help to point out the factors influencing acceptance and actual use. They can provide the clinician, IT staff and decision makers with information about the main barriers that hinder their use. For example, there is the Technology Acceptance Model (TAM), the Innovation Diffusion Theory (IDT) or the Theory of Planned Behaviour (TPB). Another limitation discussed by previous systematic reviews is that due to the limited amount of quantitative research, researchers could not identify which factors were more influential than others on acceptance and actual use (Peek et al., 2014). This raises the need for more quantitative research in the future.

In order to conduct a quantitative study, a valid and reliable questionnaire is required. Questionnaires provide a way to measure unobservable phenomena (such as acceptance, ease of use and usefulness) by operationalising the phenomenon into a set of observable items (or variables) (DeVellis, 2011). Then, it is possible to present these items in one form, a questionnaire, to facilitate measurement of this phenomenon within a sample of participants.

In addition to the questionnaire quality (i.e. validity and reliability), response rate is another issue for a quantitative study. A valid and reliable questionnaire might have a low response rate which would then inhibit the generalisability of the study results (Cull et al., 2005). Consequently, response rate is considered another indicator of whether the questionnaire is useful for collecting study data. Low response rate means low questionnaire acceptance, which might indicate an issue with the questionnaire

wording or length. The literature noted different factors which could influence the response rate (e.g. inappropriate questionnaire length, administration method or mode of distribution) (Fan and Yan, 2010; Linsky, 1975; Church, 1993; Kanuk and Berenson, 1975; Edwards et al., 2002; Heberlein and Baumgartner, 1978). Although a poor quality questionnaire would be a reason behind a low response rate, an acceptable questionnaire does not necessarily make it good (Sivo et al., 2006). Researchers can collect lots of poor-quality data. Consequently, questionnaire developers should investigate both issues in order to collect plenty of accurate data.

Although the health informatics literature includes a range of questionnaires developed to understand the factors behind acceptance, a review to evaluate the quality of these questionnaires is still absent. Consequently, some researchers might adopt these questionnaires without evidence on their quality, which might result in a body of literature that draws the wrong conclusions (Friedman and Abbas, 2003).

3.1.1 Chapter aim

This present review examines whether a valid and reliable questionnaire is available for measuring patient acceptance of an e-PROM, an application of clinician-initiated CHITs. The aim of this part of the study is to critically review the theoretically informed questionnaires developed to measure patient acceptance of CHITs.

3.1.2 Chapter objectives

I. To review theoretically informed questionnaires developed to measure patient acceptance of CHITs.
II. To understand the type of CHITs tested in each study with regards to its acceptance and use (patient-initiated or clinician-initiated CHITs).
III. To investigate the extent to which the available questionnaires can be used in another context (i.e. generalisability).
IV. To evaluate the quality of the questionnaires, including reliability, validity and response rate.
V. To identify the main factors influencing the response rate within these contexts.

3.2 Questionnaire reliability, validity and response rate

3.2.1 Questionnaire reliability

Reliability is the ability of a questionnaire to measure something in a reproducible way. The first step to developing a good questionnaire is to show that this questionnaire

would have similar measurement results if completed by different respondents, or by the same respondent but on different occasions and hence is reliable (Streiner and Norman, 2008; DeVellis, 2011).

Two broad categories of reliability exist: *equivalence reliability* and *stability*. *Equivalence reliability* (also called internal consistency) is the correlation between items (or variables) assigned to measure one construct. Thus, the equivalence reliability of a questionnaire is assumed if the item scores are highly correlated with each other. Internal consistency can be used when the questionnaire is being administered in a single time period. However, *stability* (also called test-retest reliability) is tested by administering a questionnaire to the same respondents on different occasions, by using two forms at the same occasion or by different observers (Streiner and Norman, 2008).

Usually, questionnaire reliability is measured as the ratio of respondent variability to the total variability in the scores (Streiner and Norman, 2008). Consequently, reliability is presented as a number between 0 and 1, where 0 means no reliability and 1 means high reliability.

3.2.2 Questionnaire validity

Although a questionnaire can be reliable, this does not mean it is valid (DeVellis, 2011). The term validity means the extent to which a questionnaire measures what it is designed to measure (Streiner and Norman, 2008). The literature discusses different types of validity: face validity, content validity, construct validity and criterion validly. Trochim and Donnelly (2008) consider that face, content and criterion validity all fall under construct validity. Each of these validity types has a method, either qualitative or quantitative, for measurement and assessment, as explained in the following.

3.2.2.1 Face and content validity

Face and content validity are considered at an early stage in the validation process (Alumran et al., 2012). Some researchers separate the concept of face validity and content validity (DeVellis, 2011; Kerlinger and Lee, 1999), while others discuss their linkage and the fact that measuring face validity is like measuring content validity indirectly (Carmines and Zeller, 1979; Nunnally and Bernstein, 1994b; Rungtusanatham, 1998). Thus, they have been considered in one section in this chapter.

Face validity is tested by measuring the extent to which a questionnaire is clear, understandable and presented in a logical order. It is also about whether ‘on the face of

the items' the questionnaire looks like it measures what it claim to measure. Although this type of validity does not explain how the items represent the relevant construct, it might facilitate questionnaire responses (DeVon et al., 2007). While face validity has been mentioned as the weakest type of validity (Trochim and Donnelly, 2008), it has been reported frequently in the literature because it can be established easily (DeVon et al., 2007). A panel of experts or lay people can review the questionnaire to judge its face validity (Netemeyer et al., 2003; Shultz and Whitney, 2005).

Content validity is the extent to which a questionnaire covers all of the required constructs and tackles all the aspects of the phenomenon of interest (DeVellis, 2011). Questionnaire items can be generated by defining the main constructs through reviewing the existing literature, obtaining expert opinion, undertaking population sampling or through qualitative studies (DeVon et al., 2007). Initially, a great number of items are generated. Then, the items should be reviewed by a panel of experts to check whether the items are appropriate indicators of the constructs. Although this process seems to be more qualitative, Lawshe (1975) and Lynn (1986) measured content validity quantitatively through using the content validity ratio (CVR) and content validity index (CVI); these show the proportions of experts who agree with the adequacy of the item content.

3.2.2.2 Construct validity

The second type of validity is construct validity. This is concerned with the theoretical association between the measured items (variables). Construct validity is defined as the extent to which a developed questionnaire measures what a theory requires it to measure (Alumran et al., 2012). Put another way, it is how well the items statistically belong to their constructs. Researchers can test construct validity through testing convergent and discriminant validity. Convergent validity requires that the items that should be correlated with a construct theoretically are actually correlated. However, discriminant validity (sometimes called divergent validity) shows that concepts or constructs that are supposed to be different from each other are actually distinct (Carmines and Zeller, 1979). Construct validity can be empirically tested through a multi-trait/multi-method (MTMM) matrix using a factor analysis approach (Ramaker et al., 2002). Factor analysis is more powerful than the traditional MTMM approach (Bagozzi et al., 1991; O'Leary-Kelly and Vokurka, 1998). First, because it provides a direct way through which to assess convergent and discriminant validity. Second, factor analysis overcomes MTMMs limitation, which is the strict assumption of equal method factors across all traits (O'Leary-Kelly and Vokurka, 1998).

3.2.2.3 Criterion validity

Finally, criterion validity measures the relationship between a questionnaire with a criterion variable (or a gold standard) (DeVon et al., 2007; Friedman and Wyatt, 2006). The gold standard is often considered to be the direct measure of the examined behaviour. This type of validity includes two different types based on the occurrence time. If the measured attribute correlates with a future criterion variable, it is known as predictive criterion validity (e.g. the scores from the newly developed measure, such as student intellectual ability, make accurate predictions about the construct they represent, such as student academic performance) (Streiner and Norman, 2008). However, if the measurement attribute correlates with a criterion variable or a "gold standard" at the same point in time, it is known as concurrent criterion validity (e.g. the scores from the newly developed measure are directly correlated with the scores from another well-established measure for the same construct). Within this type of criterion validity, the results are summarised as sensitivity (i.e. the ability of the questionnaire to identify the true positives, such as identifying all people who have a condition) and specificity (i.e. the ability of the questionnaire to identify those true negatives, such as identifying people who do not have the condition) of the questionnaire (Stein and Wilkinson, 2007). In both types, a researcher should look for strong correlations between the new questionnaire and the criterion variable to increase the confidence that the questionnaire is measuring what it intends to measure (DeVon et al., 2007). In the current study, the gold standard is actual use of the e-PROMs. If the questionnaire results correlate highly with actual use, criterion validity would be established.

3.2.3 Questionnaire response rate

Another way to judge questionnaire quality is through the response rate, defined as the number of returned questionnaires divided by the overall number of eligible participants in the sample (The American Association for Public Opinion Research., 2011). A high response rate means more participant acceptance of the questionnaire. Moreover, it reflects less potential bias from non-responders (Kviz, 1977). Even though the response rate could be influenced by the questionnaire quality, other factors have also been reported in the literature that might reduce response rates including questionnaire mode (i.e. paper vs. electronic), availability of reminder, questionnaire length and method of administration (i.e. directly administered vs. indirectly administered) (Fan and Yan, 2010; Linsky, 1975; Church, 1993; Kanuk and Berenson, 1975; Edwards et al., 2002; Heberlein and Baumgartner, 1978). Consequently, an understanding of these factors would help understand the reason behind the low responses, i.e. was it the questionnaire quality or not?

Of the studied factors, mode of questionnaire delivery, for example, could influence the response rate. Although there are perceived benefits of using electronic questionnaires, meta-analyses have shown that they have lower response rates than paper-based questionnaires (Shih and Fan, 2009; Manfreda et al., 2008). Consequently, researchers have worked to increase the response rate to electronic questionnaires (Fan and Yan, 2010). Moreover, it has been found that a follow-up reminder and questionnaire length can influence response rates. Follow-up reminders or notification calls were found to increase the response rate (Cook et al., 2000; Manfreda et al., 2008). Questionnaire length was found to have a negative linear relation with response rates, which means that longer questionnaires tend to have lower response rates (Cook et al., 2000; Edwards et al., 2002). Additionally, research has discussed the influence of the method of administration over the response rate. For example, questionnaires with direct administration by the researcher can improve the response rate (Gliner and Morgan, 2000).

From the above literature, it appears that there is a need to measure patient acceptance and actual use using a theoretically informed questionnaire. Consequently, this study reviews the available theoretically informed questionnaires developed to measure patient acceptance and actual use of CHITs and examines their validity and reliability. The study also compares the response rates of these, and measures and investigates some factors that might influence response rate other than questionnaire quality. Then, the researcher will explore whether the main reason for low response rate relates to such factors or to questionnaire quality.

3.3 Method

In November 2012, an electronic systematic search was conducted and included coverage of: Web of Science database (includes Web of Science and Medline) and Ovid database (including AMED – Allied and Complementary Medicine), BIOSIS Previews, EBM Reviews, Embase, Global Health, HMIC – Health Management Information Consortium, Maternity and Infant Care, Ovid MEDLINE(R), Ovid MEDLINE(R) In-Process and Other Non-Indexed Citations, PsycARTICLES Full Text and PsycINFO). This was done through using different keywords based on the study aim *(Patient* OR Old* OR elder* OR senior* OR disabilit*) AND (technolog* OR computer* OR ehealth OR e-health OR e-mail OR health* informat* OR Internet OR web OR telemedicine) AND (accept* OR use* OR Intent* OR reject* OR satisf* OR utiliz*) AND (Technology acceptance model OR unified theory of acceptance OR social*

cognitive theory OR innovation diffusion theory OR motivational model OR theory of reasoned action OR theory of planed behavi)*. This search was updated in November 2014 to include any article published after the initial search date.

3.3.1 Inclusion and exclusion criteria

The review covered studies published between 1990 and 2014. The selection criteria were as follows:

1. All reviewed studies should be published in English. Any studies published in another language were excluded (i.e. Kim and Ryu (2011)). Moreover, some of the articles were presented as abstracts for conferences and due to their limited information were excluded. For example, Or et al. (2006) published a very relevant abstract explaining the validation work of their study questionnaire which was developed to measure patient acceptance toward using CHITs. But, it was difficult to extract the information needed for this review, so the abstract was excluded.
2. The studies should measure patient acceptance based on a well-known behavioural theory, used to measure information technology acceptance as a conceptual framework, as discussed earlier. Unlike Or and Karsh (2009) and Peek et al. (2014), who reviewed all factors influencing patient acceptance regardless of the theoretical framework. Based on this criterion, any study measuring acceptance without explicitly mentioning adopting theory/model was excluded (Tsai and Rosenheck, 2012; Forquer et al., 2014).
3. The study population should be patients/elderly, but not healthcare teams, the general public or patient family members. Although the elderly can be patients, some studies used the term elderly indicating elderly patients (Wong et al., 2012; Wang et al., 2013). Consequently, both terms were used in this review.
4. Within the selected studies, patients should have been introduced to or will be introduced to a CHIT. This meant that any study aimed at measuring acceptance of medical devices was excluded (Shah et al., 2013; van Bon et al., 2011). Medical devices are associated with patients' diagnosis and treatment, rather than healthcare monitoring only, consequently the factors influencing the acceptability of these devices could differ from CHITs.
5. The selected studies should quantitatively measure the association between the key constructs in the theory and the outcome (including acceptance and actual use). This meant that the studies adopting qualitative methods to measure acceptance were excluded, as the aim of this study is to review the quality of the developed questionnaires (van Bon et al., 2010; Day and Gu, 2012; Nahm et al., 2010; Jian et

al., 2012; Cranen et al., 2012; Huang, 2011; Jung and Loria, 2010; Butler et al., 2013; An et al., 2007; Al-Qirim, 2007).

3.3.2 Data extraction

The data was extracted using two data extraction forms developed for this review. The first form was used to summarise study characteristics (refer to Appendix A for more details). To investigate the level of generalisability, access to the questionnaires was required. Although these studies used questionnaires for data collection, not all studies supplied the questionnaire/questions used to measure the study constructs. Some of the studies just described the measurement briefly in the methods section only. Consequently, an effort was made to contact the main study author to gain access to these questionnaires.

The second form was used to extract information about reliability and validity and included: the study number, study reference, population, questionnaire reliability and validity, number of participants, reliability methods (i.e. internal consistency and test-retest), content validity methods, construct validity methods (i.e. convergent and discriminant) and criterion validity methods (refer to Appendix A for more details).

3.3.3 Evaluating psychometric aspects

3.3.3.1 Reliability criteria

Reliability evaluation criteria are shown in Table 3.1. The table includes the evaluation of two main types of reliability: internal consistency and stability (test-retest reliability).

a. Internal consistency

The most common method used to measure the internal consistency of a questionnaire is Cronbach's alpha (α) and composite reliability (Streiner and Norman, 2008). A questionnaire scale with 0.80 or higher internal consistency coefficient, or with a composite reliability value of 0.70, was considered to have good internal consistency (Streiner and Norman, 2008; Fornell and Larcker, 1981). If the questionnaire includes more than one subscale, the internal consistency coefficient range or the composite reliability ranges for all subscales should be within the recommended values (Van Saane et al., 2003).

Although Cronbach's alpha is a widely used measure for internal consistency reliability, it has been shown that it is very sensitive to the number of items (Pallant, 2016). This means if the number of items increases the alpha value increases. Thus, item-to-total correlation and inter-item correlation were recommended as another method to test the

internal consistency reliability (Hair et al., 2010). However, none of the reviewed studies used this method for this purpose. Then the criteria for having a reliable measure were not included in Table 3.1.

b. Test-retest reliability

For test-retest reliability, the questionnaire should have a score equal to 0.70 or above (Streiner and Norman, 2008). In the case of multiple sub-scales, the test-retest coefficient range should be 0.70 or above for all subscales (Van Saane et al., 2003).

Table 3.1. Reliability and validity evaluation criteria

Reliability/Validity type	Evaluation criteria	Reference
Internal consistency reliability	Cronbach's α ≥ 0.70 is acceptable and ≥ 0.80 is good	(Streiner and Norman, 2008)
	Composite reliability ≥ 0.70	(Fornell and Larcker, 1981)
Test-retest reliability	Test-retest coefficient ≥ 0.70	(Van Saane et al., 2003).
Face and content validity	Conduct of qualitative work to assess face and content validity	(Streiner and Norman, 2008)
	CVI ≥ 0.80	(Lawshe, 1975).
Construct validity (both convergent and discriminant)	Using CFA: (1) goodness-of-fit indices (χ^2/d.f.≤3, CFI≥ 0.90, TLI ≥ 0.90, RMSEA (CI=90%)< 0.08 and SRMR<0.08)[(a)] (2) significance level of each item	(O'Leary-Kelly and Vokurka, 1998; Hu and Bentler, 1999)
Convergent construct validity	(1) Items should be significantly correlated with the measured construct and the item loading ≥ 0.70	(Fornell and Larcker, 1981)
	(2) Constructs with AVE higher than 0.50	(Fornell and Larcker, 1981)
Discriminant construct validity	(1) The constructs inter-correlation should be lower than the square root of AVE of the constructs	(Fornell and Larcker, 1981)
	(2) Items should correlate more with the respective constructs compared with the other constructs.	(Chin, 1998; Nunnally, 1978)
	(3) The χ2 difference values of two models (correlated and uncorrelated) and for paired constructs should be significant	(Hair et al., 2010)
Criterion validity	Correlation coefficient ≥ 0.70	(Streiner and Norman, 2008)

Note: (a) (χ^2/d.f.) chi-square to the degree of freedom, (CFI) Comparative Fit Index, (TLI) the Tucker Lewis Index, (RMSEA) the Root Mean Square Error of Approximation and (SRMR) Standardised Root Mean Square Residual

3.3.3.2 Validity criteria

Validity evaluation criteria are shown in Table 3.1. The table includes evaluation of three types of validity: face and content validity, construct validity and criterion validity.

a. Content and face validity

Content and face validity is commonly assessed using qualitative methods, as explained earlier in Section 3.2.2.1, which makes evaluation of this type of validity subjective . A qualitative approach does not enable us to state criteria to help in

evaluating whether a questionnaire's face and content validity was adequate or not. Consequently, the studies were evaluated against their conduction of face and content validity qualitative methods (Streiner and Norman, 2008). However, if the researcher used a quantitative method to assess content validity through computing the content validity index (CVI), explained earlier in section 3.2.2.1, the results could be evaluated against existing criteria. Each questionnaire item should have a CVI score of 0.80 or above to reach content validity (Lawshe, 1975).

b. Construct validity (convergent and discriminant validity)

Construct validity can be measured through convergent and discriminant validity. Using a confirmatory factor analysis, convergent and discriminant validity can be assessed directly through the significance level of each item with its construct and the chi-square (χ^2) goodness-of-fit of the overall model (O'Leary-Kelly and Vokurka, 1998; Hu and Bentler, 1999). Some researchers assess each type of construct validity individually using the following criteria.

Based on the convergent validity, the researcher should aim to find a high correlation between the items and their relevant constructs. Using factor analysis one of two criteria can be tested: (1) items should be significantly correlated with the measured construct and item loading above 0.70 (Fornell and Larcker, 1981; O'Leary-Kelly and Vokurka, 1998), and (2) it can be assessed using the average variance extracted value (AVE); constructs with AVE higher than 0.50 have adequate convergent validity (Fornell and Larcker, 1981). These numbers are influenced by the sample size. The minimum sample size has been recommended in two ways: absolute number or the subject-to-variable ratio. For the absolute number, it is recommended that participants of 100 = poor, 200 = fair, 300 = good, 500 = very good, 1,000 or more = excellent, in order to have reliable estimates (Comrey and Lee, 1992). However, for the subject-to-variable ratio it is recommended that a ratio of 10:1 is needed to have reliable estimates (Nunnally, 1978).

However, for discriminant validity, the researcher should aim to ensure differences between the constructs. This means that a questionnaire should measure related, but independent constructs. Using factor analysis one of three criteria can be tested to check for discriminant validity: (1) the construct inter-correlation should be lower than the square root of the AVE of the constructs (Fornell and Larcker, 1981); (2) items should correlate higher for the relevant constructs compared with the other constructs (Chin, 1998); and (3) by subjecting paired constructs to two models of CFA (the first model allows the correlation between the two constructs and the second model will be

without correlation). The χ^2 difference values of these two models should be significant (Hair et al., 2010).

c. Criterion validity

Criterion validity can be assessed through correlating the testing score with an established measure or criteria (Friedman and Wyatt, 2006). A correlation coefficient of 0.70 or above means a strong correlation (Streiner and Norman, 2008).

3.3.4 Evaluating response rate

An important aspect of a questionnaire that acts as a surrogate for acceptability is the response rate. A low response rate means low participant acceptance, as explained in the background section. When response rate data are extracted, it is important to ensure that all studies compute the response rate in a standardised way to interpret the data between the studies fairly. In this study, the definition used for response rate (or acceptability) was the proportion of surveys completed divided by the sample size (Kviz, 1977; The American Association for Public Opinion Research., 2011). The calculating formula used in this review is as follows:

$$RR = \frac{I}{N - IE}$$

(RR) is the response rate, **(I)** is the number of completed questionnaires, **(N)** is the total sample size and **(IE)** is the number of ineligible cases.

3.3.4.1 Data analysis

To analyse the study data for this review, descriptive statistics (sum and percentage), were used to describe the characteristics of the reviewed studies (i.e. study location, applied theoretical framework and type of CHIT) and the presented level of validity and reliability. The study data was analysed using SPSS software version 22 (IBM., 2013).

Then, to understand the correlation between the different variables and the response rate, parametric analysis tools (independent sample T-test and Pearson's product moment correlation analysis) were used. The decision for choosing parametric tools was because the main outcome (response rate) was normally distributed (as will be shown later on in Section 3.4.3). An independent sample T-test was conducted to understand: (1) whether using online questionnaires was associated with response rate compared with paper based, (2) whether direct administration of questionnaires by the researcher was associated with response rate, and (3) whether reminders to patients regarding responding to the questionnaire was associated with response rate

compared with no reminder. However, for the last association, the observations that were not applicable to have reminders were excluded from the analysis (i.e. directly administered surveys).

Pearson's product moment correlation analysis was used to explore the association between the response rate and the number of items in the questionnaire length. The variable codes are shown in Table 3.2. These variables were chosen for two reasons. The first reason is due to their association with the response rate from previous studies, as described earlier in Section 3.2.3 . The second reason is because of the possibility of extracting these data from the reviewed articles.

Table 3.2. Main variable codes

Factor	Variable	Codes
Response rate	Continuous variable (proportion)	--
Participant number (N)	Continuous variable	--
Mean age	Continuous variable	--
Implementation mode	Electronic/online questionnaire	1
	Paper-based (i.e. face to face, postal, mail and via-phone) questionnaire	2
Number of items	Continuous variable	--
Reminder	no follow-up reminder	1
	follow-up reminder	2
Administration method	Directly administered questionnaires	1
	Indirectly administered administration	2

3.4 Results

3.4.1 Descriptive analysis

A systematic search of the two main databases for studies measuring acceptance of CHITs quantitatively, and based on a theoretical framework, identified a total of 2,218 articles (see Figure 3.1 and Appendix A for more details of excluded articles). After reviewing the titles, the total number of articles decreased to 176. Then, by reviewing the abstracts, more articles were excluded and the number of articles reduced to 96. Finally, through reviewing the full text and by eliminating the duplicate articles between the two portals, the database search concluded with 34 unique articles eligible for review for the study purpose (Figure 3.1). Table 3.3 details the studies reviewed and notes their characteristics, including study location, type of CHIT, level of generalisability and study theory.

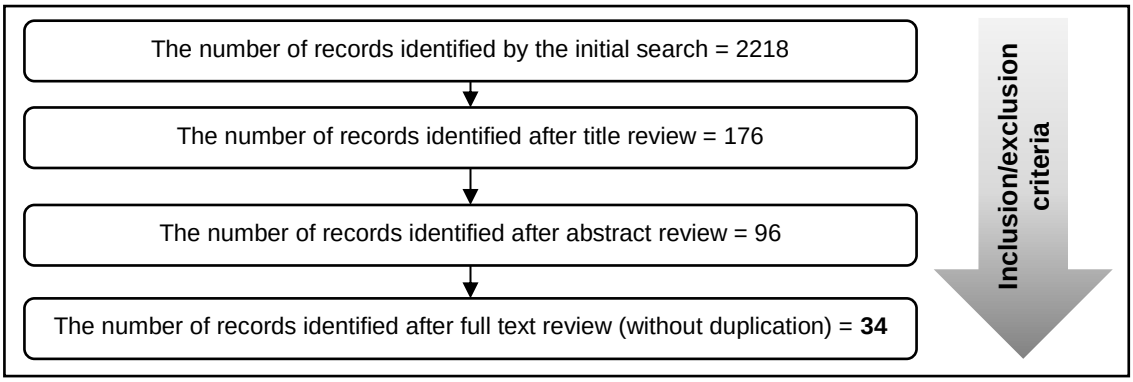

Figure 3.1. Review framework

i. **Study location:** Of these studies, 17 studies (50%) were conducted in Far Eastern countries (including 10 studies in Taiwan, two studies in China, two Singaporean studies, two studies in Korea and one study in Thailand), 10 studies (29%) were conducted in the US (nine studies) and Canada (one study), six studies (18%) were conducted in Europe (including one study in Germany, three studies in the Netherlands, one study in Spain and one study in Turkey) and one study (3%) was conducted in Australia (Figure 3.2 and Table 3.3).

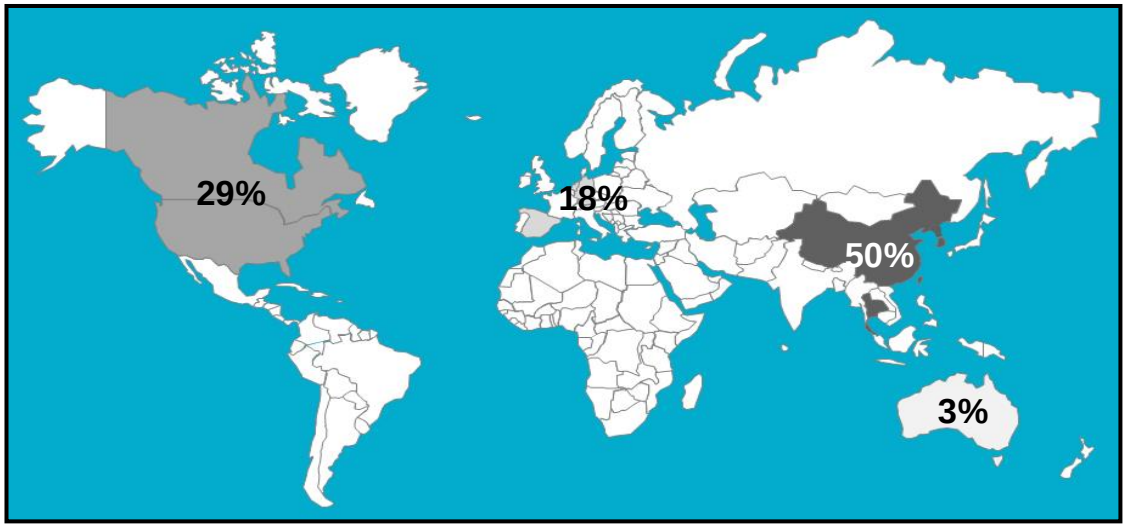

Figure 3.2. Study locations

ii. **Type of consumer health information technology:** The review found that thirty-four studies measured the acceptance of different type of CHITs (Table 3.3). Twenty-two studies (65%) measured acceptance of patient-initiated CHITs. This included four studies measuring the acceptance of mobile health technologies and mobile applications (Guo et al., 2013; Xue et al., 2012; Bidmon et al., 2014; Lishan et al., 2009), six measuring the acceptance of personal health records and patient platforms (Emani et al., 2012; Jian et al., 2012; Klein, 2007; Liu et al., 2013; Agarwal et al., 2013;

Noblin et al., 2013), ten articles measuring acceptance of using information system interventions (i.e. medication safety support system, management of depressive symptoms system and technology assisted homecare nursing practice) and the Internet for improving patients' self-care and seeking healthcare information (Liang et al., 2011; Phatthana and Mat, 2011; Wong et al., 2012; Chang and Im, 2014; Lai et al., 2008; Tseng and Wu, 2014; Or et al., 2011; Kelley et al., 2011; Martínez-Caro et al., 2013; Wilson and Lankton, 2004) and two measuring acceptance of telecommunication systems for seeking advice from healthcare professionals (Klein, 2006; Cranen et al., 2011).

On the other hand, twelve studies (35%) measured the acceptance of clinician-initiated CHITs. They included seven studies measuring acceptance of telecare and telehealth services (Tsai, 2014b; Wang et al., 2013; Huang, 2013; Wade et al., 2012; Hsu et al., 2011; Tsai, 2014a; Peeters et al., 2012), one measuring the acceptance of online communication systems (Van Uden-Kraan et al., 2011), two measuring acceptance of clinician-initiated mobile health (Lee and Rho, 2013; Lin and Yang, 2009) and two testing the acceptance of a health monitoring platform (Tsai et al., 2013; Daim et al., 2013).

iii. **Level of generalisability:** From the reviewed studies, twenty-two studies (65%) supplied the utilised questionnaire. However, the other twelve studies provided only a brief description of the study questionnaire within the method section. After contacting the authors to access these questionnaires, it appeared that: (1) ten questionnaires were still inaccessible as the main authors did not respond to the sent e-mail (Klein, 2007; Lai et al., 2008; Hsu et al., 2011; Phatthana and Mat, 2011; Lee and Rho, 2013; Tsai et al., 2013; Wang et al., 2013; Tsai, 2014a; Tsai, 2014b; Chang and Im, 2014), (2) twelve questionnaires were very context-relevant (including one using a non-English language (Daim et al., 2013) and eleven were tailored to a specific CHIT platform (Emani et al., 2012; Xue et al., 2012; Agarwal et al., 2013; Van Uden-Kraan et al., 2011; Lin and Yang, 2009; Lishan et al., 2009; Bidmon et al., 2014; Jian et al., 2012; Klein, 2006; Cranen et al., 2011; Or et al., 2011), and (3) twelve questionnaires were only appropriate to be generally used for specific types of CHITs, e.g. mobile/online health services (Guo et al., 2013; Martínez-Caro et al., 2013), telehealth (Wade et al., 2012), telecare (Peeters et al., 2012; Huang, 2013), using internet for health information seeking (Wong et al., 2012; Liang et al., 2011), electronic health (Kelley et al., 2011; Wilson and Lankton, 2004), medication safety support systems (Tseng and Wu, 2014) and personal health records (Liu et al., 2013; Noblin et al., 2013) (Table 3.3).

iv. **Theoretical framework and the prediction of the outcome:** By reviewing the applied theory/model, it appears that twenty-six studies (76%) measured acceptance based on

the Technology Acceptance Model (TAM) and its expansion (TAM3), four studies (12%) applied the Unified Theory of Acceptance and Use of Technology (UTAUT), two studies (6%) were based on the Innovation Diffusion Theory (IDT), one study (3%) was based on the Social Cognitive Theory (SCT) and one study (3%) was based on the Theory of Planned Behaviour (TPB) (Table 3.3). From the review, it appears that additional factors (i.e. personal factors) were added to the questionnaire in addition to the theory constructs within the majority of the studies (the exceptions were Hsu et al. (2011); Tsai et al. (2013); Wong et al. (2012); Cranen et al. (2011); Wade et al. (2012), Chang and Im (2014) and Noblin et al. (2013)). In these studies, both the theoretical constructs and the additional factors were associated with the study outcome (acceptance/actual use).

Another factor worth considering is that even though the reviewed studies built their assumptions on a well-known theory and they explained this theory very well, the justification for choosing this theory as opposed to other theories was absent in almost all of them, except the one conducted by Guo et al. (2013). With regards to the predicted results, it appears that all utilised questionnaires were a good measure for acceptance or/and actual use.

Table 3.3. List of the characteristics of the reviewed studies ordered by date of publication and then alphabetically (N=34).

Reference	Country	Type of CHITs	Generalisability level	Used theory[(1)]	Additional construct (yes/no)	Theory justification [(2)]
Wilson and Lankton (2004)	United States	Patient-initiated	General for e-Health	TAM	yes	no
Klein (2006)	United States	Patient-initiated	Very specific CHITs platform	TAM	yes	no
Klein (2007)	United States	Patient-initiated	inaccessible	TAM	yes	no
Lai et al. (2008)	United States	Patient-initiated	inaccessible	TAM	yes	no
Lin and Yang (2009)	Taiwan	Clinician-initiated	Very specific CHITs platform	TAM	yes	no
Lishan et al. (2009)	Singapore	Patient-initiated	Very specific CHITs platform	TAM	yes	no
Cranen et al. (2011)	Netherlands	Patient-initiated	Very specific CHITs platform	TAM	no	no
Hsu et al. (2011)	Taiwan	Clinician-initiated	inaccessible	UTAUT	no	no
Kelley et al. (2011)	Canada	Patient-initiated	General for e-Health	UTAUT	yes	no
Liang et al. (2011)	United States	Patient-initiated	General for using internet for health information seeking	TAM	yes	no
Or et al. (2011)	United States	Patient-initiated	Very specific CHITs platform	UTAUT	yes	no
Phatthana and Mat (2011)	Thailand	Patient-initiated	inaccessible	TAM	yes	no
Van Uden-Kraan et al. (2011)	Netherlands	Clinician-initiated	Very specific CHITs platform	TPB	yes	no
Emani et al. (2012)	United	Patient-	Very specific CHITs	IDT	yes	no

Reference	Country	Type of CHITs	Generalisability level	Used theory[(1)]	Additional construct (yes/no)	Theory justification[(2)]
	States	initiated	platform			
Jian et al. (2012)	Taiwan	Patient-initiated	Very specific CHITs platform	TAM	yes	no
Peeters et al. (2012)	Netherlands	Clinician-initiated	General for telecare	IDT	yes	no
Wade et al. (2012)	Australia	Clinician-initiated	General for Telehealth	TAM	no	no
Wong et al. (2012)	People's Republic of China	Patient-initiated	General for using internet for health information seeking	TAM	no	no
Xue et al. (2012)	Singapore	Patient-initiated	Very specific CHITs platform	TAM	yes	no
Agarwal et al. (2013)	United States	Patient-initiated	Very specific CHITs platform	SCT	yes	no
Daim et al. (2013)	Turkey	Clinician-initiated	Turkish language	TAM	yes	no
Guo et al. (2013)	China	Patient-initiated	General for mobile/online health services	TAM	yes	yes
Huang (2013)	Taiwan	Clinician-initiated	General for telecare	TAM	yes	no
Lee and Rho (2013)	Korea	Clinician-initiated	inaccessible	UTAUT	yes	no
Liu et al. (2013)	Taiwan	Patient-initiated	General for personal health record	TAM	yes	no
Martínez-Caro et al. (2013)	Spain	Patient-initiated	General for mobile/online health services	TAM	yes	no
Noblin et al. (2013)	United States	Patient-initiated	General for personal health record	TAM	no	no
Tsai et al. (2013)	Taiwan	Clinician-initiated	inaccessible	TAM	no	no
Wang et al. (2013)	Taiwan	Clinician-initiated	inaccessible	TAM	yes	no
Bidmon et al. (2014)	Germany	Patient-initiated	Very specific CHITs platform	TAM	yes	no
Chang and Im (2014)	Korea	Patient-initiated	inaccessible	TAM3	no	no
Tsai (2014a)	Taiwan	Clinician-initiated	inaccessible	TAM	yes	no
Tsai (2014b)	Taiwan	Clinician-initiated	inaccessible	TAM	yes	no
Tseng and Wu (2014)	Taiwan	Patient-initiated	General for medication safety support system	TAM	yes	no

Note: (1) TAM= Technology Acceptance Model, IDT= Innovation Diffusion Theory, UTAUT = Unified Theory of Acceptance and Use of Technology, SCT= Social Cognitive Theory and TPB = Theory of Planned Behaviour. (2) Yes= there is justification for selecting the theory, No= there is no justification for selecting the theory.

3.4.2 Psychometrics quality

All questionnaires utilised in the reviewed studies were developed by the researchers through adopting items from previously validated questionnaires or by initiating items in the study (see Appendix A for more details). None of the studies used and validated an existing questionnaire. Moreover, none of the studies solely focused on the questionnaire development process, but instead the questionnaire development was part of the questionnaire demonstration, or to put it another way, a theory testing study. Moreover, the questionnaires included in the review purported to be based on a

specific theory, but as some authors did not provide or only provided limited data validating this. Consequently, the researcher might have inaccurately measured the constructs. As discussed earlier in the introduction, invalid questionnaires would collect inaccurate data and would lead to misleading results.

By reviewing the validity and reliability methods, it became clear that three studies did not actually report the questionnaire validity or reliability data (Lai et al., 2008; Daim et al., 2013; Tseng and Wu, 2014) (Table 3.4). Moreover, Agarwal et al. (2013) mentioned that the validity testing was conducted previously, but the paper did not include any details of this work or a reference to a previously published study. The absence of evidence in these studies makes judgment regarding the level of reliability and validity of their questionnaire difficult. The rest of the studies were varied in terms of the level of the methods used for reliability and/or validity assessment, as discussed in the following sections.

Table 3.4. The reviewed studies ranked based on the level of validity and reliability. Ordered by the level of validity and reliability testing (from least to most), by date and alphabetically.

Reference	Reliability (internal consistency)	Test-retest reliability	Face and content validity	Construct validity	Criterion validity
Lai et al. (2008)	X	X	X	X	X
Daim et al. (2013)	X	X	X	X	X
Tseng and Wu (2014)	X	X	X	X	X
Wilson and Lankton (2004)	√	X	X	X	X
Cranen et al. (2011)	√	X	X	X	X
Or et al. (2011)	√	X	X	X	X
Van Uden-Kraan et al. (2011)	√	X	X	X	X
Peeters et al. (2012)	√	X	X	X	X
Wade et al. (2012)	√	X	X	X	X
Wong et al. (2012)	√	X	X	X	X
Agarwal et al. (2013)	√	X	X	X	X
Chang and Im (2014)	√	X	X	X	X
Tsai et al. (2013)	X	X	X	√	X
Jian et al. (2012)	√	X	√	X	X
Noblin et al. (2013)	√	X	√	X	X
Klein (2006)	√	X	X	√	X
Klein (2007)	√	X	X	√	X
Lin and Yang (2009)	√	X	X	√	X
Lishan et al. (2009)	√	X	X	√	X
Kelley et al. (2011)	√	X	X	√	X
Phatthana and Mat (2011)	√	X	X	√	X
Emani et al. (2012)	√	X	X	√	X
Xue et al. (2012)	√	X	X	√	X
Guo et al. (2013)	√	X	X	√	X
Lee and Rho (2013)	√	X	X	√	X
Liu et al. (2013)	√	X	X	√	X

Reference	Reliability (internal consistency)	Test-retest reliability	Face and content validity	Construct validity	Criterion validity
Martínez-Caro et al. (2013)	√	X	X	√	X
Wang et al. (2013)	√	X	X	√	X
Bidmon et al. (2014)	√	X	X	√	X
Hsu et al. (2011)	√	X	√	√	X
Liang et al. (2011)	√	X	√	√	X
Huang (2013)	√	X	√	√	X
Tsai (2014a)	√	X	√	√	X
Tsai (2014b)	√	X	√	√	X

Note: (X) means that the study did not report reliability/validity and (√) means that the study reported reliability/validity.

3.4.2.1 Questionnaire reliability

Most of the studies (thirty studies) attempted to measure reliability. Some studies were content with measuring reliability only (Peeters et al., 2012; Wilson and Lankton, 2004; Wong et al., 2012; Cranen et al., 2011; Wade et al., 2012; Van Uden-Kraan et al., 2011; Or et al., 2011; Chang and Im, 2014; Agarwal et al., 2013), while others (21 studies) measured both reliability and validity of the questionnaires (Guo et al., 2013; Xue et al., 2012; Liang et al., 2011; Phatthana and Mat, 2011; Kelley et al., 2011; Klein, 2007; Klein, 2006; Tsai, 2014b; Liu et al., 2013; Martínez-Caro et al., 2013; Huang, 2011; Lin and Yang, 2009; Lishan et al., 2009; Bidmon et al., 2014; Lee and Rho, 2013; Hsu et al., 2011; Noblin et al., 2013; Jian et al., 2012; Emani et al., 2012; Wang et al., 2013; Tsai, 2014a). However, in one study where validity was tested, (Tsai et al. (2013) the reliability evidence was absent.

Internal consistency reliability was measured through Cronbach's alpha or composite reliability. Based on the assessment criteria, it appears that fifteen questionnaires had good internal consistency results and ten had acceptable internal consistency results (Table 3.5). Of these, only eight questionnaires were evaluating clinician-initiated CHITs, which can be selected to measure the acceptance of e-PROMs in the current research. The rest were partially passed the recommended criteria for reliability (i.e. some of the constructs have a Cronbach's alpha value lower than 0.70). Moreover, and from the findings, it appears that none of the previous studies provided evidence of questionnaire stability (test-retest reliability).

Table 3.5. Internal consistency reliability evaluation results. Ordered by the level of reliability testing, by date and alphabetically.

Reference	Reliability results	Reliability criteria	Criteria met?(1)/ reliability value(2)
Emani et al. (2012)	Cronbach's α = 0.57 to 0.88	Cronbach's α ≥ 0.80	Partially/ acceptable and good

Reference	Reliability results	Reliability criteria	Criteria met?(1)/ reliability value(2)
Van Uden-Kraan et al. (2011)	Cronbach's α = 0.65 to 0.93	Cronbach's α ≥ 0.80	Partially/ acceptable and good
Wilson and Lankton (2004)	Cronbach's α = 0.60 and above	Cronbach's α ≥ 0.80	Partially/ acceptable
Xue et al. (2012)	Cronbach's α = 0.52 to 0.983 Composite reliability= 0.81 to 0.99	Cronbach's α ≥ 0.80 Composite reliability ≥ 0.70	Partially/ acceptable and good
Tsai (2014a)	Cronbach's α = 0.72 to 0.99 Composite reliability= 0.67 to 0.99	Cronbach's α ≥ 0.80 Composite reliability ≥ 0.70	Partially/acceptable and good
Hsu et al. (2011)	Cronbach's α = 0.70 and above	Cronbach's α ≥ 0.80	Yes/ acceptable
Jian et al. (2012)	Cronbach's α = 0.70 and above	Cronbach's α ≥ 0.80	Yes/ acceptable
Wong et al. (2012)	Cronbach's α = 0.72 to 0.73	Cronbach's α ≥ 0.80	Yes/ acceptable
Chang and Im (2014)	Cronbach's α = 0.70 and above	Cronbach's α ≥ 0.80	Yes/ acceptable
Klein (2007)	Cronbach's α = 0.79 to 0.92	Cronbach's α ≥ 0.80	Yes/ acceptable and good
Cranen et al. (2011)	Cronbach's α = 0.77 to 0.93	Cronbach's α ≥ 0.80	Yes/ acceptable and good
Liang et al. (2011)	Cronbach's α = 0.76 to 0.97	Cronbach's α ≥ 0.80	Yes/ acceptable and good
Or et al. (2011)	Cronbach's α = 0.77 to 0.95	Cronbach's α ≥ 0.80	Yes/ acceptable and good
Peeters et al. (2012)	Cronbach's α = 0.74 to 0.88	Cronbach's α ≥ 0.80	Yes/ acceptable and good
Agarwal et al. (2013)	Cronbach's α = 0.72 to 0.96	Cronbach's α ≥ 0.80	Yes/ acceptable and good
Klein (2006)	Cronbach's α = 0.83 to 0.91	Cronbach's α ≥ 0.80	Yes / good
Lin and Yang (2009)	Cronbach's α = 0.82 to 0.94 Composite reliability= 0.80 to 0.95	Cronbach's α ≥ 0.80 Composite reliability ≥ 0.70	Yes / good
Lishan et al. (2009)	Cronbach's α = 0.80 to 0.92	Cronbach's α ≥ 0.80	Yes / good
Kelley et al. (2011)	Composite reliability = 0.86 to 0.98	Composite reliability ≥ 0.70	Yes / good
Phatthana and Mat (2011)	Cronbach's α = 0.88 to 0.97 Composite reliability= 0.88 to 0.96	Cronbach's α ≥ 0.80 Composite reliability ≥ 0.70	Yes / good
Wade et al. (2012)	Cronbach's α = 0.92 to 0.95	Cronbach's α ≥ 0.80	Yes / good
Guo et al. (2013)	Composite reliability = 0.88 to 0.93	Composite reliability ≥ 0.70	Yes / good
Huang (2013)	Cronbach's α = 0.82 to 0.92 Composite reliability= 0.83 to 0.92	Cronbach's α ≥ 0.80 Composite reliability ≥ 0.70	Yes / good
Lee and Rho (2013)	Cronbach's α = 0.87 to 0.97	Cronbach's α ≥ 0.80	Yes / good
Liu et al. (2013)	Cronbach's α = 0.84 to 0.94	Cronbach's α ≥ 0.80	Yes / good
Martínez-Caro et al. (2013)	Composite reliability = 0.83 to 0.85	Composite reliability ≥ 0.70	Yes / good
Noblin et al. (2013)	Cronbach's α = 0.87 to 0.90	Cronbach's α ≥ 0.80	Yes / good
Wang et al. (2013)	Cronbach's α = 0.94 to 0.98	Cronbach's α ≥ 0.80	Yes / good
Bidmon et al. (2014)	Cronbach's α = 0.82 to 0.93 Composite reliability= 0.89 to 0.95	Cronbach's α ≥ 0.80 Composite reliability ≥ 0.70	Yes / good
Tsai (2014b)	Cronbach's α = 0.80 to 0.99 Composite reliability= 0.81 to 0.99	Cronbach's α ≥ 0.80 Composite reliability ≥ 0.70	Yes / good

Note: (1) yes=met the criteria, no= did not meet the criteria and partially= part of the constructs met the criteria. (2) Reliability value is acceptable (above 0.70 and below 0.80) and/or is good (above 0.80)

3.4.2.2 Questionnaire validity

There was less attention shown, however, towards validity. As there are different types of validity, studies were diverse in testing approaches. Starting with face and content validity, these were reported in only seven studies. However, detailed documentation of the results of such was absent from all reviewed studies. Face and content validity

were ensured by conducting interviews with stakeholders (i.e. research participants, academics or clinicians) (Tsai, 2014b; Huang, 2011; Noblin et al., 2013; Hsu et al., 2011; Tsai, 2014a; Jian et al., 2012; Liang et al., 2011) (Table 3.6). In addition, one of these studies also evaluated the face and content validity quantitatively using CVI (Jian et al., 2012). As the questionnaire items had a CVI value above 0.8, the questionnaire was shown to have good content and face validity.

On the other hand, construct validity was tested more widely compared with the other types of validity. Twenty studies tested and reported results for construct validity (by measuring discriminant validity, convergent validity or both) (Guo et al., 2013; Xue et al., 2012; Liang et al., 2011; Phatthana and Mat, 2011; Kelley et al., 2011; Klein, 2007; Klein, 2006; Tsai et al., 2013; Tsai, 2014b; Liu, 2009; Martínez-Caro et al., 2013; Huang, 2013; Lin and Yang, 2009; Lishan et al., 2009; Bidmon et al., 2014; Lee and Rho, 2013; Wang et al., 2013; Hsu et al., 2011; Tsai, 2014a; Emani et al., 2012). From the review, and compared with the defined criteria, it appears that ten questionnaires showed good construct validity. However, nine had construct validity issues (Table 3.7). Although content, face and construct validity retained some attention within the reviewed studies, criterion validity was absent from all of them.

Table 3.6. Content validity evaluation results: ordered by date and alphabetically

Reference	Content and face validity	Content and face validity criteria	Criteria met?(1)
Hsu et al. (2011)	Interviews with two professors and three experts	Conducting interviews with key stakeholders	Yes
Liang et al. (2011)	Questionnaire pre-tested by two nursing professors, two business professors and thirty undergraduate freshmen in a university in the US	Conducting interviews with key stakeholders	Yes
Jian et al. (2012)	Conducting interviews and the CVI was above 0.8	CVI above 0.8	Yes
Huang (2013)	Interviews with eight experts in the domain	Conducting interviews with key stakeholders	Yes
Noblin et al. (2013)	Peer reviewed by both clinicians (one physician and one research nurse) and non-clinicians	Conducting interviews with key stakeholders	Yes
Tsai (2014a)	Feedback from twenty participants	Conducting interviews with key stakeholders	Yes
(Tsai, 2014b)	Interviews with senior system users	Conducting interviews with key stakeholders	Yes

Note: (1) yes=met the criteria, no= did not meet the criteria and partially= part of the constructs met the criteria.

Table 3.7. Construct validity evaluation results: ordered by the level of validity, by date and alphabetically

Reference	Construct validity	Construct validity criteria	Criteria met?(1)
Wang et al. (2013)	[Convergent] 1- Item significant in their loading	[Convergent] criteria (1)	No
Lishan et al. (2009)	[Convergent] 1- Item loading = 0.447 to 0.954	[Convergent] criteria (1)	Partially
Hsu et al. (2011)	[Convergent] Item loading = 0.343 to 0.961	[Convergent] criteria (1)	Partially

Reference	Construct validity	Construct validity criteria	Criteria met?(1)
Tsai et al. (2013)	[Convergent] 1- Item loading = 0.431 to 0.850	[Convergent] criteria (1)	Partially
Klein (2006)	[Discriminant] 1- the square roots of AVEs were greater than the constructs correlations. 2- Items were highly assigned to the respective construct compared with other constructs	[Discriminant] criteria (1) and (2)	Yes
Klein (2007)	[Discriminant] 1- The square roots of AVEs were greater than the constructs correlations.	[Discriminant] criteria (1)	Yes
Emani et al. (2012)	[Convergent] 1- Item loading = 0.70 to 0.91/ >0.70	[Convergent] criteria (1)	Yes
Lin and Yang (2009)	[Convergent] Item loading = 0.57 to 0.90 and items significantly correlate with measured constructs	[Convergent] criteria (1)	Partially
	[Discriminant] 1- All chi-squares of paired models (correlated and uncorrelated) were statistically significant at p<0.01	[Discriminant] criteria (3)	Yes
Liang et al. (2011)	[Convergent] 1- Item loading = 0.625 to 0.931	[Convergent] criteria (1)	Partially
	[Discriminant] 1- the square roots of AVEs were greater than the constructs correlations 2- Items were highly assigned to the respective constructs compared with other constructs	[Discriminant] criteria (1) and (2)	Yes
Xue et al. (2012)	[Convergent] 1- Item loading = 0.547 to 0.982	[Convergent] criteria (1)	Partially
	[Discriminant] 1- the square roots of AVEs were greater than the constructs correlations 2- Items were highly assigned to the respective constructs compared with other constructs	[Discriminant] criteria (1) and (2)	Yes
Huang (2013)	[Convergent] Item loading = 0.59 to 0.90 and items significantly correlate with measured constructs	[Convergent] criteria (1)	Partially
	[Discriminant] 3- All chi-squares of paired models (correlated and uncorrelated) were statistically significant at p<0.01	[Discriminant] criteria (3)	Yes
Lee and Rho (2013)	[Convergent] 1- Item loading = 0.568 to 0.893 2- AVE = 0.665 to 0.990	[Convergent] criteria (1) and (2)	Partially
	[Discriminant] 1- All factors have no-cross construct loading above 0.50	[Discriminant] criteria (2)	Yes
Phatthana and Mat (2011)	[Convergent] 1- Item Loading = above 0.70, but the details not reported	[Convergent] criteria (1)	Yes
	[Discriminant] 1- the square roots of AVEs were greater than the constructs correlations	[Discriminant] criteria (1)	Yes
Kelley et al. (2011)	[Convergent] 1- Item loading = above 0.707 but the details not reported 2- AVE =0.680 to 0.812	[Convergent] criteria (1) and (2)	Yes
	[Discriminant] 1- the square roots of AVEs were greater than the constructs correlations 2- Items were highly assigned to the respective construct compared with other constructs	[Discriminant] criteria (1) and (2)	Yes
Guo et al. (2013)	[Convergent] 1- Items loading= 0.734 to 0.955 / > 0.70	[Convergent] criteria (1)	Yes
	[Discriminant] 1- all correlations with the highest value of 0.546 were significantly lower than the square roots of AVEs	[Discriminant] criteria (1)	Yes
Liu et al. (2013)	[Convergent] 1- Item loading = 0.72 to 0.98 2- AVE = 0.76 to 0.77	[Convergent] criteria (1) and (2)	Yes
	[Discriminant] 1- The square root of AVEs were greater than the construct correlations	[Discriminant] criteria (1)	Yes
Martínez-Caro et al. (2013)	[Convergent] 1-AVE = 0.63 to 0.66	[Convergent] criteria (2)	Yes
	[Discriminant] 1- The square root of AVEs were greater than the construct correlations	[Discriminant] criteria (1)	Yes
Bidmon et al. (2014)	[Convergent] 1- Item loading = 0.85 to 0.95 2- AVE = 0.71 to 0.90	[Convergent] criteria (1) and (2)	Yes
	[Discriminant] 1- The square root of AVEs were greater than the construct correlations	[Discriminant] criteria (1)	Yes
(Tsai, 2014a)	[Convergent] AVE = 0.50 to 0.99	[Convergent] criteria (2)	Yes
	[Discriminant] 1- The square root of AVEs were greater than the construct correlations	[Discriminant] criteria (1)	Yes
Tsai (2014b)	[Convergent] 1- AVE = 0.59 to 0.99	[Convergent] criteria (2)	Yes

Reference	Construct validity	Construct validity criteria	Criteria met?(1)
	[Discriminant] 1- The square root of AVEs were greater than the construct correlations	[Discriminant] criteria (1)	Yes

Note: (1) yes=met the criteria, no= did not meet the criteria and partially= part of the constructs met the criteria.

3.4.2.3 Summary of the psychometric quality results

Table 3.8 shows a summary of the psychometric quality of the reviewed studies. Out of the 30 studies testing internal consistency reliability, only 25 studies completely met the criteria. Only seven studies tested face and content validity. Moreover, for construct validity, only 11 studies out of the 20 studies testing construct validity, totally met the criteria. However, none of the reviewed studies tested the stability of the measure (test-retest reliability) and criterion validity.

Table 3.8. Summary of the psychometric quality results

Reliability/validity type	Evaluation criteria	Number of studies tested it (%)	Number of studies totally met the criteria (%)
Internal consistency reliability	Cronbach's α ≥ 0.70 is acceptable and ≥ 0.80 is good	30 (88%)	25 (74 %)
	Composite reliability ≥ 0.70		
Test-retest reliability	Test-retest coefficient ≥ 0.70	0 (0%)	0 (0%)
Face and content validity	Conduction of qualitative work to assess face and content validity	7 (21%)	7 (21%)
	CVI ≥ 0.80		
Construct validity (both convergent and discriminant)	Using CFA: (1) goodness-of-fit indices (χ^2/d.f.≤3, CFI≥ 0.90, TLI ≥ 0.90, RMSEA (CI=90%)< 0.08 and SRMR<0.08)[(a)] (2) significance level of each item	20 (59%)	11 (32%)
Convergent construct validity	(1) Items should be significantly correlated with the measured construct and the item loading ≥ 0.70		
	(2) Constructs with AVE higher than 0.50		
Discriminant construct validity	(1) The constructs inter-correlation should be lower than the square root of AVE of the constructs		
	(2) Items should correlate higher to the respective constructs compared with the other constructs.		
	(3) The χ2 difference values of two models (correlated and uncorrelated) and for paired constructs should be significant		
Criterion validity	Correlation coefficient ≥ 0.70	0 (0%)	0 (0%)

3.4.3 Questionnaire response rate and the associated factors

As explained earlier in the introduction section, the response rate is also a method for judging how well designed a questionnaire is. As shown in Table 3.9, there is a clear difference in response rates between the reviewed studies. Hsu et al. (2011); Daim et al. (2013),Tsai et al. (2013), Noblin et al. (2013), Lai et al. (2008),Tseng and Wu (2014), Chang and Im (2014) Wong et al. (2012) and Cranen et al. (2011) had the highest response rates (100%), while Wilson and Lankton (2004) had the lowest (9%). The

next section explores the association between the availability of reminders, administration methods, questionnaire mode and number of items, and the response rates in the reviewed studies. From the descriptive results (Table 3.10), it appears that the response rate (RR) is normally distributed (see Appendix A for more details). Consequently, parametric tools were used for the analysis.

Table 3.9. Response rate (RR) of the reviewed studies. Ordered from the lowest response rate to the highest

Reference	N[(1)]	No. of responses	Computed response rate (%)[(2)]	Reminders[(2)]	Administration method[(1,3)]	Questionnaire Mode[(4)]	No. of items
Wilson and Lankton (2004)	1750	163	9	0	2	1	27
Klein (2006)	871	143	16	1	2	1	30
Agarwal et al. (2013)	1801	283	16	1	2	1	81
Klein (2007)	1473	294	20	1	2	1	21
Xue et al. (2012)	2273	700	31	0	2	2	27
Jian et al. (2012)	3000	1465	49	N/A	1	2	17
Emani et al. (2012)	1500	760	51	2	2	2	25
Peeters et al. (2012)	468	254	54	0	2	2	22
Lee and Rho (2013)	400	219	55	N/A	1	2	38
Liu et al. (2013)	90	50	56	N/A	1	2	10
Lin and Yang (2009)	400	229	57	N/A	1	2	27
Bidmon et al. (2014)	1561	1006	65	0	2	1	23
Van Uden-Kraan et al. (2011)	1013	679	67	1	2	2	64
Lishan et al. (2009)	1500	1071	71	N/A	1	2	21
Martínez-Caro et al. (2013)	380	277	73	N/A	1	2	15
Phatthana and Mat (2011)	320	236	74	N/A	1	2	24
Wang et al. (2013)	350	271	77	NS	NS	NS	NS
Or et al. (2011)	124	101	82	0	2	2	31
Guo et al. (2013)	250	204	82	N/A	1	2	21
Tsai (2014a)	370	365	99	N/A	1	2	31
Tsai (2014b)	370	365	99	N/A	1	2	19
Daim et al. (2013)	161	161	100	N/A	1	2	53
Hsu et al. (2011)	125	125	100	N/A	1	2	23
Tsai et al. (2013)	101	101	100	N/A	1	2	20
Wong et al. (2012)	98	98	100	N/A	1	2	30
Noblin et al. (2013)	562	562	100	N/A	1	2	8
Cranen et al. (2011)	30	30	100	N/A	1	2	14
Lai et al. (2008)	32	32	100	N/A	1	2	11
Tseng and Wu (2014)	20	20	100	N/A	1	2	22
Chang and Im (2014)	300	300	100	N/A	1	2	45

Reference	N[(1)]	No. of responses	Computed response rate (%)[(2)]	Reminders[(2)]	Administration method[(1,3)]	Questionnaire Mode[(4)]	No. of items
Liang et al. (2011)	NS	369	N/A	0	2	1	28
Kelley et al. (2011)	NS	29	N/A	0	2	2	29
Huang (2013)	NS	369	N/A	N/A	1	2	21
Wade et al. (2012)	NS	32	N/A	N/A	NS	2	8

Note: (1) NS = not shown, (2) N/A= not applicable, (3) 1= directly administered questionnaires and 2= indirectly administered questionnaires and (4) 1= electronic/online questionnaire and 2= paper-based (i.e. face to face, postal, mail and via-phone) questionnaire.

Table 3.10. Descriptive statistics of response rate

N		Mean	Median	Mode	SD	Variance	Skewnesss	Std. error of skewnesss	Kurtosis	Std. error of Kurtosis	Min.	Max.
Valid	Missing											
30	4	70.0	73.3	100	29.6	873.8	-0.659	0.427	-0.650	0.833	9	100

a. Response rates and reminders

An independent sample t-test was applied to compare the differences in response rates between those studies that reminded respondents to complete the questionnaire and those that did not remind respondents (Table A.**6**). The sample number in each group was five only. This is because the reminder was not applicable for some studies (i.e. questionnaires that were directly administered by the researcher). There was no significant difference between the two groups, $t(8) = 0.856, p>0.05$.

b. Response rates and the administration method

To understand the association between response rates and the method of administration (i.e. directly administered questionnaires and non-directly administered questionnaires) an independent sample t-test was conducted (Table A.**7**). There was a significant difference between the two groups, $t(27)= 5.19, p< 0.001$, with the directly administered questionnaires (*Mean = 85, SD= 28*) having higher response rates than non-directly administered questionnaires (*Mean = 41, SD= 24*). The magnitude of the difference in the mean (*Mean difference= 43.9, 95% CI: 26.6 to 61.3*) was large (*eta squared= 0.56*).

c. Response rates and the questionnaire mode

Another independent sample t-test was conducted to compare response rates of both modes of questionnaires online/electronic questionnaire vs. paper-based questionnaires (including self-completion questionnaires, interview-based questionnaires and mail/posted questionnaires) (Table A.**8**). There was a significant

difference between the two groups, *t(27) = -4.95, p< 0.001*, with paper-based questionnaires (*Mean= 79, SD= 22*) having a response rate higher than online/electronic questionnaires *(Mean= 25, SD= 22)*. The magnitude of the difference in the mean (*mean difference = -53.9, 95% CI: -76.3 to -31.5)* was large *(eta squared = 0.48)*.

d. Response rate and number of items

To test the relationship between response rates (*Mean= 70, SD= 29.6*) and the number of items (*Mean= 26.9, SD= 15.3)*, Pearson's product-moment correlation analysis was conducted (Table 3.11, Table 3.12 and Figure 3.3. Preliminary analyses were performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There was no correlation between the two variables *r= -0.3, n= 27, p>0.05*.

Table 3.11. Descriptive data of the response rate and the number of items

Descriptive statistics	Mean	Std. Deviation (SD)	N
Response rate	70.03	29.561	30
Items	26.85	15.301	33

Table 3.12. Pearson product-moment correlation analysis to test the association between response rate and number of items

		Response rate	Items
Response rate	Pearson Correlation	1	-0.237
	Sig. (2-tailed)		0.216
	N	30	29
Items	Pearson Correlation	-0.237	1
	Sig. (2-tailed)	0.216	
	N	29	33

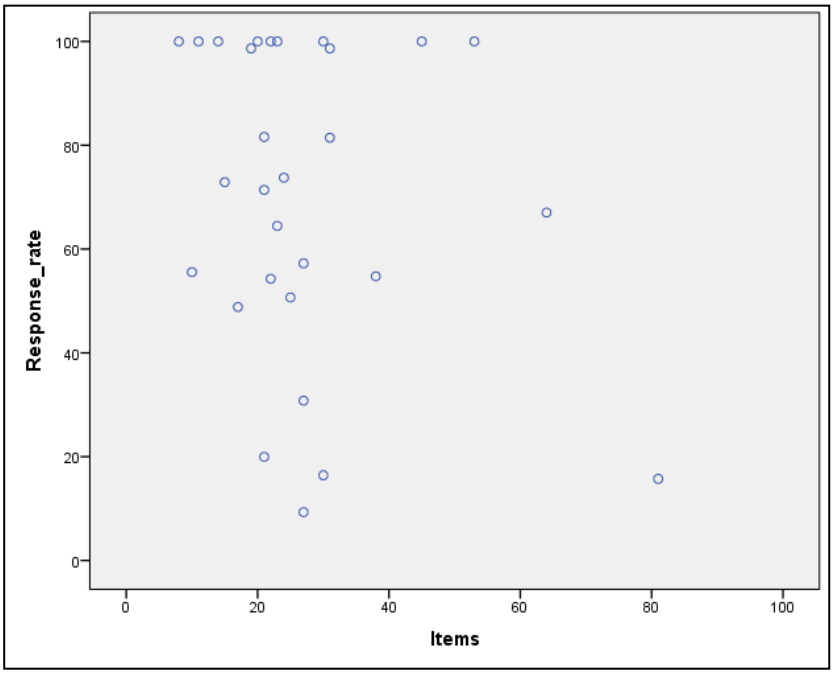

Figure 3.3. Scatterplot graph of the correlation between response rates and number of items

e. Multiple regression to understand the factors influencing the response rates

Multiple regression analyses were performed to investigate the ability of the administration method and questionnaire mode of distribution to predict response rates. They were the only two variables showing significant association with response rates (see Section 3.4.3. b and c). Preliminary analyses were conducted to ensure no violation of the assumptions of normality, linearity and homoscedasticity. Furthermore, the associations between the predictor variables included in the study were examined. The method of administration does not correlate with the mode of distribution ($r = -0.10, p=0.29$). This indicates that multicollinearity was unlikely to be an issue (Tabachnick and Fidell, 2007).

Since no a priori hypotheses had been made to determine the order of entry of the predictor variables, a direct method was used for the multiple linear regression analysis (Table 3.13). The two independent variables explained 48% of the variance in response rates ($F(2, 26) = 11.8, p < 0.001$).

In the final model only the mode of distribution was statistically significant, with Beta value ($\beta = 0.44, p < 0.05$). This means that in this sample of studies, paper-based questionnaires had a higher response rate compared with electronic modes.

Table 3.13. Results from regression analysis between response rate and two variables (administration methods and mode of distribution)

Variable	Response rate			
	B	*SE B*	*β*	CI 95% (B)
Administration method	0.005	0.18	0.004	-0.357 / 0.366
Mode	52.06	10.78	0.69*	29.91 / 74.212
R^2			0.475	
Adjusted R^2			0.435	
F			11.78***	

*** p > .05, ** p>.01, *** p>.001**

3.5 Discussion and conclusion

The aim of this part of this part of the study was to review all the theoretically informed questionnaires so far developed to measure patient acceptance of CHITs and to evaluate their quality, including questionnaire reliability and validity, and response rates. Moreover, it explored the main factors associated with response rates within the reviewed studies. The aim being to highlight whether or not there is a valid and reliable questionnaire that can be used to measure patient acceptance of e-PROMs in the United Kingdom. Thirty-four articles passed the inclusion/exclusion criteria. Of these, the questionnaire validation process was part of the hypothesis testing for each of the studies. However, none focused only on the process of questionnaire development and validation.

3.5.1 Reflection on the questionnaire characteristics

Starting with the study locations, the results showed that the majority of these studies were conducted in the Far East, which makes use of these questionnaires in a UK context difficult, as there are significant cultural differences between the two regions (Berry, 1992). Yet, to date, there has been no study conducted in the UK to test the acceptance of CHITs using a theoretically informed questionnaire. Although Shah et al. (2013) developed a questionnaire to measure acceptance, it was aimed towards using a medical device, not a CHIT application. As discussed earlier, measurement of acceptance is crucial before system implementation begins. It is significantly linked with later system use and, ultimately, system success (Or and Karsh, 2009). Accordingly, researchers in the UK have to work more on measuring patient acceptance of CHITs before actual system use occurs.

By looking at the type of CHITs evaluated in the reviewed articles, the majority of studies (65%) focused on measuring patient acceptance of patient-initiated CHITs. However, only 35% of the studies developed a questionnaire to understand the factors influencing acceptance of clinician-initiated CHITs. Again, as the aim of the study was to find an appropriate questionnaire to measure patient acceptance toward using e-PROMs, the main interest is clinician-initiated CHITs. This type of CHIT was expected to be rejected more than patient-initiated ones, because the benefits from using them may be unseen by patients (Basch et al., 2007; Wilkie et al., 2003). In that case, the patient may be reluctant to learn to use these technologies. Consequently, even if there is a good questionnaire to explain the acceptance of patient-initiated CHITs, it might not help to understand acceptance within the e-PROM context.

The third element of the current review related to the generalisability of the questionnaires, i.e. the ability to use the reviewed questionnaires in another context. Of the thirty-four studies, ten questionnaires were inaccessible even after contacting the main authors and twelve questionnaires were very context specific (non-English questionnaires or focused on very specific CHITs platforms). The other twelve questionnaires were more general, but could only be used to evaluate the acceptance of a different types of CHIT, other than e-PROMs (e.g. telecare, telehealth and e-health). Consequently, none of the available questionnaires were adequate for use in the e-PROM context. This result highlighted the need for a reliable, valid and theory informed generic questionnaire to measure e-PROM acceptance. This generic questionnaire then could provide a standardised method of assessment and allow comparison between different settings (Benson and Potts, 2014).

The fourth element considered was the theoretical framework. Although these studies applied well-known theories, almost all added more factors in the utilised questionnaires. To understand the reason behind this extension, we looked for the reason for selecting the particular theory and for adding more constructs. It appears that the justification was absent in the majority of cases, although this was highlighted in a previous study as a weakness that needed to be improved in future research (Wilson and Lankton, 2004). Consequently, and because of the missing justification, the reasons for adding more constructs could be: (1) researchers might have chosen the wrong model that did not reflect the correct factors (Venkatesh et al., 2003), or (2) the theory may have originally been developed in another field (e.g. social sciences) and might be missing some important factors within the health informatics field (Holden and Karsh, 2010). Therefore, this emphasises the need for precise selection of the study theory based on the study context. Although there are some theories developed

in the information technology context to understand general user acceptance (i.e. Technology Acceptance Model), the health informatics field deals with a specific group of users that would be influenced by more factors (e.g. user health status, upper extremity functional ability, visual functional status) (Or and Karsh, 2009; Or et al., 2011). The field of health informatics then would need to do more work in developing an appropriate theory to understand patient-CHIT acceptance. Some researchers acknowledged this need and started to pave the way for developing a patient acceptance model (i.e. Or et al. (2011), but this process is still immature and needs more attention. However, the field of health informatics will not be able to proceed to this step without developing and validating questionnaires to facilitate theory testing.

3.5.2 Questionnaire validity and reliability

Although the descriptive findings justified the need to develop a generic measure to understand e-PROM acceptance, a review of the validity and reliability work of the available questionnaires highlighted important points for future research. As discussed earlier, questionnaire validity and reliability are important to ensure the collection of accurate data. From the review, it appears that the only studies that conducted advanced validity and reliability testing were Huang (2013), Hsu et al. (2011), Tsai (2014a), Liang et al. (2011) and Tsai (2014b). They tested one type of reliability (internal consistency) and different types of validity. When looking at the level of validity and reliability conducted by these questionnaires, it appears that the only questionnaire passing the evaluation criteria was Tsai (2014b).

On the other hand, test-retest reliability and criterion validity were absent from all of the reviewed studies. Although some studies did not show any reliability or validity testing results, it does not mean these questionnaires are not reliable or valid. However, the use of these questionnaires by health informatics researchers, with no apparent evidence, would create some risks in terms of using poor reliability/validity questionnaires.

This finding emphasised that there are some issues that need to be improved upon in future health informatics research. In fact, the questionnaire validation process within studies measuring CHITs is, theoretically, still incomplete and needs more work. For example, the majority of studies failed to report face and content validity which is the most basic step, and were content with measuring construct validity only. Indeed, none of the reviewed studies documented well the detailed work conducted to evaluate face and content validity, even the studies that reported on this element. Moreover, the stability (test-retest) reliability and the criterion validity were not tested. The absence of

criterion validity could be reasonable because there is no “gold-standard”/well-established measure that has existed until now to measure patient acceptance, or the researchers were unable to conduct a longitudinal study to compare acceptance with actual use (Friedman and Wyatt, 2006). However, an evaluation of test-retest reliability is still needed (Streiner and Norman, 2008).

Full validation work, including the level of reliability and validity, is important to minimise different types of bias (or questionnaire error) (Streiner and Norman, 2008). Making a questionnaire as error free as possible is crucial to successful science. Many fields of science have integrated a specific branch of science focused on studying the process of questionnaire development and validation (i.e. psychometrics and sociometrics). Based on these branches, researchers present the process of questionnaire development and validation in a separate and independent study from the demonstration studies. However, this separation was noticeably absent in the health informatics field. Friedman and Abbas (2003) highlighted the need for more questionnaire development and validation studies in the field of health informatics for it to be considered a mature science. Since their call and based on this study finding, health informatics is still an immature science and requires more focus on questionnaire development and validation process studies.

3.5.3 Response rate

In addition to validity and reliability, this review explores questionnaire response rates. It appears that the studies were varied in their response rates. However, when looking carefully for factors that might be associated with response rates from all reviewed studies, initially and from the univariate analysis, it was revealed that the mode of distribution and administration methods were the only factors associated with response rates. For the mode of distribution, the current study results were consistent with previous study findings where it was noted that electronic questionnaires have lower response rates than paper-based questionnaires (Shih and Fan, 2009; Manfreda et al., 2008). In fact, not all people have frequent access to the Internet which might be a logical reason for the low response rate. For the administration mode, the current study found directly-administered questionnaires to have higher response rates than the indirectly-administered ones, which is also consistent with previous study findings (Gliner and Morgan, 2000). This could be simply due to the fact that a researcher might not count the people not participating, which increases the value of the response rate.

However, in this group of studies the availability of a reminder did not demonstrate any significant relationship with response rate. Nevertheless, the number of analysed

studies should be considered. There were only ten studies available to test the aspect of a reminder because the other studies used face-to-face data collection, which does not require reminders. Consequently, this unequal number of observations might hide the association with reminders which was discussed widely in the extant literature (Cook et al., 2000; Manfreda et al., 2008).

In addition to reminders, questionnaire length was also shown to have no effect on response rate in the reviewed studies. In the previous reviews, the association between questionnaire length and response rate had an effect ranging from strong to very weak (Fan and Yan, 2010; Edwards et al., 2002; Singer, 1978; Heberlein and Baumgartner, 1978). This could be due to variation in the methods of measuring questionnaire length (i.e. number of items, number of pages and number of screens). Consequently, the reason for not showing a significant relationship between questionnaire length and response rate in this study, could be because the former was measured using the number of items only, due to limited access to other information. So, if other aspects of questionnaire length were measured, different results may be expected, as consistent with the previous literature results.

When the questionnaire mode and distribution method was tested using multivariate regression analysis, it was found that the questionnaire mode was the only significant predictor of response rate. Online questionnaires had a lower response rate compared with paper-based questionnaires. A number of studies mentioned the low response rate of electronic mode questionnaires (Shih and Fan, 2009; Manfreda et al., 2008). Since then, research has focused on understanding the factors that might increase the response rate with electronic questionnaires (Fan and Yan, 2010; Deutskens et al., 2004; Sheehan, 2001). However, because the sample size in the two modes of categories was significantly different in this study (electronic = 5 and paper = 24), the results might be biased by this sample size. So, further research needs to be conducted to investigate the association between the questionnaire mode and the response rate.

3.6 Summary

1- More studies need to be conducted in the UK to measure patient acceptance of CHITs, as acceptance is associated with later system use.
2- In general, the majority of the reviewed studies focused on understanding the acceptance of patient-initiated rather than clinician-initiated CHITs. However, the

clinician-initiated CHITs might have higher rejection levels, as their benefits are not always seen by patients. Consequently, more research, in the health informatics field, should be conducted to understand the factors influencing acceptability of clinician-initiated CHITs.

3- It appears that none of the questionnaires within the reviewed studies were appropriate for use to understand patient acceptance of e-PROMs. This is because the questionnaires were inaccessible, the questionnaires were very context-specific or the questionnaires were general, but designed for another type of CHIT. Consequently, a generic questionnaire for this purpose is needed.

4- In the reviewed studies, a justification for choosing the theoretical framework was absent from almost all of the studies. This may have led to researchers choosing an inappropriate theory that missed some important factors. Consequently, before a researcher develops a questionnaire to understand CHITs acceptance, he/she needs to review the available theories and precisely select the appropriate one based on the study context. More importantly, he/she needs to clearly articulate the reason for his/her selection in the study report.

5- It is important to fully validate the questionnaire before using it to understand the factors behind CHITs acceptance. Validity and reliability testing help to ensure the accuracy of the collected data because collection of the wrong data can lead to the wrong conclusion. The questionnaire validation process needs to be published in a separate study from the demonstration study. This would fill the health informatics literature gap and would take the field towards the direction of being a more mature science.

6- From this review, it appears that the electronic mode of questionnaires is the only factor reducing response rate. Consequently, if a researcher decided to use this method, he/she needs to know more about increasing the response rates of electronically distributed questionnaires. Although reminders, mode of distribution and length of questionnaire did not appear to have any influence over response rates, the uneven number in the study should be taken into account. More meta-analyses should be conducted to understand the factors influencing response rates.

CHAPTER 4. Review of Existing Theories/Models Useful for Understanding Information Technology Acceptance and Use

4.1 Introduction

Consumer health information technologies (CHITs) were introduced into clinical practice to improve healthcare delivery, as they have a positive impact on mortality rates, patients' quality of life and hospital readmission rates (Or and Karsh, 2009). However, patients may not always engage with these technologies (Lohr, 2011; Greenhalgh et al., 2010a). It has been shown that a considerable number of potential users do not accept and use the technology (Jimison et al., 2008). Consequently, study of the factors influencing acceptance and actual use is needed to encourage the use of these technologies, to fulfil the patients' needs and to increase the chances of technology success (Or and Karsh, 2009).

Or and Karsh (2009) and Peek et al. (2014) conducted systematic reviews to understand the factors influencing acceptance and use of CHITs. The reviews concluded that researchers in health informatics were focusing greatly on user relevant factors (e.g. sociodemographic factors and health-related factors). However, the factors influencing the acceptance and use of any information technology are in fact relevant widely to three different contexts: users, technology and organisation/environment (Chau and Hu, 2002; Hu et al., 1999). Based on Or and Karsh (2009) results, the focus on personal factors was due to a failure to engage a theoretical approach to understand acceptance and use. Using a theoretical approach can not only cover a range of contexts, it can also facilitate interpretation and comparison between studies, as mentioned by Peek et al. (2014). Consequently, both reviews, Or and Karsh (2009) and Peek et al. (2014), emphasised the application of a theory/model to understand acceptance and use for future researches.

To date, there has been no generic theory/model developed specifically and validated to understand patient acceptance toward using CHITs. Although Or et al. (2011) made some efforts to develop a patient acceptance model, the study concluded that the proposed model was not valid. In addition, their model had limitations as it included some factors that made it very context specific (e.g. perceived upper extremity functional ability and perceived visual functional status, which were factors more associated with an elderly population). Consequently, and similar to that conducted in the information technology literature, researchers in the health informatics field tried to

ground their theatrical justification based on behavioural theories/models developed in other disciplines, including psycho-social literatures, to understand the CHITs users' behaviour toward using or rejecting the technology (Dillon and Morris, 1996; Venkatesh et al., 2003).

This chapter reviews the behavioural theories used within the information technology literature to explain user acceptance and use. Although an understanding of user behaviour can help to predict the success of the information technology and justify the reason behind using or rejecting the e-PROMs, as discussed in Chapter 2, the main outcome of interest in this research is behavioural intention (BI), which helps to understand pre-implementation acceptance. Consequently, it is important to highlight the ability of the reviewed theories/models to explain BI, in addition to actual behaviour.

4.1.1 Study aim

The aim of this study is to understand the different factors that could influence patient acceptance toward using e-PROMs based on theoretical and empirical evidence.

4.1.2 Study objectives

I. To review the different theories/models that have been used to understand user acceptance and actual use of information technologies.
II. To understand the extent to which the identified theories/models were adopted and validated.
III. To choose an appropriate, well-validated, theory/model to measure patients' acceptance of e-PROMs.
IV. To review the empirical studies that qualitatively or quantitatively reported the factors influencing patient acceptance and use of electronic measures to report health information.
V. To check if there is a need to add more factors to the selected theory/model through mapping the empirical finding and the theoretical finding.

4.2 Background

Health informatics researchers can use one of the behavioural theories/models from the psycho-social or information technology literature to understand CHITs acceptance and use (Dillon and Morris, 1996; Venkatesh et al., 2003). In general, the behavioural theories/models that aim to explore behaviour change originate from two disciplines (i.e. sociology and psychology) (Prager, 2012; Morris et al., 2012). Theories/models study the behaviour from psychological prospective is different than the ones study behaviour from sociological perspectives. In psychology, theories/models focus on the individual

as they hold the individual behaviour as an outcome of competing factors, or personal beliefs, decided upon by the individual himself (e.g. Theory of Planned Behaviour (TPB) and Theory of Reasoned Action (TRA) which will be explained later in this chapter). Most of these theories/models depict personal beliefs influencing behavioural intention, which is a main predictor of actual behaviour. On the other hand, in sociology, researchers focus on the influence of external factors (e.g. the behaviour environment) over behaviour. Thus, these theories/models focus more on the behaviour itself or the association between behaviour, individuals and the environment in which they occur as an agent of change (e.g. Innovation Diffusion Theory and Normalisation Process Theory (NPT) explained later in this chapter). In this sense, environment and objects become also an active part in the behavioural change. However, in reality, the individual behaviour is influenced by both internal and external factors. Consequently, more recent theories/models incorporate both internal and external factors to understand individual behaviour (Prager, 2012).

Although information technology literature grounded their theories/models on those two disciplines, the theories/models have been adapted to make them appropriate for the information technology context, and additional constructs have been integrated relevant to the technology context, which helps to understand technology adoption (e.g. Technology Acceptance Model (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT), explained later in this chapter) (Davis, 1985; Davis, 1989; Venkatesh et al., 2003). Thus, the theories/models developed in this field have additional assumptions to the sociology and psychology literature. However, researchers in information technology still adopt theories/models from psycho-social literature to understand information technology adoption, which might be due to limitations within the information technology theories/models (Van Uden-Kraan et al., 2011; Yousafzai et al., 2010).

Consequently, there are different theories/models that a researcher can apply to understand a particular behaviour. As these are diverse in their underlying assumptions, researchers need to be cautious when selecting an appropriate one. Some factors may have a strong influence in one particular setting, but low influence in another setting (Chismar and Wiley-Patton, 2003). Venkatesh et al. (2003) argued that researchers face different options in terms of acceptance and use theories/models. However, they argued that once researchers have selected their favoured theory/model, they tend to ignore others without justifying the reason for their selection. This was consistent with findings from the earlier review, (Chapter 3), where it was shown that researchers offered insufficient explanations about the reasons for choosing their theory/model. Although some researchers may justify their choice of a particular theory/model due to

an understanding and appreciation that it has been widely tested and used (Or et al., 2011; Shah et al., 2013), this alone is not a sufficient reason for adoption, as they might miss another model that reflects the study context better, even with limited theory/model adoption and testing studies.

Indeed, Taylor and Todd (1995a) suggested two main criteria to facilitate decision making of the appropriate theory/model and can be applied to justify the selection. These were: (1) the theory/model should have both good predictive ability and enough contribution to understand the investigated phenomena. This can be reached by understanding the aim of this theory/model (e.g. understanding behaviour or changing an existing behaviour), the nature of the behaviour (volitional vs. non-volitional), the study contexts, including the population of interest (e.g. general public or professionals), and the power of generalisability (widely adopted and validated theory or not); (2) the theory should be parsimonious, which means it has few constructs and provides good predictive or explanatory power.

Although application of a theoretical approach is good to predict the phenomena of interest, it could be more powerful and convey more information if it was informed by empirical evidence (Streiner and Norman, 2008). This can help to ensure that the theory/model is able to predict the actual factors in a specific context (Holden and Karsh, 2010; Legris et al., 2003). Reviews of prior patient feedback would provide some hints of the expected factors that might influence acceptance empirically within the study context. Then mapping the selected theory/model, based on Taylor and Todd (1995a), with this finding can explain any gap in the theory/model and may highlight where additional factors are needed. In fact, extending the theories/models, by adding additional constructs, to understand CHITs acceptance is a common step as shown in the previous chapter (Chapter 3). This might highlight the fact that the existent theories/models are not predicting technology acceptance and use very well within the patient context. This integration would change the original theory/model which might then influence the theory/model validity. However, because the reason for the theory/model extension was absent in most of the reviewed studies and was a limitation indicated previously by Wilson and Lankton (2004), the mapping of both the theoretical and the empirical evidence could be a good way to justify the additional factors.

Therefore, this chapter includes a review of the empirical and theoretical evidence of the factors influencing patient-technology acceptance. The theoretical evidence review complements and updates the work conducted by Dillon and Morris (1996) and Venkatesh et al. (2003) who reviewed the different theories/models that can predict

acceptance and use of ITs in 1996 and 2003, respectively. Then, based on Taylor and Todd (1995a), the appropriate theory/model would be selected. After that, mapping the selected theory/model with the empirical evidence findings, as discussed earlier, would help to articulate the theoretical gap and further factors. The selected theory/model and the additional factors can help in understanding why patients reject this technology. It will help the clinician to predict who will use the CHITs (or the e-PROMs in this study) and who won't, and will provide them with a guide as to how to increase actual use in the future (e.g. providing training courses for patients). Which could then increase the chance of system success (Or and Karsh, 2009).

4.2.1 Defining key study terms

Before reviewing the literature on the factors influencing e-PROM acceptance, it is helpful to know the meaning of some key terms (i.e. theory, model and theory validation/testing).

A *model* is a visual representation of a particular phenomenon within a specific context (Lefrancois, 1999). A model can help to simplify a concept that is impossible to observe directly. Although the model should be tested experimentally, it is limited only to the studied context. However, a *theory* is conducted through a process of ongoing abstractions to show a set of hypotheses (Lefrancois, 1999). Through a theory, a hypothesis explaining a specific phenomenon is justified and generalised based on different experiments. Consequently, based on the previous definitions, a model could be included in or derived from a specific theory (Lefrancois, 1997).

A researcher can apply theories/models using both qualitative and quantitative methods (Creswell, 2008). Qualitatively, the theory/model can be used generally as a lens to help the researcher shape the questions they want to ask to understand a particular phenomenon (i.e. interviewing key participants to understand their views of something). A qualitative method is commonly used for theory/model generation (Neuman, 2005). However, quantitatively, the theory/model can be applied and tested to answer specific research questions (i.e. using a theoretically informed questionnaire). The results from the quantitative analyses would confirm or reject the hypothesis depicted by the applied theory/model. A quantitative method is the most commonly used type of method for theory/model testing (Creswell, 2008). In addition to these methods, a theory/model can be applied also in experimental research to provide a comparison framework, such as comparing different behaviours or different systems (Klandermans, 1993).

As this research aims to understand e-PROM acceptance and its main predictor, the quantitative approach was chosen to try to reach the study aim. Consequently, through

reviewing the theories/models that are appropriate for understanding acceptance, the theories/models operationalised will be justified. The developed questionnaires used to operationalise these theories/models can be adopted and modified to be appropriate to the study context.

4.3 Method

Figure 4.1 is a flow diagram explaining the process of searching the empirical and theoretical evidence to understand the factors influencing acceptance and actual use of CHITs. This search process facilitated the decision to choose the study theory/model and the need to add more constructs relevant to the context (e-PROM acceptance and use). In 2013, three literature searches were conducted that aimed to answer specific questions to reach the study objectives (Section 4.1.2). The databases used for searching the literature were Web of Knowledge, AMED (Allied and Complementary Medicine), BIOSIS Previews, Global Health, HMIC Health Management Information Consortium, Ovid MEDLINE, PsycARTICLES, PsycINFO, Leeds University Library's Journals. This review was updated in February 2015.

The first literature search: searching for theories/models used generally to measure IT acceptance and actual use within the IT literature (accomplished in July and August 2013 and updated in February 2015).

a. What are the available theories/models used to understand IT acceptance?

The second literature search: understanding the level of adoption and testing (i.e. level of generalisability) accomplished for the previously identified theories/models (accomplished in August 2013 and updated in February 2015).

b. To what extent have these theories/models been adopted, tested and validated?

The third literature search: although studies aimed at understanding the factors influencing e-PROM acceptance are still not available, some empirical studies have reported briefly some factors that could have a relationship with e-PROM use. The empirical studies in this literature search included studies of e-PROM implementation and studies comparing paper-based and electronic reporting of outcome measures. The third literature review entailed investigating the factors that could correlate with or influence patient acceptance and actual use toward e-PROMs from the previous empirical studies (accomplished in July 2013 and updated in February 2015).

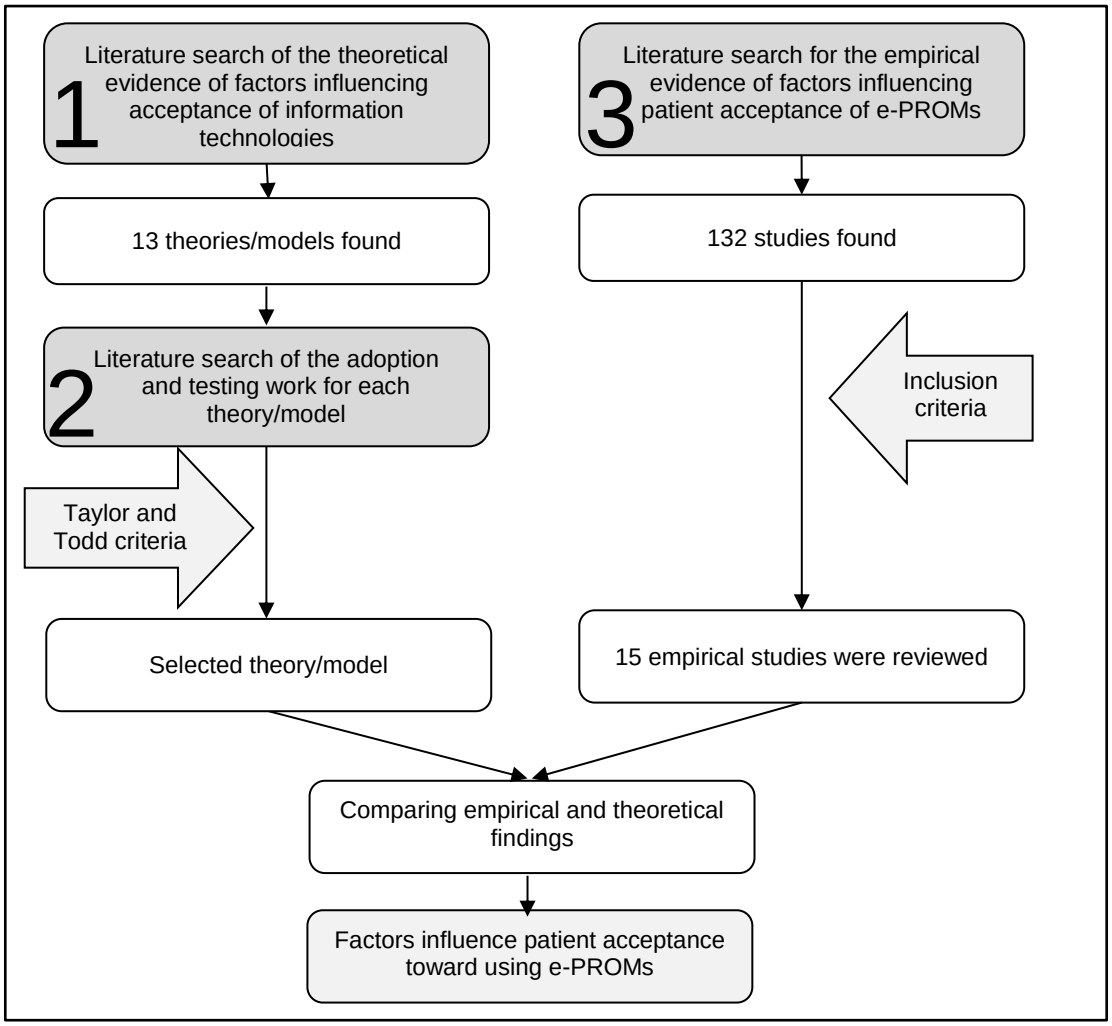

Figure 4.1. Flow diagram for literature searching strategy

4.3.1 Search criteria

The search criteria were purposely developed to be broad in this review. For the first literature review, different terms were used to identify the different theories/models used to measure IT acceptance. Including terms related to technology (technolog* OR system* OR Inform* technolog* OR computer* OR online) AND terms related to user acceptance (user* OR accept* OR use* OR Intent* OR reject* OR satisf* OR utiliz*) AND terms related to theory/model (theor* OR model*).

Then, for the second literature review, the name of each theory or model, located from the first review, was integrated with a set of words (i.e. valid*, test* and adopt*) to understand the extent to which the identified theories/models were validated and tested.

Finally, for the third literature review, the search terminology employed included terms related to electronic (electronic OR online OR internet OR computer*) AND terms related to patient reported measures (“patient-reported-outcome*” OR “Quality-of-life”

OR “patient-experience” OR “reporting-measure*” OR “pain-assessment”). The broad selection of search terms is because some e-PROM implementation studies reported patient feedback as a minor part of the study.

4.3.2 Inclusion and exclusion criteria

The inclusion and exclusion criteria were different for each literature search.

For the first literature review, no date limits were set (start of the database to date). All included studies had to be published in the English language. The study should measure user acceptance or the actual use of an information technology. Moreover, the study should apply a theoretical framework to understand user acceptance. The broad search for these theories/models within the information technology literature was because there are few studies within the patient context that apply valid theories/models compared to the IT literature (Or et al., 2011). Hence, some theories/models could have been applied to measure patient acceptance that have not been used by health informatics researchers to date. The literature search continued until no additional theory/model was identified. Around 13 theories/models were found that can explain IT acceptance and usage.

For the second literature review, no date limits were set (start of the database to date). All included studies had to be published in the English language. The included studies should adopt, validate or test one of the previously identified theories/models. The literature search was continued until saturation was reached and some information regarding theory adoption and testing work was extracted, including: the utilised theory and whether additional constructs were integrated to the model; how the theory/model operationalised to collect the study data; number of items; sample size; response rate; type of population; and the study finding, including the level of theory/model validity.

Finally, for the third literature review, no date limits were set (start of the database to date). All the included studies had to be published in the English language. The study should focus on implementing an e-PROM and should include participant feedback toward using the software qualitatively or quantitatively. Studies that contained feedback from only non-patient users (i.e. clinicians or administrative staff) or only measured the validity of online questionnaires without reporting patient feedback were excluded. A total of 15 studies were reviewed for this purpose.

4.4 Theoretical evidence

The information technology literature used a range of behavioural theories/models with different constructs to understand how and why individuals accept and adopt new information technology. Most developed a questionnaire based on the selected theory/model to operationalise the main phenomena. One way of categorising these theories/models is based on the theoretical concept. They can be divided into innovation-based and user-based theories/models (Han, 2003; Venkatesh et al., 2003). Although this way of categorising does not show the level of complexity of each theory/model, which can help to clarify whether the theory/model can be empirically tested or not, it was helpful to understand the nature of the factors depicted (i.e. internal or external factors) (Prager, 2012). Innovation-based theories/models focus on the overall information technology implementation success starting from the technology initiation and ending with the way the technology is embedded in everyday practice (Rogers, 1962; May, 2006). These theories/models show the influence of the external factors over the individual behaviour. Then, they can be applied at an organisational level to serve management decision making. However, health informatics researchers are more interested in understanding how CHITs users differentiate from those who reject the technology, with regards to their personal beliefs, demographic characteristics and other internal factors (Or and Karsh, 2009). Thus, user-based theories/models can be used as they highlight the internal reason behind the individual behaviour. The majority of these theories/models depict the individual behaviour and how it is predicted by behavioural intention and other personal beliefs. Consequently, the latter was the focus of this research, as behavioural intention was shown in Chapter 2 to be the main study outcome to understand pre-implementation acceptance.

Although innovation-based theories/models focus more on the external factors, some researchers used these theories to understand the user's adoption perception toward using information technology (Moore and Benbasat, 1991; Emani et al., 2012; Peeters et al., 2012). Moreover, they were used also to understand behavioural intention (Venkatesh et al., 2003). Consequently, both types of behavioural theories/models are reviewed and presented here.

It was found that 13 theories/models from the psycho-social literature were used to understand CHITs acceptance and actual use. These theories/models are described and critiqued in the following section. Table 4.1 includes the identified theories/models, the relevant constructs and the construct definitions (and Appendix B includes a summary of the different theories/models and their main gaps).

Table 4.1. List of the identified theories/models and their relevant constructs

Theory	Related study	Direct constructs of intention and use	Construct Definitions
Innovation Diffusion Theory (IDT)	(Rogers, 1995; Rogers and Shoemaker, 1971) and used by Moore and Benbasat (1991) to understand IT use	Relative advantage	"The degree to which an innovation is perceived as being better than its precursor." (Moore and Benbasat, 1991)
		Compatibility	"The degree to which an innovation is perceived as being consistent with the existing values, needs, and past experiences of potential adopters." (Moore and Benbasat, 1991)
		Complexity	"The degree to which an innovation is perceived as being difficult to use." (Moore and Benbasat, 1991)
		Observability	"The degree to which the results of an innovation are observable to others." (Moore and Benbasat, 1991)
		Trialability	"The degree to which an innovation may be experimented with before adoption." (Moore and Benbasat, 1991)
Normalization Process theory (NPT)	(May, 2006)	Interactional workability	"How does a complex intervention affect interactions between people and practices?"(May et al., 2007)
		Relational integration	"How does a complex intervention relate to existing knowledge and relationships?" (May et al., 2007)
		Skill-set workability	"How is the current division of labour affected by a complex intervention?" (May et al., 2007)
		Contextual integration	"How does a complex intervention relate to the organisation in which it is set?" (May et al., 2007)
Theory of Reasoned Action (TRA)	(Fishbein and Ajzen, 1975)	Attitude toward behaviour	"An individual's positive or negative feelings (evaluative affect) about performing the target behaviour." (Fishbein and Ajzen, 1975)
		Subjective norms	"The person's perceptions that most people who are important to him think he should or should not perform the behaviour in question" (Fishbein and Ajzen, 1975)
Social Cognitive Theory (SCT)	Bandura (1977) and refined by Compeau and Higgins (1995b)	Outcome expectations performance	The consequences of the behaviour related to the performance that deal with the job-related outcomes (Compeau and Higgins, 1995b)
		Outcome expectations personal	The consequences of the behaviour related to the personal expectations deal with the individual esteem and sense of accomplishment (Compeau and Higgins, 1995b)
		Self-efficacy	Judgment of one's ability to use a technology to perform a particular task (Compeau and Higgins, 1995b)
		Affect	A person's liking of a particular behaviour (Compeau and Higgins, 1995b)
		Anxiety	Emotional reactions when it comes to performing a behaviour (Compeau and Higgins, 1995b)
Theory of Planned Behaviour (TPB)	(Ajzen, 1985; Ajzen, 1991)	Attitude toward behaviour	Adapted from TRA
		Subjective norms	Adapted from TRA
		Perceived behavioural control	"The perceived ease or difficulty of performing the behaviour." (Ajzen, 1991)
Technology Acceptance Model (TAM)	(Davis, 1989)	Perceived usefulness	"The degree to which a person believes that using a particular system would enhance his or her job performance." (Davis, 1989)
		Perceived ease of use	"The degree to which a person believes that using a particular system would be free of effort." (Davis, 1989)
Model of Personal Computer Utilization (MPCU)	(Thompson et al., 1991)	Long-term consequences of PC utilization	"The expected consequences of the behaviour." (Triandis, 1971)
		Job-fit with PC use	"The extent to which an individual believes that using a PC can enhance the performance of his or her job." (Thompson et al., 1991)
		Complexity of PC use	"The degree to which an innovation is perceived as relatively difficult to understand and use." (Rogers and Shoemaker, 1971)
		Affect toward PC use	"An idea, charged with affect, that predisposes a class of actions to a particular c lass of social situations." (Triandis, 1971)

Theory	Related study	Direct constructs of intention and use	Construct Definitions
		Social factors influence PC use	"The individual's internalization of the reference groups' subjective culture, and specific interpersonal agreements that the individual has made with others, in specific social situations." (Triandis, 1979)
		Facilitating conditions for PC use	"Objective factors, 'out there' in the environment, that several judges or observers can agree make an act easy to do." (Triandis, 1979)
Motivational Model (MM)	(Davis et al., 1992)	Extrinsic Motivation	"The performance of an activity because it is perceived to be instrumental in achieving valued outcomes that are distinct from the activity itself, such as improved job performance, pay, or promotions." (Davis et al., 1992)
		Intrinsic Motivation	"The performance of an activity for no apparent reinforcement other than the process of performing the activity per se." (Davis et al., 1992)
Decomposed model of TPB (DTPB)	(Taylor and Todd, 1995a)	Attitude toward behaviour	Adapted from TRA/TPB
		Subjective norms	Adapted from TRA/TPB
		Perceived behavioural control	Adapted from TRA/TPB
Combined Model of TAM and TPB (C-TAM-TPB)	(Taylor and Todd, 1995b)	Attitude toward behaviour	Adapted from TRA/TPB
		Subjective norms	Adapted from TRA/TPB
		Perceived behavioural control	Adapted from TPB
		Perceived usefulness	Adapted from TAM
Technology Acceptance Model 2 (TAM2)	(Venkatesh, 2000)	Perceived usefulness	Adapted from TAM
		Perceived ease of use	Adapted from TAM
		Subjective norms	Adapted from TRA/TPB
Unified Theory of Acceptance and Use of Technology (UTAUT)	(Venkatesh et al., 2003)	Performance expectancy	"The degree to which an individual believes that using the system will help him or her to attain gains in job performance." (Venkatesh et al., 2003)
		Effort expectancy	"The degree of ease associated with the use of the system." (Venkatesh et al., 2003)
		Social influence	"The degree to which an individual perceives that important others believe he or she should use the new system." (Venkatesh et al., 2003)
		Facilitating conditions	"The degree to which an individual believes that an organisational and technical infrastructure exists to support use of the system." (Venkatesh et al., 2003)
Technology Acceptance Model 3 (TAM 3)	(Venkatesh and Bala, 2008)	Perceived usefulness	Adapted from TAM
		Perceived ease of use	Adapted from TAM
		Subjective norms	Adapted from TRA/TPB

4.4.1 Innovation-based theories/models

4.4.1.1 Innovation Diffusion Theory

Diffusion of Innovation has been used since the 1960s and was introduced by Rogers, a sociologist (Rogers, 1995; Rogers and Shoemaker, 1971) (Figure 4.2). The aim of this theory is to show how a new technology spreads through a specific culture. Diffusion is defined as the process by which a **new technology** is transferred through different **channels** among **social system** members and over **time**. From this definition,

it appears that the spread of a new technology is influenced by four elements; the technology itself, transfer channels, the social system and time. Starting with the technology itself, Rogers explained that technology characteristics (i.e. *relative advantage, compatibility*, *complexity*, *observability* and *trialability* – as defined in Table 4.1) influence actual technology adoption, which influences the technology spread. The second element is the technology transfer or communication, which is the way of sharing and developing some knowledge about the new technology. The third element is the social system which is a set of interrelated decision-making units (i.e. individuals, organisations, etc.) that could form the boundaries of technology spread. The characteristics of the decision-making unit (i.e. socio-economic characteristics, personal variables and communication behaviours) also influence the diffusion of the technology. The last element is time, which is directly involved in the new technology decision process and is composed of five steps, including: knowledge, persuasion, decision, implementation and confirmation.

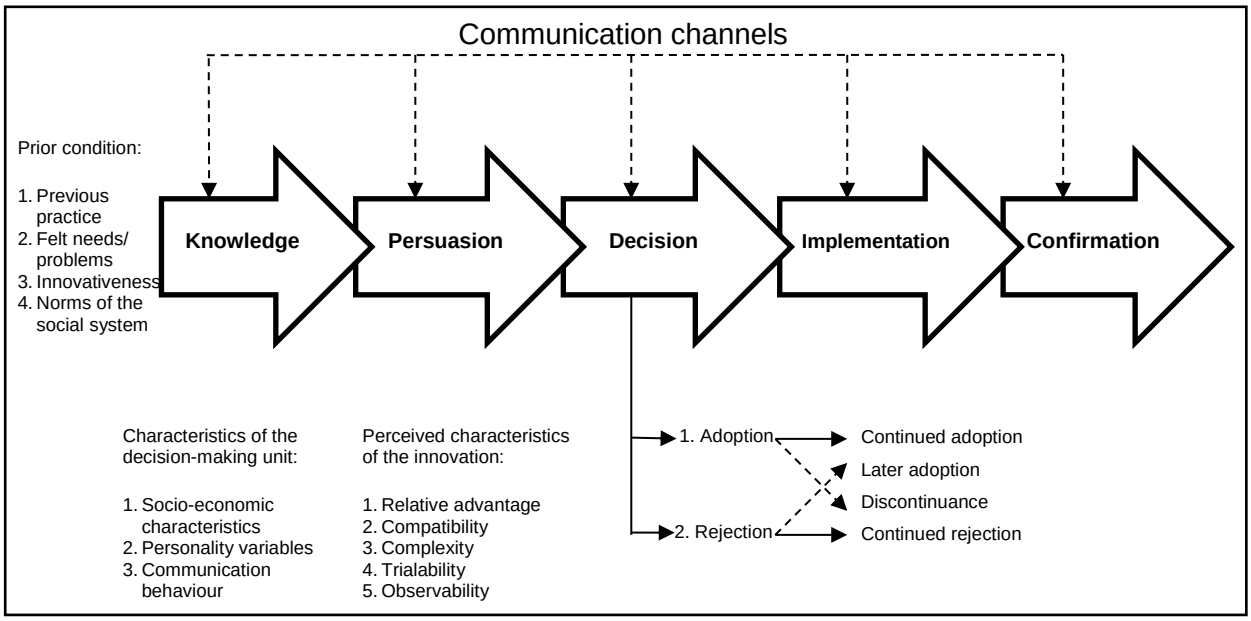

Figure 4.2. I Innovation Diffusion Theory (Rogers, 1995)

As this theory is based on sociology, it does not focus on the internal factors from the individual behaviour. Indeed, it generally focuses on how new innovation is embedded in routine work and how external factors influence the ultimate adoption. So, it might not be fully applied to understand the internal factors of an individual's behaviour (Venkatesh et al., 2003). However, it might be argued that the technology characteristics factors can be used as internal factors to understand information technology user behaviour (i.e. adopt or reject the technology). Moore and Benbasat (1991) adopted these five technology characteristics from the IDT to develop and

validate a questionnaire to understand potential technology adopters' perceptions. It was composed of 30 items used to measure eight constructs of user perceptions. These included relative advantage, complexity (or ease of use), trialability, compatibility, observability (including visibility and results demonstrability) and two additional factors including image and voluntariness of use. The integration of additional factors was drawn from previous literature that studied the characteristics of information system (Davis, 1985; Hurt and Hibbard, 1989; Larcker and Lessig, 2007; Rogers, 1995; Tornatzky and Klein, 1982).

The questionnaire was distributed to business individuals in seven companies from different industries to test their adoption of a personal workstation. Around 540 questionnaires were returned out of 800, yielding a response rate of 68%. Although, there was a chance of non-response bias, researchers did not explain how they dealt with this issue. Moreover, the study did not include details regarding how the 800 people were sampled. Moore and Benbasat (1991) were able to develop and validate a questionnaire informed by IDT, but they did not test the hypothesis behind this questionnaire. Another researcher followed Moore and Benbasat's work to test their proposed model (Venkatesh et al., 2003). The study hypothesised that these factors would be direct predictors of behavioural intention, which is by itself the main predictor of technology adoption. This association was tested at three points in time (post-training, one month after implementation and three months after implementation) and they showed up to 39% of both BI variance and actual use variance. However, the model was not fully validated and only relative advantages and ease of use showed significant influence over BI. It is important to note that the questionnaire within the study by Venkatesh et al. (2003) integrated factors from eight different theories/models and tested them using a very small sample size (a total of 215 participants) which might flaw the study finding. Thus, this evidence is not enough to show the validity of the IDT technology characteristics in predicting technology adoption.

Within CHITs, Peeters et al. (2012) applied four of the five characteristics to understand the reasons for home telecare use. Trialability was not investigated, as it was the same for all participants involved in this study. The study also integrated additional factors relevant to patients. The questionnaire was developed and validated for the study purpose. It included 22 items to measure five constructs (four technology characteristics and self-reported adoption measures) and some questions about individual characteristics. The questionnaire was distributed to all clients who used home telecare (468 clients). A total of 254 clients responded, yielding a response rate of 54%. This low response rate might raise an issue of non-response bias in this study, and researchers did not justify how they dealt with this kind of bias, which might affect

the reliability of the study findings. Peeters et al. (2012) found that one of the individual characteristics (living situation – i.e. living alone), relative advantage, compatibility, complexity and observability all influenced home telecare use and explained 62% of the use variance. The different results found within Peeters et al. (2012) and Venkatesh et al. (2003) might be because these studies tested the model in different contexts (i.e. business worker vs. patients) and so different constructs were important in different settings.

It appears that all of the above studies integrated additional factors or removed some factors from the five technology characteristics factors. This modification suggests that the technology characteristics within IDT may not map the technology adoption very well. Moreover, the characteristics predict adoption through focusing on user perception of technological factors and neglecting the environmental and the user factors. However, from previous CHITs acceptance studies in the patient context, it appears that factors relevant to the user are actually important to understand CHITs acceptance and use (Or and Karsh, 2009). Furthermore, the five technology characteristics were used to understand volitional behaviour and did not take into account some important factors relevant to understanding non-volitional behaviour (e.g. perceived behavioural control, which is the extent of an individual's control over resources) (Ajzen, 1985). This means if a researcher is interested in understanding the factors hindering the acceptance and use of clinician-initiated CHITs, this model might not be helpful as these included non-volitional behaviour. So, IDT was excluded from being the theoretical framework to understand e-PROM acceptance.

4.4.1.1 Normalisation Process Theory

The Normalisation Process Model (NPM) is a medical sociology theory which was developed by May (2006) to explain how technology is embedded in healthcare processes. NPM was developed in the healthcare context and was generalised then through developing the Normalisation Process Theory (NPT) (May et al., 2009). May et al. explained that an intervention in healthcare usually focuses on the relationships between three elements: actors – the individuals available in the healthcare settings; objects – the ways of reporting institution roles and guides; and finally, the contexts – the physical boundaries.

NPT depicted four constructs to promote the operationalisation of an intervention: interactional workability – the extent to which an intervention can affect the interactions between healthcare individuals; relational integration – the extent to which an intervention relates to the individual's knowledge; skill-set workability – the extent to which the current division of labour is influenced by an intervention; and contextual

integration – the extent to which an intervention relates to the organisation setting (May et al., 2009). NPT was increasingly used qualitatively to understand the individual perceptions of new practices (McEvoy et al., 2014). For example, Pope et al. (2013) used NPT to understand how a computer decision support system was embedded in routine work through undertaking ethnographic comparative analysis of a single computer decision support system in three different settings.

Although NPT worked well with Pope et al. (2013), to date NPT has not been used to understand technology acceptance or use. This could be because this theory does not focus on individual's own intentions and behaviour as primary drivers of normalisation. However, the assessment of the individuals' perceptions focuses on the work involved in a new practice, rather than their own intentions or actions (May, 2006). Another limitation of the NPT is that to date, NPT has not been operationalised to collect quantitative data and the majority of studies adopting NPT used qualitative approaches (May et al., 2010). In fact, it has been shown that "*complex networks of objects, actors, and processes with which the NPT is concerned present challenges for designing scientifically valid quantitative studies*" (May et al., 2010). Consequently, it would not be a good option for researchers interested in understanding acceptance and use of CHITs quantitatively. So, this model was also excluded from being the theoretical framework to understand e-PROM acceptance and use.

4.4.2 User-based theories/models

Additional to the previous innovation-based theories/models, there is a body of literature which has shown that user-based theories/models are good predictors of user acceptance and actual use of an information technology.

4.4.2.1 Theory of Reasoned Action

One of the social cognition theories is the Theory of Reasoned Action (TRA) which is a well-known psycho-sociological theory that predicts volitional behaviours, and was developed by Ajzen and Fishbein (1975) (Figure 4.3 and Table 4.1). The theory proposes that an individual behaviour is influenced by his intention to do the behaviour, which is in turn influenced by personal attitude (At) and subjective norms (SN). TRA was tested widely to understand different behaviours (e.g. health behaviour and social behaviour) (Manstead et al., 1983; Fishbein and Middlestadt, 1989; Bright et al., 1993; Bagozzi et al., 2014). Within information technology literature, Yousafzai et al. (2010) and Shih and Fang (2004) used TRA to study user acceptance (measured by behavioural intention – BI) and usage (measured by behaviour – USE) toward using Internet banking. In the Shih and Fang (2004) study, the questionnaire was developed by the researcher based on existing measures and included 33 items. The

questionnaire was informed by three different theories, including TRA, Theory of Planned Behaviour (TPB) and decomposed TPB, as the aim of the study was to compare the prediction power of these theories. A total of 425 personal banking customers from fifty-three Taiwanese banks completed the questionnaire. However, there were few details reported about the total number of participants recruited and the method of sampling. The majority of respondents (80%) were young adults aged between 21 and 40, and 81% had Internet experience of more than one year. Based on the finding, the TRA model explained 46% of BI variance and 20% of the USE variance. It was found that the largest and the only significant factor influencing BI within TRA was attitude.

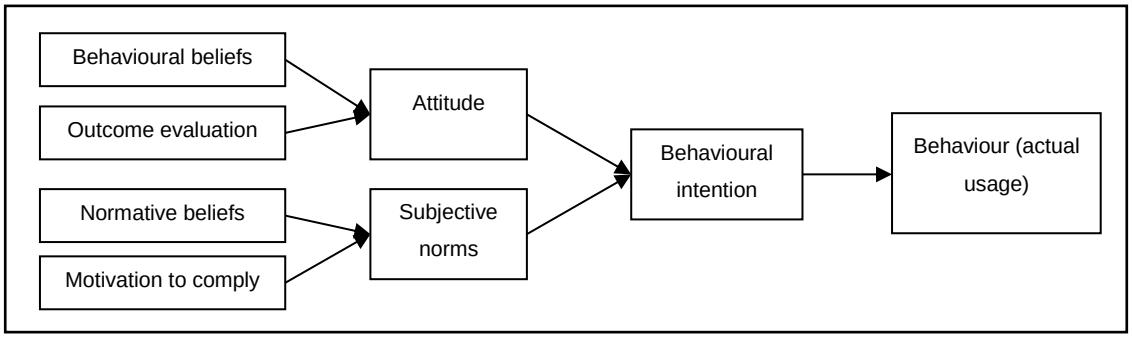

Figure 4.3. Theory of Reasoned Action (TRA) (Ajzen and Fishbein, 1980)

Later on, Yousafzai et al. (2010) applied TRA to understand the behaviour (i.e. adoption) of Internet banking. The questionnaire included 35 items developed within the study, based on existing measures and informed by four different theories/models (including TRA, TPB, Technology Acceptance Model (TAM) and modified TAM). Researchers also aimed to compare the prediction power of the models with regards to BI and actual use. Out of 2,000 questionnaires distributed, 441 were returned, yielding a response rate of 22%. The largest age group (around 42%) contained those aged between 26 and 45. Researchers investigated whether there was non-response bias due to the low response rate. From the results, it was shown that TRA was explained at 47% of BI variance and 37% of Internet banking USE variance. In the Yousafzai et al. (2010) the largest and only significant predictor was attitude which was also consistent with the Shih and Fang (2004) study. However, it is important to note that the study result was built on data that did not fit well on TRA, which might flaw the study results.

Although the influence of SN was absent within the two reviewed studies, other studies showed SN to be influencing BI (Karahanna et al., 1999; Brown et al., 2002). The absence of SN within Yousafzai et al. (2010) and Shih and Fang (2004) could be because both studies tested the model within participants that included young adults as

the majority group. However, from the perspective of elderly adults the beliefs of others, subjective norms, may be highly influential in determining how the elderly behave. Thus, when the influence of SN over behavioural intention was measured within aging participants, the association was significant (Xue et al., 2012; Lu, 2012).

In fact, it has been shown that TRA predicts BI well when the user has control over the decision of use. However, if any issue is not under the control of the user (e.g. Internet disconnections when evaluating an online tool), TRA would miss some factors and would not perform very well (Hale et al., 2002). Consequently, further researches by Ajzen (1985; 1991) were accomplished to overcome this limitation by adding perceived behavioural control factor to the model and introducing a modified model called the Theory of Planned Behaviour (TPB) (more details shown later in the TPB section). Based on this, TRA is not a good model to explain non-volitional behaviour such as the acceptance of clinician-initiated CHITs (i.e. e-PROMs), because the model will not explain the influence of factors not under patient control over the acceptance and mandatory use of CHITs (i.e. access to CHITs and the availability of resources). Thus, if a researcher wants to understand the acceptance of this kind of CHIT, they need to look for a better theory.

4.4.2.2 Social cognitive theory

Social cognitive theory (SCT) is another social cognition theory grounded in sociology (Bandura, 1977). It shows that the person's behaviour is understood by the interaction of three factors: personal (whether a person has low or high self-efficacy), behavioural (the consequences of behaviour related to the performance deal with the job related outcome and related to personal expectations dealing with individual esteem), and environmental (features of the environment that affect an individual's ability to conduct a specific behaviour). Although, this theory can explain behavioural change, it has some weaknesses. First, SCT is very broad-reaching as it includes very broad factors (i.e. personal, behavioural, environmental), it is difficult to be entirely operationalised (Munro et al., 2007). Second, the theory describes the fact that all three constructs are assumed to influence each other but, it is not mandatory, changes in environment should influence and change the personal factors (School of Public Health, 2013).

With regards to these limitations, Compeau and Higgins (1995b) made an effort to adapt the SCT to assess the cognitive influences over information technology use (measured by behaviour) Figure 4.4 and Table 4.1. Five direct predictors were identified to influence actual use: computer self-efficacy (extracted from SCT), two outcome expectation constructs (including performance-related outcome expectation

and personal outcome expectations and this was extracted from SCT) and two additional constructs that were not part of the original SCT (i.e. anxiety and affect).

Compeau and Higgins (1995b) tested their model on Canadian professionals whose work required them to process large amounts of information (i.e. managers, financial analysts, researchers and consultants). A questionnaire with 48 items measuring eight constructs was developed and validated to understand the use of information technology. Out of 2,000 questionnaires distributed, 1,020 questionnaires were returned with a response rate of 53.4%. The method of sampling was well designed and documented within the study and the participants were randomly selected which minimised the chance of sample-selection bias. Moreover, the issue of non-response bias associated with a low response rate was investigated and researchers made an effort to address this source of bias.

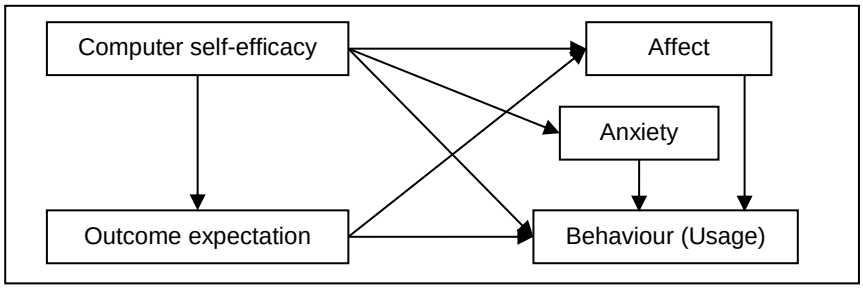

Figure 4.4. Compeau and Higgins' (1995b) model

The Compeau and Higgins (1995b) questionnaire explained 32% of variance in information technology use. All constructs showed small significant correlations with actual use. However, the strongest predictor was computer self-efficacy and the weakest was personal performance expectations. It is important to note that the majority of participants were male professionals (80%) who were familiar with Internet use, which limited the generalisability of the study findings. Later on, Compeau et al. (1999) tested Compeau and Higgins's model in a longitudinal study. A total of 394 respondents out of 2,000 completed the questionnaire at two points in time (the second point was one year after distribution of the first questionnaire). Researchers found the Compeau and Higgins's model was able to predict 34% of the variance on IT use within subscribers in a Canadian business periodical. However, the influence of anxiety over actual use was not significant. The reason for this might be due to the increased experience in using the technology, as there was a one-year time interval. It has been shown that increased experience reduces computer anxiety (Ayersman and Michael Reed, 1995; Dyck and Smither, 1994; Maurer and Simonson, 1993).

Although the Compeau and Higgins (1995b) model was able to explain the reason behind information technology usage, it did not include the influence of intention over behaviour, which is the main measure of pre-implementation acceptance in this research (see Chapter 2 for more details) (Or et al., 2011). In addition, this model was used to understand volitional use of a system which makes its adoption to understand the use of clinician-initiated CHITs not appropriate. Thus, the SCT was excluded from being the study theory to understand e-PROM acceptance and use.

4.4.2.3 Theory of Planned Behaviour

In 1985, Ajzen introduced the Theory of Planned Behaviour (TPB) to overcome TRA limitations by integrating a perceived behavioural control (PBC) factor to the theory to cover non-volitional behaviours (Ajzen, 1985; Ajzen, 1991) (Figure 4.5 and Table 4.1). Ajzen suggested a procedure of scale implementation for each construct. TPB was validated in different contexts to understand different behaviours (e.g. health related behaviour, dietary behaviour and behaviour associated with policymaking) (Scott et al., 2007; Schifter and Ajzen, 1985; Povey et al., 2000; Peters and Templin, 2010; Boyko et al., 2011). One of these contexts predicts the BI and USE in information technologies research. For example, Shih and Fang (2004) applied TPB to understand the acceptance and use of Internet banking. The study was conducted to compare competing theories/models (including TRA, TPB and a decomposed version of TPB). As shown previously in the TRA section, their questionnaire was developed by researchers from previous studies and included 33 items to measure the constructs of the different models. Although the total sample number was not reported, a total of 425 questionnaires were returned for the analysis. The study showed that TPB showed 54% of BI and 24% of USE. However, attitude was the largest and the only influential factor over BI, and BI the only predictor of actual use. Although the TPB hypothesised that attitude, subjective norms and perceived behavioural control would be the predictors of behavioural intention, the influence of SN and PBC were not significant within the study. This could be because of the participants' age, as the majority were young adults, and these two factors have been shown to be influential within elderly populations (Xue et al., 2012; Lu, 2012). Moreover, the influence of PBC was proposed when non-volitional behaviour was investigated. However, the behaviour in Shih and Fang (2004) study was volitional, so it should be expected that the influence of PBC would not be significant.

Baker et al. (2007) used TPB also to understand the factors influencing acceptance of a new technology within knowledge workers from 56 private and public sector organisations in Saudi Arabia. However, this study included the moderating effect of gender, age and education level with the main TPB constructs over behavioural

intention. The questionnaire was adapted from a previous study and included 14 items measuring TPB constructs. Although the total sample number recruited was not reported, it was shown that 1,088 participants completed and returned the survey. Those respondents were aged between 18 and 58, but the distribution of participants within the age categories was not presented. It has been found that TPB was able to predict 37% of BI variance. This study found that all three predictors of BI significantly influenced the outcome. Perceived behavioural control was the largest influential factor of BI and attitude was the lowest. Baker et al. (2007) measured non-volitional behaviour, so this might be the reason behind achieving different results to Shih and Fang (2004).

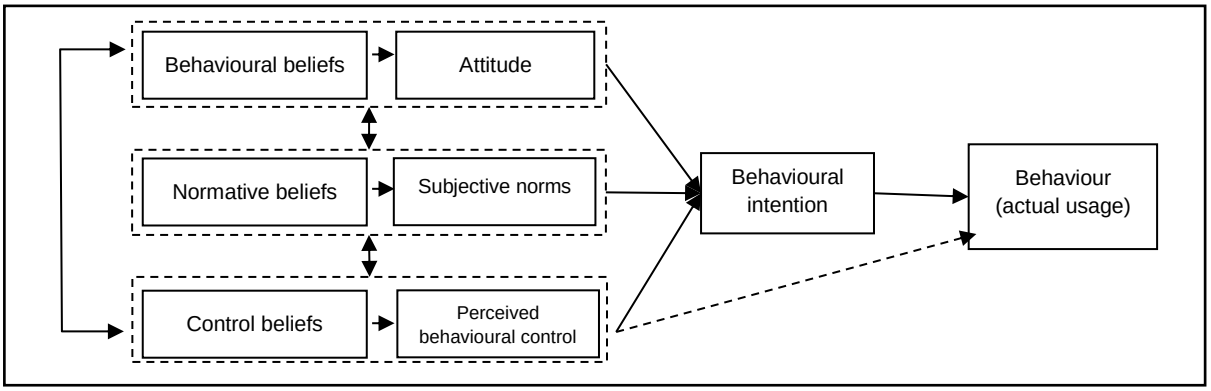

Figure 4.5. Theory of Planned Behaviour (TPB) (Ajzen, 1985; Ajzen, 1991)

In addition to the previous studies, TPB has been used within a patient context to define the determinants of the behavioural intention to engage in face-to-face and online patient support groups (Van Uden-Kraan et al., 2011). A 64-item questionnaire was developed by the researcher within the study based on the previous literature. Of the 1,013 questionnaires distributed, 679 were returned, yielding a response rate of 69%. The results showed that TPB explained 26% of BI variance to engage in online contact. Consistent with the Baker et al. (2007) finding, all TPB constructs showed a significant influence over BI. This could be because this study measured non-volitional behaviour where the influence of PBC is expected. The distribution of the age group was not reported, but it was shown that the mean age of participants was 54. Thus, the presence of elderly participants might be behind the significant influence of SN over behaviour. It is important to note that in this study, researchers did not discuss how different sources of bias were addressed, including non-response bias. Consequently, this bias might influence the study finding.

Consequently, from the previous evidences, and as TPB includes the PBC construct, it makes the model suitable for use to predict non-volitional behaviour (i.e. acceptance of

clinician-initiated CHITs). However, this can be a theory limitation if the researcher intends to measure volitional behaviour, as the ones who do not have the facilities to use the information technology might not be going to use it. Then, the influence of PBC over intention and actual use would be weakened, and the reason for this would not be clear. Another limitation was because the behaviour within TPB is not only predicted by BI as in TRA, but it is also predicted by ability (perceived behavioural control). This assumes that a person can successfully perform the behaviour through acquiring the resources, regardless of the individual intention (School of Public Health, 2013). Indeed, this is not actually the case and availability of resources only is not enough to accomplish the behaviour, so researchers need to be careful when applying the TPB. Even with the previous limitations, TPB can still be a good model to understand the acceptance and use of clinician-initiated CHITs. This is because the theory was initiated to explain non-volitional behaviour. Moreover, it can show the meditation influence of behavioural intention, the measure for per-implementation acceptance, over the actual use.

4.4.2.4 Technology acceptance model

The technology acceptance model (TAM) is another extension of TRA that been proposed to measure BI and USE of information technology (Davis, 1985; Davis, 1989) (Figure 4.6). TAM shows that perceived usefulness (PU) and perceived ease of use (PEOU) are the main predictors of BI, which is by itself the main predictor of individual behaviour (i.e. information technology USE). The practical application of this model is based on the fact that the two main determinants are factors that can be controlled, to some degree, by system developers. Thus, as a determinant of acceptance and actual use, they can provide system developers with a direction as to where they can put their efforts. In the TAM study, Davis developed and validated a questionnaire to understand BI and USE of an information technology.

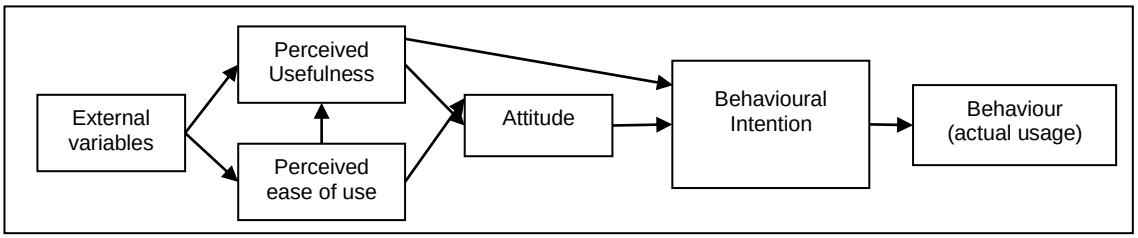

Figure 4.6. Technology Acceptance Model (TAM) (Davis, 1985; Davis, 1989)

TAM has been tested widely and in different contexts to measure user acceptance of an information technology. As shown in the previous review (Chapter 3) most of the studies used this model to understand acceptance and use of CHITs (Legris et al.,

2003; Venkatesh, 1999; Hu et al., 1999; Xue et al., 2012; Guo et al., 2013; Tsai, 2014a; Daim et al., 2013; Liang et al., 2011). For example, Guo et al. (2013) adopted TAM to understand elderly acceptance of preventive mobile health services. The main study outcome was BI as it was proposed as the measure of technology acceptance. Researchers integrated additional constructs including, technology anxiety and resistance to change. The study was well designed and documented. A questionnaire with 21 items was developed based on previous literature and validated within the study. A total of 250 questionnaires were distributed. Of these, 204 were returned yielding a response rate of 81.6%. The results show that PEOU and PU, the two predictors of TAM, were the only predictors of BI and they showed 34% of its variance.

Even with the success of TAM in measuring the technology acceptance, the degree of parsimoniousness of the model could help to generally understand the constructs effect, but not explain these constructs in detail to maximise support to system developers (Taylor and Todd, 1995a). Moreover, Holden and Karsh (2010) and Legris et al. (2003) thought TAM unsuitable to be used in the healthcare context as it missed some important factors relevant to the healthcare context. So, if a researcher proposes TAM to study the individual use of information technology within a healthcare context, they may need to extend the model by adding more context-related factors. With regards to this and from the previous review (Chapter 3), it has been shown that the majority of studies applying TAM actually integrated more patient relevant factors to understand acceptance and/or actual use. In fact, integrating TAM with additional factors has been found, in general, to be a common procedure in studies that applied TAM (Turner et al., 2010). For example, addition of the subjective norms factor which has an effect over the BI (Taylor and Todd, 1995a; Venkatesh and Davis, 2000; Venkatesh and Morris, 2000; Lucas and Spitler, 2007; Karahanna et al., 1999).

Another limitation is that most of the studies measured the subjective (self-reported) USE and there were few studies that considered an objective measure of USE, which is the actual measure of behaviour (Turner et al., 2010; Legris et al., 2003). However, there are differences in the relationship of BI with the objective and subjective measure of USE. Consequently, more research is needed on the objective measure (Turner et al., 2010). The complete testing of the model, including the objective measure of USE, is important to understand how TAM can help in predicting the actual use (Taylor and Todd, 1995a).

In addition to the previous TAM limitations, TAM is similar to TRA as it is unable to predict non-volitional behaviour (Torres-Coronas, 2012). This means that the model is inappropriate for use when a researcher aims to understand the acceptance of

clinician-initiated CHITs. Thus, TAM was excluded as the study model to understand e-PROM acceptance and use.

With regards to the previous issues, more researches have been conducted on extending TAM and introducing newer versions of the model (e.g. TAM2, TAM3) or combining TAM with other theories (e.g. C-TAM-TPB and DTPB) (the latter will be explained further in Section 4.3.2.7). TAM2 aimed to explain perceived usefulness and usage intentions in terms of social influence and cognitive instrumental processes (Venkatesh and Davis, 2000) (Figure 4.7). Thus, usefulness was decomposed by five additional constructs including subjective norms, job relevance, image, output quality and results demonstrability. A longitudinal study was conducted within organisational employees using a questionnaire developed within the study. The results found that TAM2 was able to predict up to 52% of BI. However, the study did not test the influence of BI over actual use. Moreover, the attitude construct was removed, but the justification behind removing this construct was absent.

Later on, TAM3 extended TAM2 and the main factors influencing perceived ease of use were depicted (Venkatesh and Bala, 2008) (Figure 4.8). Thus, the model integrated an additional six factors to predict PEOU. It was tested within organisational employees as well. The model explained around 53% of BI variance and 35% of actual use variance. However, with this expansion, the modified TAMs lose the parsimonious power and include many factors which increases the chance of construct multicollinearity (Taylor and Todd, 1995a). Moreover, the new versions of TAM (TAM2 and TAM3) include constructs that make them explicit to a specific context (i.e. measuring acceptance of business workers as they include the construct job-fit) which makes these models inappropriate for use in the patient context. So, the TAM extensions were also excluded from being the study models to help to understand patient acceptance of e-PROMs.

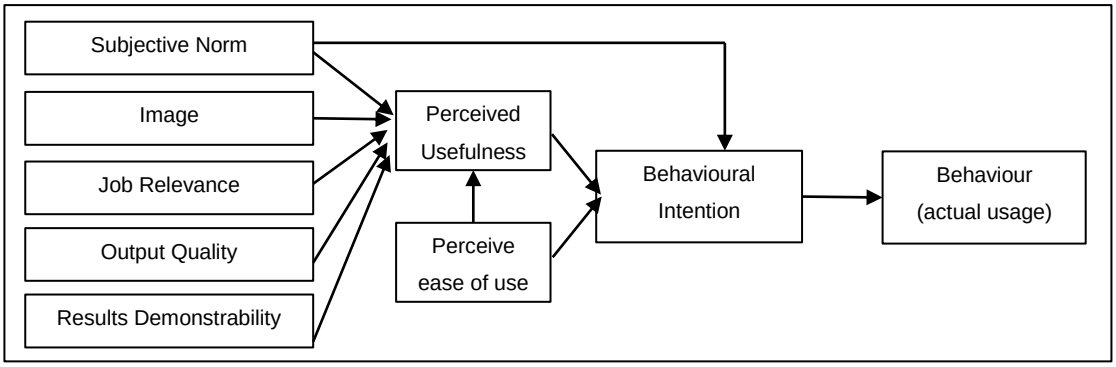

Figure 4.7. Technology acceptance model 2 (TAM2) (Venkatesh and Davis, 2000)

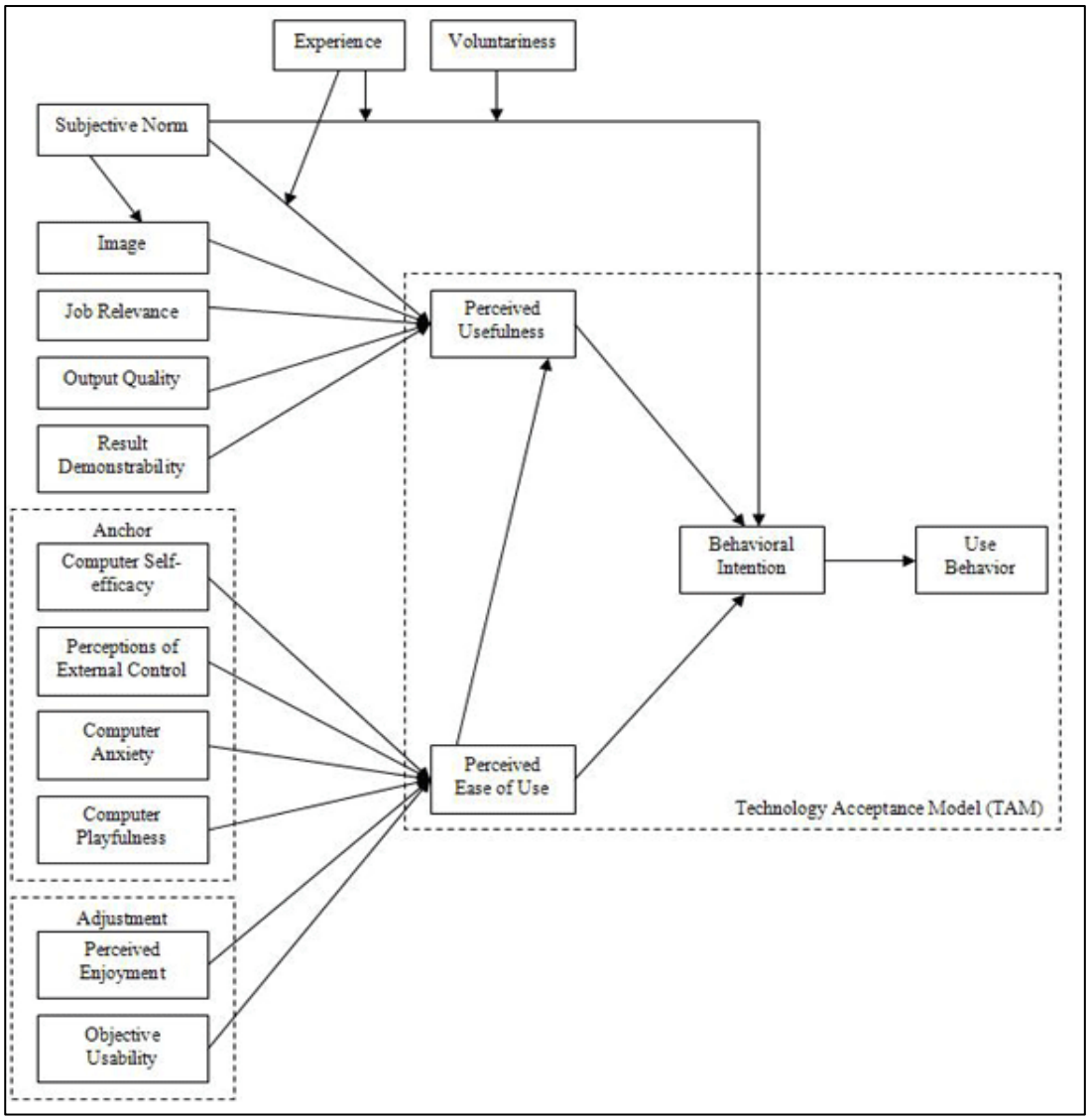

Figure 4.8. Technology Acceptance Model 3 (TAM 3) (Venkatesh and Bala, 2008)

4.4.2.5 Model of Personal Computer Utilisation

Model of Personal Computer Utilisation (MPCU) was grounded in the theory of human behaviour from psychology (Triandis, 1977). It was developed by Thompson et al. (1991) within knowledge workers in multi-national firms to understand the factors influencing personal computer utilisation. Basically, MPCU proposed that the volitional utilisation of an information technology would be affected by six factors: long-term consequences of PC utilisation, job-fit with PC use, complexity of PC use, affect toward PC use, social factors influencing PC use and facilitating conditions for PC use (Figure 4.9 and Table 4.1). The questionnaire was developed by the researcher based on previous studies. It included 30 items measuring the model constructs. Out of 455 questionnaires distributed, 279 were returned resulting in a 61% response rate. The model resulted in 24% of the utilisation variance (Thompson et al., 1991).

Although this model had a good start and explained the actual use, there are some obstacles that might hinder its use. First, the model was developed to understand the volitional use of information technology, which means it is not appropriate for the researchers interested in understanding non-volitional behaviour (i.e. clinician-initiated CHITs). Second, based on the model constructs it appears that this model was developed to understand information technology use in a professional work context, as it has the job-fit construct, which makes it unsuitable for use in another context, such as the patient context. Third, the application work of the model was limited and to date it has not been tested in another study or another context. Fourth, the model did not take into account the influence of BI over actual behaviour. And as the BI is the commonly used measure for acceptance, it would be difficult to use to understand user acceptance and how the acceptance would influence information technology use (Or et al., 2011).

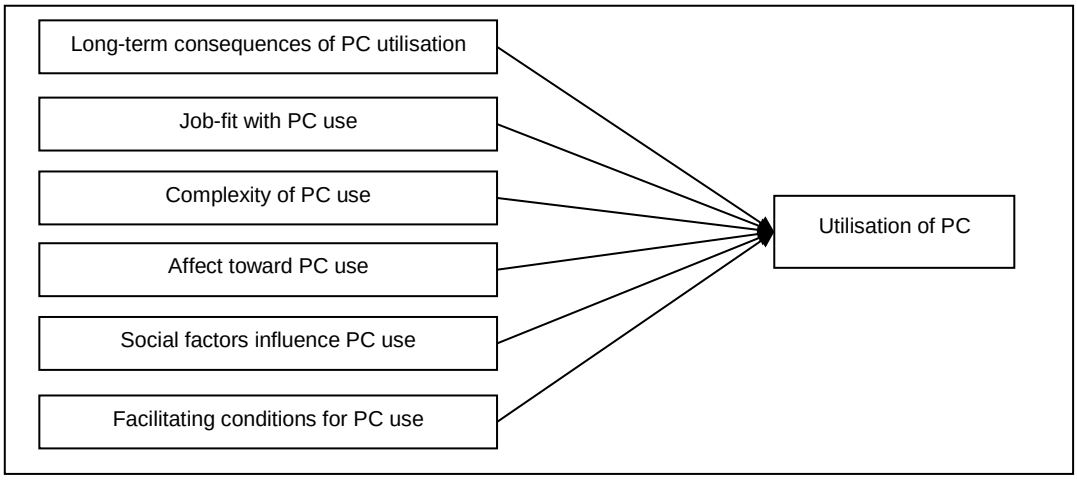

Figure 4.9. Model of Personal Computer Utilisation (MPCU) (Thompson et al., 1991)

4.4.2.6 Motivational Model

The Motivational Model (MM), proposed by Davis et al. (1992), has also been used to measure computer acceptance and USE in a workplace. It was grounded in motivation theories from the social-psychology studies, such as cognitive evaluation theory (Deci and Ryan, 1985). Generally, the motivation theorists distinguished between two types of motivations: extrinsic motivation and intrinsic motivation (Calder and Staw, 1975; Pinder, 1976). Extrinsic motivation means that doing an activity will provide the individual with a valued outcome (i.e. usefulness), while intrinsic motivation denotes that doing an activity is limited to the performing of it only (i.e. enjoyment). Davis et al. (1992) adopted these concepts to measure the usage of new information systems through his model (MM).

Through the Davis et al. (1992) study, it was shown that intrinsic motivation (enjoyment) and extrinsic motivation (usefulness) have indirect effects on system usage through usage intention. In addition, both the intrinsic motivation and extrinsic motivation interact positively with each other. Davis et al. (1992) hypothesised also that the influences of perceived output quality and perceived ease of use on the usage intention are mediated by the intrinsic and extrinsic motivation. Moreover, the measure of task importance has an influence only over the relationship between the perceived output quality and perceived ease of use with the extrinsic motivation as a moderator (Figure 4.10 and Table 4.1). To understand all of these associations, Davis et al. developed and validated an 18-item questionnaire to understand the outcome of interest. These items were developed based on previous researches. The questionnaire was distributed within 80 MBA students. Their model was able to explain up to 75% of BI variance and up to 40% of actual use variance. However, the fact that only MBA students were used to test the model influences the generalisability of the study finding. Although Davis et al. (1992) adopted MM to understand technology acceptance, the application of MM within IT acceptance and actual use studies is still limited. In 2004, Wilson and Lankton applied the Motivational Model to measure the effects of intrinsic and extrinsic motivation over the BI of patient-initiated CHITs (Wilson and Lankton, 2004). An online questionnaire included 27 items measuring three constructs (intrinsic motivation, PU/extrinsic motivation and PEOU) and five additional factors. The questionnaire was developed based on previous literature and aimed at comparing three competing models (TAM, MM and integrated TAM and MM). Only questionnaire reliability was reported within the study. Out of 1,750 individuals invited to complete the questionnaire, only 163 (9%) completed the questionnaire. Non-response bias was not investigated even with the low response rate, which might influence the research findings. Their results showed around 70% of the BI variance. This high prediction power may be caused by low variability on BI intention, but no descriptive information was presented about the study constructs.

In general, the MM has some limitations hindering its use to understand e-PROM acceptance and use. The MM model has some constructs relevant to professional contexts (i.e. task importance) this means the application of the model in the patient context requires model modification. For example, in the Wilson and Lankton (2004) study, the indirect factors of BI were omitted (i.e. task importance, perceived output quality and perceived ease of use). More importantly, this model explains volitional behaviour which makes it inappropriate for understanding non-volitional behaviour (i.e. clinician-initiated CHITs). This might be the reason behind its ability to justify the

acceptance in the Wilson and Lankton (2004) study, which related to understanding the acceptance of patient-initiated CHITs (a volitional behaviour).

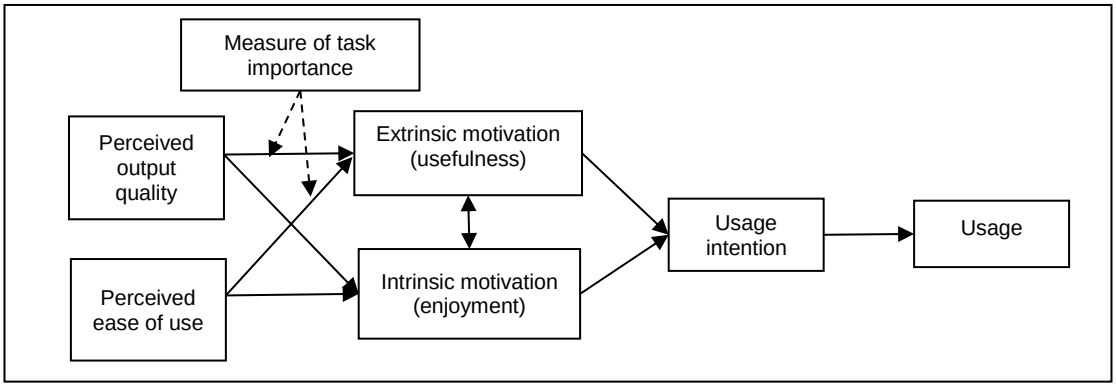

Figure 4.10. Motivational Model (MM) (Davis et al., 1992)

4.4.2.7 Extended models of TAM and TPB

Taylor and Todd (1995a; 1995b) introduced two models, the Decomposed TPB (DTPB) and Augmented TAM/Combined TAM and TPB (C-TAM-TPB) as an extension to the Theory of Planned Behaviour (TPB) and Technology Acceptance Model (TAM). The reasons for their research are: (1) TAM had not been tested previously with actual measures of USE/behaviour as in TPB, but in BI and self-reported USE/behaviour; (2) the TPB did not provide a complete explanation of user BI of information technology as TAM; and (3) TAM was tested on experienced users only.

DTPB decomposed the TPB constructs into specific beliefs drawn from innovation literature and tested within the information technology context (Figure 4.11) (Taylor and Todd, 1995a). It included perceived ease of use and perceived usefulness as antecedents of attitude to improve the TPB explanation power, the second reason discussed previously. The new model was tested to understand the usage of a computing resource centre by business school students. Consequently, without cross-validation over different contexts the results cannot be generalised. The utilised questionnaire was developed and validated by the researchers based on the available literature. It included 60 items reflecting all of the constructs of the three models (TPB, TAM and DTPB) and was distributed to 1,000 business students. A total number of 786 questionnaires were completed and returned with a response rate of 78.6%. They were recruited one month after the fall semester began to understand their usage intention. The actual measure of use was collected for a three-month period using usage cards. This method aimed to track both users and non-users of the information technology. Thus, the new model was tested with regards to actual measure of usage to overcome the first limitation discussed earlier. Moreover, the participants included experienced

and non-experienced users to overcome the third TAM and TPB limitations, discussed earlier.

Within the Taylor and Todd (1995a) study, a comparison of the three models TAM, TPB and DTPB was implemented. The results showed a similar USE prediction (34%) for the first two models and a slightly better prediction (36%) for the third one. Moreover, DTPB explained the BI better than TAM and TPB (60%, 52% and 57% of BI variance, respectively). Within DTPB, attitude was the highest significant factor and subjective norms the lowest significant factor influencing BI. Moreover, both perceived behavioural control and BI influenced the actual use with BI having the largest effect. As justified by Taylor and Todd (1995a), the differences in the prediction power between the three models might be due to the decomposition of the attitude, subjective norms and perceived behavioural control constructs which increase the explanatory power of the DTPB. All the factors hypothesised to influence BI and actual use were significant, however the results revealed that some paths were not shown. This included the association between ease of use and attitude, the association between compatibility and attitude and the association between the technology facilitating condition and perceived behavioural control. So, full validation of the model did not occur. Although the initial assumption of this model is that TAM has better prediction power of BI and use than TPB, the results within the study showed that in fact TPB acted similarly to TAM in predicting usage. Moreover, TPB had better explanation power of BI than TAM.

The second model was the C-TAM-TPB (Taylor and Todd, 1995b) which combined TAM and TPB constructs (Figure 4.12). The study model was tested using the data collected in the previous study (Taylor and Todd, 1995a). Thus, the methodology discussed in the previous paragraphs is the same here. As discussed earlier, the questionnaire was distributed between both experienced and inexperienced users of the information technology. Thus, researchers conducted this study to overcome TAM testing weaknesses discussed earlier, relating to the limited testing of experienced users only. The results explained 21% variance of USE and 43% variance of BI within the experienced users. While, within the inexperienced user set it demonstrated 17% of the USE variance and 60% of the BI variance. This explained that when users have experience with a system the BI-USE association could be stronger. Moreover, pre-implementation acceptance of the technology would be greater for the inexperienced users than for the experienced users. However, the model was not fully valid as some paths were found to be not significant (for example, the association between attitude and BI, the association between perceived usefulness and attitude and the association

between subjective norms and BI). Thus, it has not been used to understand acceptance and use in further studies.

DTPB and C-TAM-TPB were tested on volitional behaviour, but the availability of the construct perceived behavioural control makes these models appropriate to be used in studying non-volitional behaviour. In addition to the validity issue of these models (i.e. partially validated), they have other limitations that might hinder their use in understanding acceptance and actual use. First, due to the limited testing of these models, there is not enough evidence to support the models' generalisability. For example, two studies tested the DTPB and none found that all whole paths within the model were valid (Hsu et al., 2006; Shih and Fang, 2004). On the other hand, one study was found that tested the C-TAM-TPB and the study revealed that the model paths were not completely valid (i.e. the association between attitude and BI was not significant) (Venkatesh et al., 2003). Second, in the second study, Taylor and Todd (1995b) used secondary data which might have a number of issues, including measurement reliability, bias and data error. Using secondary data might cause a loss of hypothetically perfect indicators (Kiecolt and Nathan, 1985).

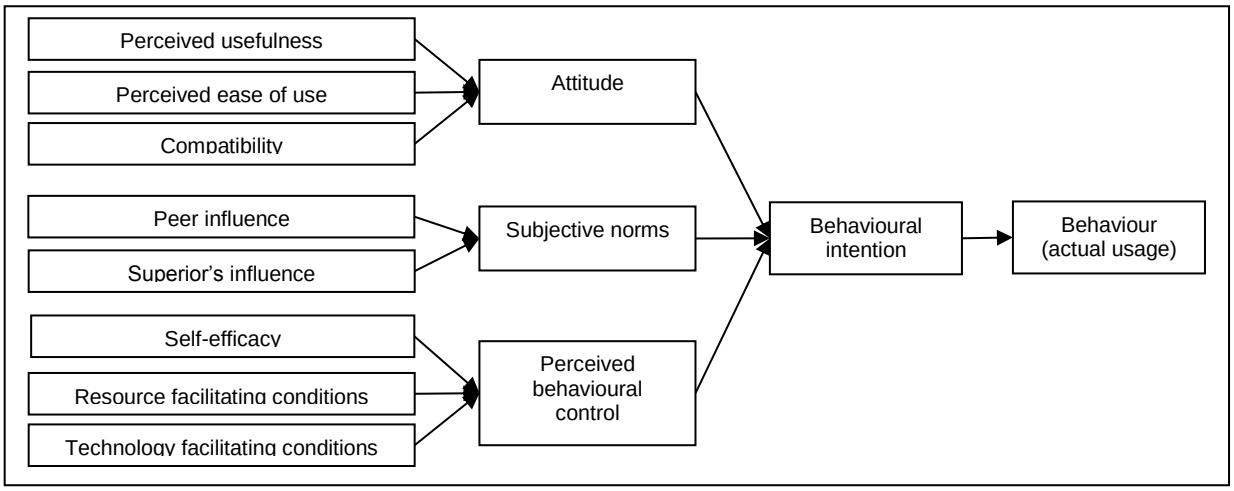

Figure 4.11. Decomposed Theory of Planned Behaviour (DTPB) (Taylor and Todd, 1995a)

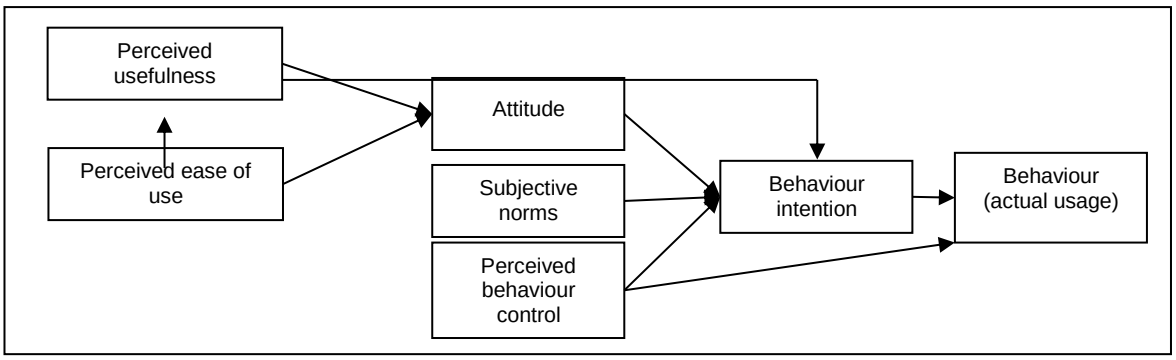

Figure 4.12. Combined TAM and TPB (C-TAM-TPB) (Taylor and Todd, 1995b)

4.4.2.8 Unified Theory of Acceptance and Use of Technology

Venkatesh et al. (2003) introduced the Unified Theory of Acceptance and Use of Technology (UTAUT) (Figure 4.13 and Table 4.1). According to Venkatesh et al., the reason for developing this model was because researchers were confronted with choosing between eight different theories/models measuring acceptance and use. Consequently, a researcher might go with the favourite theory/model and ignore the contributions of the other theories/models. Thus, Venkatesh et al. (2003) aimed to combine the constructs from the eight different models and empirically tested their similarities. Then their new model (UTAUT), which integrated constructs from the eight theories/models, was developed to understand the acceptance and actual use of new workplace technology. Performance expectancy, effort expectancy, social influence and facilitating conditions are the UTAUT main constructs that predict BI and USE. The study questionnaire was developed by the researcher based on the available literature informed by all eight theories/models (Taylor and Todd, 1995a; Taylor and Todd, 1995b; Davis, 1985; Ajzen, 1985; Compeau and Higgins, 1995b; Ajzen and Fishbein, 1975; Rogers, 1995). Although this increased the explanatory power of the model, having these combined factors reduced the parsimoniousness of this model. In addition, the fact that this model integrated factors from different theories/models may have created more issues, as will be explained later in this section. This longitudinal study captured users' perceptions as the users' experiences with the technology increased. The questionnaire was administered at three different points in time: post-training, one month after implementation, and three months after implementation. Actual usage behaviour was measured over the six-month post-training period. A total of 215 employees were recruited from four different organisations (including, an entertainment organisation, telecomm services, banking and public administration). The new model, UTAUT, showed 69% of the BI variance and 47% of the variance on the objective measure of USE. However, the sample size, the method of recruitment, age distribution, gender distribution and user experience with the technology were not shown in the study report. Thus, the high prediction of 69% might be influenced by different types of bias (e.g. sample selection bias and non-response bias).

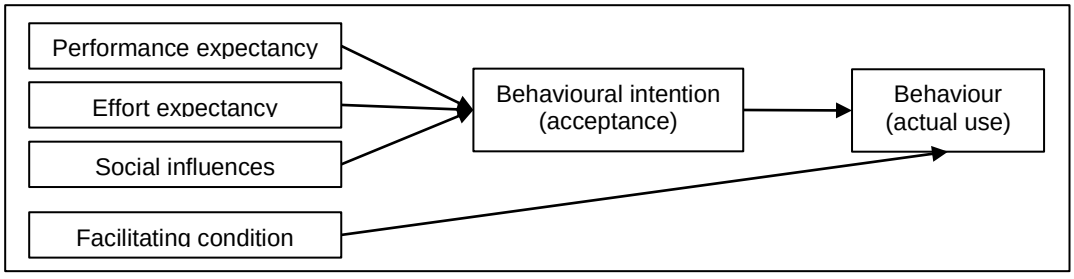

Figure 4.13. Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003)

UTAUT has been fully or partially adopted within researches and has tested both types of behaviour (volitional and non-volitional) (Williams et al., 2011). It has been validated and its success in measuring acceptance of information technology in different contexts of users has been demonstrated (Wang et al., 2006; Wang and Shih, 2009; El-Gayar and Moran, 2006), including for healthcare professionals and within different cultures (e.g. eastern culture as in Al-Gahtani et al. (2007) and AlAwadhi and Morris (2008)) (Oshlyansky et al., 2007). Or et al. (2011) adopted the UTAUT to understand patient acceptance and use of CHITs. The study was conducted through analysing secondary data collected earlier for another non-published study, a randomised field study involving homecare patients with chronic cardiac disease. Within the study, Or and his colleagues extended UTAUT by adding several patient factors based on previous studies (Wilson and Lankton, 2004; Davis, 1989; Taylor and Todd, 1995a) (Figure 4.14). These factors included perceived upper extremity functional ability, perceived visual functional status, health information seeking preference and healthcare knowledge. Of 124 participants recruited in the acceptance study, 101 participants completed the survey. Thus, the response rate was 81%. Their model, the patient technology acceptance model (PTAM), showed 54% of BI variance and 69% of the variance on subjective measure of use.

Although UTAUT and PTAM were able to predict the outcome of interest, there were some issues hindering their use. Both models were tested originally using an unbalanced number of participants to the number of constructs. They tested too many constructs with a limited number of participants. The general rule-of-thumb for a valid result when considering the model complexity is to have 15 participants per single item (Hair et al., 2005). Consequently, this limitation might negatively affect the study validity. Although other studies have tested the UTAUT and found good results in different contexts, the PTAM has not been tested in another context yet, which means that the study validity remains unconfirmed.

Another issue is that the UTAUT and PTAM main predictors are very broad and include a lot of underlying factors. They do not really work as constructs anymore. Consequently, this makes both models non-parsimonious models and this could lead to issues with multicollinearity (Taylor and Todd, 1995a). For example, due to the multicollinearity, Venkatesh et al. (2003) wrongly hypothesised there to be no direct influence of attitude over BI. However, vast quantities of literature has demonstrated the significant influence of attitude over BI (Ajzen, 1985; Davis, 1985; Taylor and Todd, 1995a; Hsu et al., 2006; Baker et al., 2007). Moreover, it has been shown that attitude is the largest significant factor, compared with the other predictors, as explained earlier in TAM, TRA and TPB (Shih and Fang, 2004; Yousafzai et al., 2010).

Within the Venkatesh et al. (2003) study, self-efficacy and anxiety over BI and USE were also hypothesised not to be direct determinants of BI. However, absence of the relationship between both constructs and BI could logically be due to the study setting and the study sample (product development employee, sales employee, business accounting management employee and accounting employee). Using technology for daily processes was part of their routine work process and might increase their IT experience, which would weaken the effect of self-efficacy (Pajares and Urdan, 2006) and anxiety (LaLomia and Sidowski, 1993; Roberts and Henderson, 2000) on the BI/USE over time. Therefore, it could be helpful to investigate the effects of those factors over BI within an older population context (Lai et al., 2008; Lober et al., 2006; Chau and Hu, 2002; Chau and Hu, 2001; Durndell and Haag, 2002; Compeau et al., 1999). Because the model was not developed to understand BI and USE in the patient context, Or et al. (2011) integrated additional patient relevent factors to the UTAUT model.

The Or et al. (2011) model demonstrates the influence of the constructs over a subjective measure of actual use. To date, PTAM has not been tested to understand the objective measure of actual use. Consequently, this and the previous reasons could discourage researchers from using UTAUT and PTAM to study acceptance and USE of CHITs.

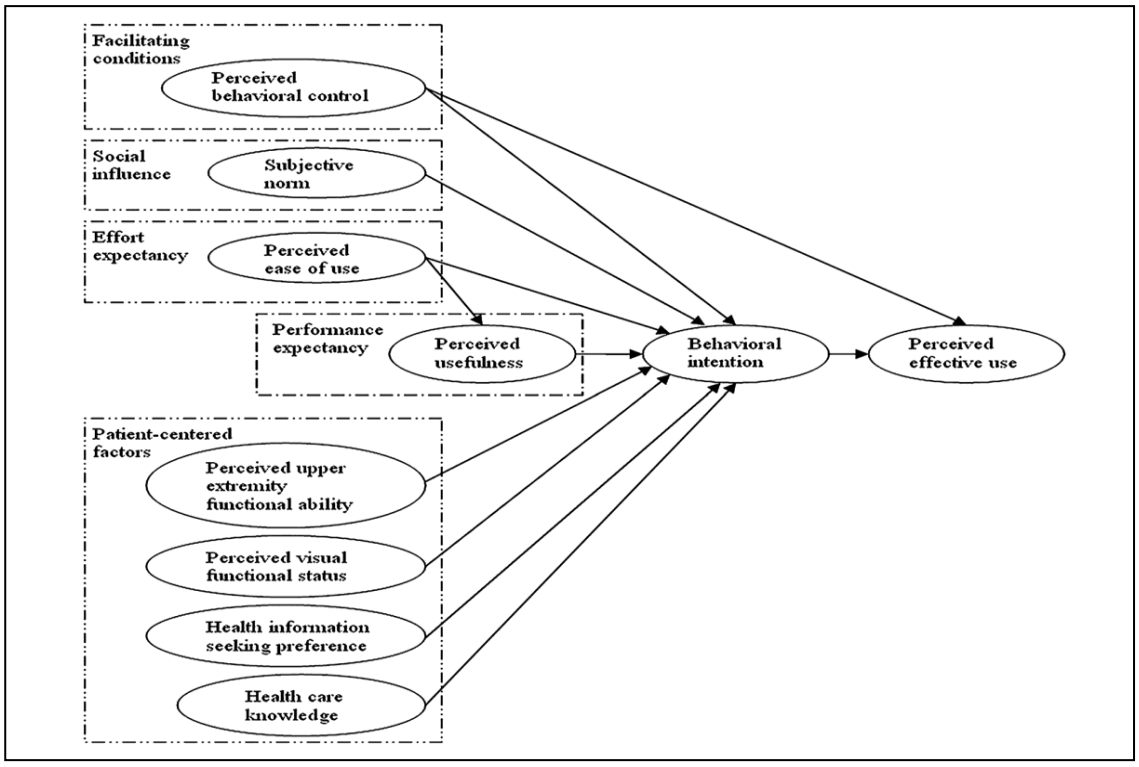

Figure 4.14. The patient technology acceptance model (PTAM) from Or et al. (2011)

Note: rectangles represent the core determinants from UTAUT and the circles represent the measured variables.

4.4.3 Overall reflection on the theoretical evidence

From the above, the factors influencing behavioural intention (acceptance) and/or usage directly can be classified into three main areas organisational/environmental factors, technological factors and user factors (Chau and Hu, 2002) (Figure 4.15). As these theories/models originated from different literature sources, sociology literature, psychology literature and information technology literature, it appears that each theory/model measured intention and usage by focusing on some of these areas. For example, UTAUT, TAM2 and TAM3 focus greatly on environmental and technological factors, but not on individual factors. Conversely, TRA focuses on environmental or individual factors, but not technological factors and so on. Moreover, recent literature showed the importance of integrating the factors from different literatures (e.g. sociology and psychology), so some of the reviewed studies demonstrated factors from all areas (Prager, 2012). For example, the model of C-TAM-TPB and the MPCU include factors from the three different areas.

For the nature of behaviour, the theory was used to measure either volitional or non-volitional behaviour (Appendix B). Based on the reviewed theories/models, the majority, nine theories/models, measured volitional behaviour, where the user has the option to use the system (e.g. IDT, SCT, TRA, MPCU, MM, TAM, TAM 2, DTPB and C-TAM-TPB), two theories measured non-volitional behaviour, where the user is directed by authority (TPB and NPT) and the last two theories/models are tested and used to measure both volitional and non-volitional behaviour as in TAM3 and UTAUT.

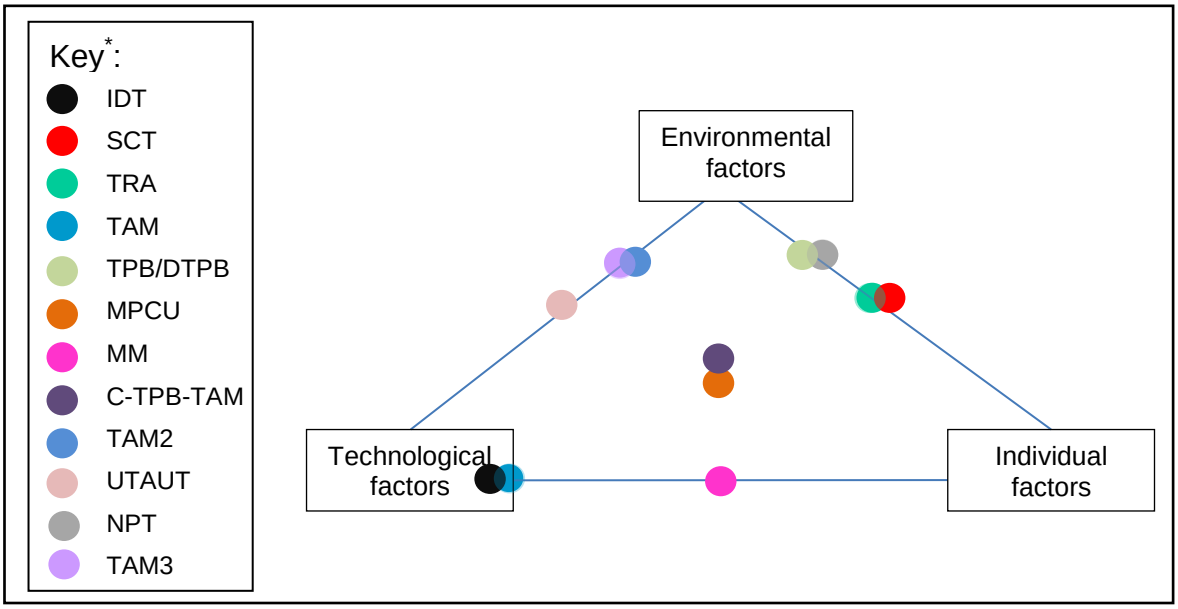

Figure 4.15. Conceptual figure of the differences between theories with regards to factors influencing directly acceptance/intention or usage

Note: (*) The colour shades explain how these theories related to each other's (e.g. blue and green shades for the TRA and its extensions TAM (blue) and TPB (green))

4.5 Empirical evidence

Research on e-PROM implementation has increased recently. However, few studies have reported patients' perceptions of using e-PROMs, although, user perception is helpful for future research as it could reflect the different factors that might correlate with or predict patients' acceptance and actual use of information technology (Nijland et al., 2011). From the third literature search, only 15 studies were identified that reported factors qualitatively or quantitatively based on the researcher's observation or based on the patients' feedback from their experience with the implemented system. Table 4.2 shows the reviewed studies and summarises the reported factors. In fact, the majority actually empirically evaluated the feasibility of a system (e.g. compared paper-based and electronic versions, system performance, response rate, patient feedback and/or validity and reliably of the electronic version). The exception was the Bennett et al. (2012) study which entailed a review of five different versions of e-PROMs. Although some studies used simple statistical techniques to measure the correlation of the factors with the system use (i.e. Weber et al. (1998), Wilson et al. (2002), Salaffi et al. (2013) and Cook et al. (2004)), none focused only on understanding the main predictors of e-PROM acceptance or use.

Of the 15 studies, eight were conducted in the USA (Ruland et al., 2003; Wilkie et al., 2003; Cook et al., 2004; Olmsted et al., 2006; Basch et al., 2007; Andikyan et al., 2012; Bennett et al., 2012; Sebrow et al., 2012), two in the United Kingdom (Ashley et al., 2013; Wilson et al., 2002), two in Canada (Taenzer et al., 2000; Bhinder et al., 2010), one in Germany (Weber et al., 1998), one in Italy (Salaffi et al., 2013) and one in Sweden (Rolfson et al., 2011). The studies reported the implementation of different electronic measures to report health information including seven studies on patient reported outcome measures (Olmsted et al., 2006; Basch et al., 2007; Rolfson et al., 2011; Andikyan et al., 2012; Bennett et al., 2012; Ashley et al., 2013; Salaffi et al., 2013), three studies on quality of life measures (Taenzer et al., 2000; Bhinder et al., 2010; Sebrow et al., 2012), two studies on pain assessment measures (Cook et al., 2004; Wilkie et al., 2003), two studies on self/health assessment measures (Weber et al., 1998; Wilson et al., 2002) and one study on symptom reporting measures (Ruland et al., 2003). Although the studies evaluated types of electronic measures, each reported different factors, which could be associated with the system acceptance and use. The following sections explain an overall summary of the reported factors.

While the patient's health status could logically obstruct the CHITs use, as shown by Rolfson et al. (2011), other technical and behavioural concerns could also hinder the electronic measure use as reported by patients and researchers from the patient experience with the system. Patients' concerns about the technology itself were

commonly reported within the reviewed studies. These included the electronic measure benefits, electronic measure usefulness and electronic measure ease of use (Wilkie et al., 2003; Andikyan et al., 2012; Olmsted et al., 2006). Some patients did not use electronic measures because they did not feel any benefit from using it (Basch et al., 2007). In addition, they felt that they would lose an important feature, such as patient-clinician interaction (Wilkie et al., 2003). Moreover, it was reported in a previous study that participants have less positive attitudes toward electronic reporting as compared with paper-based reporting (Weber et al., 1998). Although this study was old and the attitude toward technology use might be different now, a more recent study also reported that patients found the use of electronic modes difficult and not useful (Rolfson et al., 2011). This increases the need for a closer view to understand the reasons behind their negative attitude.

From the review, another concern was raised about individuals' abilities to use the electronic measures, such as patients' willingness to use electronic mode or computers instead of paper-based resources. Researchers reported that patients are unwilling to use electronic measures as they have low self-confidence levels when using computers and electronic platforms (Basch et al., 2007; Weber et al., 1998). Although the Weber et al. (1998) study is almost 20 years old, the finding from the more recent study of Basch et al. (2007) highlighted that this might still be an issue.

On the other hand, other researchers reported that patients are happy to complete the electronic measures even if they do not have experience with computers (Ruland et al., 2003; Wilkie et al., 2003). This was also highlighted recently by Salaffi et al. (2013) where they failed to find an association between computer experience and the use of electronic measures. This means that people might have experience using computers, but still have some fears (i.e. anxiety) when using them (Beckers and Schmidt, 2003). Consequently, the low self-confidence in using computers may not be associated with computer experience, but with a level of computer anxiety. In another way, computer experience might have no relationship with acceptance and usage, as found by Ruland et al. (2003), Wilkie et al. (2003) and Salaffi et al. (2013), but computer anxiety might, based on the findings of Weber et al. (1998) and Basch et al. (2007). From this perspective, user training could facilitate the implementation of a system as training could increase confidence in using a system even if the person does not have previous experience with computers (Bennett et al., 2012).

Additional concerns highlighted were the association between demographic characteristics and the use of electronic measures. Age, gender and education level all might have associations with acceptance and actual use of a system. Wilson et al.

(2002) found that increasing age could be related to lower usage of e-PROMs. This is consistent with the findings from Ashley et al. (2013) where they reported that older patients are most likely to reject the completion of PROMs electronically. However, Salaffi et al. (2013) and Bhinder et al. (2010) reported that none of the demographic characteristics influenced the use of e-PROMs. The studies that found these contradictory results were similar with regards to the variance in participant mean age and sample size. Consequently, these differences raise the need to further investigate the association between demographic characteristics and acceptance and use of electronic measures.

The last concern related to the availability of facilities. One researcher explained that patients prefer to complete electronic measures in the clinic rather than at home (Basch et al., 2007). Although they have the willingness to use computers, they might have no time or no computer/Internet access to do them (Bhinder et al., 2010).

To summarise, this review highlighted some factors that might be correlated with or predict the acceptance and use of an electronic measure to report health information. This includes the patient's attitude toward using the electronic measures (i.e. ease of use and usefulness), computer anxiety, demographic characteristics and availability of facilities. However, further empirical study needs to be conducted to understand the nature of the relationship. Then, working with the factors associated with the e-PROM use would improve overall system success in the future.

Table 4.2. The reported factors based on the empirical evidence

Study	CHIT	Study aim	Participants	N[(1)]	Mean age[(1)]	Country	Reported feedback
Weber et al. (1998)	Computerised self-assessment tool	To empirically evaluate the user experience and acceptability of the computerised tool	Psychiatric patients	30	30.5 and 51	Germany	• Less positive attitude toward electronic reporting • Lack of self-confidence in interacting with computers
Taenzer et al. (2000)	Electronic quality of life questionnaire	To empirically evaluate the electronic quality of life questionnaire and compare it with the paper-based questionnaire	Lung cancer patients	53	65	Canada	• Ease of use
Wilson et al. (2002)	Electronic health assessment questionnaire	To empirically evaluate the electronic health assessment questionnaire and comparing this version with the paper-based version	Patients with systemic lupus erythematosus and vasculitis	51	50 and 43	UK	• Ease of use • Time to complete • Computer literacy • Age
Ruland et al. (2003)	Computerised symptoms reporting system	To empirically evaluate a computerised symptoms reporting system	Cancer patients	52	56	USA	• Participants who used the system reported high system ease of use
Wilkie et al. (2003)	Computerised PAIN-reporting tool	To empirically evaluate the usability of computerised tool.	Cancer patients and participants from general public	213	65, 50 and 54	USA	• Needs some help • Ease of use • Loss of the human factor in patient-clinician interaction
Cook et al. (2004)	E-pain assessment questionnaire	To empirically compression between paper and electronic passed PROMs	Patients with chronic pain	189	47.5	USA	• Computer anxiety (anxiety had modest correlation with age)
Olmsted et al. (2006)	e-PROMs	To empirically evaluate the user experience and acceptability of e-PROMs	Patients receiving the smallpox vaccination	379	40.5	USA	• System benefits (fast and easy to use)
Basch et al. (2007)	e-PROMs	To empirically develop and use an e-PROMs	Lung cancer patients receiving chemotherapy	107	59.5	USA	• No benefits • Unwilling to use computers • Prefer to complete it at clinic

Study	CHIT	Study aim	Participants	N[(1)]	Mean age[(1)]	Country	Reported feedback
Bhinder et al. (2010)	Internet-HRQoL	To empirically evaluate the patient willingness toward using Internet-HRQoL	Patients with lung disease or lung transplants	644	49.5	Canada	• Patients have no time to complete the questionnaire • Availability of resources
Rolfson et al. (2011)	e-PROMs	To empirically evaluate electronic e-PROMs and compare paper and electronic based PROMs	Patients who had hip arthroplasty surgery	2290	The majority over 50	Sweden	• System difficult to use • Low attitude toward using e-PROMs • Health status
Andikyan et al. (2012)	e-PROMs	To empirically evaluate the feasibly and acceptability of an e-PROMs	Women recovering from major gynaecologic cancer surgery	49	56	USA	• Usefulness (including the benefits) • Ease of use
Bennett et al. (2012)	e-PROMs	A review study of 5 e-PROMs examples used in oncology practice (from researcher's opinion)	Oncology clinic patients	N/A	N/A	USA	• Patients training
Sebrow et al. (2012)	Online-HRQoL	To empirically study to develop and evaluate an Online-HRQoL	Patients who had robotic assisted laparoscopic prostatectomy	293	60	USA	• Length of survey (time)
Ashley et al. (2013)	e-PROMs	To empirically evaluate the feasibility of the system	Cancer survivors	636	61	UK	• Sociodemographic factors (i.e. age and gender)
Salaffi et al. (2013)	interactive e-PROMs	To empirically evaluate the validity, reliability, feasibility of e-PROMs through comparing paper and electronic versions	Patients with axial spondyloarthritis	55	51	Italy	• Age, computer experience and education level had no significant impact on the e-PROM use

Note: (1) N/A = not applicable

4.6 Discussion and conclusion

The aim of the current review was to find the different factors that might influence patient acceptance of e-PROMs based on the theoretical and empirical evidence. Theoretically, the extant literature has been applied to test different theories/models adopted from different fields and subjects to understand acceptance or actual use of information technologies. As these theories/models actually explain different core constructs, a theory/model in a particular context could predict acceptance and use better than the others (Chismar and Wiley-Patton, 2003). Consequently, it is important to choose the appropriate theory/model carefully.

After demonstrating the differences between the reviewed theories/models, it was time to choose the best theory/model to study patient acceptance and actual use in the current research context. Although the reviewed theories/models have been used for a variety of factors, the researcher chose the best theory/model following the Taylor and Todd criteria. Table 4.3 shows the selection criteria matrix to test each theory/model.

Table 4.3. Selection criteria matrix based on Taylor and Todd (1995a) criteria

Model/Criteria	(1) User-based	(2) Non-volitional behaviour	(3) Study context	(4) Generalisability power	(5) Parsimonious power
IDT	×	×	×	√	√
SCT	√	×	√	√	√
TRA	√	×	√	√	√
TAM	√	×	×	√	√
TPB	√	√	√	√	√
MPCU	√	×	×	×	√
MM	√	×	√	×	√
DTPB	√	×	√	×	×
C-TAM-TPB	√	×	√	×	√
TAM2	√	×	√	×	×
UTAUT	√	√	√	√	×
NPM	×	√	×	√	√
TAM3	√	√	×	×	×

The first criterion was that the theory should have both good predictive ability and enough contribution to understand the investigated phenomena. This includes the type of model (i.e. innovation-based or user-based), the type of behaviour (i.e. non-volitional or volitional), the study context and the generalisability power.

For this context, the main dependent variable is patient acceptance or behavioural intention (as discussed earlier in Chapter 2). Researchers need to identify the user differences with regards to accepting e-PROMs. Consequently, innovation-based

theories/models are not helpful, such as IDT and NPT. These theories/models could help decision makers to understand how e-PROMs lay in the routine process more than focusing on the behavioural intention or the actual behaviour predictors. Although, the IDT was used to understand the actual use of an information technology, it did not show the mediation influence of the behavioural intention over use. Therefore, these theories/models have been excluded as a theoretical framework to understand e-PROM acceptance and use.

Furthermore, the type of behaviour, whether non-volitional or volitional, would also help in selecting the study theory/model. This study measures the patients' acceptance of a clinician-initiated technology which has a non-volitional nature of behaviour. From the review, it appeared that the majority of theories/models were tested to understand volitional behaviour. Consequently, these theories/models have been excluded from being a theoretical framework to understand e-PROM acceptance (i.e. SCT, TRA, MPCU, MM, DTPB and C-TAM-TPB).

Then, the study context also guides the selection of an appropriate model. The aim of the study is to understand patient acceptance, however some theories/models included constructs relevant to another context (i.e. job-fit), which were not appropriate. These included TAM3 and MPCU. Moreover, this research was initiated to help clinicians understand the reason behind patient rejection of using e-PROMs. Clinicians are more interested in understanding patient's beliefs rather than technical problems with systems. Therefore, models that tested the influence of technical factors only, rather than social and environmental factors, were not helpful (i.e. TAM).

In addition to the previous justifications, the generalisability power of the theory/model can also help in selecting the study theory/model. Generalisability power is the level of validation work implemented for a particular theory/model. This on its own is not enough reason, but it can provide some information about the success of the theory/model in predicting the outcome variable. Models validated widely within different populations, different contexts and between different cultures will be more preferable as there is a theoretical baseline to predict an outcome (Sargent, 2005). Consequently, TAM2, TAM3, MM, C-TAM-TPB, DTPB and MPCU were not preferable as these theories/models, when compared to TPB, TAM, TRA and UTAUT have very limited adoption.

The second criterion suggested by Taylor and Todd is that the chosen theory/model should be parsimonious. This mean that a good model is one that can predict the outcome of interest with fewer constructs. The level of parsimoniousness of a

theory/model has the potential for developing the study questionnaire. More constructs means more items which will increase the questionnaire length. Then, completion of this questionnaire could be difficult for participants and might reduce the response rate (Galesic and Bosnjak, 2009). When comparing the theories/models, TAM2, TAM3, DTPB and UTAUT seem to be less parsimonious, when compared with the other theories/models. Consequently, a researcher might avoid using them if there is a better option to explain the outcome with fewer factors.

From all the above and based on the Taylor and Todd criteria, TPB can be justified as the best theory to measure the acceptance and usage of e-PROMs in the study context (Figure 4.16). However, before applying TPB in this context, it is important to map this theory with the empirical finding. This will help to investigate whether there are additional factors that could facilitate the acceptance and use. Integration of these constructs with the TPB might improve understanding of the e-PROM acceptance and use.

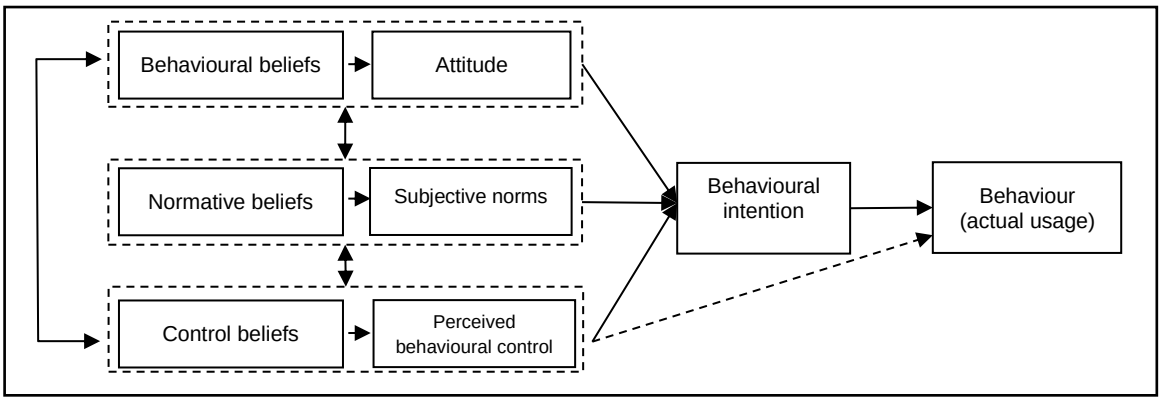

Figure 4.16. Theory of Planned Behaviour (TPB) (Ajzen, 1985; Ajzen, 1991)

While reviewing the empirical evidence, different concerns were discussed which could reduce the e-PROM acceptance and actual use. The first concern related to the technology itself. This includes the perceived benefits or usefulness and ease of use of the e-PROMs. Some patients are not interested in using an electronic mode of PROMs because they do not feel that this system is useful (Basch et al., 2007). Moreover, they might find the e-PROMs difficult to use (Weber et al., 1998).

The second concern was relevant to the individuals themselves. Some patients have fears (or anxiety) about using electronic devices to report their health information (Weber et al., 1998; Basch et al., 2007). For example, they fear losing their privacy through the information being accessed by unauthorised people. However, this fear

has been shown to be not related to the level of experience. People might have good experience in using computers, but still have some fears (i.e. anxiety) when using them (Beckers and Schmidt, 2003). Consequently, the researcher should try to minimise the level of fear before implementing the e-PROMs. A good way to reduce computer anxiety is through offering IT training courses (Bennett et al., 2012).

The third concern is relevant to demographic characteristics. They could also play a role in the acceptance and use of CHITs (Or and Karsh, 2009). However, within the e-PROM context, only age has been reported to hinder the use of electronic measures (Wilson et al., 2002; Ashley et al., 2013). As the demographic characteristics are actually influenced by the study context, researchers might expect different results compared with previous findings.

The last concern was the availability of facilities. Some people prefer to complete electronic measures in the clinic as they might not have facilities to do it at home (Bhinder et al., 2010). Also, as the e-PROMs is a non-volitional behaviour, the researcher needs to make sure that the absence of facilities is not an obstacle for e-PROM use. Consequently, these factors need to be taken into account when measuring acceptance or usage of e-PROMs. The next section maps the TPB and the empirical findings to justify the need for additional factors.

4.6.1 TPB fit with the empirical findings

Although, TPB is a general psychological theory, it appears that its main constructs could reflect most of the factors reported empirically and based on the researcher's opinion to measure e-PROM acceptance and usage (Table 4.4 and Figure 4.17). The social influences construct was not reported by the e-PROMs user empirically, but it was found to influence patient acceptance in different CHITs research (Or et al., 2011), therefore, it could shed light on an important factor influencing acceptance theoretically, but which has not been mentioned by patients.

Based on the empirical evidence, additional factors can be measured to understand e-PROM acceptance and use better (Figure 4.17). These include computer anxiety and patient characteristics factors (age, gender and education level). Measuring computer anxiety means that even if patients feel positive towards e-PROMs they might feel anxious about using a computer, as reported in the empirical results. This factor was reported in the empirical studies as a reason for rejecting e-PROMs (Weber et al., 1998; Basch et al., 2007).

Additionally, patient characteristics factors were mentioned by the empirical studies to have an association with system acceptance and use. Moreover, Or and Karsh (2009) stated that patient characteristics were the most commonly tested factors within the non-theoretical acceptance studies. Consequently, the relationship between those characteristics, or part of them, with e-PROM acceptance and use could be tested within the current research context.

As the main outcome of this study is behavioural intention, which is the measure for pre-implementation acceptance, the study tests the influence of the additional factors over BI. However, there is still a need to understand the direct influence of these factors over the actual use of the e-PROMs as well.

After initial justification of a theory that can help in predicting e-PROM acceptance, further studies need to be conducted (starting with developing and validating an acceptance questionnaire and ending with testing the study model in different contexts). The questionnaire validation work, as discussed in the previous review, requires systematic and concise work, otherwise the researcher will collect inaccurate data and will end up with the wrong results. In the next chapters, the process of developing and validating a questionnaire based on the TPB theory and the additional factors will be explained. It will involve an explanation of the initial questionnaire design, questionnaire pre-testing and questionnaire field-testing for assessing the validity and reliability. The need to develop this new questionnaire was highlighted earlier in the previous review chapter. Then, once the questionnaire is ready, it will be used to understand patient acceptance of e-PROMs in a particular context.

Table 4.4. Mapping the empirical and the theoretical findings

TPB constructs	Empirical findings
Attitude	The benefit of the e-PROMs
Social influences	Not reported
Perceived behavioural control	The availability of resources
Not depicted	Confidence in using a computer
Not depicted	Demographic characteristics

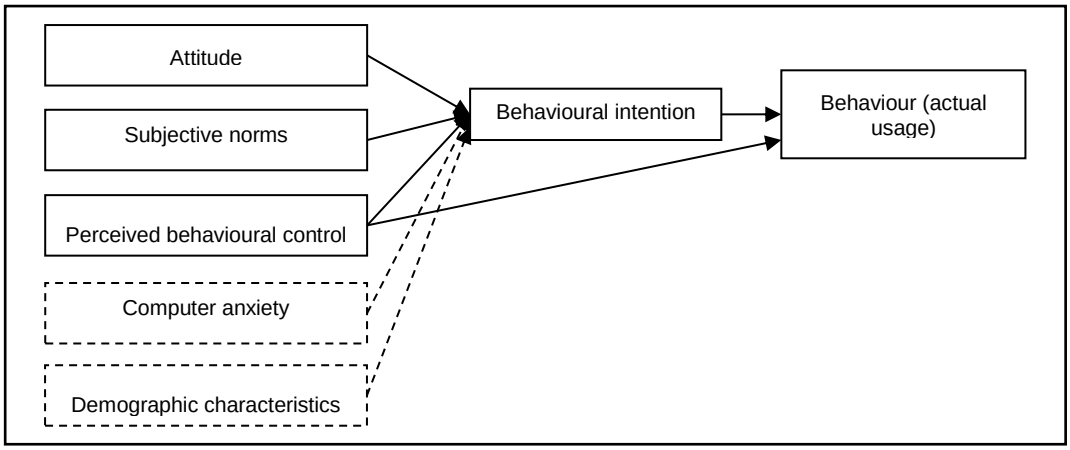

Figure 4.17. The current study theoretical framework based on TPB and the empirical findings

Note: Factors within the dashed box are those added from the empirical finding and are not part of the TPB.

4.7 Summary

1- Before implementing a CHIT, there is a need to understand the factors influencing its acceptance and actual use. This will facilitate the future use of the system and will increase the chance of system success.

2- The aim of this review is to determine the different factors that might influence patients' acceptance and use of e-PROMs, empirically and theoretically.

3- Thirteen theories/models were found to have been used previously to measure information acceptance. These theories/models derived from different sciences, had different assumptions and determined different factors. Based on the theoretical concept, they can be divided into innovation-based theories/models and user-based theories/models. The former focused on the information technology implementation process and the latter focused on understanding the reason behind an individual behaviour (i.e. use of information technology). Although user-initiated is best to be used to understand factors behind acceptance and use, some researchers used innovation-based theories/models to understand the reason behind information technology adoption.

4- Based on the nature of behaviour, nine theories/models tested volitional behaviour two theories/models measured non-volitional behaviour and two measured both volitional and non-volitional behaviour.

5- After reviewing these theories/models and following Taylor and Todd (1995a), it appears that the Theory of Planned Behaviour (TPB) is the best theory to understand patient acceptance in this study context.

6- The review also examined 15 studies that identified empirically a number of factors that could be associated with patient acceptance and use of e-PROMs. These factors included computer anxiety, relative e-PROM benefits, availability of resources and patient characteristics factors.

7- From comparing the theoretical and the empirical findings, additional factors to the TPB constructs could be associated with the acceptance and use of e-PROMs including, computer anxiety and demographic characteristic factors.

8- Further research will be conducted to develop and validate a questionnaire based on this review finding and use the developed questionnaire to measure patients' acceptance toward using e-PROMs in a particular patient context.

CHAPTER 5. Research Methodology and Design

5.1 Introduction

In order to justify the research design, the researcher first needs to justify the philosophical worldview underpinning the research, the research strategy and the main research methods (Creswell, 2008). Different research designs are available but, selection of the appropriate one depends on the main study purpose.

The aim of this research is to explore and understand the factors influencing patient acceptance and use of e-PROMs based on a well-defined theoretical framework. From the previous literature review, Chapter 4, it appears that the most appropriate theory to explain patient acceptance of e-PROMs is the Theory of Planned Behaviour (TPB) (Ajzen, 1985). Applying and testing this theory to explain and answer the research question commonly utilises a quantitative method (i.e. a questionnaire) which can help to collect large quantities of data in a timely manner (Creswell, 2008). However, from the review, it appears that there is no reliable and valid questionnaire available to collect patient feedback on e-PROMs. Consequently, to understand the acceptance and use of e-PROMs, a valid and reliable questionnaire needs to be developed. This is best clarified by conducting exploratory quantitative research (i.e. survey research) (Babbie, 1990; Creswell, 2008).

This chapter explains the overall study methodology and design. However, more details of the methods for each sub-study will be presented later on in each of the relevant chapters. Before explaining the overall research design and methodology, it is worth understanding more about the process of questionnaire development, because this process influences the selection of the main research design and methodology.

5.2 Definition of the key terms

Before explaining the process of questionnaire development and the study method, it is necessary to briefly clarify the meaning of some key terms. Within the previous chapter, the definitions of both theory and model were shown. In general, a *model* is a visual representation of a particular phenomenon within a specific context (Lefrancois, 1999), however, a *theory* is more general and is conducted through a process of ongoing abstraction to show a set of hypotheses (Lefrancois, 1999). Both model and theory are used to facilitate the understanding of particular phenomena. The building blocks of these theories/models are called theoretical/model constructs, which help to

understand why and how a particular phenomenon behaves the way that it does (Simons-Morton et al., 2011). A theoretical/model construct is the mental abstraction that a researcher uses to express the idea, people, organisations and/ objects/things (Lund Research Ltd, 2012; Nestor and Schutt, 2014). The reference to mental abstractions is due to the fact that, commonly, constructs are difficult to observe directly (e.g. the researcher cannot observe depression directly, but it can be associated with common signs such as crying, self-harm, and so on). So, they need to be operationalised into a set of concrete measurable variables/items to be measured (Nestor and Schutt, 2014).

5.3 Questionnaire development

A questionnaire is a set of questions developed to capture quantitative information from participants in a standardised way and provides a means to measure constructs and phenomena that cannot be directly observed (Sapsford, 2006). In research, the decision to develop a new questionnaire depends on whether there is an existing validated questionnaire available to use for this purpose or not (Figure 5.1). If there are existing questionnaires in the literature measuring the intended phenomena, it is recommended to use one of these rather than develop a new one (Streiner and Norman, 2008). The benefits of doing this are: (1) available questionnaires usually have been tested repeatedly and their validity and reliability has already been demonstrated, which assures the questionnaire quality, and (2) using an existing questionnaire will save the researcher time (Streiner and Norman, 2008). However, if the available questionnaire is inadequate for use in the proposed study (i.e. it has been tailored for a specific population or does not cover all constructs), the researcher could decide to develop a new questionnaire (Streiner and Norman, 2008). It is important to note that badly designed questionnaires collect poor quality, undesirable or useless information which may lead to erroneous conclusions (Boynton and Greenhalgh, 2004).

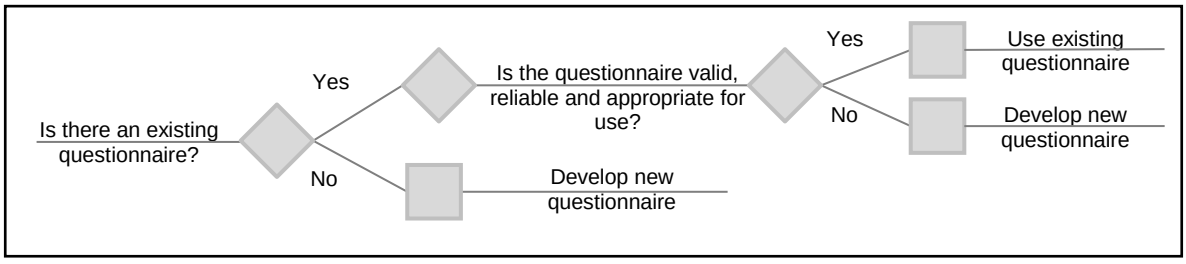

Figure 5.1. Questionnaire-development decision tree

5.3.1 State-of-the-art in questionnaire development

Questionnaire development comprises a set of different phases that work together to minimise bias in research. These phases can be summarised as (1) questionnaire design, (2) questionnaire pre-testing and (3) questionnaire testing (Figure 5.2) (Friedman and Wyatt, 2006; Streiner and Norman, 2008; Rattray and Jones, 2007; DeVellis, 2003; Creswell, 2008). Each phase of the development process reflects a method to evaluate the questionnaire properties and test the validity and reliability of the questionnaire. This process becomes a branch of science within different fields. For example, in psychology it is called psychometric study and in sociology it is called sociometric study (Feinstein, 1987). In the following section, these phases will be explained briefly. More details will be presented later on in this thesis (please refer to Chapter 6 for questionnaire design and pre-testing and Chapter 7 for questionnaire testing).

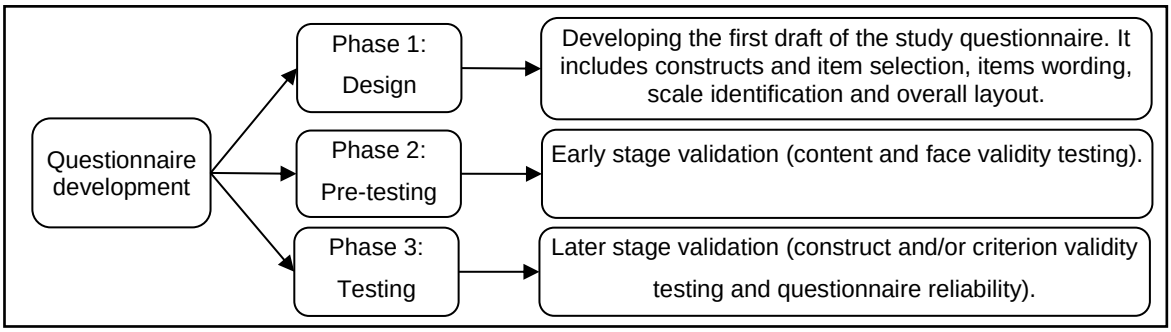

Figure 5.2. Questionnaire development phases

Phase 1. Questionnaire design: Questionnaire design includes four main principles: construct and item selection, item wording, scale identification and overall questionnaire layout. In the first phase the researcher aims to generate a first full draft of the questionnaire. Starting with the first principle, which is construct and item selection, there are two methods for selecting the study constructs: empirically (e.g. consultation with the field experts) and theoretically (e.g. adopting a behavioural theory). Using the theoretical approach has some advantages, including increasing the validity and reliability of the questionnaire and providing a standardised way to compare results between studies (DeVellis, 2011; Peek et al., 2014). However, the importance of the empirical way is in the fact that the factors justifying particular phenomena could be different when the context change (Holden and Karsh, 2010; Legris et al., 2003). Then, more constructs that are relevant can be identified compared with applying the theoretical approach. However, integrating the two ways would cover

the advantages of both, as discussed earlier in Chapter 2 and as will be shown in Chapter 6 (Streiner and Norman, 2008).

Once the constructs have been identified, they need to be well defined to help in generating the relevant items (Streiner and Norman, 2008; Rattray and Jones, 2007). The more a researcher understands the phenomena of interest, the easier the process of item selection will be and the more valid and reliable the questionnaire developed (DeVellis, 2011). Items can be extracted from available literature or developed by the researcher. Extracting ready developed items helps to ensure the face and content validity of the items (Rattray and Jones, 2007; Streiner and Norman, 2008). However, sometimes the available items are not appropriate to reflect the dimensions within the study context. Then, these need to be modified or redeveloped to better reflect the phenomena of interest (Rattray and Jones, 2007).

The second principle is item wording. This means that the selected items need to be worded correctly with regards to the main questionnaire audience. Item wording and language may all bias questionnaire responses (Rattray and Jones, 2007). In this regard, a questionnaire designer needs to avoid particular questions (e.g. double-barrelled questions and sensitive questions) (Streiner and Norman, 2008). An example of a double-barrelled question is “do you think that students should have more classes about history and maths?". This question asks about two different issues, history and maths, and participant might have different answers for each question. On the other hand, a simple example of a sensitive question would be asking about a respondent’s income. Respondents may feel that such questions are simply none of the researcher’s business (Tourangeau and Yan, 2007). Then, they will skip the question or provide the wrong answer. More details will be shown later in Chapter 6.

The third principle is item scaling. After selecting and ensuring the language of all of the items, an appropriate scaling method to observe main audience responses needs to be selected. Questionnaire scaling is the mechanism through which to distinguish individual responses from the respondents with regards to the measured variables (Sekaran and Bougie, 2009). There are many types of response scales, so selection of the appropriate scale is important as the method of scaling the items can bias the responses and increase the instrument error (Streiner and Norman, 2008). Four types of scales and response styles are available. These are nominal (e.g. religion), ordinal (e.g. educational level), interval (e.g. temperature) and ratio (e.g. weight balance). Based on these response styles, researchers have developed specific scales to facilitate data collection. For example, a Likert scale is a well-known unidimensional

(measuring a single attribute) ordinal scale designed to examine how participants agree or disagree with a defined statement (Likert, 1932). It is commonly used in health and social sciences to measure attitudes and perceptions (Clason and Dormody, 1994; O'keefe, 2002). Although a Likert scale is easy to construct, one of its disadvantages is that all the items proposed to measure a particular construct need to be included and summed, even if they are not overtly related to the construct being tested. The inclusion of non-relevant items would then weaken the internal consistency reliability of the scale (Streiner and Norman, 2008).

On the other hand, the Thurstone scale is another unidimensional ordinal scale developed by Thurstone (1928). It consists of different items to measure a particular issue. Each statement has a numerical value indicating the respondent's attitude toward the issue. Respondents indicate which of the statements they agree with and the average of responses of the agreed items is computed. The Guttman scale has a similar assumption to the Thurstone scale, where a number of items are presented to which respondents agree or disagree with each item (Guttman, 1950). However, the difference is that items in the Guttman scale are arranged in an order, so that respondents who agree with a particular item also agree with lower-ranked items (LeCompte and Schensul, 2013; Rattray and Jones, 2007). The Guttman scale is a dichotomous (yes or no) nominal scale (LeCompte and Schensul, 2013). One disadvantage of the Guttman and Thurstone scales is that the assumption of an equally strong association between the construct and each of the relevant items is not applied on the items constructed in this type of scale (DeVellis, 2011). So, this type of scale is not applied in theoretical constructs where the construct could be measured by a set of equal-strength items and a Likert scale might be a better option (DeVellis, 2011).

After this point, the items should be ready, however, attention should be also given to the way of presenting and ordering these items. For example, easy-to-complete questions should be moved to the end of the questionnaire (e.g. demographic information) as participants might feel tired at the end and unable to answer difficult questions (Sudman et al., 1996). In fact, item order and item structure can create response bias. One of the biases linked with item structure is called context bias. This bias means that the response for one item influences the response of the subsequent item(s), also called the halo-effect (Streiner and Norman, 2008; McColl et al., 2001). More details on this issue discussed in Chapter 6.

Phase 2. Questionnaire pre-testing: Questionnaires are developed to form a standardised method of data collection. Consequently, the researcher would like to

ensure that differences in responses are in fact actual differences and not occurring due to a problem with the instrument or the questionnaire. In other words, standardisation assumes that (a) the questionnaire includes feasible questions that can be answered easily, (b) all respondents understand the questions in the same way, and (c) the questions are clear enough to enable participants to respond without problems (Collins, 2003).

Fundamentally, questionnaire responses or scores are composed of a true score and measurement error (Murphy and Davidshofer, 2005). Even with a well-designed questionnaire, measurement error is still inevitable (Streiner and Norman, 2008). There are two types of measurement error: random error and systematic error (Trochim and Donnelly, 2007).

Random error is caused by factors that randomly influence the measurement of the questionnaire variable across the sample (Trochim and Donnelly, 2007; Lavrakas, 2008). For example, respondent mood can affect their responses. It might positively influence the responses of some participants (the ones who feel depressed). This type of error does not have a constant influence over the whole sample, but it pushes some of the observed scores randomly up and down. So, it does not affect the average of the scores for the whole sample, but only variability of the data around the average. In this instance, it is considered noise rather than bias. Increasing the sample size reduces the influence of random error over the scores (Lavrakas, 2008).

On the other hand, systematic error is caused by factors that systematically influence the measurement of the questionnaire variable across the sample (Trochim and Donnelly, 2007). For example, if students are taking a test in a very noisy environment, the noise is likely to influence the student score negatively. In this case, this type of error influences the average of the scores for the whole sample. Then, it is considered a bias (Trochim and Donnelly, 2007). Any issue with the content or formatting of the questionnaire is considered a systematic error, as this will influence the whole sample (United Nations Statistical Division., 2008). In contrast to random error, systematic error cannot be reduced by increasing the sample size.

Formal testing of the validity and reliability of questionnaires aims to estimate these types of errors and suggest ways to reduce them to improve the overall questionnaire (Streiner and Norman, 2008). Random error is considered as part of the reliability (Wood and Kerr, 2006). For example, by comparing the scores collected from the same respondent on two occasions it is possible to estimate the random error associated with the questionnaire. However, systematic error is considered as part of the validity

assessment (Carolyn Waltz et al., 2010). In this case, improvements to the layout of the questionnaire can reduce the bias associated with systematic measurement error.

In general, questionnaire pre-testing exists to ensure two types of validity: face and content validity. As explained earlier in Chapter 3, face validity is defined as the degree to which the question appears to measure the intended construct (DeVon et al., 2007). It considers any issue with the content and the formatting of the questions. Content issues include problems with question clarity, question meaning and relevance to the main construct. Format issues include problems in navigating the questionnaire and dealing with skip patterns (Willis, 2005). It is a basic type of questionnaire validity. However, content validity means that the questionnaire items actually represent all of the study constructs (Streiner and Norman, 2008). Both types of validity are subjective in nature as they are conducted in a qualitative way, although the literature has introduced a quantitative method to assess content validity (Lynn, 1986; Lawshe, 1975).

A central part of the results' accuracy is based on the questionnaire pre-testing (Scheuren, 2004). To undertake the pre-testing, different methods can be used (e.g. expert review, focus group, a questionnaire appraisal coding system and cognitive interviews). Although each one has its own strengths and weaknesses, as will be shown later in Chapter 6, it is recommended to use more than one method to reduce questionnaire error as much as possible (Willis, 2005). More details of the questionnaire pre-testing will be discussed in Chapter 6.

Phase 3. Questionnaire testing: A researcher might have good questions and appear to measure the right construct, but in fact, may unwittingly tap into other related constructs. Consequently, further testing procedures need to be conducted. Questionnaire testing is a type of field-testing to ensure that all questions statistically reflect the study constructs and are correlated highly with the intended construct, rather than the other constructs. Through this phase, more advanced types of validity (e.g. construct and criterion validity) and reliability are examined. As shown in Chapter 3, construct validity measures how items correlate with one construct. This type of validity can be measured by applying advanced statistics (i.e. factor analysis) to understand more about the inter respondent and the intra respondent correlation of the items (Ramaker et al., 2002). On the other hand, criterion validity, as explained in Chapter 3, is the degree to which measurement results correlate with external standards or with another measure (Friedman and Wyatt, 2006). It can be concurrent or predictive criterion validity (Streiner and Norman, 2008) (see chapter 3 for more details). This

validity requires the existence of a validated measure or gold standard to be proved (Alumran et al., 2012).

In addition to validity, another thing that could be tested in this phase is questionnaire reliability. As shown in Chapter 3, reliability is the ability of a questionnaire to measure something in a reproducible way. It is the way to estimate random errors (Wood and Kerr, 2006). It includes two different types: equivalence and stability reliability (DeVon et al., 2007). More details of these types were provided earlier in Chapter 3. Although questionnaire reliability is important, reliability alone is not enough to show how good the questionnaire is (Schweigert, 2011). A questionnaire may not measure what the researcher thinks it measures, even when it provides consistent scores.

5.4 Research design

Research design, as defined by Creswell (2008), is the "plan or proposal to conduct a research". To identify the appropriate research design, the researcher should identify the three intersectional components that form the design; **philosophies**, **strategies** and **methods**. The aim is to directly influence the decision in selecting the appropriate item within each component.

The aim of this research is to understand the factors influencing e-PROM acceptance through testing a theoretical framework. Testing a theory to answer a research question requires the use of a questionnaire for data collection (Creswell, 2008). But because there is no reliable, valid and adequate questionnaire to be used, there is a need to develop and validate a new questionnaire measuring acceptance of e-PROMs. This questionnaire needs to be developed based on the Theory of Planned Behaviour (TPB) with the additional factors (computer anxiety and demographic characteristics), as shown in Chapter 4. Thus, the current study developed and validated a new questionnaire to facilitate the understanding of patient acceptance and use of the e-PROMs.

5.4.1 Philosophical worldview

Even though the philosophical parts of any research are usually hidden (Slife and Williams, 1995), it is important to identify them to facilitate the decision for choosing the appropriate method (Creswell, 2008). The term worldview is defined as "a basic set of beliefs that guide action" (Guba, 1990). There are different types of philosophical worldview (e.g. post-positivism, constructivism, advocacy and pragmatism). Each of these worldviews guide the selection of the study design. For example, post-positivism

embraces a philosophy that identifies a cause and effect association and usually emphasises conducting quantitative studies. However, the social construction worldview is a philosophy that highlights a deep understanding of a specific problem, which emphasises conducting qualitative studies. The advocacy or participatory worldview, was initiated by researchers who felt that the post-positivist imposed theories did not fit marginalised individuals and the constructivists did not go far enough in producing an action agenda to help the marginalised individuals (Kemmis and Wilkinson, 2002). This worldview is appropriate when the aim of the study is to change practice. At the end of a study applying this worldview, a researcher produces an action agenda for change (Kemmis and Wilkinson, 2002). This worldview is well suited to qualitative research, but it can be a foundation for quantitative research also (Creswell, 2008). Finally, in a pragmatic worldview, the researcher uses all available approaches to understand the study problem (Rossman and Wilson, 1985). Thus, pragmatism is the philosophical worldview that underpins the mixed methods approach to study (Creswell, 2008).

As the current researcher is aiming to develop a questionnaire to identify an association between predictors and an outcome, the social construction worldview, which highlights deep understanding, and the advocacy worldview, which emphasises changes in practice, were not appropriate. However, the pragmatic worldview could be appropriate here as this study included, in addition to the quantitative method, a qualitative part. But, because this qualitative part was conducted as a method to improve the utilised questionnaire only and was actually hidden under the quantitative part, the post-positivism worldview was more appropriate here (Creswell, 2008).

5.4.2 Research strategy

The second component of the study design is the research strategy or research methodology, i.e. “types of qualitative, quantitative and mixed methods designs or models that provide specific directions for procedures in a research design” (Creswell, 2008, p11). Each of these three main methods, qualitative, quantitative and mixed methods, has different strategies. For example, quantitative researches have two main strategies (i.e. experimental design and non-experimental/survey design). While qualitative researches have several different strategies, such as ethnographies (i.e. studying an intact cultural group in their natural setting over a long period of time) and case studies (i.e. when a researcher explores in great depth an event or process). Finally, mixed method researches have strategies such as sequential (i.e. the researcher wants to expand the finding from one method with the finding from the other

method to better understand the problem) and concurrent (i.e. the researcher converges the findings from different methods to better understand the problem).

Although, the study included a qualitative method, the qualitative part was not used to elaborate on or expand the findings of the quantitative methods, and was not merged with the quantitative findings to provide a deep understanding of the problem (i.e. the main assumptions of the mixed method approach) (Creswell, 2008). So, it was not appropriate to refer to the mixed methods approach here. Then, as discussed earlier in the previous section and as will be shown in the following section, this research was conducted using a post-positivist quantitative research method.

In the quantitative researches, there are two main strategies, as shown earlier (i.e. experimental design and non-experimental/survey design). The non-experimental or survey design can be used when a researcher aims to obtain a numeric description of population opinion through studying a sample of that population (Creswell, 2008). However, an experimental design can be used, for example, to determine whether a specific treatment influences an outcome (Creswell, 2008). So, following the aim of this study, it become clear that this aim could be perfectly conducted through a non-experimental/survey research strategy (Babbie, 1990; Creswell, 2008).

Within the research strategy, it is also important to justify the timescale in conducting the research (Creswell, 2008). If the data collection occurs at one point in time, this is called a cross-sectional study. However, if the study occurred over more than one point in time, the study is called a longitudinal study (Sekaran and Bougie, 2009). Although both timescales are applicable in this research and although the longitudinal timescale would provide us with the main barriers influencing both acceptance and actual usage, this study was conducted at one point in time, namely “cross-sectional research”. This is because the e-PROMs were not implemented in the clinic during the study conduct period. Therefore, the actual use of the system could not be measured. Further studies need to be accomplished to understand the factors that influence actual use. In fact, collecting the objective measure of actual use would also facilitate measuring the criterion validity of the study questionnaire.

5.4.3 Research methods

The last element of the research design is research methods or data collection methods; these include “the forms of data collection, analysis and interpretation that researchers propose for their studies” (Creswell, 2008). Aligned with the research purpose, the philosophical worldview and the research strategy, this research was best

clarified by conducting quantitative survey research (Babbie, 1990). Quantitative research can be used when the researcher wants to examine associations between factors and test a particular theory to answer research questions. The decision for not choosing qualitative was because this method helps in answering different types of questions. For example, it can be useful when a researcher wants to know more about a specific concept as the concept has not been sufficiently well discussed and addressed in the literature (Creswell, 2008), but this was not the case here in this study. Although this study could be conducted using a mixed methods approach, as this approach can be used if a researcher wants to understand both the concept and the associations between factors (Creswell, 2008), it was not applied due to time constraints as this is a PhD research study.

In survey research, the questionnaire is the main data collection method (Creswell, 2008). A researcher faces different options for data collection including the questionnaire type and the mode of distribution. Starting with the questionnaire type, the questionnaire responses could be collected using a self-administered questionnaire or interview-based questionnaire. The advantages and disadvantages of each method have been studied widely (Kaplan et al., 1997; Vuillemin et al., 2000; Bowling, 2005; Babbie, 2015). However, the choice of appropriate type is subjective to the study context. Although interview-based questionnaires are good for reducing the non-completion rate, they are time consuming to conduct and require more than one interviewer to collect a reasonable number of questionnaires (Kaplan et al., 1997; Creswell, 2008). However, because this PhD research is restricted by a timeline, self-completion questionnaires were used to collect questionnaire responses. Although this method of data collection is good to collect data from a wide range of participants in a timely manner, it has some limitations. One of the limitations is that the questionnaire might have issues with clarity, formatting and language. Then a respondent might provide untruthful answers or leave questions without answers, which might bias the study result (non-sampling systematic error) (United Nations Statistical Division., 2008). So, the pre-testing phase was conducted here to minimise this kind of error and to improve the questionnaire layout (Willis, 2005). Another limitation is that this method has lower response rates than interview-based questionnaires. So, this was taken into account when the sample size was counted (see Chapter 7 for more details).

The second decision involved the mode of distribution. Questionnaires can be distributed manually (i.e. paper-based questionnaires) or electronically (i.e. online questionnaires). Each mode has advantages and disadvantages (Wright, 2006). For example, the advantages of online questionnaires compared to paper-based

questionnaires include: (1) saving the researcher time, (2) accessibility to more people, and (3) low conduction costs associated with paper printing. However, they have disadvantages as well, including: (1) technical issues, such as unavailability of electronic devices or Internet connections, and (2) sampling issues as it did not include people with poor computer literacy (Dillman et al., 1998; Wright, 2006).

Although online questionnaires might have some advantages, in this research, a paper-based questionnaire was used to collect patients' feedback. This is because the researcher was interested in getting feedback from both computer literate patients and computer illiterate patients. Thus, an online questionnaire would hinder access to the second population. Moreover, from the previous review, Chapter 3, it appears that online questionnaires have a low response rate compared with paper-based questionnaires. Then using a paper-based method will increase the likelihood of collecting more data in a timely manner.

5.5 Investigation plan

In order to accomplish the research objectives, the research was conducted in two stages (Figure 5.3). Each stage aimed to answer specific research questions relevant to specific objectives. The first stage was a literature review and the second stage was the questionnaire development and distribution.

Stage 1. Literature review: before undertaking any research, and after identifying the topic of interest, the researcher needs to start searching the literature. A literature search helps to define the previous study gaps and the need to extend previous researches (Creswell, 2008). Although the literature review shows the importance of the study, it could also be a method used to answer a specific research question (Creswell, 2008). In the current research project, the literature review aligned with three main objectives (Table 5.1):

(1) Review the theoretically informed questionnaires developed to measure patient acceptance of a Consumer Health Information Technology and assess their overall quality (i.e. reliability, validity and response rate). This literature review was discussed in Chapter 3 and concluded that none of the questionnaires within the reviewed studies were appropriate to understand patient acceptance of e-PROMs. This is because the reviewed questionnaires were inaccessible, very context-specific, or were general but designed for another type of CHIT. Consequently, a generic questionnaire for this purpose was needed.

(2) Review the different theories/models that have been used to understand technology acceptance and choose the appropriate validated theory for the study purpose. This literature review was discussed in Chapter 4 and concluded that there are around 13 theories that could be used to understand e-PROM acceptance. Of these, the Theory of Planned Behaviour (TPB) was selected to understand e-PROM acceptance.

(3) Understand the factors associated with patient acceptance of e-PROMs from the patients' and researcher's perspective within the literature. This literature review was discussed in Chapter 4 and concluded that additional constructs highlighted within the empirical study might also help to understand e-PROM acceptance, including computer anxiety and patient characteristics (age, gender and education level).

Table 5.1. Research objectives, questions and method used for stage 1 - literature review

Objective	Question	Test (method)	Relevant chapter
1. Review the theoretically informed questionnaires developed to measure patient acceptance of a CHIT and assess their overall quality (i.e. reliability, validity and response rate).	What are the available literatures aimed at measuring acceptance of a CHIT within patients quantitatively? Is there an appropriate valid and reliable questionnaire that can be used to understand patients' acceptance of e-PROMs?	Literature review (review 1)	Chapter 3
2. Review the different theories/models that have been used to understand technology acceptance and choose the appropriate validated theory for the study purpose.	What are the available theories or models that can be used to explain the information technology acceptance? To what extent have these theories been adopted, tested and validated, and what is the most appropriate theory to understand the patient acceptance or e-PROMs?	Literature review (review 2)	Chapter 4
3. Understand the factors associated with patient acceptance of e-PROMs from the patients' and researcher's perspective within the literature.	What are the factors that could influence acceptance from previous empirical studies and based on patients' experience with the e-PROMs?	Literature review (review 2)	Chapter 4

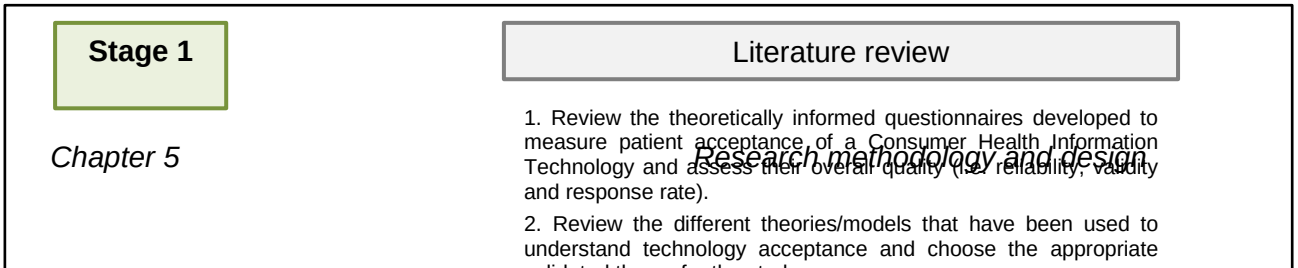

Figure 5.3. Overall study plan

Stage 2. Questionnaire development and distribution: In this stage, the validation work of the developed questionnaire was investigated. Then, the questionnaire was used to investigate the main barriers hindering the acceptance of e-PROMs within a

particular group. Consequently, stage 2 covers the rest of the study objectives (as shown in Table 5.2):

(4) Develop and undertake initial validation of a questionnaire to measure patient acceptance of e-PROMs. Details regarding the methods applied are presented in Chapter 6 and Chapter 7.

(5) Measure patients' (cancer survivors) acceptance toward using e-PROMs in Leeds Teaching Hospitals NHS Trust using the developed questionnaire. Details of the relevant methods are presented in Chapter 8.

Although this stage aimed to address two research objectives, the stage was accomplished through different phases (see Figure 5.4).

- Phase 1. The initial questionnaire development was conducted based on the previous literature guidelines (Friedman and Wyatt, 2006; Streiner and Norman, 2008; Rattray and Jones, 2007; DeVellis, 2003; Creswell, 2008) and as explained in Section 5.2, included construct and item selection, item wording, scale identification and overall questionnaire layout. After this phase, an initial complete version of the research questionnaire was designed.
- Phase 2. A questionnaire pre-testing phase followed the previous phase and was initiated to ensure content and face validity.
- Phase 3. A questionnaire testing phase (field-testing phase) involved testing for construct validity and questionnaire reliability.
- Phase 4. The questionnaire demonstration phase was accomplished using the data from Phase 3 and after removing the weak questionnaire items. The main objective behind this phase was to measure patients' (cancer survivors) acceptance toward using e-PROMs in Leeds Teaching Hospitals NHS Trust using the developed questionnaire. This phase describes the association between the theoretical factors.

Table 5.2. Research objectives, questions and method used for stage 2

Objective	Question	Test (method)	Relevant phase	Relevant chapter
4. Develop and undertake initial validation of a questionnaire to measure patient acceptance of e-PROMs.	Is the developed questionnaire adequate to be used in the clinic to measure patients' acceptance? (i.e. Does the questionnaire measure what it intends to measure? Does it represent the content? Does the questionnaire look like a good questionnaire? Do the items reflect the relevant constructs? Do these constructs differ from each other? Does the questionnaire consistently measure whatever it measures?)	Test validity and reliability of the questionnaire	Phase 1, Phase 2 and Phase 3	Chapter 6 and chapter 7
5. Measure patients' (cancer survivors) acceptance toward using e-PROMs in Leeds Teaching Hospitals NHS Trust using the developed questionnaire.	What are the main factors influencing acceptance within cancer survivors at St. James's Hospital?	Statistical analysis (structural equation modelling)	Phase 4	Chapter 8

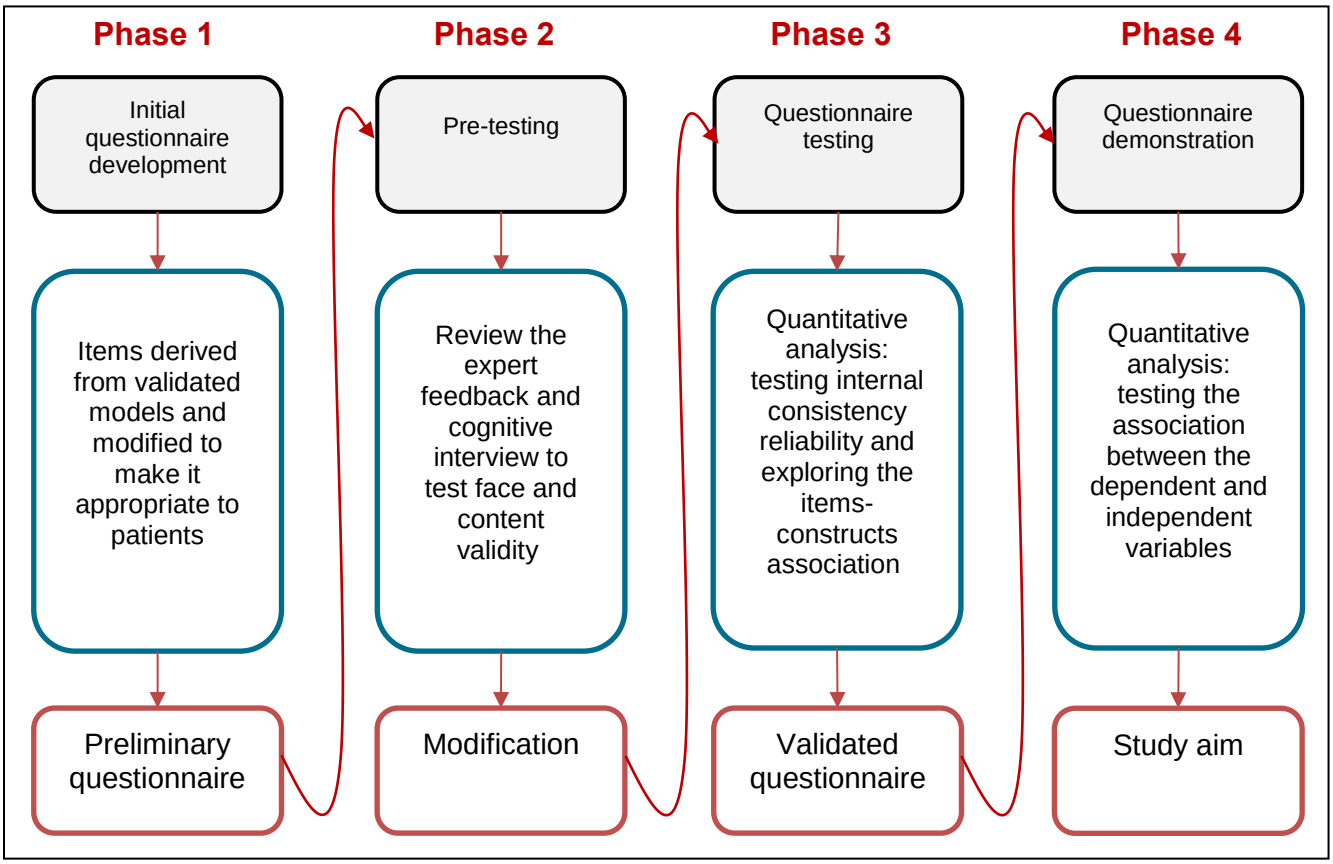

Figure 5.4. Questionnaire development and distribution process

5.6 Ethical consideration

As this research deals with human participants, it was critical to ensure the participants' safety and human rights (Harriss and Atkinson, 2013). An ethical review helps the researcher to think about all the different legal aspects of the research and ensure that both participants and the researcher are not exposed to any type of harm (Harriss and Atkinson, 2013). Different risks to participants are associated with conduct of research. These include confidentiality issues, the participants' right to withdraw, data privacy and data storage. Participants need to be informed about the associated risks and consent was required from them to evidence their agreement with participation (Harriss and Atkinson, 2013).

In this research, all of the study participants were informed about confidentiality and anonymity, their right to withdraw, privacy and data storage. Moreover, each participant signed a consent form before the data was collected. Details are discussed in the relevant chapters (Chapter 6 and Chapter 7).

To ensure that this research was conducted in an ethical manner, two bodies reviewed the feasibility of the research process: the University of Leeds ethical review committee and the NHS ethical review committee (NRES). Each of the ethical review bodies provide ethical reviews for different participant groups. For the general public, recruited from community centres, the University of Leeds ethical approval was granted (Reference no. HSLTLM/13/001 dated November 12, 2013) (see Chapter 6 and Appendix C for more details). However, for the cancer survivors recruited from Leeds Teaching Hospital NHS Trust, approval was sought from the Wales Research Ethics Committee (REC) (Reference no. 14/WA/0048, dated February 5, 2014) and the Research and Development (R&D) department of Leeds Teaching Hospital NHS trust (LTHT R&D no. PO14/11075, dated March 6, 2014) (see Chapter 7 and Appendix D for more details).

5.7 Research motivation

As discussed in Chapter 1, in the United Kingdom, the Department of Health (DH) Information Strategy has a key commitment to provide better access to healthcare information by having less paperwork in patient processes (Department of Health., 2012). The push from NHS management to adopt e-PROMs will put healthcare organisations at risk of project failure if patients reject them. To help clinicians to

motivate patients to use these technologies, clinicians should understand the barriers that hinder acceptance and usage.

In spite of the existence of studies measuring patients' acceptance toward using different types of CHITs (Or and Karsh, 2009), Chapter 3 showed that, to date, no study has measured patient acceptance toward using electronic measures to report health information (i.e. e-PROMs) quantitatively based on a theoretical framework. Moreover, Chapter 4 concluded that the best model to justify e-PROM acceptance and use is the Theory of Planned Behaviour (TPB) (Ajzen, 1991). However, no appropriate, valid and reliable questionnaire was found to understand patients' acceptance and use informed by the TPB. Consequently, this thesis describes the initial development and validation of a new questionnaire based on the TPB to understand e-PROM acceptance and use.

5.8 Contribution to the field of study

As explained in Chapter 2, user acceptance is a concept that is difficult to measure as it cannot be observed or measured directly. Therefore, studies use questionnaires to assess what people think and feel about the construct under consideration. Friedman and Abbas (2003) showed that within the health informatics field there is a dearth of well-designed, reliable and well-validated measures. Friedman and Abbas (2003) argued that before health informatics can be called a fully mature science health informatics researchers need to engage with the development of questionnaires and understand the link between the questionnaire and the phenomenon of interest, so called measurement studies. Application of these measures to understand a specific concern is called demonstration study (Friedman and Wyatt, 2006).

Measurement studies have been recognised widely in other disciplines (e.g. psychology, sociology and biomedical science) as discussed earlier in chapter 3. This is because all scientific questionnaires have a degree of measurement error. So, the aim of the measurement studies is to minimise the error associated with the questionnaire, which is vital to successful science (Streiner and Norman, 2008). Although the call for measurement studies in health informatics came a decade ago, while reviewing the quantitative literature on measuring CHITs acceptance for this study (Chapter 3), it became apparent that this limitation still exists in the published literature. Thus, as the current study aims to develop and validate a new questionnaire to measure patient acceptance of e-PROMs, the questionnaire development and

validation process will add to the sparse body of literature relating to measurement studies within the health informatics field.

As there are no precise steps justifying the development of measurement in the health informatics field, a health informatics researcher can draw on the wealth of evidence and expertise from other disciplines (i.e. psychology and sociology) (Friedman and Abbas, 2003). Therefore, it is possible to understand the importance of the measurement studies and how the validation process can improve the quality of the developed questionnaire, which will then help in collecting accurate data for analysis.

5.9 Conclusion

Underpinning this thesis is the Department of Health information strategy which has a key commitment to reducing paperwork in the patient process (Department of Health., 2012). Based on this, NHS management had a plan to use electronic modes to collect patient reported outcome measures (e-PROMs) instead of paper-based modes (Ashley et al., 2011a). Consequently, understanding the barriers that hinder e-PROM acceptance and use can help clinicians to optimise the system use.

Thus, the research aims to help clinicians to measure patient acceptance and understand the barriers towards e-PROM adoption through developing and validating a new e-PROM acceptance questionnaire. It is being conducted to achieve the following objectives: (1) review the theoretically informed questionnaires developed to measure patient acceptance of a Consumer Health Information Technology and assess their overall quality (i.e. reliability, validity and response rate), (2) review the different theories/models that have been used to understand technology acceptance and choose the appropriate validated theory for the study purpose, (3) understand the factors associated with patient acceptance of e-PROMs from the patients' and researcher's perspective within the literature, (4) develop and undertake initial validation of a questionnaire to measure patient acceptance of e-PROMs and (5) measure patients' (cancer survivors) acceptance toward using e-PROMs in Leeds Teaching Hospitals NHS Trust using the developed questionnaire. The process of questionnaire development will also contribute directly to the field of health informatics that has demonstrated a literature gap in terms of measurement studies. More details of the research methodology are presented later on in Chapter 6, Chapter 7 and Chapter 8.

CHAPTER 6. Questionnaire Design and Pre-Testing

6.1 Introduction

Patient acceptance is an unobservable phenomenon that requires the development and validation of a questionnaire to measure it. As shown earlier in this thesis, it appears that until now there has been no adequate, theoretically informed questionnaire to measure patient acceptance towards using electronic patient-reported outcome measures (e-PROMs). Consequently, a valid and reliable questionnaire is needed.

When researchers develop questionnaires, they aim to provide a complete, unbiased, valid and reliable understanding of the phenomena studied. This means that researchers want to make sure that the questions within the questionnaire actually measure the phenomenon they want to measure, and that the questionnaire covers all relevant constructs. Moreover, they want to ensure that the data collected actually represent true values (i.e. actual responses) and the questionnaire is sensitive enough to reflect the differences between the respondents (Collins, 2003).

In the previous chapter, the process of questionnaire development was discussed. The development phases include the initial questionnaire design, questionnaire pre-testing and questionnaire testing (see Chapter 5 for more details). The focus of this current chapter is the initial questionnaire design and the pre-testing phase of a theoretically informed questionnaire to understand patient acceptance of e-PROMs. Questionnaire pre-testing can help to improve questionnaire clarity and reduce errors on understanding. In the pre-testing phase, the researcher aims to test the face and content validity of the questionnaire.

6.1.1 Study aim

The aim of this phase of the study is to design a draft version of a questionnaire based on the Theory of Planned Behaviour to measure patient acceptance of e-PROMs and to gather face and content validity evidence.

6.1.2 Study objectives

I. To design and develop the first questionnaire draft to measure patient acceptance of using e-PROMs
II. To evaluate the content and face validity of the first questionnaire draft.

6.2 Questionnaire design

In developing and designing the initial version of a questionnaire, a researcher needs to ensure that the developed questionnaire is good enough to collect research data by avoiding common issues (Streiner and Norman, 2008). This can be achieved by following some predefined guidelines covering four areas: (1) constructs and item selection, (2) scale identification, (3) item wording and (4) overall questionnaire layout (Rattray and Jones, 2007; Streiner and Norman, 2008). Further details regarding each of these areas are provided in the following sections.

6.2.1 Constructs and item selection

The initial stage of questionnaire development involves developing a bank of items that cover all areas of interest (Streiner and Norman, 2008; Rattray and Jones, 2007). Consequently, a researcher needs first to select the main constructs and then develop relevant items. Selection of the main study constructs can be accomplished using two sources: (1) empirical sources (i.e. through consultation with experts in the field and from proposed participants, for example through conducting focus groups, interviews or clinical observations), and (2) theory driven sources (i.e. through searching literature for global theories of an illness or behaviour) (Streiner and Norman, 2008). The use of both sources for extracting the study constructs will increase the chances of covering as many relevant constructs as possible. After selecting the study constructs, each construct should be defined clearly to facilitate the generation of items (DeVellis, 2011). Then, based on the definitions, the relevant items for each construct can be generated.

6.2.2 Item wording

Questionnaire items are the sets of observable variables/questions that help in measuring the unobservable phenomenon/construct (Puri and Treasaden, 2009). Put in another way, each construct can be measured through identifying a set of items. However, before using these items for data collection, it is important to ensure the appropriateness of the item wording that allows participants to understand and answer questions properly. A poorly worded questionnaire has been described as "*like an awkward conversation – can turn an initially pleasant situation into a boring or frustrating experience*" (Bradburn et al., 2004 , p9). An important aspect to consider when wording an item is stating it in a non-biased way. Streiner and Norman (2008) presented four important strategies to improve item wording:

- **Readability level and length of item:** In wording a questionnaire item, it is essential to avoid ambiguous sentences or use technical terms. Moreover, it is important to avoid very long sentences because they require excessive load in

respondent memory (McColl et al., 2001). To measure the readability level and length of sentences, the Flesch–Kincaid readability scale can be used. This scale is automated in Microsoft Word and has been demonstrated to be reliable and valid (Kincaid et al., 1975). This scale measures readability on the basis of the average number of syllables per word and the average number of words per sentence (Paasche-Orlow et al., 2003). Researchers have recommended some values for the scale variables to ensure the readability of a questionnaire (Table 6.1).

Table 6.1. Recommended values of the Flesch–Kincaid readability scale generated by Microsoft Word

Readability criteria	Recommended values	Reference
Flesch–Kincaid grade level (range from 0 to 12),	Items should not require a reading skill for 12-years-old (grade 8)	(Streiner and Norman, 2008).
Flesch–Kincaid Ease (100-point scale)	Over 50; the higher the score the easier it is to understand	(Ford et al., 2007; Harris et al., 2000).
Percentage of passive sentences	Less than 15%; the lower the score the better readability	(Kincaid et al., 1975).
Average number of words per sentences	Less than 15-20 words; the lower the score the better readability	(Kincaid et al., 1975; McColl et al., 2001).

- **Double-barrelled items:** The items that include subparts which might have different possible answers are called double-barrelled items. Researchers could gather ambiguous responses because of participant confusion (Streiner and Norman, 2008). It is recommended to have a single idea per question to make it clearer for the audience.
- **Leading items:** Some researchers phrase items in ways that lead respondent answers. The inclusion of leading items biases the responses which then ultimately biases the study results (Sekaran and Bougie, 2009). Consequently, when developing questionnaire items, leading items need to be avoided.
- **Positive and negative wording:** Some respondents tend to agree on all the questionnaire items without taking care of their content. This type of bias is called “response set” bias. To minimise this bias, it has been suggested that researchers should include both negatively and positively worded items and these should be placed randomly within the questionnaire (Coolican, 2004). However, including positively and negatively worded items is debated in questionnaire development studies. Although this is helpful in minimising the “response set” bias, some people find it confusing to move from one direction to another. Others have suggested that the items should be worded using one direction of wording only (i.e. positive or negative) (Streiner and Norman, 2008). The conduction of the pre-testing process is helpful in the early stage to determine whether having negative worded items is

confusing (Collins, 2003). Based on the finding, the researcher can then decide on the best method.

When negatively worded questions are used, double negative questions should be avoided. An example of a double negative item is this sentence "Not using electronic devices to record health information is inappropriate". This is because excessive use of the word 'not' appears to confuse participants (Sekaran and Bougie, 2009).

6.2.3 Scale identification

The third area involved in designing the initial questionnaire version entails deciding on appropriate scales for collecting responses. Questionnaire scaling is the mechanism to distinguish each individual's responses from other individuals with regards to the measured variables (Sekaran and Bougie, 2009). Four basic types of scales are available: nominal (i.e. religious), ordinal (i.e. educational level), interval (i.e. clinical thermometer) and ratio (i.e. weight balance). However, before deciding on the appropriate scale, it is important to understand the types of responses that might be obtained.

6.2.4 Overall layout

Not only can question wording create response bias, also the item order and the item structure can do so. Context effect is one of the biases linked with item structure. This bias means that the response for one item influences the response of the subsequent items; this is called the halo-effect (Streiner and Norman, 2008; McColl et al., 2001). In order to reduce halo effects, it has been recommended that questionnaire developers structure items based on two or more unrelated "filler" questions (i.e. heading questions) (De Jong et al., 2012).

In addition to the item structure, the structure of the whole questionnaire might influence the responses as well. Participants may be careless or too tired to answer the last part of the questionnaire (Sudman and Bradburn, 1982), consequently it is recommended that easy-to-complete questions are moved to the end of the questionnaire.

Although overall questionnaire length did not appear to have any influence over the response rate in the previous literature review (Chapter 3 for more details), previous researchers have shown that length is important (Galesic and Bosnjak, 2009; Dillman et al., 1993; Sahlqvist et al., 2011). Participants might feel very tired when completing a long questionnaire which may be another source of bias (Edwards et al., 1996). It has been recommended that a questionnaire should not exceed 10 pages to have a good

response rate (Burchell and Marsh, 1992). In addition, it has been suggested that non-directly administered questionnaires should be shorter than directly-administered ones (McColl et al., 2001). For example, for a mail questionnaire, it was recommended that the number of pages should not exceed six pages (Zikmund et al., 2013).

6.3 Questionnaire pre-testing

Questionnaires are developed to form a standardised method of data collection. Consequently, researchers like to ensure that the differences in responses are in fact actual differences, and not created due to problems with the questionnaire. Standardisation assumes that (a) the questionnaire includes feasible questions that can be answered easily, (b) all respondents understand the questions in the same way and (c) the questions are clear enough that participants can respond to them without problems (Collins, 2003).

In addition to standardisation, a researcher needs to ensure that there are no issues with item scaling or overall layout and the questionnaire actually reflects all constructs of interest.

The questionnaire pre-testing process can help to identify issues with the content and the format of the questions (Collins, 2003). Content issues include problems with question relevancy to the main construct. However, format issues include problems with question clarity, a question's meaning during navigating the questionnaire and dealing with skip patterns (Willis, 2005). Therefore, a central part of the accuracy of results is based on the questionnaire pre-testing (Collins, 2003).

Questionnaire pre-testing is applied through the use of a small number of participants to judge on item relevancy and clarity (Sekaran and Bougie, 2009). There are different methods for questionnaire pre-testing (Czaja, 1998). The most commonly used techniques are:

- *Expert review:* A questionnaire is reviewed and critiqued by a small number of experts, from two or three to over 20, who have experience in the field of interest or questionnaire development (Willis, 2005; Czaja, 1998; Olson, 2010). Expert review can be done using structured interviews or through using the Delphi technique, which is the process of sending a questionnaire through a number of rounds until consensus is reached (Gerrish and Lacey, 2013). In both methods, experts provide feedback on the questionnaire content and format including the appropriateness of the questionnaire items and the overall constructs. This is a cost effective method

compared with other methods that require actual participates (Collins, 2014). It not only focuses on the issues through the layout of the questions, but it provides feedback on the way of operationalising the concepts as well (de Leeuw et al., 2008). However, this method mainly depends on the ability of the experts. If the wrong person is recruited, issues will still exist (de Leeuw et al., 2008). More importantly, it does not show how the actual participants interpret the questions (Collins, 2014).

- *Focus group:* It has been widely used in literature to investigate people's thinking toward specific topics. In questionnaire development, a focus group is a form of group interviewing conducted to inform the design of the questionnaire (Willis, 2005). From these group discussions, researchers can extract general themes of questionnaire content. One of the main advantages of this method is that it can offer a broad range of information while spending less time and money compared to individual interviews (Stewart and Shamdasani, 2014). It allows researchers to interact directly with participants and ask for further clarification if needed (Morgan, 1997). However, this method does not focus on the micro-level of questionnaire items (Krueger, 2009).
- *Behaviour coding:* This method is used when conducting survey interviews and focuses on the general behaviour of the interviewer and respondent. A set of codes has emerged by the research team to study the course of interaction between interviewer and respondent and can be used by trained coders to point out problems with the questionnaire items, based on both interviewer and respondent behaviour while the coder observes the process. Then, using frequency statistics, the results will reveal the items with problems and the frequency of occurrence within the interviews (Rothgeb et al., 2007). Although this method provides rigorous analysis of the behaviour of both interviewer and respondent, it has its own disadvantages as it is labour intensive (e.g. the coder needs to listen to each interview, which requires double the time spent in each interview (Burgess and Paton, 1993).
- *Cognitive interviews:* This method derives from social psychology. It helps the researcher to observe the respondent while he/she is completing the questionnaire. It includes two techniques: the think-aloud process and the use of probing (Willis, 2005). During the interviews, the respondent speaks aloud while completing the questionnaire to explain what he/she is thinking about when answering the questions. If a respondent fails to explain his/her thought process, the researcher asks some probing questions. This method of expression can help a researcher to discover items that have clarity issues, ensure that all participants understand the items in the way intended, and check whether a respondent can easily retrieve the

information required to answer the question from his/her memory (Willis, 2005; Campanelli, 1997). This method, including the think-aloud technique, minimises the bias imposed by interviewer interjection and requires minimal interviewer training. However, the main participant (i.e. interviewee) needs good training as they might struggle to articulate their thoughts (Haeger et al., 2012). Additionally, participants possibly stray from the topic at hand (Willis, 2005).

It has been shown that all of these methods are actually affiliated methods and not counted as alternative methods (Snijkers, 2002). However, when looking at the main theory behind these methods, it appears that there are some differences. For example, when comparing the focus group method and the other methods, it appears that the former is better placed to gain an understanding of the topic in general (Presser and Blair, 1994). Thus, it has been suggested that a researcher could start with the focus group method to select the content and the construct of the questionnaire (Willis, 2005). Then, the other methods (expert review, behaviour coding and cognitive interviews) can be used to explore the issues with a questionnaire.

Although expert review, behaviour coding and cognitive interviews seem to have the same aim, there are differences between them. For example, the use of behaviour coding is more practical for interview-based questionnaires, rather than self-administered ones. A study was conducted to compare expert reviews, behaviour coding and cognitive interviews when conducting survey interviews and showed that expert review and behaviour coding methods reveal more problems about the interviewers. However, cognitive interviews provide more information in terms of revealing problems through the experience of respondents (Presser and Blair, 1994). Moreover, when looking at the expert review method, it appears that this method is powerful for investigating problems with the overall questionnaire and its content. However, when a researcher wants to look at the item level, cognitive interviews will be best as they deal with the main questionnaire participants, and it has been recommended that participants are the best source through which to evaluate the clarity of the questionnaire (Streiner and Norman, 2008).

From all the above, it appears that these methods can be used for different objectives: (1) To understand more about the study topics it is good to use a focus group. (2) To point out issues with the overall questionnaire, including the overall content and the way of administration, expert review and behaviour coding can be used. (3) To understand detailed problems about each individual question and difficulties in respondents answering these questions, cognitive interviews can be used. Because

those methods have different objectives, combining them would improve the overall quality of the questionnaire. Consequently, the current study will apply expert reviews and cognitive interviews to pre-test the questionnaire. Focus groups were excluded because the study concept was based on a well-known theory (the Theory of Planned Behaviour) and so adequate information of the current research issue was obtained from the literature review. Moreover, behaviour coding is excluded because the questionnaire was developed to be a self-administered questionnaire which requires fewer researchers and reduced time to collect data (see Chapter 5).

6.4 Methods

6.4.1 Design of the study

This study started in 2013 and comprised of two stages: (a) the first stage entailed the development of the initial questionnaire version (first draft) including the selection of items, scaling and layout (Figure 6.1) and (b) the second stage is the pre-testing process for the initial questionnaire version (Figure 6.2).

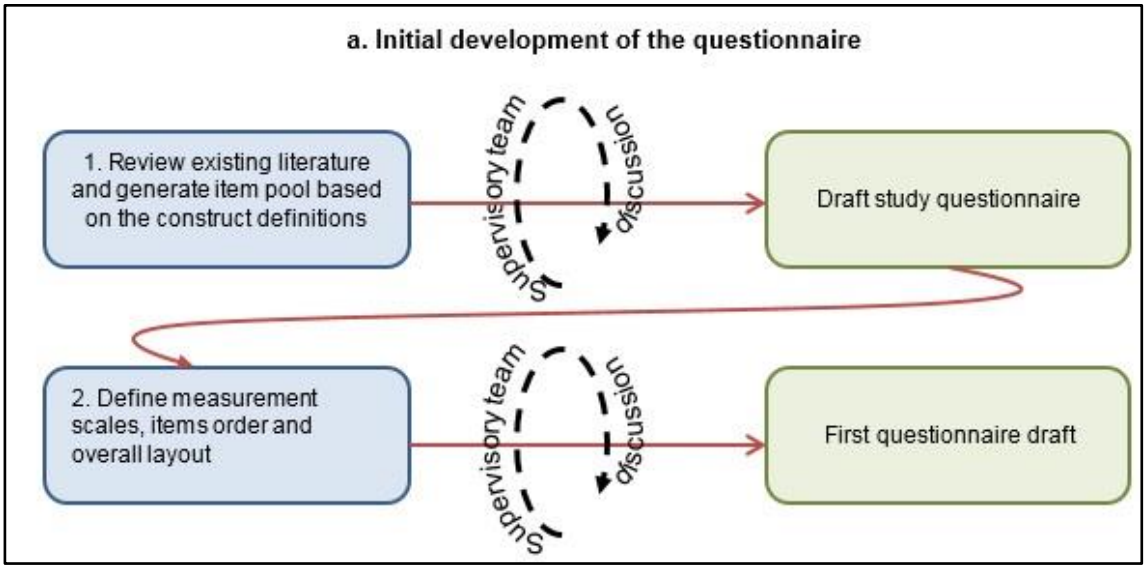

Figure 6.1. Study framework (a).

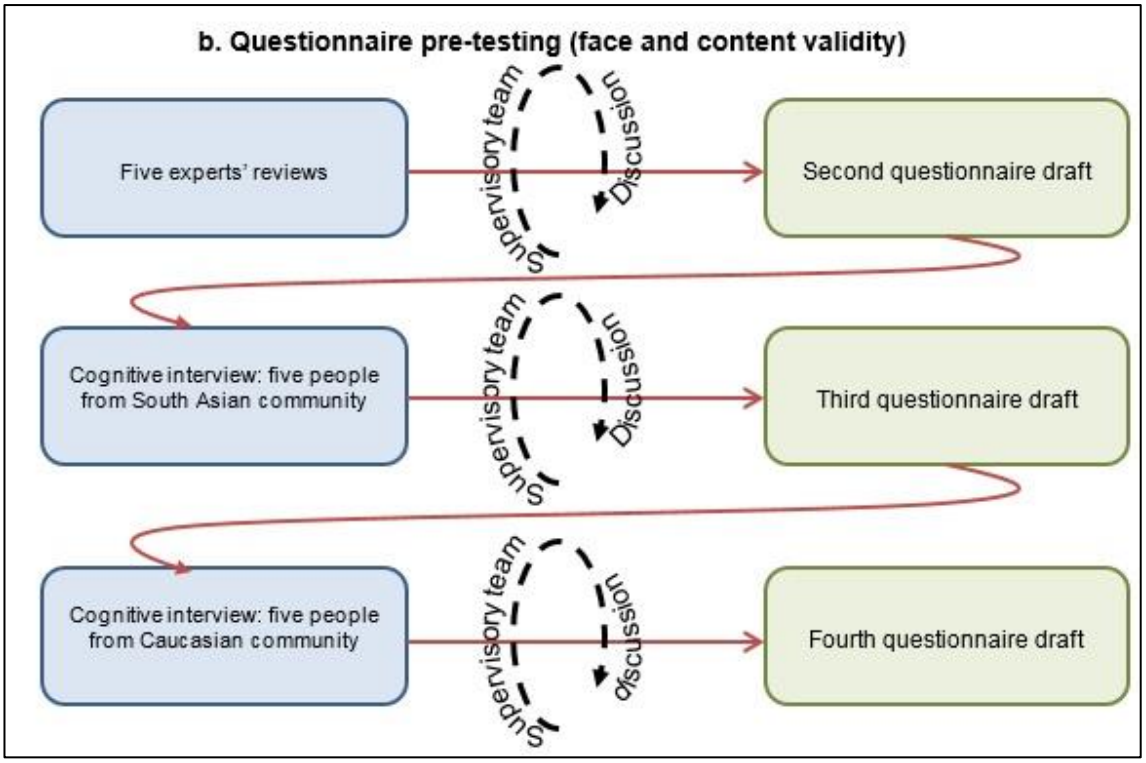

Figure 6.2. Study framework (b).

6.4.1.1 Initial development of the research questionnaire

The questionnaire was developed following Rattray and Jones (2007) and Streiner and Norman's (2008) recommendations.

6.4.1.1.1 Constructs and item selection

From the review (Chapter 4), the Theory of Planned Behaviour (TPB) was selected to explain patient acceptance of e-PROMs. Besides, after reviewing the findings it was decided to include an additional construct called computer anxiety. As a result, the main predictors of patient acceptance for this study context would be attitude, perceived behavioural control, subjective norms and computer anxiety. Additionally, patient demographics are expected to influence technology acceptance as well. Each construct was defined clearly (DeVellis, 2011) (see Table 6.2). Then, based on those definitions, an item pool was developed. Some items were extracted from existing validated questionnaires and others were generated by the researcher. A consultation with the supervisory team was conducted to review the initial items list with regards to the constructs definitions.

Table 6.2. Definitions of the questionnaire main constructs

Main constructs	Definition
Behavioural intention	"An individual's motivation or willingness to exert effort to perform the target behaviour." (Holden and Karsh, 2010, p23)
Attitude	"An individual's positive or negative feelings (evaluative affect) about performing the target behaviour." (Fishbein and Ajzen, 1975, p216)
Subjective norms	"The person's perceptions that most people who are important to him/her thinks he/she should or should not perform the behaviour in question." (Fishbein and Ajzen, 1975, p302)
Perceived behavioural control	"The perceived ease or difficulty of performing the behaviour."(Ajzen, 1988, p132). It is also defined as "perceptions of internal and external constraints on behaviour" in the information systems contexts (Taylor and Todd, 1995a, p149).
Computer anxiety	Emotional reactions when it comes to performing a behaviour (Compeau and Higgins, 1995b).

6.4.1.1.2 Scale identification

Although health studies recommend the use of continuous responses (Streiner and Norman, 2008), the most commonly used scale in health and social sciences is the Likert scale (i.e. measuring attitudes and perceptions) (Clason and Dormody, 1994; O'keefe, 2002). The Likert scale is a well-known unidimensional (measuring a single attribute) ordinal scale designed to examine how participants agree or disagree with a defined statement (Likert, 1932). It shows a negative evaluation in one extreme and positive evaluation in the other (i.e. strongly agree to strongly disagree). It typically consists of five points. Likert-type scales have features that are similar to Likert scales. However, in Likert-type scales, it is possible to use more points (e.g. 7 or 9) and other descriptors (e.g. not at all important to very important) (Streiner and Norman, 2008; Malhotra, 2006). Likert scales, or Likert-type scales, are one of the scales recommended by Ajzen (2002) to measure the TPB construct and have been used within previous studies that applied TPB (Boyko et al., 2011; Innan and Moustaghfir, 2012; Patterson, 2001; Fila and Smith, 2006). Consequently, all items of the questionnaire constructs were scored using a 7-point Likert scale. The psychology literature recommends that a scale with more points is better (e.g. a 7-point is better than a 5-point scale) (Nunnally and Bernstein, 1994a). But it has been shown that there is a diminishing return after around 11-points as the number of options becomes confusing (Nunnally and Bernstein, 1994a). In addition, most adults can store seven items in their short-term memory (Miller, 1956). Thus, having 7-points is a good balance between having an adequate number of points to facilitate discernment, without including too many response options.

6.4.1.1.3 Item wording

The next step involved ensuring the appropriateness of the item wording. As discussed earlier, items should be stated in clear language appropriate to the target population. Then, these items were tested based on the strategies of Streiner and Norman (2008), as explained earlier in Section 6.2.2.

Starting with the readability level and length of items, readability statistics were examined using the Microsoft Word processing tool. All values were compared with the pre-defined criteria discussed in Section 6.2.2 Moreover, the researcher ensured that each item contained a single idea only and that the items were phrased in a way that did not lead responses. In addition, the developed questionnaire included both positively and negatively worded items. The researcher avoided double negative items, as these would be confusing to participants. Then all items were reviewed by the supervisory team to ensure clarity.

6.4.1.1.4 Overall layout

To comply with Ajzen's recommendation for mixing questionnaire items within TPB studies, items were placed randomly and not arranged based on the constructs (Ajzen, 1991). Each set of items was headed by a primary question (questionnaire section) to guide the respondents. Easy-to-answer questions were placed at the end of the questionnaire (i.e. demographic characteristics and Internet experience questions) (Streiner and Norman, 2008). As the questionnaire was designed to be sent through the mail to participants, the initial questionnaire version was six pages long (excluding the introduction page) following recommendations by Zikmund et al. (2013).

6.4.1.2 Questionnaire pre-testing

To understand as many of the questionnaire issues as possible, two pretesting methods were used: expert review and cognitive interviews. The expert review helps to ensure the content and face validity of the items from the expert perspective. On the other hand, cognitive interviews help to ensure the face validity of the questionnaire from the participant perspective. The details of both methods are explained in the following sections.

6.4.1.2.1 Expert review

The expert review process was used to get an expert opinion of questionnaire-associated error and items of construct relevancy by reviewing the questionnaire items one by one. Expert review is about introducing the research questionnaire to a panel of experts as suggested by Presser and Blair (1994). Due to the difficulty in recruiting

experts in one session and getting access to these experts more than once, the researcher used expert-based interviews to test the study instrument.

- Study settings: University of Leeds.
- Study participants and sample size: Five experts were invited to review the study questionnaire. The selection of those experts followed recommendations by Willis (2005). Thus, three types of experts were interviewed: experts familiar with questionnaire design and development, experts familiar with TPB and behavioural theories and experts on patient research and e-PROM implementation.
- Recruitment: With the help of supervisors, the researcher was provided with some expert names in the faculty at the University of Leeds using a convenient sampling approach. An invitation e-mail was sent to each expert to ask for their participation; it included a brief description of the research (see Appendix C for more details). Once they agreed another e-mail was sent including a copy of the questionnaire and a participant information sheet (available in Appendix C). In the e-mail, a meeting date was arranged to discuss their feedback.
- Analysis: To facilitate the analysis process, an evaluation form was used to collect the experts' feedback (see Appendix C). This form was divided in different parts based on the five constructs, the demographic information and the Internet experience questions. Each part contained three sections and each had three options (agree, disagree and comments). In the first section, each expert was asked to evaluate the clarity and the adequacy of the constructs' definitions. In the second section, experts were asked to provide their level of agreement on the relevancy, clarity and adequacy of the response format of each item. The last section aimed to obtain expert suggestions and recommendations for additional items (see Appendix C). The data collected through face-to-face interviews took around an hour to obtain.

  Data collected from the experts were analysed quantitatively and qualitatively. Quantitative data was analysed using frequencies. Each item should have a percentage of *agreement score* (the number of experts agreeing on the item divided by the total number of experts). To retain an item without modification, Lynn (1986) recommended that complete agreement should exist between all experts (*agreement score = 100%*) as the number of experts was less than seven. If the item has less than 100% agreement, then the item has an issue with relevancy, clarity or response option and it requires modification or deletion. The following decision was made based on the qualitative data collected from the experts: if the problem was an issue with item relevancy (R), the item was removed. However, if

there was a problem with item clarity (C) or response options (RO), a modification was conducted.

6.4.1.2.2 Cognitive interviews

- Study settings: participants were recruited from the HAMARA Healthy Living Centre and Leeds Involving People. Both centres are based in Leeds and aim to address health issues and social exclusion for communities. These two centres were selected because the HAMARA Living Centre focuses more on the local Asian population and Leeds Involving People focuses more on the Caucasian population.
- Study participants and sample size: The participants eligible to be included in this study are: (i) adults over 17 years of age, (ii) with different computer experiences, (iii) able to give their written consent (can understand verbal explanations or written information (understand English language and have no learning difficulties), and (iv) do not have special communication needs. Following Willis (2005), 10 people from the general community were interviewed. As the population of interest for the questionnaire was adults who understand the English Language, five of the people who were interviewed were White British. The other five were from an Asian community who were able to understand the English language. This ensured that all questions used a simple English language and were understandable by non-native speakers. A purposive sampling method was planned to be used to ensure the population variation coverage for each centre (Tongco, 2007) (Table 6.3). However, within the study the participants were indirectly recruited through the centre's representative. So, a self-selection sampling method was used (Lavrakas, 2008).

Table 6.3. Purposive sampling framework.

PC literacy/age	Young (18-65)	Old (65+)
PC literate[1]	2-3 participants	2-3 participants
No PC literacy	2-3 participants	2-3 participants

- Recruitment: University of Leeds ethical approval was obtained. Then, participants were recruited from the two centres with the help of each centre representative. The cognitive interview phase was accomplished in two rounds, one for each centre. The

[1] Computer literacy is defined as "amount[ing] to a minimal set of skills that enables the user to operate effectively with software tools, or in performing basic information retrieval tasks" (BUCKINGHAM, 2010). A person who uses search engines, who uses a word processor, who browses the Internet is a computer literate person. Centre representatives categorised and allocated people based on this criterion.

questionnaire was modified following each round. The representative staff from each centre introduced the study to the centre members. Then, the ones who showed willingness to participate received the participant information sheet (see Appendix C). Each person read this one week before participation. Both centre representatives were guided by the participant framework to ensure the covering all sample requirements. From each centre, five people were interviewed with a diverse range of ages and Internet experience. Each interview took around an hour. Before the cognitive interview started, participants signed a consent form to show his/her agreement in participation (see Appendix C). Then, participants were asked to complete the questionnaire and provide feedback on each question for the wording, clarity and the overall layout. After finishing the interviews, each participant received £10 as a thank you gift.

- Analysis: The researcher recorded each interview and wrote additional notes to facilitate the analysis. The researcher analysed the interview records and the notes using a previously developed, structured coding scheme based on Willis (2005) (refer to Appendix C). This includes codes such as: question-objective mis-match, item-specific issues (i.e. question expresses uncertainty or difficulty answering, question includes vague words/phrases, question leads to difficulties with recalling answers), question or section ordering issues, overall length issues and visual layout issues (Willis, 2005). Each code was supported by quotes from the interview records and the notes.

6.4.2 Ethical consideration

It was important to ensure that the study was conducted in a safe and ethical manner to protect the participants. Deception was not required in this study and the participants had a full explanation of the study purpose and the fact that the data would be used to award a PhD degree and for publication. This information was communicated to the study participants through a research information sheet which included details on the purpose of the research, the right to withdraw, confidentiality assurances, and researcher contact details. Each participant signed a consent form before the data was collected.

Interview (think aloud) respondents were reminded that they did not have to take part if they did not want to. After the interview, respondents were able to contact the researcher in case of any further questions and if the issue of withdrawal of data arose, it could be open for discussion at that point. Participants were advised that once the data was used to modify the questionnaire for the next research phase and written up,

their anonymity was preserved and they were unidentifiable; then at the point of publication (submission) they would no longer be able to withdraw their data.

All participants were advised that information would be treated in the strictest confidence and that the raw data would not be made available for or by any other persons or purposes. Only the chief investigator and the primary supervisor would access this information and the data would be presented in a way which would not enable participants to be identified as individuals.

Interview participants were assured of confidentiality and anonymity through the use of pseudonyms through the transcripts. Data (including electronic transcripts and audio recordings) would be stored on a password-protected university PC on the secured university system. All interview paper-based transcripts (after names removed and pseudonyms assigned) and consent forms would be stored in a locked filing cabinet within a locked office at the University of Leeds. It would be shredded (permanently destroyed) three years after thesis submission (expected termination of study May 2016). Collected information was handled strictly in accordance with the 1998 Data Protection Act. The chief investigator was guided by the policy of University of Leeds for "Safeguarded Data – Storage, Backup and Encryption".

Ethical approval was obtained from the University of Leeds Ethics Committee for interviewing participants (Reference no. HSLTLM/13/001 dated November 12, 2013) (see Appendix C for more details).

6.5 Results

6.5.1 Initial study questionnaire

The first questionnaire draft included thirty-five items used to measure five constructs (behavioural intention, attitude, subjective norms, perceived behavioural control and computer anxiety) (see Appendix C for more information). All items were presented randomly, grouped by four heading questions and designed to measure the study phenomenon (e-PROM acceptance). Item responses for the main study constructs were collected using seven-point Likert scales with different descriptors (i.e. ranging from disagree strongly = 1 to agree strongly = 7; from not at all = 1 to a great deal = 7; and from not at all important = 1 to very important = 7). In addition, the questionnaire included a section on demographic characteristics and Internet experience. The overall questionnaire showed good readability values following the predefined criteria (Table 6.4). Each construct was assessed as follow:

- Behavioural intention: Five items were used to measure behavioural intention. Of these, an item was developed by the study researcher and four were extracted from existing measures and modified to be appropriate for the target population (Taylor and Todd, 1995a; Herrero and Rodríguez Del Bosque, 2008; Armitage and Conner, 1999; Ajzen and Madden, 1986).
- Attitude: Five items were used to measure attitude. One of the items was developed by the researcher and the other four items were extracted from the literature and modified to be appropriate for the target population (Herrero and Rodríguez Del Bosque, 2008; Venkatesh et al., 2003).
- Subjective norms: Subjective norms were measured specifically and generally with a total of nine items. The specific measures listed seven individual factors that might influence a person's behaviour (Ajzen and Madden, 1986). In addition, two general items to measure the subjective norms were directly adopted from Taylor and Todd (Taylor and Todd, 1995a).These two items were modified to be appropriate for the target population.
- Perceived behavioural control: Similar to subjective norms, perceived behavioural controls were measured specifically and generally with eleven items overall. The eight specific items were a list of different facilities that might be important to participants when using electronic devices to report health information (Ajzen and Madden, 1986). However, the other three general items were extracted from the literature (Conner and McMillan, 1999; Ajzen and Madden, 1986) with some modifications to be more appropriate for the target population.
- Computer anxiety: Computer anxiety was measured using five items. One was developed by the study researcher and four were extracted from literature and modified to be appropriate for the target population (Venkatesh et al., 2003).
- The general participant information section: In addition to the study constructs, the questionnaire included eight questions to collect demographic information and Internet experience. For demographic characteristics, three questions were developed to collect responses on age, gender and education level. For Internet experience, five questions were developed: one general question and four specific questions (commonly used devices, common purposes, frequency of Internet use and common places where participants access the Internet). The general Internet experience question was a Yes/No question. However, the responses for the Internet experience specific questions were collected using a scale ranging from never = 1 to extensively (many times/day) = 7.

Table 6.4. Readability statistics results for the first questionnaire draft

Readability measure	Questionnaire readability result	Criteria	Reference
Average words per sentence	12.2	Not to be greater than 15-20 words: the lower the score the better readability	(Kincaid et al., 1975; McColl et al., 2001).
Passive sentences	1%	Less than 15%: the lower the score the better readability	(Kincaid et al., 1975).
Flesch reading ease	55.2	Over 50: the higher score the better readability	(Ford et al., 2007; Harris et al., 2000).
Flesch-Kincaid grade level	8.5	Grade 8	(Streiner and Norman, 2008).

6.5.2 Questionnaire pre-testing

6.5.2.1 Expert review

6.5.2.1.1 Feedback on the construct definitions

All panel members (100%) agreed with the adequacy and clarity of the construct definitions. Consequently, no changes were made with these definitions.

6.5.2.1.2 Feedback on the introduction and instruction questions

Two of the experts (2/5) suggested modifying the questionnaire introduction. The modifications included (1) adding more details about the used technology, and (2) informing participants that the questionnaire includes similar items and this was done on purpose. Second, experts had some comments about the heading questions. Some wording modification was recommended to improve the clarity of the questions (1/5) (Q4 in Table 6.5). Moreover, five experts (5/5) requested modification of another instruction question (Q5 in Table 6.5). In addition to the expert comments, some modifications were applied to the instruction questions with regards to the supervisory team discussion to minimise the length of sentences (i.e. Q1, Q2 and Q3 in Table 6.5).

In addition to the previously noted modifications, a major comment related to expressing the behaviour of interest by two experts (2/5). Instead of using “the use of an electronic device to **record** my health”, the researcher should use the word “report” to be “the use of an electronic device to **report** my health”.

Table 6.5. Expert review results of the instruction questions.

Original instruction question	Reviewer comments	Modified instruction question
1. Here are some things that other people have said	The supervisory team recommended some modifications to minimise the length of	1. People may have different feelings and beliefs towards

Original instruction question	Reviewer comments	Modified instruction question
about their feelings towards using electronic devices to record their health information. Please tell me how much you agree or disagree with each one.	sentences.	using electronic devices to report their health information. Please tell me how much you agree or disagree with each sentence.
2. Here are some things that other people have said about the advantages and disadvantages of using electronic devices to record their health information. Please tell me how much you agree or disagree with each one	The supervisory team recommended some modifications to minimise the length of sentences.	2. Using electronic devices to report health information may have different advantages and disadvantages. Here are some things that other people have said about this. Please tell me how much you agree or disagree with each one.
3. Now, I am going to show you some things that other people have said about using electronic devices to record their health information. Please tell me how much you agree or disagree with each one.	The supervisory team recommended some modifications to minimise the length of sentences.	3. Some people want to use electronic devices others reject. The following statements are what people have said about using electronic devices to report their health information. Please tell me how much you agree or disagree with each one.
4. How much will the following individuals influence whether or not you would use electronic devices to record your health information?	One of the experts suggested not using the word "**will**" to make the questions more normalised. E.g. "The word will suggests absolute so will is wrong. Maybe how influential are the following individuals in supporting/guiding my decision whether to use…" (An expert on questionnaire design and development) This is a motivation to comply question. Additional items should be added to measure the beliefs for subjective norms. This is recommended by one of the experts and the supervisory team. Consequently the question divided in two sections (a and b) E.g. "This question is like motivation to comply question." (An expert on TPB and behavioural theories)	4. Below are list of people who may be influential in your life. Please indicate: a. First, how much they would think that you should use electronic devices to report your health information. b. Second, how much you will do what they want you to do.
5. How important are the availability of the following facilities for you to use the Internet to record information about current health?	The word facilities needs to be modified as suggested by one expert. In addition using "IS" instead of "ARE". e.g. "very bad wording of the heading question" (An expert on patients' researches and e-PROM implementation)	5. How important is the availability of the following support for you to use electronic devices to report your health information?

6.5.2.1.3 Feedback on the questionnaire items

The expert panel members reviewed the questionnaire items with regards to relevancy (R), clarity (C) and adequacy of response options (RO) (Table 6.6). The agreement score between those experts for all items is shown in Table C.2 in Appendix C. As

mentioned earlier in the method section, one irrelevant item was deleted and the items with clarity or response option issues were modified. Eighteen items (51.4%) were revised, including four items (11.4%) with relevancy issues, six items (17.1%) with relevancy and clarity issues, and eight items (22.9%) with clarity issues.

Out of the eight demographic information and Internet experience questions, six questions (75%) had issues. One question (12.8%) had a relevancy issue, one question (12.8%) had a clarity problem, one question (12.8%) had a problem with response options, and two questions (25%) had both clarity and response options problems.

Table 6.6. Expert review results of the overall questionnaire items

Section	R[1]	R and C[1]	C[1]	C and RO[1]	RO[1]	overall
35 construct items	**4 items (11.4%)**	**6 items (17.1%)**	**8 items (22.9%)**	0 item (0%)	0 item (0%)	**18 items (51.4%)**
8 demographic information and Internet experience questions	**1 question (12.8%)**	0 question (0%)	**1 question (12.8%)**	**2 questions (25%)**	**1 questions (12.8%)**	**6 questions (75%)**

Note: (1) Item main issues divided into three categories: R= relevancy, C= clarity or RO= response options

- Behavioural intention (BI): One expert (1/5) familiar with TPB and behavioural theories, mentioned a problem with the relevancy of one of the BI items (item 4), with an 80% agreement score, as the item measured attitude rather than BI. Consequently, the item was removed. Another expert on TPB and behavioural theories (1/5) suggested adding an additional item to the behavioural intention variable. This should include the word "intend" to directly measure the variable of interest. Consequently, the new item was added: *"I intend to use electronic devices to report my health information"* (more details in Appendix C).
- Attitude (At): Item 2 was modified to improve clarity from "I would find electronic devices a bad way to record my health information" to "Using electronic devices to report my health information does not appeal to me". Also, based on feedback from an e-PROM implementation and questionnaire design and development expert, two items were added relevant to attitude to capture the effect of using the health information in patient care. These are "If I use electronic devices to report my health information doctors will be able to monitor me more closely" and "If I use electronic devices to report my health information it will help hospital services to improve" (more details in Appendix C).

- Subjective norms (SN): Five items had clarity issues (item 3 and items 5 to 8). Of these, four items were modified and one (item 8) was removed with agreement of the majority of experts. From the interviews, there was a consensus that the seven items measuring SN tapped motivation to comply. Consequently, one expert experienced in the TPB, suggested adding seven items to measure the normative beliefs for the same individuals. Consequently, seven types of people were added headed to this question “First, how much do these people think that you should use electronic devices to report your health information”. These were your family (e.g. partners, parents and children), your friends, celebrities, hospital administrative staff (e.g. clerks and receptionists), your nurses, your GP and your doctor/consultant (more details in Appendix C).
- Perceived behavioural control (PBC): The initial questionnaire included eleven items to measure PBC. Of these, eight items were removed due to relevancy issues, as recommended by an expert familiar with TPB and behavioural theories (from item 1 to item 8). Consequently, PBC would be measured through three items within the modified version of the questionnaire (more details in Appendix C).
- Computer anxiety (CA): CA was measured by five items. The wording of four items were changed based on expert feedback (item 2 to item 5) (more details in Appendix C).
- The general participant information section: Additional changes were made to the demographic information section and Internet experience. One of the demographic information questions revised to improve clarity (question 3). For the Internet experience questions, one question was removed and four questions were revised to improve clarity. Following a recommendation from the supervisory team, an additional question was added to measure the importance of resources (IR) if patients complete the PROMs at home/clinics or general support. “How important is the availability of the following support for you to use electronic devices to report your health information?” It includes eight sub-items and the responses measurement is through a 7-point Likert scale (not at all important = 1 – very important = 7). This question helps clinicians to understand more about the facilities necessary to report health information electronically (more details in Appendix C).

6.5.2.1.4 Feedback on the overall layout of the questionnaire

No problems were mentioned by the expert panel and supervisory team regarding the overall questionnaire layout. Consequently, no changes were made.

6.5.2.1.5 Summary of the expert review findings

Following the expert panel review, a revised version of the questionnaire was developed. A total of 10 items were removed, 10 items were added and eight items were modified to better reflect the constructs. Moreover, in the general participant information section four questions were modified, one question was removed and one question was added to measure the importance of resources. The second questionnaire draft contained thirty-five items measuring five constructs and had a further eight questions to measure general participant information .

6.5.2.2 Cognitive interviews

Cognitive interviews were conducted with 10 members of the general public. This process was conducted in two rounds, with the questionnaire modified after each round.

6.5.2.2.1 Round 1: HAMARA Centre

Five Asian people from the HAMARA Living Centre were interviewed (see Table 6.7).

Table 6.7. Participants' characteristics from the first cognitive interview round

PC literacy/age	Young (18-65)	Old (65+)
PC literate	1 female and 1 male participant	1 male participant
No PC literacy	1 female participant	1 female participant

A. Feedback on the introduction and instruction questions

Analysis of the interviews and notes identified issues with the instruction questions. Three questions (Q1, Q4 and Q4.b) required further clarification as the participants had difficulty understanding them (see Table 6.8 for more details).

Table 6.8. Cognitive interview results of the instruction questions (first round)

Original question	Reported problems	Modified question
Q1. People may have different feelings and beliefs towards using electronic devices to report their health information. Please tell me how much you agree or disagree with each sentence.	Participant had the wrong definition of an electronic device. E.g. "All the electronic devices like whatever used in the hospital I have been in CT scan" (Female aged 18-65 and computer literate).	Q1. People may have different feelings and beliefs towards using electronic devices *(e.g. touch screens, personal computers, mobile phones and computer tablets)* to report their health information. Please tell me how much you agree or disagree with each sentence.
Q4. Below is a list of people who may be influential in your life. Please indicate:	Four participants had difficulties judging and choosing the appropriate answer because it had not been discussed with others. E.g., "It's not been discussed, I supposed I've never heard of it, so	Q4. Below is a list of people who may be influential in your life. If you have discussed the idea of electronic devices with them, please indicate:

Original question	Reported problems	Modified question
	I can't really answer that question" (Male aged 18-65 and computer literate).	
Q4.b. Second, in general, how much do you do what they want you to do.	One of the participants read this sentence several times: "you do what they want you to do." (Male aged 18-65 and computer literate).	Q4.b. Second, in general, how much do you follow their advice.

B. Feedback on the questionnaire items

Nine out of thirty-five items were modified. This included one item on PBC, two on CA, four attitude items, one BI item and one subjective norms item. Three items in one of the general participant information questions, importance of resources, was modified as well. Further details are presented in Table 6.9.

Table 6.9. Cognitive interview results of the questionnaire items (first round)

Cons -truct	Original item	Reported problems	Modified item
(PBC)	1.e. If I wanted to, I could easily use electronic devices to report my health information.	Participant had difficulty judging the appropriate answer. E.g., "I do not know what kind of device you gonna develop, if is a nice and easy device a touch screens where you just touch you actually feeling bad …" (Male aged 18-65 and computer literate)	1.e. If I wanted to, I could easily use *any* electronic device to report my health information.
(CA)	1.g. I am confident that I would be able to use an electronic device to report my health information unaided.	Participant had difficulty judging the appropriate answer. E.g., "again all depends on the electronic device how complicated it is, how is it designed" (Male aged 18-65 and computer literate) Another participant commented on the time when help supported. E.g. "on the first time you do need some help" (male aged 65+ and computer literate)	1.g. I am confident that I would be able to use *any* electronic device to report my health information at the first time unaided.
(CA)	2.c. I am worried that the information I provide via electronic devices would be seen by the wrong people.	The word wrong people was not clear for two participants. E.g. "which wrong people? Like someone else!" (Female aged 18-65 and computer literate) One participant reported that the word information is not clear. E.g., "I don't know about which information are they talking… so I don't know the answer" (Female aged 18-65 and computer literate).	2.c. I am worried that *my health information* I provide via electronic devices would be seen by the wrong people *(e.g. unauthorised doctors/nurses or other individuals).*
(At)	2.d. Using electronic devices to report my health information will be quicker than on paper.	One participant was confused whether to put general opinion or an individual opinion. E.g., "I will put agree strongly, but that's everybody's opinion not mine, Okay!" (Female aged 18-65 and computer illiterate).	2.d. *For me,* using electronic devices to report my health information will be quicker than on paper.
(At)	2.e. Using an electronic device will help me to report my health	Two participants expressed difficulty understanding the term "wherever I am".	2.e. Using an electronic device will help me to report my health

Cons -truct	Original item	Reported problems	Modified item
	information from wherever I am.	E.g., "when you say from wherever I am does it mean in the country or other parts of the country or in the world?" (Female aged 65+ and computer illiterate)	information from wherever I am *(i.e. in the hospital, at home or outside the country).*
(At)	2.f. Using an electronic device to report my health information is a waste of my time.	One participant was confused whether to put general opinion or individual opinion. E.g., "So, let me understand this one, this is asking my opinion here, yeah!? Right, no then I will not put those, because if I want to do it I need to do it myself?" (Female 18-65 and computer illiterate)	2.f. *For me,* using an electronic device to report my health information is a waste of my time.
(At)	2.g. If I use electronic devices to report my health information doctors will be able to monitor me more closely.	One of the participants understood the question incorrectly. Participant thought that patients would take responsibility for filling all health information then the doctor do nothing. E.g., "If I use electronic not the doctor. If the doctors use it that's fair enough!" (Female aged 65+ and computer illiterate)	2.g. If I use electronic devices to report my health information *it will help doctors* to monitor me more closely.
(BI)	3.d. I intend to use electronic devices to report my health information.	One participant had difficulty judging and choosing the appropriate answer. E.g., "for me that's a misleading question because I can't intend to use electronic devices if they're not there…. You can use (I will be willing to use it if it was available)" (Male aged 18-65 and computer literate)	3.d. I intend to use an electronic device to report my health information *once it is available to me.*
(SN)	3.f. People who are important to me think that I should use electronic devices to record my health information.	Four participants had difficulties choosing the appropriate answer because: A. It had not been discussed with others. E.g., "we haven't talked about that at all within the family … so how do you answer that question?" (Male aged 65+ and computer literate) B. Don't know who the important people are. E.g., "what do you mean by people who are important to me" (Female aged 65+ and computer illiterate)	3.f. *If I have discussed the idea of electronic devices with people,* people who are important to me *(i.e. family, friends and doctors)* would they think that I should use an electronic device to record my health information.
(IR)	Q5.4. Previous knowledge and skills necessary to use electronic devices.	This item was vague to some participants. E.g. "I don't understand that, what is that mean?" (Male aged 18-65 and computer literate)	Q5.c.3. *To have computer skills.*
	Q5.8. Someone to help with any electronic device difficulties in the hospital. Q5.9. Someone to help with any electronic device difficulties at home.	One participant had an issue with the word "someone". E.g., "who would help at home? Would the hospital help at home or would you have to find a friend or somebody else?" (Female aged 65+ and computer illiterate)	Q5.b.2. Someone to help with any electronic device difficulties in the hospital *(e.g. clinical staff).* Q5.a.3 Someone <u>to help</u> with any electronic device difficulties at home *(e.g. family member or clinical staff).*
	Q5.10. Families or friends to do it for me.	Participant confused between this item and (someone to help with any electronic device difficulties at home).	Q5.a.4. Families or friends <u>*to do it for me*</u>*.*

Note: (PBC) Perceived behavioural control, (At) Attitude, (BI) Behavioural intention, (SN) subjective norms and (IR) Importance of resources

C. Feedback on the overall layout of the questionnaire

A summary of the modifications to the overall layout of the questionnaire are provided below (for more information refer to Appendix C):

1. Generally, when the participant read the more general items first (e.g. I feel worried about using electronic devices to record my health information), they thought about the specific issues within the items. Then once they had read the specific question (e.g. I am scared I will lose information by doing something wrong if I use an electronic device to record information about my current health), participants thought it was a repetition of the previous one. Consequently, the order of the items was modified. Specific items came first then general items later.

2. All participants were confused when moving between negative and positive items, and had some difficulty in responding to negatively worded sentences. As a result, the researcher grouped negative and positive items within each section. All positive items were presented first then all negative items presented later.

3. Another modification was made to Q4 (includes 14 subjective norms items). This question was presented in a table to measure two questions presented horizontally: (a) First, how much do they think that you should use electronic devices to report your health information, and (b) Second, how much will you do what they want you to do). All participants completed section (a) and left section (b) empty. Accordingly, each question was presented in a separate table following each other.

4. Some participants were confused when completing the importance of resources question. As the question items were presented randomly, participants found some confusion (i.e. repetition) on some items. Thus, the researcher categorised the items based on three areas: to do it at home, to do it at the clinic and general support.

5. The first Internet experience question was presented on a different page to the other Internet experience questions, which created some confusion for some participants. Therefore, the researcher ensured this question would be on the same page as the subsequent IE questions.

6. The final issue was with the background shading. Participants had difficulties reading the items due to the dark background shading. Consequently, the researcher changed the background colour to be lighter.

D. Summary of the cognitive interviews findings (first round)

After conducting the first round of cognitive interviews, a third version of the questionnaire was developed. This version included thirty-five items measuring five constructs. It also contained three demographic information (DI) questions, four Internet experience (IE) questions and one importance of resources (IR) question. This questionnaire (third draft) was tested later with another five participants in the second cognitive interview round.

6.5.2.2.2 Round 2: Leeds Involving People

Five white British people were recruited from Leeds Involving People to be interviewed (see Table 6.10). After analysing the interview records and notes, the draft was further modified to improve the introduction and instruction questions, questionnaire items and overall questionnaire layout.

Table 6.10. Participants' characteristics from the second cognitive interview round

PC literacy/age	Young (18-65)	Old (65+)
PC literate	1 female participant	1 male participant
No PC literacy	1 male participant	2 female participants

A. Feedback on the introduction and instruction questions

Few modifications were made. Within the instruction questions, one participant was confused when reading Q2 as it was structured similarly to Q3. Consequently, changes were applied to Q2. Another modification was carried out on both sections of Q4 to improve the clarity (see Table 6.11).

Table 6.11.Cognitive interview results of the instruction questions (second round)

Original question	Reported problems	Modified question
Q2. People may have different feelings and beliefs towards using electronic devices to report their health information. Please tell me how much you agree or disagree with each sentence.	Participant was confused when reading Q2 as it looked like Q3. E.g., "I think there is a possibility of those two there…., try to fit them into one." (Female aged 18-65 and computer literate)	Q2. People may have different opinions towards the idea of reporting their health information using electronic devices. Please tell me how much you agree or disagree with each sentence.
Q4. Below are list of people who may be influential in your life. If you have discussed the idea of electronic devices with them, Please indicate:	One of the participants was confused with the word "discussed" as this was not appropriate word to be used for one of the subcategories E.g., "how I would discuss this with celebrities!?" (Male aged 18-65 and computer illiterate)	Q4. Below is a list of people who may be influential in your life. Imagine that you have discussed the idea of electronic devices with them, please indicate:
a. First, how much they would	Two participants felt confused because	a. First, imagine how much they

Original question	Reported problems	Modified question
think that you should use electronic devices to report your health information.	they had not discussed that with the people. E.g., "because I haven't discussed it, I'm going to be a bit cautious in this" (Male aged 65+ and computer literate)	approve of using electronic devices to report your health information.

B. Feedback on questionnaire the items

From the participants' feedback, some items within the five constructs and two questions within the general information section were modified (Table 6.12). Modifications were made to the phrasing of item 2.b and the format of other items (item 1.a and item 1.f) to improve their clarity. Two of the subjective norms items required more explanation (Q4.a.7 and Q4.b.7). However, one SN item was removed as this item was still shown to be an issue even after being modified in the previous expert review phase and the previous cognitive interview round (item 3.f). Finally, two additional general items were added based on participant feedback. These items were added to understand whether patients prefer to complete paper-based PROMs or electronic PROMs (2.d. "I think hospitals should keep both paper questionnaires and electronic devices to report my health information" and 3.g. "I prefer to use electronic devices rather than papers to report my health information"). Those questions were placed randomly within the questionnaire and were measured using a 7-point Likert scale.

Table 6.12. Cognitive interview results of the questionnaire items (second round)

Construct	Original item	Reported problems	Modified item
(At)	1.a. For me, using electronic devices to report my health information will be quicker than on paper.	One of the participants hesitated when answering the question, she could not choose the answer as she thought it not a waste of time but for her it would be time consuming.	1.a. For me, using electronic devices to report my health information will be quicker than on paper.
	1.f. For me, using electronic device to report my health information is a waste of my time.	One of the participants hesitated when answering the question, she did not have the ability to choose the answer as she thought it not a waste of time but for her it would be time consuming.	1.f. For me, using electronic device to report my health information is a waste of my time.
(PBC)	2.b. If I wanted to, I could easily use any electronic device to report my health information.	Participant got confused when read the word "any". E.g., "what do you mean by that, using any electronic device" (Female aged 65+ and computer illiterate). Another participant has an enquiry about the type of devices. E.g., "if you are using one device, are they all the same" (Male aged 18-65 and	2.b. If I wanted to, I could easily use any electronic device (i.e. *touch screens, computers, mobile phones*…) to report my health information.

Construct	Original item	Reported problems	Modified item
		computer illiterate).	
(SN)	3.f. If I have discussed the idea of electronic devices with people, people who are important to me (i.e. family, friends and doctors) would think that I should use an electronic device to record my health information.	Three participants did not get the meaning of the question. E.g., "I don't quite get that, it's not quite clear to me in that one would think that I should use electronic device, can you explain that question more" (Female aged 65+ and computer illiterate)	Item was removed
(SN)	Q4.a.7. celebrities and Q4.b.7. celebrities	Two participants asked about the meaning of celebrities. E.g., "Now this celebrities, what does that mean?" (Male aged 65+ and computer literate)	Q4.a.7. celebrities (i.e. TV and radio stars) and Q4.b.7. celebrities (i.e. TV and radio stars).
(IR)	Q5. How important is the availability of the following support for you to use electronic devices to report your health information? a. To do it at home 1. Computer and broadband (Internet) access at home. 2. Access to smart phone or tablets at home (e.g. iPhone, iPad, Android phones). 3. Someone to help with any electronic device difficulties at home (e.g. family member or clinical staff). 4. Families or friends to do it for me. b. To do it in clinic 1. Computer and broadband (Internet) access in the hospital. 2. Someone to help with any electronic device difficulties in the hospital (e.g. clinical staff). c. General support 1. Availability of online help (e.g. help function) for any electronic device difficulties. 2. Availability of telephone help for any electronic device difficulties. 3. To have computer	One of the participants understood that generally as being to have access to the Internet for entertainment purpose, not to fill these kinds of measures.	Q5. How important is the availability of the following support for you to use electronic devices to report your health information?. a. To do it at home 1. Electronic device access at home to report your health information. 2. Someone to help with any electronic device difficulties at home (e.g. family member or clinical staff). 3. Families or friends to do it for me. b. To do it in clinic 1. Electronic device access in the hospital to report your health information. 2. Someone to help with any electronic device difficulties in the hospital (e.g. clinical staff). c. General support 1. Availability of online help (e.g. help function) for any electronic device difficulties. 2. Availability of telephone help for any electronic device difficulties. 3. Computer skills. 4. Training sessions to learn how to use electronic devices.

Construct	Original item	Reported problems	Modified item
	skills. 4. Training sessions to learn how to use electronic devices.		
(IE)	9. Do you use the Internet?	One participant asked whether this question asked about the ability to use the Internet or current usage e.g., "I can use the Internet but I don't" (Male aged 18-65 and computer illiterate)	9. Have you used the Internet in the last few months?

Note: (At) Attitude, (PBC) Perceived behavioural control, (SN) subjective norms, (IR) Importance of resources and (IE) Internet experience.

C. Feedback on the overall layout of the questionnaire

The layout of the questionnaire was modified (Table 6.13). For Q2, one item had been presented on one page while the other items were on the following page. Consequently, one participant completed the ranking based on the instruction question without reading the item and another participant skipped this item and moved to the following page. Thus, having both items on one page will reduce the likelihood of this. Moreover, one participant pointed out that improvements could be made to Q4 layout through re-ordering the items.

In addition to the participant feedback, more changes were recommended within the supervisory team consultation. The first improvement was to use the sentence "to report information about my health" instead of "to report my health information" to present the behaviour of interest. Consequently, all items were modified based on the comment. The second improvement related to the layout and format of the questionnaire. Supervisors recommended shading the response options, for each single item, with different colours (white and grey) respectively to facilitate the completion.

Table 6.13. Cognitive interview results on the overall layout (second round)

Original layout	Reported problems	Modified layout
The only available item was Q2. People may have different feelings and beliefs towards using electronic devices to report their health information. Please tell me how much you agree or disagree with each sentence. 2.a. I like the idea of using electronic devices to report my health information.	One participant assigned the mark based on the instruction question not the relevant item. Another participant missed the first item and moved to the following page.	The only available item was Q2. People may have different feelings and beliefs towards using electronic devices to report their health information. Please tell me how much you agree or disagree with each sentence. 2.a. I like the idea of using electronic devices to report my health information. 2.b. If I wanted to, I could easily use any electronic device (i.e. touch screens, computers, mobile phones…) to report my health information.
4. Below is a list of people who may be	The item order	4. Below is a list of people who may be influential

influential in your life. If you have discussed the idea of electronic devices with them, Please indicate: a. First, how much they would think that you should use electronic devices to report your health information. 1. Your doctor/consultant 2. Your nurses 3. Your GP 4. Hospital administrative staff (e.g. clerks and receptionists) 5. Your family (e.g. partners, parents and children) 6. Your friends 7. Celebrities	needed some modification as commented by one of the participants. E.g., "I have not been visiting doctor or consultant, but I have visited GP"	in your life. Imagine that you have discussed the idea of electronic devices with them, please indicate: First, imagine how much they approve of using electronic devices to report your health information 1. Your GP 2. Your nurses 3. Your doctor/consultant 4. Hospital administrative staff (e.g. clerks and receptionists) 5. Your family (e.g. partners, parents and children) 6. Your friends 7. Celebrities (i.e. TV and radio stars)

D. Summary of the cognitive interviews findings (second round)

The end of the second cognitive interview round produced a modified version of the questionnaire (fourth questionnaire draft) (see Appendix C). Changes included modifying eight items and removing one item. In addition, two questions in the general participant information section were modified and another two were added from the participants' point of view. This questionnaire version included thirty-four items measuring the main study constructs and ten questions in the general participant information sections (demographic information, Internet experience, importance of resources and two general questions).

6.6 Discussion and conclusion

The aim of this study was to develop an initial version of the questionnaire to measure e-PROM acceptance. Then, to collect face and content validity evidence of the developed questionnaire through expert review and cognitive interview processes. The first questionnaire draft included thirty-five items used to measure five constructs (behavioural intention, attitude, subjective norms, perceived behavioural control and computer anxiety). Those items were either extracted from previous studies or developed by the study researcher. The items were presented randomly, grouped by four main instruction questions and introduced as being appropriate for the study behaviour (CHITs acceptance) and for the main study participants. In addition, the questionnaire included collected data on the demographic characteristics and Internet experience of participants.

6.6.1 Reflection on the expert review

With the expert review, the researcher aimed to obtain expert opinions on the content and face validity of the first questionnaire draft. These types of validity look at the appropriateness and the clarity of the questionnaire items to measure the constructs of interest (Willis, 2005). It has been shown that expert reviews provide good information on questionnaire issues compared with the other methods (e.g. behaviour coding and focus groups) (Presser and Blair, 1994). However, Willis (2005) called for improvements to the documentation of this process. Consequently, the work conducted in this chapter is in line with good practice in reporting face and content validity.

Even with the advantages of the expert review to improve the questionnaire, this method has some disadvantages. Selection of the experts might affect the effectiveness of these reviews (Willis, 2005). Moreover, it has been shown that this method can explain issues with the questionnaire and its content from the experts' perspective, but it cannot show whether the questionnaire participants will have any issues with items (Presser and Blair, 1994). However, the researcher attempted to overcome these issues by (1) using Willis (2005) guidelines to select the expert panel and (2) following Streiner and Norman (2008) recommendations by involving the questionnaire participants to evaluate item clarity (face validity). The best method to show respondents' feedback is the cognitive interviews (Willis, 2005).

6.6.2 Reflection on the cognitive interviews

Cognitive interviews, including think-aloud and probing techniques, help to ensure that the participant understands the items in the way that the researcher intended. Two rounds of cognitive interviews were conducted to review the study questionnaire: one with a South Asian community and one with Caucasian people. As expected, the numbers of issues reported in the second cognitive interview round were fewer than those reported in the first interview round.

From the interviews, it appears that participants were confused when moving from negative to positive questions. This was consistent with previous studies that rejected the use of both directions of items in one questionnaire (Streiner and Norman, 2008). However, before deleting the negative items, another solution was applied for testing in the following cognitive interview round. This involved re-ordering the items for each question by placing positive items first then placing negative items after. If this was still an issue for participants, then negative items would be deleted from the questionnaire.

The re-ordering of the positive and negative items appeared to improve participant responses and participant ability to respond to both directions equally. Evidently, having both directions of items in this way does not cause an issue for respondents.

Even though cognitive interviews are good for understanding participant feedback on the questionnaire items, they might have some limitations, as discussed by Willis (2005). First, this requires a think-aloud process, and many participants are not good at thinking loudly when doing interviews. Second, some items require quick responses from participants, which make the cognitive process difficult to verbalise. Third, analysis of the feedback can be time-consuming for the researcher. However, the researcher attempted to solve these issues by (1) training the participants to think loudly at the beginning of each interview by providing an example, (2) asking probing questions during the interview to emphasise the verbalisation of participant thinking and (3) using the chart scheme framework recommended by Willis (2005) to facilitate the analysis.

6.6.3 Overall feedback

Although the researcher successfully improved the overall questionnaire using cognitive interviews, there was a limitation. Cognitive interviews should ideally be conducted using a sample of the main study population. However, there was difficulty in recruiting participants from the hospital (cancer survivors) as recruitment of patients requires NHS ethics, which would take a minimum of four months to obtain a committee decision. Because this study was constrained by time limits of the PhD study, and this phase was only the first step in the whole research project, the researcher decided to use participants from the general public to represent the main study audience (hospital patients). In this case, the researcher needed to apply to the University of Leeds ethical approval team, which took only one month for a decision.

To conclude, this study developed the initial version of the questionnaire and tested its face and content validity. After the pre-testing, the final version of the questionnaire included thirty-four items measuring five constructs and ten questions for general participant information (i.e. demographic information, Internet experience, importance of resources, and two general questions about the patients' preference for using e-PROMs). The questionnaire was now ready to be tested in the field to collect more evidence of reliability and construct validity. Then, if good enough, it would be used to understand the barriers that hinder the acceptance and the use of e-PROMs.

6.7 Summary

1- From this study, the first questionnaire draft was designed based on the four main strategies recommended by Streiner and Norman (2008). It included thirty-five items measuring the five study constructs and eight questions to collect data relating to general participant information (including demographic characteristics and Internet experience).

2- An expert panel review was conducted to evaluate the content and face validity of the first questionnaire draft. From this phase, a total of 10 items were removed, 10 items were added and eight items were modified to better reflect the constructs. Moreover, in the general participant information section, four questions were modified, one question was removed and one question was added to measure the importance of resources. Then the second questionnaire draft was developed.

3- After the expert review, the second questionnaire draft was tested in two rounds of cognitive interviews. Modifications took place at the end of each round. The first round was conducted with five people from a South Asian community. Based on their feedback, nine items out of thirty-five construct items and three items within general participant information questions and importance of resources, were modified.

4- The newer version of the questionnaire (third version) was then tested in another round by five Caucasian people. Eight items out of thirty-five were modified and one item was removed. For the general participant question section, two questions were modified and two questions were added based on the participants' point of view.

5- This study tested theories about including both negative and positive items. It was discovered that when both directions are included randomly respondents were confused when completing the questionnaire. However, from the study findings, it appears that by ordering items, starting with all positive items and then all negative items, it is possible to solve this issue and respondents are able to respond to both directions equally.

6- Although this study initially tested the questionnaire, more field testing needs to be conducted before using this questionnaire for data collection.

CHAPTER 7. Questionnaire Testing and Construct Validity

7.1 Introduction

This chapter describes the process of testing the psychometric properties of the questionnaire. This will help to reduce the questionnaire's non-sampling systematic error (e.g. error associated with the questionnaire design) and increase the accuracy of the collected data (Streiner and Norman, 2008). The testing of psychometric properties involves measuring different types of validity and reliability.

This chapter describes the process of evaluating the construct validity (i.e. that the items actually represent the relevant construct and are not correlated with the other constructs) and the reliability (i.e. consistency and stability) of the questionnaire. Evaluation of construct validity and reliability is conducted through field testing. One of the psychometric testing methods is the classical test theory, which will be explained later in this chapter. Through the testing, any item found to poorly represent the relevant construct could be eliminated, as this may reduce its construct validity.

7.1.1 Study aim

The aim of this study is to evaluate the psychometric properties of the developed questionnaire including construct validity and internal consistency reliability.

7.1.2 Study objectives

The main objectives of the field testing phase were:

I. To evaluate the construct validity and internal reliability using classical test theory (CTT).
II. To reduce the number of items by removing the ones that do not represent the assigned construct.

7.2 Questionnaire testing

As discussed in the previous chapter, the development of a questionnaire can be conducted by following guidelines covering four main areas: 1) constructs and item selection, (2) scale identification, (3) item wording and (4) overall questionnaire layout (Rattray and Jones, 2007; Streiner and Norman, 2008). Although these guidelines are

important, there may still be non-sampling errors which have two main types, random and systematic error (Lavrakas, 2008). Random error is the unpredictable error resulting from estimation. This type of error can be ignored if a large sample size is used. An increase in random error would increase the variability of responses (Lavrakas, 2008). Systematic error is the type of error that tends to accrue over the entire sample. For example, if a questionnaire has an issue with its design, this could cause problems with participant responses, e.g. participants misunderstanding a question. The collection of inaccurate data would then influence the accuracy of the study results (Litwin, 1995). Consequently, an increase in systematic error leads to an increase in the bias of the scores (Lavrakas, 2008). Since random error can be cancelled out with large sample sizes, systematic error is the main cause for concern (Durand and Chantler, 2014). In contrast to random error, systematic error cannot be reduced by increasing the sample size. Formal testing of the validity and reliability of questionnaires aims to estimate both types of errors and suggest ways to reduce them to improve the overall questionnaire (Streiner and Norman, 2008).

Face and content validity were determined in the previous chapter, but are not sufficient to conclude that the questionnaire is valid (Skott and Ward, 2012). A higher level of validity can be achieved through testing construct and criterion validity. Construct validity, as explained in Chapter 3, is defined as the extent to which a developed questionnaire measures what a theory proposes to measure and it is composed of two types: convergent and discriminant validity (Alumran et al., 2012; Carmines and Zeller, 1979). Criterion validity is concerned with the relationship between the questionnaire scores and the criterion variable (e.g. the direct measure of the examined behaviour).In addition to the questionnaire validity, questionnaire reliability is also important to ensure the appropriateness of a questionnaire.

7.2.1 Testing questionnaire validity and reliability

Although the process of questionnaire testing is still immature within the field of health informatics, questionnaire testing methods developed from psychology can facilitate questionnaire development and validation. This field of study is called psychometric testing. To evaluate the psychometric properties, a researcher can use a theoretical approach such as the classical test theory (CTT). The CTT, including factor analysis, originally lead the way in psychometric testing methods (Weiner et al., 2012; Streiner and Norman, 2008). This method is the most commonly used approach for evaluating the psychometric properties of newly developed health questionnaires (Streiner and Norman, 2008). It contains different principles and statistical techniques for developing

and testing a measure and determines how this questionnaire successfully estimates the unobservable phenomenon of interest.

CTT includes methods to estimate questionnaire reliability and validity. Reliability is assessed through consideration that the variance of obtained scores is the sum of the variance of true scores and the variance of errors of measurement (Murphy and Davidshofer, 2005). However, because there is no way to directly measure the true score, CTT provides different statistical methods to estimate questionnaire reliability including internal consistency reliability, parallel–form reliability test-retest reliability (Hunsley and Mash, 2011). The internal consistency reliability is commonly measured using Cronbach's alpha and item correlation, which determines the association between the items that measure one construct (Nunnally and Bernstein, 1994b). However, test-retest reliability and parallel form reliability can be measured using correlation coefficient or interclass correlation coefficients (ICC) which determine the association between the individual's responses on the two occasions or between the two forms (Blacker, 2005; Lusardi et al., 2013).

On the other hand, CTT justifies that the construct validity tests the correlation between the mean scores of the items. CTT uses factor analysis to statistically estimate the construct validity of the questionnaire (Hunsley and Mash, 2011; Delis et al., 2003). Factor analysis includes two techniques: confirmatory factor analysis (CFA), and exploratory factor analysis (EFA) (Delis et al., 2003). Practically, CFA is used when the main questionnaire constructs have been designated a priori (Maruyama, 1997; Suhr, 2006). It is used to confirm whether the items hypothesised to measure a construct are a good measure of that construct. This is known as a theory oriented approach (Suhr, 2006). In contrast, EFA is used when the questionnaire constructs are designated post hoc (Fabrigar and Wegener, 2012). It is used to group a large set of variables and to explore the constructs they may reflect. In this case, the researcher has not previously hypothesised the relationship between these items (Finch and West, 1997; Suhr, 2006).

For criterion validity, correlation analysis can be used to understand the association between the test score and another relevant score (i.e. criterion). The criterion score can be the score of another questionnaire measuring the same concept simultaneously (i.e. concurrent criterion validity) or an independent future or past outcome/event (i.e. predictive criterion validity) as discussed earlier in chapter 5 (Streiner and Norman, 2008).

Although CTT has some advantages in improving the questionnaire quality, it has limitations. The psychometric properties tested through CTT are questionnaire and

sample dependent (Hambleton, 2000). Moreover, due to the nature of study design within the CTT (i.e. cross-sectional design for most of the validity and reliability types), the questionnaire is static and not dynamic (De Champlain, 2010). Consequently, item response theory (IRT) and Rasch analysis were developed and have been used recently to overcome the limitations of CTT. These theories have common assumptions, including unidimensionality (which means that all items measure one construct), local item independence (which means that items are not correlated with each other after controlling for respondent ability) and the last assumption relevant to the environment which requires a non-rushed situation (i.e. the respondent did not have a time restriction) (De Champlain, 2010; Rasch, 1993). However, due to the difficulty in meeting these common assumptions, IRT and Rasch were not used in this research. First, the current study applies the Theory of Planned Behaviour (TPB) which focuses on behaviour and how behaviour is influenced by behavioural intention (BI) and other factors. Consequently, the study questionnaire is neither unidimensional nor provides local independence (De Champlain, 2010; Rasch, 1993). Second, the current study necessitated the completion of the questionnaire in the clinic while the patient was waiting for his/her appointment, which made the last IRT/Rasch assumption impossible.

Moreover, sample size is another obstacle that hinders the use of IRT/Rasch. This is because these theories require large sample sizes (i.e. at least 500 for 30 items or 1000 for 60 items) (Hambleton and Jones, 1993; Wood and Zhu, 2006). However, as this study was conducted in a clinic that provided access to around 900 patients only and as this study was non-portfolio research which was expected to have limited participants, the use of the CTT approach was more appropriate.

So, this chapter aimed to answer the following questions:

- Does the questionnaire measure what it intends to measure?
- Do the items reflect the relevant constructs?
- Do these constructs differ from each other?
- Does the questionnaire consistently measure whatever it measures?

7.3 Methods

7.3.1 Study design and setting

This cross-sectional study began in 2014. It was accomplished through distributing the study questionnaire to participants from the long-term follow-up (LTFU) clinic, an

outpatient oncology clinic, in Leeds Teaching Hospitals NHS Trust. In this clinic, cancer survivors have yearly long-term follow-up appointments, either by telephone, or at the clinic, depending on patient circumstances and needs.

This setting was chosen because staff currently ask patients to complete a holistic needs assessment (HNA) when they arrive at the clinic. Clinicians use this information to discuss any issues and give appropriate referrals. For the telephone clinic, the patient is not asked to complete a HNA questionnaire. The hospital plans to use e-PROMs to collect a HNA electronically from all patients and so they want to know what patients think of these technologies, and identify ways of introducing this most effectively.

7.3.2 Participants

The participants of this study were cancer survivors treated in the LTFU clinic in Leeds, and were young adult survivors of childhood cancers and survivors of childhood illnesses requiring chemotherapy and bone marrow transplants. The participants eligible to be included were (i) adults over 18 and eligible to use e-PROMs, (ii) able to give their written consent (can understand verbal explanations or written information, i.e. understand the English language and have no learning difficulties), (iii) did not have special communication needs. Participants were selected using a consecutive sampling method which is the best of all non-probability sampling techniques as it includes all subjects who meet the inclusion criteria (Polit and Beck, 2013).

7.3.3 Sample size

It is important to ensure an appropriate minimum sample size to provide a powerful fit analysis, to provide accurate results estimations and to minimise the likelihood of distorting the statistical findings through type I (i.e. detecting an effect that is not present) or type II errors (i.e. failing to detect an effect that is present) (Linacre, 1994). The sample size was selected based on gold-standard recommendations of the sample size required for CTT and the planned statistical methods for data analysis. For CTT, it has been recommended that a sample size of 100 is enough to test the psychometric properties (Pope, 2009). Moreover, the internal consistency reliability was measured using Cronbach's alpha and item correlations (as will be discussed later in Section 7.3.7.3), which requires a minimum sample size of 30 participants (Johanson and Brooks, 2010). In addition, the construct validity was tested using confirmatory factor analysis (CFA), partially from structural equation modelling (SEM) (as will be discussed later in Section 7.3.7.3). This method of analysis requires an absolute minimum sample size of 200 participants (MacCallum et al., 1999). Consequently, as CFA requires the

larger sample size of the above three recommendations, the minimum sample size in this study was considered to be 200 participants.

In fact, it was anticipated that a sample size more than 200 would be helpful to conduct this study. This was due to two reasons: (1) as the CFA/SEM is influenced by extreme outliers and missing data, more data was collected in order to avoid losing sample size power when there is a need to remove extreme outliers and missing data records; and (2) from the previous studies conducted in similar contexts, the anticipated response rate was 67% (Wright et al., 2008; Wright et al., 2007; Bartlett et al., 2012).

7.3.4 Recruitment process

The recruitment process took place between May 2014 and November 2014. As there were two different clinics, the participants were recruited in two ways. First, for the telephone clinic, the participant's information sheet, consent forms, a stamped envelope/free mail service using the researcher's address and a copy of the questionnaire were sent with the appointment information four to six weeks before the appointment (Figure 7.1) (copies of the forms are available in Appendix D). Letters were sent via the long-term follow-up (LTFU) admin and the researcher had no access to patient information prior to consent. The researcher's contact details were provided on the information sheet for any enquiries regarding the study. Those who agreed to participate completed the questionnaire, signed one of the consent forms and posted these using the stamped envelope/free mail service to the researcher.

Second, for the medical and nurse's clinic, the participant's information sheet (but not the consent form and questionnaire) was sent with the appointment letter four to six weeks before the appointment via long-term follow-up (LTFU) admin. When potential participants arrived at the clinic, if they were eligible to participate, the research nurse asked if they were willing to talk to the researcher. Then, the researcher gave a brief explanation of the research and if interested, they were provided with a consent form to sign and a copy of the questionnaire to complete. The researcher was in the clinic (in the reception area) to collect the completed questionnaires. The questionnaire was completed within an average of 10 minutes. Each questionnaire and consent form was linked using a unique study number for each participant so that they had the opportunity to withdraw even after data collection. In contrast to the interview participants in the previous chapter, participants in this study were not paid to take part in the survey.

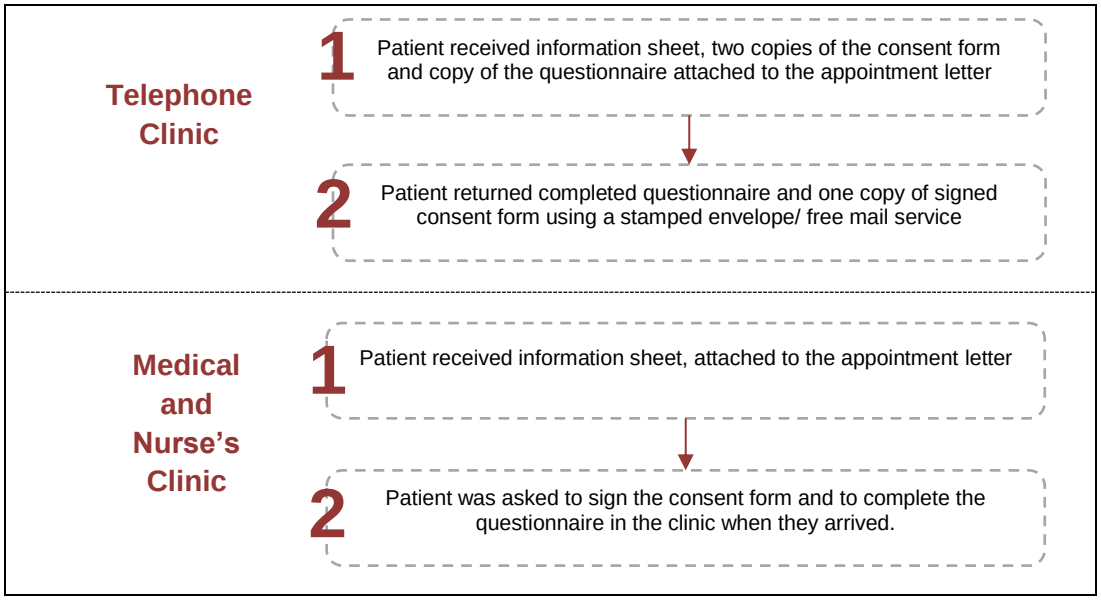

Figure 7.1. Questionnaire testing recruitment process

7.3.5 Ethical approval

It was important to ensure that the study was conducted in a safe and ethical manner to protect the participants. Deception was not required in this study and the participants had a full explanation of the study purpose and the fact that the data would be used to award a PhD degree and for publication. This information was communicated to the study participants through a research information sheet which included details on the purpose of the research, the right to withdraw, confidentiality assurances, and researcher contact details. Each participant signed a consent form before the data was collected.

All participants had the option to withdraw from the research even after the data collection phase using the unique study number. If a participant decided to withdraw, the relevant questionnaire and consent form would be destroyed and the questionnaire responses extracted. It was explained to participants that they could not withdraw after the data had been analysed.

All participants were advised that information would be treated in the strictest confidence and that the raw data would not be made available for or by any other persons or purposes. Only the chief investigator and the primary supervisor would access this information and the data would be presented in a way which would not enable participants to be identified as individuals. Moreover, all data (including questionnaire encrypted data) would be stored on a password-protected university PC on the secured university system. Questionnaires and consent forms would be stored

in a locked filing cabinet within a locked office at the University of Leeds. Then it would be shredded (permanently destroyed) three years after thesis submission (expected termination of study May 2016). Collected information was handled strictly in accordance with the 1998 Data Protection Act. The chief investigator was guided by the policy of University of Leeds for "Safeguarded Data – Storage, Backup and Encryption".

As the main participants in this phase were oncology patients from St. James's University Hospital, approval was sought and received from the Wales Research Ethics Committee (REC) (Reference no. 14/WA/0048, dated February 5, 2014) and the Research and Development (R&D) department of Leeds Teaching Hospital NHS trust (LTHT R&D no. PO14/11075, dated March 6, 2014). See Appendix D for more details of the ethics documents.

7.3.6 Study questionnaire

A questionnaire with 34 items to measure five constructs was developed earlier in this thesis, see Chapter 6 and see Appendix D. These constructs includes attitude (5 items), perceived behavioural control (3 items), subjective norms (14 items), computer anxiety (5 items) and behavioural intention (7 items). However, it is important to note that the subjective norms scale is actually the result of multiplying 7 normative beliefs items and 7 motivation to comply items. Thus, the total number of the items within the subjective norms scale for the analysis was 7 instead of 14 items. This makes the total number of items in the analysis for the five constructs 27 instead of 34 questionnaire items.

This questionnaire was distributed manually (paper-based) because (1) it is important to get feedback from computer illiterate participants in this study, and (2) from the first literature review (Chapter 3), it was suggested that an electronic version of the questionnaire would have a lower response rate compared to a paper-based questionnaire.

7.3.7 Data analysis strategy

All data were entered using Statistical Package for the Social Sciences (SPSS) version 22 (IBM., 2013). Missing items were assigned a number of (-99) in the data spreadsheet. After entering the data, reversed scoring was assigned to the negative items. A random sample of ten questionnaires were checked against the entered data in the SPSS to ensure that data had been entered successfully. To start with, descriptive statistics were formulated to explore the study data and to present some

descriptive results about the participants. After that, the psychometric properties were tested using confirmatory factor analysis, Cronbach's alpha and item correlation scores.

7.3.7.1 Missing data, outliers and normality testing

Before running the analysis, the data sets were explored to identify missing variables, outliers and the distribution of responses. This step is important to clean the data and generate a format that is appropriate for conducting analysis techniques. The characteristics of data, including non-normal distributed data, the availability of missing values and the existence of extreme outliers, are considered to be issues that could affect the CFA results. If these issues are detected, the researcher can use specific functions within the analysis software packages (i.e. AMOS and MPlus) to deal with them and run the analysis (Muthén and Muthén, 1998-2010; IBM., 2013).

a. Missing data

Missing values have an impact in multivariate analysis (Hair et al., 2005), as deletion of missing values records might result in an inadequate sample size for performing multivariate analysis, and the existence of non-random missing values could bias the statistical results. The availability of missing data within CFA/SEM analysis requires extensive computations to measure the fit between the observed model and the expected model. This extensive computation can be conducted because the missing data would lead to difficulty in fitting the observed model and an inability to compute the goodness-of-fit indices of CFA/SEM (Schumacker and Lomax, 2004).

Although missing data can be problematic, but when applying CFA/SEM analysis using AMOS or MPlus, the maximum likelihood estimation can be used to analyse variables with missing data (Muthén and Muthén, 1998-2010; IBM., 2013). This enables the AMOS and MPlus to use all available data points, even the cases with missing values.

Missing data can also be used as a parameter of data quality (McHorney et al., 1994). A survey study with a high percentage of missing data would threaten the representativeness of the sample. The acceptable level of missing data is to be less than 20% of the overall sample (Converse and Schuman, 1974). Calculation of the frequency and the percentage of missing data was conducted on three levels: (1) all variables for all cases, (2) all variables for the cases with Internet experience only, as the participants without Internet experience should not complete the last three questions and (3) all variables needed for the CFA/SEM analysis only (this would exclude the general questions, the question of the availability of resources and the three Internet experience questions). Two indicators were calculated: (1) the overall number of questionnaires with missing values and (2) the overall number of missing

values within the whole dataset. In addition, qualitative analysis was conducted to further investigate the missing data through observing and assigning common themes for the missing data occurrence.

b. Outliers

Outliers can bias the results, but the decision to keep or delete the outliers is subjective to the researcher (Simmons et al., 2011). In this study, all data requiring analysis using CFA were collected using a 7-point Likert scale. After checking the boxplot diagram, it appeared that the outliers were probable responses by respondents (i.e. points within the 7-point Likert scale). Consequently, those were retained without any amendment to better reflect reality.

c. Normality

Normality relates to the distribution of the data which is the basis for choosing the appropriate statistical method (Hair et al., 2005; Field, 2007). In this study, normality was investigated using two measures, skewness and kurtosis in addition to investigating the normality curve in the histogram. If skewness or kurtosis statistics are more than twice the standard error, this might indicate an issue with normality (Coolican, 2014). As will be shown later in Section 7.3.7.3, the normality test reveals that all constructs in the two versions of the questionnaire were not normally distributed.

In factor analysis, the use of non-normal distributed data is an issue that affects the model-fit indices, in addition to the missing values (Schumacker and Lomax, 2004). However, AMOS and MPlus packages provide an alternative method to deal with the non-normally distributed data. In AMOS, a researcher can use the Bollen-Stine bootstrap method to produce the Bollen-Stine *p* value instead of using the default maximum likelihood *p* value (IBM., 2013). On the other hand, a researcher can use the repost maximum likelihood estimator (MLR) to analyse non-normally distributed data in MPlus (Muthén and Muthén, 1998-2010). Thus, bootstrapping and repost maximum likelihood estimator were used in analysing this study data.

7.3.7.2 Descriptive data analysis

First, the means, modes, minimum and maximum values, and standard deviations were calculated for each variable. It included calculating missing values, checking normality and checking the availability of outliers for each study construct discussed in the previous section.

Descriptive statistics (percentages, frequencies, means, medians and standard deviation) were run for (i) participants' demographic data, (ii) participants' Internet

experience and (iii) the importance of facilities. As the questionnaire was distributed in the clinic and through the post, the Chi-square test (X^2) was conducted to investigate whether there were significant differences in the demographic characteristics of participants from the two modes (i.e. age, gender and education level). It is important to note that Chi-square assumptions are violated if the expected sample count is less than 10 in any cell for two-by-two tables and less than five for more than 20% of the cells if the table is greater than two-by-two. If this assumption is violated, Fisher's exact test can be utilised if the expected count is less than 10 for a two-by-two table, and the Likelihood Ratio test if more than 20% of the cells have an expected count less than five for tables more than two-by-two (McHugh, 2013).

7.3.7.3 Psychometric properties analysis

The psychometric properties of the test was conducted in two rounds to evaluate three types of validity and reliability: (1) construct validity (convergent), (2) construct validity (discriminant) and (3) internal consistency reliability (Figure 7.2). The first round was accomplished on the full version of the questionnaire (including 27 items). Then, due to the poor model fit, those items with poor prediction power were removed. After that, another round of psychometric testing was conducted on the reduced version of the questionnaire (including 19 items). AMOS and MPlus statistical packages were used to test the construct validity and SPSS version 22 was used for measuring the internal consistency reliability.

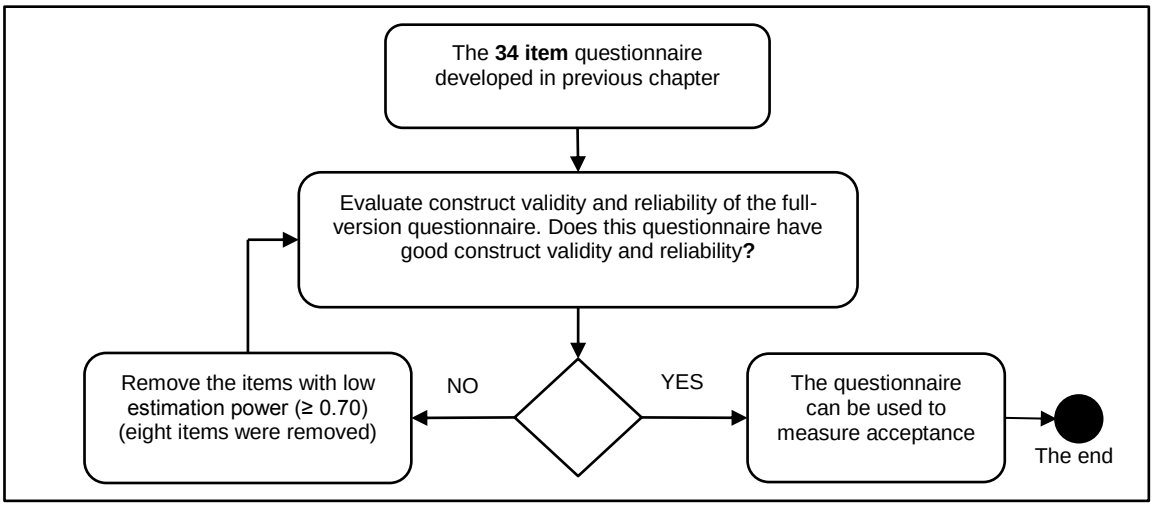

Figure 7.2. Psychometric properties data analysis flowchart

a. Construct validity

As explained earlier in this thesis, the study phenomena are unobservable and need to be operationalised through a set of items (variables) to be measured (e.g. BI). Assessing the construct validity is important to show whether the assigned items for each construct actually represent this construct (Streiner and Norman, 2008). CFA can be calculated independently or through structural equation modelling (SEM) which provides more results on the causal relationship between theory constructs than calculating CFA independently (Maruyama, 1997). As the study questionnaire developed based on a theoretical framework and the relationship between the variables and the constructs were designated a priori, the construct validity of the hypothetical constructs was assessed using CFA.

To evaluate the construct validity of the questionnaire using CFA, two conditions need to be considered (O'Leary-Kelly and Vokurka, 1998; Hu and Bentler, 1999). First, it is important to examine the consistency of the model fit parameters. CFA has different parameters to determine the significance of the analysis and to measure the construct validity. These parameters measure whether the model fits the research data and are called the model goodness-of-fit indices (Table 7.1) (Schumacker and Lomax, 2004). The first parameters relate to a chi-square and indicate the level of difference between the expected and observed model. The chi-square can be interpreted in one of two ways: the significance level or the ratio of chi-square to the degree of freedom (χ^2/d.f.). An acceptable model should have a high p-value to show that there is no statistically significant difference between the expected and the observed models. Moreover, chi-square goodness-of-fit can be calculated by measuring the ratio of chi-square to the degree of freedom (χ^2/d.f). If the value is greater than 3.0, the observed model has a poor model fit compared to the expected model (Byrne, 2013). The second parameters relate to the discrepancy function adjusted to sample size including the Comparative Fit Index (CFI) and the Tucker Lewis Index (TLI). Both CFI and TLI values range from 0 to 1 with a greater value indicating a better fit. A value of 0.90 or more indicates an acceptable model fit (Hu and Bentler, 1999). The third parameters relate to residuals in the model, including the Root Mean Square Error of Approximation (RMSEA) and Standardised Root Mean Square Residual (SRMR). Both values range from 0 to 1 with a smaller value indicating a better fit. A value of 0.08 or less indicates an acceptable model fit (Kline, 2011; Browne and Cudeck, 1993; Reeve et al., 2007; Hu and Bentler, 1999). Consequently, if the CFA fit indices do not show a good fit with the data, there is an issue with the construct validity of the developed questionnaire.

Table 7.1. Gold standard criteria for the goodness-of-fit indices values

Fit indices	Recommended value	Reference
χ^2/d.f.	≤3	(Byrne, 2013)
CFI	≥ 0.90 is acceptable and ≥ 0.95 is excellent	(Hu and Bentler, 1999)
TLI	≥ 0.90 is acceptable and ≥ 0.95 is excellent	(Hu and Bentler, 1999)
RMSEA (CI=90%)	<0.08 is acceptable and ≤0.05 is excellent	(Browne and Cudeck, 1993; Reeve et al., 2007)
SRMR	<0.08 is acceptable and ≤0.05 is good	(Kline, 2011; Hu and Bentler, 1999)

The second principle to evaluate construct validity involves ensuring that any one item significantly correlates with all other items claiming to measure the same construct. This is achieved through assessing the item estimation power (also called factor loading) and the significance level. It is recommended that the item should have an estimation power ≥ 0.7 to have good representation of the construct (Fornell and Larcker, 1981). This means that this item would explain 50% and above of the construct variance. Moreover, the estimation path between the items and the measured construct should be significant. If the item is below this value or not significantly correlated with the construct, it needs to be removed (see the following section for more details). The MPlus statistical tool was used to conduct the CFA (Muthén and Muthén, 1998-2010).

Although CFA could be used to evaluate overall construct validity, some researchers acknowledge that this method actually evaluates the convergent validity of the questionnaire (Fornell and Larcker, 1981). This type of validity can help in justifying how each item is correlated with the main construct. However, there is still need to understand whether the main constructs are actually different from each other and not measuring the same thing. This can be assessed through testing the discriminant validity of the questionnaire (Carmines and Zeller, 1979).

In this study, discriminant validity was tested using two methods: the correlation method and the CFA method. The correlation method involves evaluating the correlation coefficient between two constructs. A very high correlation (correlation coefficient equal to or above 0.85) might indicate that the two variables are actually measuring the same thing (Kline, 2011). However, this is not usually the case. Sometimes the variables are highly correlated but are still distinct (Torkzadeh et al., 2003). Thus, investigating the confidence interval around the estimates as well as the correlation estimation can assess whether the two factors are actually distinct or not. If the correlation is significantly less than one and the confidence interval does not

include “one”, then we can say these constructs are distinct but highly correlated (Torkzadeh et al., 2003). The distinct constructs show the discriminant validity. In order to choose the appropriate correlation test, the normality, linearity and homoscedasticity of the main construct scales were checked using the preliminary analyses. For both the full version and the reduced version of the study questionnaire, all construct scales were not normally distributed, as will be shown later in the results section (discriminant validity). Consequently, the spearman’s rank order correlation was used to measure the association between the different scales (Field, 2007).

On the other hand, CFA methods were conducted through subjecting paired constructs to two models of CFA (the first model allows correlation between the two constructs (constrained model) and the second model without correlation (unconstrained model)). The χ^2 difference in these two models should be significant in order to show the discriminant validity (Hair et al., 2010). The AMOS statistical tool provided by SPSS was used to analyse the discriminant validity data using CFA methods (IBM., 2013).

b. Item reduction

One way to improve the goodness-of-fit indices, which will then improve the construct validity, is through removing items with weak estimation power (Carvalho et al., 2013). Based on the previous section, the recommended estimation power to enable good prediction ability should be equal to or greater than 0.7 for each item.

After conducting CFA on the full version of the study questionnaire, it appears that there was an issue with the model fit. Consequently, the questionnaire was modified by removing items with weak estimation, with the exception of constructs that included only three items. If these constructs had an item with an estimation power equal to or above 0.6, then the item remained. This is because it is recommended, that when running factor analysis and SEM, a construct should have at least three items (Hoyle, 2011). Moreover, an estimation power equal to or above 0.6 is considered an acceptable value to show the variation on the latent construct (Hair et al., 1998).

c. Questionnaire reliability

Reliability was calculated through measuring the internal consistency (or inter-item consistency including the inter-item correlation) to assess whether respondents responded in a consistent manner to questionnaire items. Moreover, it is used to show that different sets of items represent specific constructs through measuring their correlations with each other.

In the current study, internal consistency was calculated using Cronbach's coefficient alpha (Cronbach's α) (Peterson and Kim, 2013). To demonstrate good internal consistency reliability, a value greater than 0.70 is required (Streiner and Norman, 2008; DeVellis, 2011). This means that the closer the coefficient gets to 1.0, the better the questionnaire reliability. Some researchers recommend that the Cronbach's alpha should not exceed the value of 0.95 as this might reveal the redundancy of items (Streiner, 2003; Cappelleri et al., 2013).

As discussed earlier in Chapter 3, Cronbach's α appears to be very sensitive to the number of items. So, another method was also used to test the internal consistency through measuring the item-to-total correlation and the inter-item correlation (Hair et al., 2010). For a questionnaire to be reliable, the item-to-total value is recommended to be more than 0.50 and the inter-item correlation value is recommended to be more than 0.30 (Robinson et al., 1991).

To test the questionnaire stability (i.e. test-retest reliability), the questionnaire would need to be distributed at two points in time within the same participants. Moreover, it has been suggested that the absolute minimum sample size should be 30 participants (Flansbjer et al., 2005; Hopkins, 2000). In the current study, data was collected to measure the stability of the study questionnaire. Forty-five participants completed the study questionnaire at the first point. However, only eight participants completed the questionnaire at the second point. Thus, it was difficult to evaluate the test-retest reliability.

7.4 Results

7.4.1 Response rate and data quality

From April 2014 to November 2014 a total of 494 questionnaires were distributed in the two clinics; 243 questionnaires in the telephone clinic and 251 questionnaires in the medical and nurse clinic. Only 231 questionnaires were returned indicating 46.67% response rate. Table 7.2 shows the response rate based on the mode of distribution (or type of clinic). The response rate of the clinic distributed questionnaires (medical and nurse clinic) is greater than the response rate of the mail distributed questionnaires (telephone clinic) with a value of 82.47% and 9.88% respectively. However, when the demographic characteristics of the respondents from both modes were compared, it was found that there was no significant difference between the two modes with regards to age (χ^2 *(3) = 4.2, p = .240*) and education level (Lχ^2 *(5) = 8.1, p = .15*). In contrast,

the chi-square test shows that there were significant differences between the two modes with regards to gender (χ^2 *(1) = 6.24, p < 0.05*), but the effect size (*phi φ*) was *equal to* 1.6 indicating a small effect size (Cohen, 1988) (see Table 7.3, Table 7.4 and Table 7.5). This shows that there were almost no differences between the responses of the two modes. However, it was important to ensure that the responses to the main study dependent variable (BI) were not biased by the modes of distribution (no difference between mail distributed and clinic distributed questionnaires), as if there had been any difference, it would have been difficult to analyse the data from both clinic as one data set. Further testing will be conducted in Chapter 8 with regards to the association between the mode of distribution and response to BI.

Table 7.2. Response rate of questionnaire testing phase

Mode of distribution	Type of clinic	Number of distributed questionnaires	Response number	Response rate
Clinic distributed	Medical and nurses clinic	251	207	82.47%
Mail distributed	Telephone clinic	243	24	9.88 %
Both modes	Both clinics	494	231	46.67 %

Table 7.3. Cross-tabulation of gender and questionnaire distribution mode

			gender		
			Male	Female	Total
method	Telephone clinic	Count	7	17	24
		Expected Count	12.8	11.2	24.0
	Medical and nurses clinic	Count	116	91	207
		Expected Count	110.2	96.8	207.0
Total		Count	123	108	231
		Expected Count	123.0	108.0	231.0

Table 7.4. Chi-square test of the association between gender and questionnaire distribution mode

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	6.238[a]	1	.013		
Continuity Correction [b]	5.206	1	.023		
Likelihood Ratio	6.348	1	.012		
Fisher's Exact Test				.017	.011
Linear-by-Linear Association	6.211	1	.013		
N of Valid Cases	231				

Note: 0 cells (0.0%) have expected count less than 5. The minimum expected count is 11.22.

Table 7.5. Effect size of chi-square test

		Value	Approx. Sig.
Nominal by Nominal	Phi	-.164	.013
	Cramer's V	.164	.013
N of Valid Cases		231	

Table 7.6 indicates the percentage of missing data. For the medical and nurse clinic a total of 31 (15%) questionnaires returned with 195 missing items. For the telephone clinic (n=24), a total of four (17%) questionnaires returned with 24 missing items.

Second, the missing data for those participants with no Internet experience (10 cases) was calculated. This category was defined, as this group was not expected to complete 19 items of the questionnaire which would obviously influence the randomness of missing data. For the medical and nurses clinic a total of 23 (12%) questionnaires were returned with 59 (0.43%) missing items. For the telephone clinic a total of three (13%) questionnaires were returned with five (0.32%) missing items.

The percentages of missing data, per questionnaire and item, were below the recommended value of 20%. This indicates that the questionnaire was able to collect data with good data quality. Moreover, the availability of the missing data would not threaten the representativeness of the sample.

Table 7.6. Frequency and percentage of missing data (N=231)

Type of clinic	N*	N with missing data* (%)	Number of missing items (%)
Overall missing data			
Medical and nurses clinic	207	31 (14.97%)	195 (1.36%)
Telephone clinic	24	4 (16.67%)	24 (1.45%)
Both modes	231	35 (15.15%)	219 (1.37%)
Missing data with Internet experience participants only			
Medical and nurses clinic	198	23 (11.61%)	59 (0.43%)
Telephone clinic	23	3 (13.04%)	5 (0.32%)
Both modes	221	26 (11.76%)	64 (0.41%)

Note: (*) N = number of participants

7.4.1.1 Qualitative observation of the missing values

The 35 questionnaires with missing values were investigated to find a common pattern between the missing values. The majority of missing values occurred in the demographic characteristics, Internet experience questions and importance of

resources questions and few were found in the main construct items section. When analysing the common pattern within the general questions missing items, it was found that two respondents failed to answer an entire general question that included three parts with a total of 10 items (Q.5. availability of resources), one respondent answered only one item per section for the same question and 17 respondents missed items at random. On the other hand, when analysing the missing values in the main construct items section, five respondents missed five questions at random. Three respondents omitted to answer the item regarding celebrities (i.e. TV and film stars) in both sections of Q.4.

7.4.2 Participants characteristics

As shown earlier, a total of 231 participants completed the questionnaire (24 recruited from the telephone clinic and 207 recruited from the nurses and medical clinic) (Table 7.7). Of these, 53.2% were female and 46.8% were male. The largest age group was 18-24 representing 40.3% of the total participants. Around half of the sample (47.4%) had college/certificate/diploma as the higher level of education. Although when the largest age group of participants (18-24) was excluded, around 38% of the participants had college/certificate/diploma as the higher level of education. A detailed look into the gender distribution between the education levels revealed that females had higher educational levels than males (Figure 7.3).

Table 7.7. Participants characteristics (N= 231)

Participant characteristic		N = (231)	%
Gender	Male	123	53.2
	Female	108	46.8
Age	18-24	93	40.3
	25-34	82	35.5
	35-44	50	21.6
	45-54	6	2.6
Higher education level	Secondary school or below	36	15.7
	College/certificate/diploma	109	47.4
	Trade/ technical/vocational training	22	9.6
	Bachelor degree	39	17.0
	Post-graduate degree	17	7.4
	Professional degree (e.g. MD or LLB)	7	3

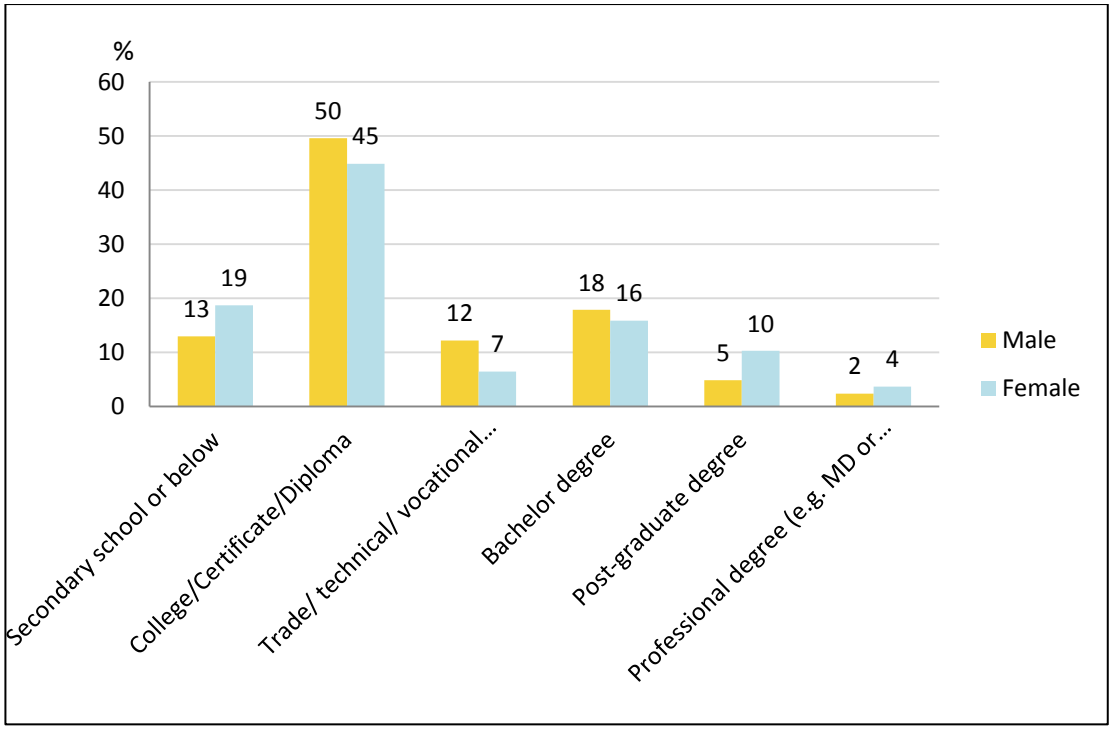

Figure 7.3. Percentages of education level per gender (females and males)

7.4.2.1 Participants' experience with the Internet

The majority of participants (95.7%, n=221) had Internet experience compared with only 4.3% (n=10) that had no Internet experience. Looking at the characteristics of those with no Internet experience, six were female, five were within the age range 35-44 and half had secondary school or below as their highest educational level.

The most common device used to access the Internet was the mobile phone (around 70% extensively used this type of device) compared with 43.9% and 34.5% who extensively used personal computers and tablet computers, respectively (Figure 7.4). Although the results reveal that the majority of participants use the Internet for sending and receiving e-mails (46.6% extensively use the Internet for this purpose) and using Internet banking (30% frequently use the Internet for this purpose), few participants use the Internet to seek health-related information (45% rarely use the Internet for this purpose and 15% never use the Internet for this purpose) (Figure 7.5). This is contrary to what was expected, as the literature showed around 50% of the young adults reported their use of the Internet to seek health related information (Office for National Statistics., 2013). Thus, the current study results could be because those groups are survivors who do not want to be reminded of their past illness. The majority of participants access the Internet at home (65.5% extensively access the Internet at

home) (Figure 7.6). This is compared with only 7.2% and 4.5% of participants who reported their extensive access the Internet to be in the café or library, respectively.

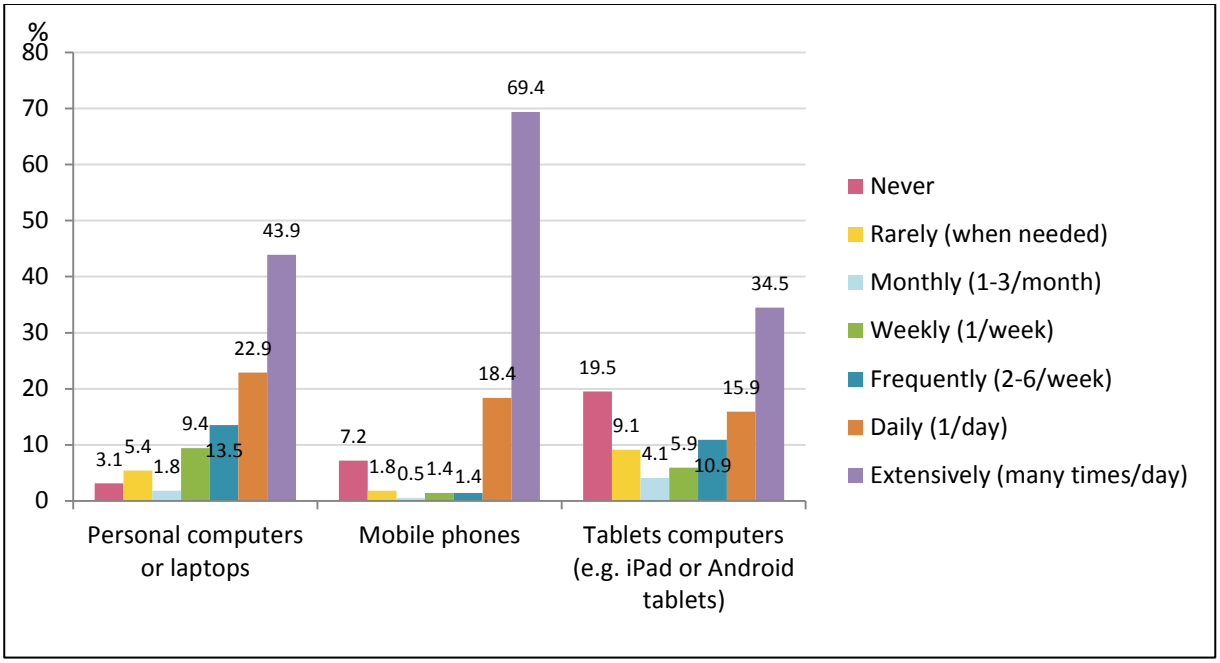

Figure 7.4. Common devices for accessing the Internet within the study participants (N=221)

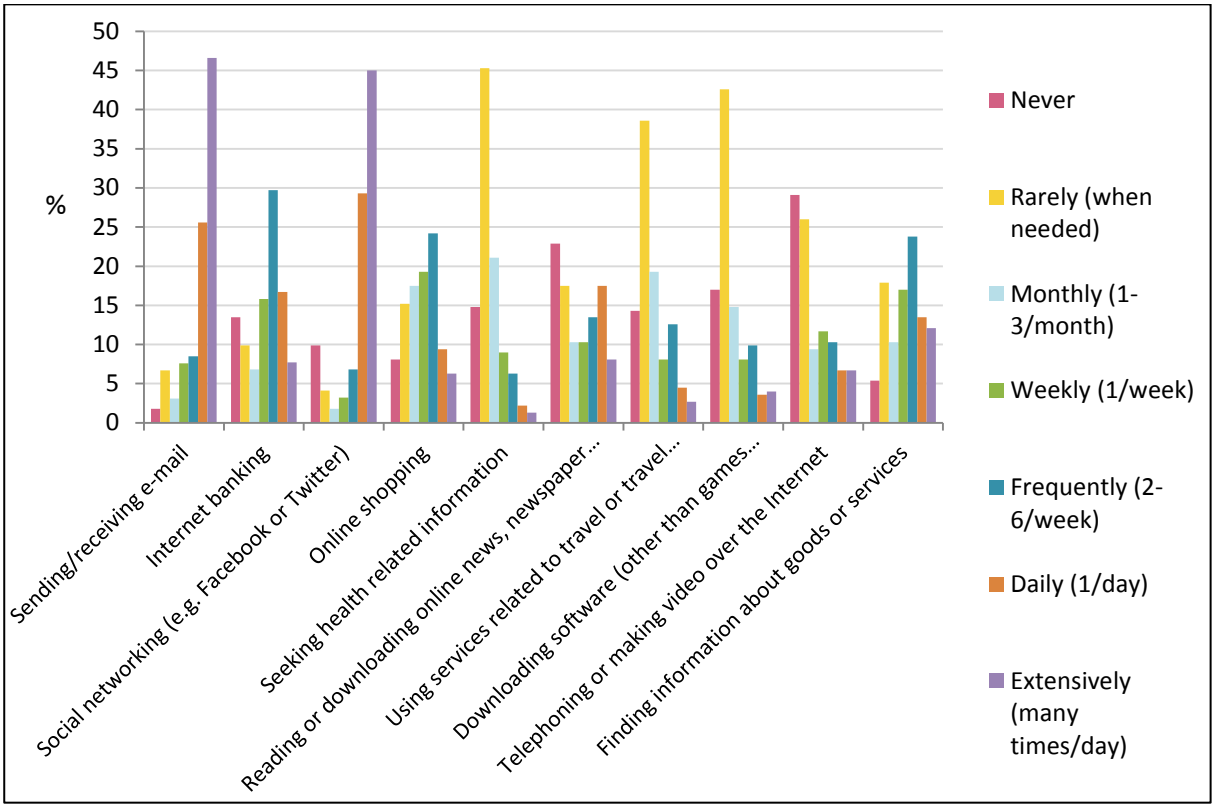

Figure 7.5. Common reasons for accessing the Internet within the study participants (N=221)

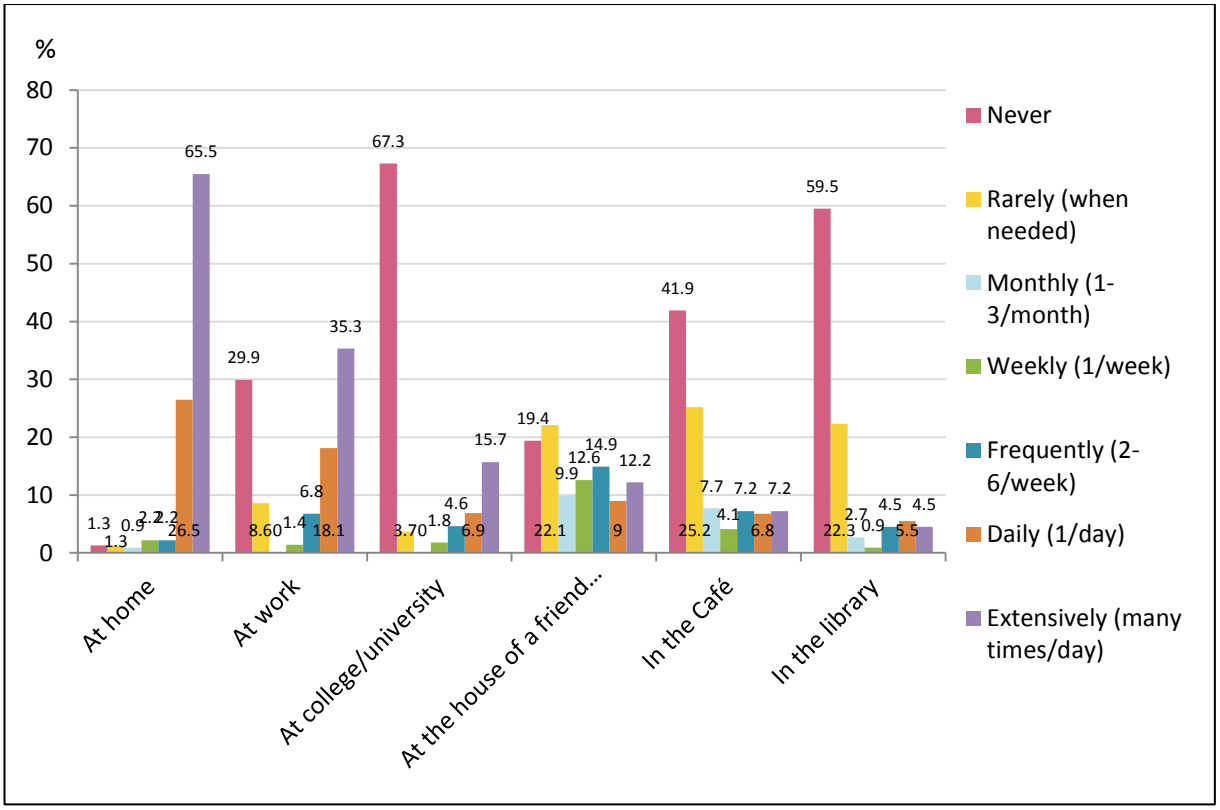

Figure 7.6. Common places for accessing the Internet within the study participants (N=221)

7.4.2.2 The importance of facilities

Participants were asked what type of support they thought they would need to use e-PROMs at home or in the clinic, and the importance of providing general support, such as the availability of online and telephone support, having computer skills and providing training sessions. In general, most of the participants agreed that accessibility to the device itself was the most important facility to using e-PROMs, either at home (very important (34.5%)) or in the clinic (important (22.4%)) (Figure 7.7 and Figure 7.8). This was expected, as patients would be unable to use e-PROMs if they did not have access to the system. On the other hand, support from other people (offering help to complete e-PROMs for patients) was not flagged as an important facility here.

In addition, participants were asked about the importance of four types of general support to completing e-PROMs (Figure 7.9). More than half of the participants agreed on the importance of three of them: availability of online support (67.5% viewed it as at least slightly important), telephone support (61% cited it as at least slightly important and having a computer skills as a user (62.4% rated it as at least slightly important). However, providing a training session was viewed as unimportant by 68.7% of participants. This was expected as e-PROMs is considered a new platform and

participants have no previous experience with the system, so they might ask for some help when they start using it. Moreover, as they were young adults with previous Internet experience, it is expected that they would choose a training session as the least important facility.

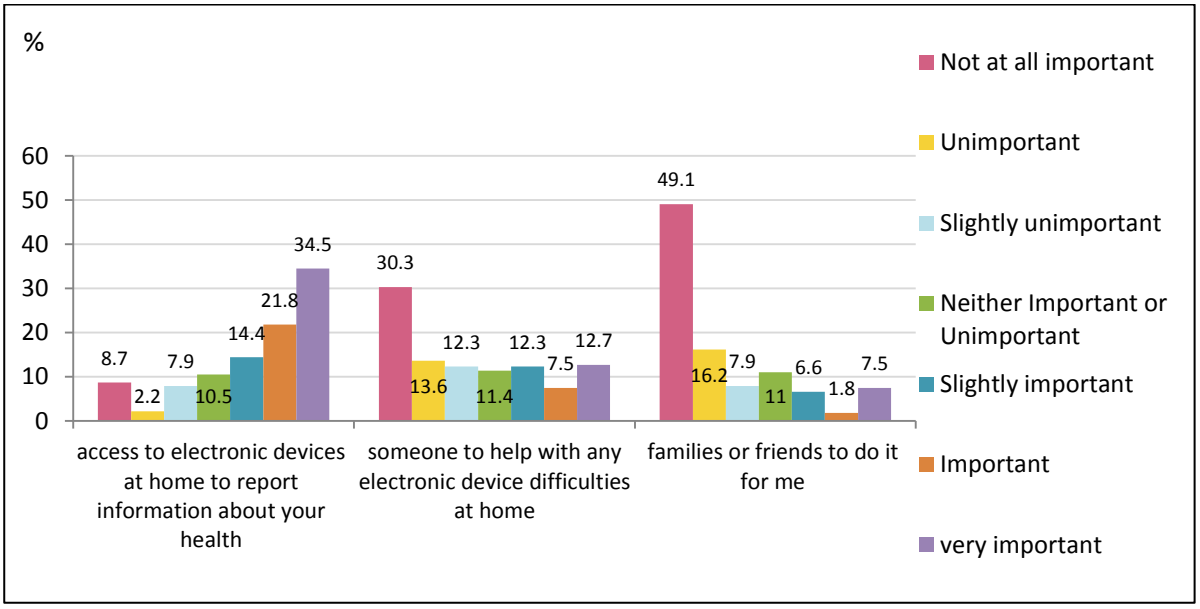

Figure 7.7. Participants' opinion toward the importance of facilities when completing the e-PROMs at home (N=231)

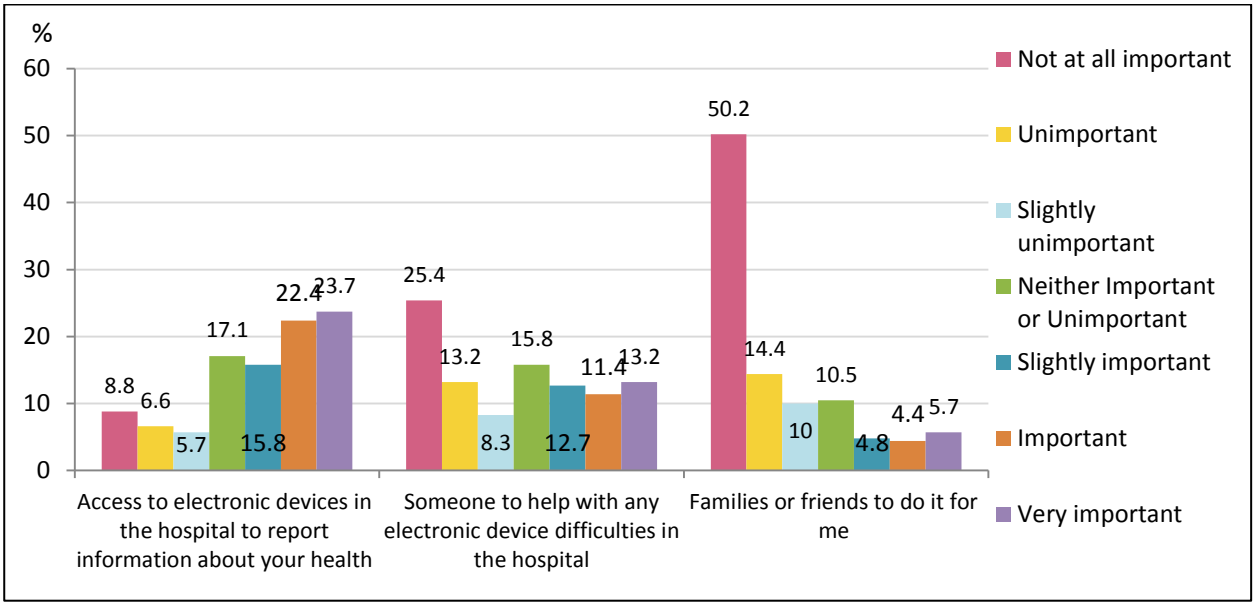

Figure 7.8. Participants' opinion toward the importance of facilities when completing the e-PROMs in the clinic (N=231)

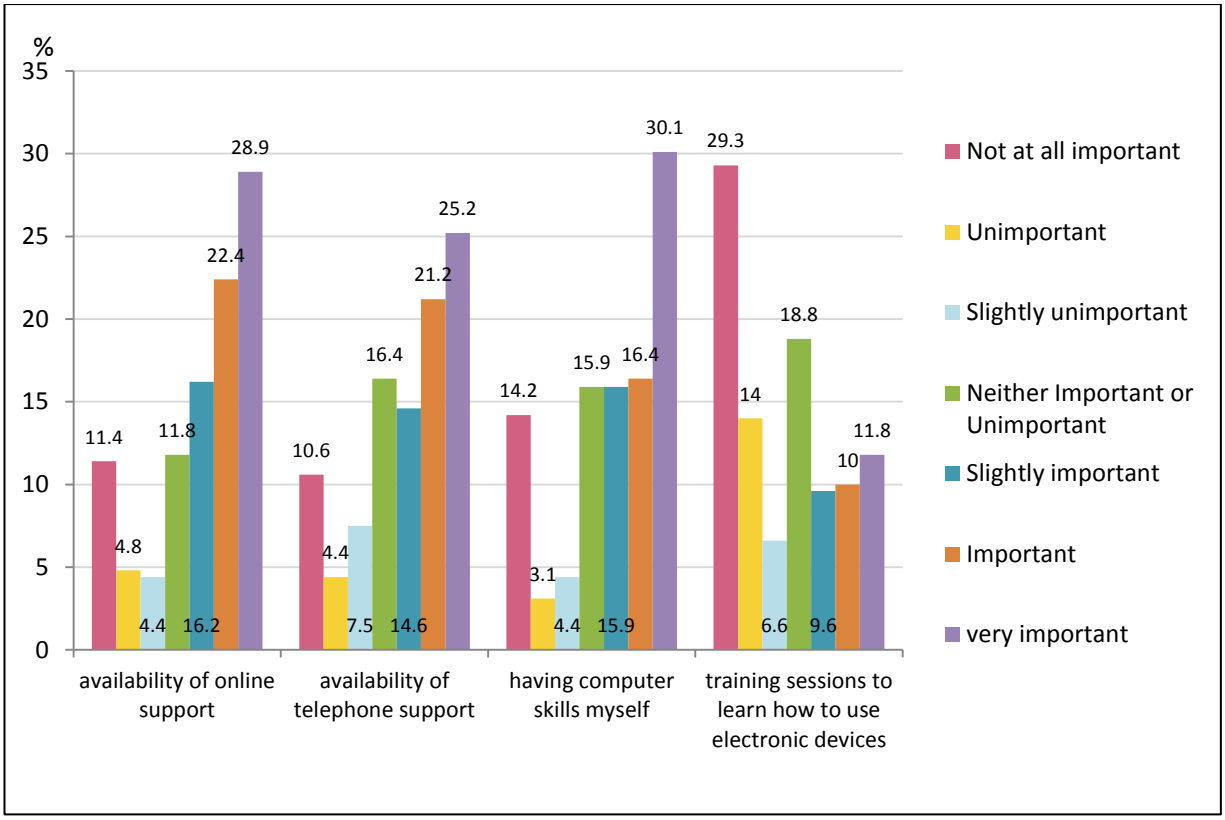

Figure 7.9. Participants' opinion toward the importance of general support/facilities for completing the e-PROMs (N=231)

7.4.3 Psychometric properties: full-version

The construct validity, including convergent and discriminant validity, and internal consistency reliability were tested for the full-version questionnaire. The results then helped to justify the removal of some of the items, as shown in the following sections.

7.4.3.1 Construct validity

a. Convergent validity

A questionnaire with 27 items, measuring five constructs, was tested against the construct validity and reliability. As discussed earlier, CFA provides the model fit indices and the measurement level results (i.e. item estimation power and significant level). For the full-version questionnaire, the chi-square value over the degree of freedom (χ^2/d.f = 3.1) was close to the recommended value (χ^2/d.f = 3). Both CFI = 0.84 and TLI = 0.82 were below the recommended value of ≥ 0.90. Moreover, both RMSEA = 0.095 and SRMR = 0.091 were above the recommended value of < 0.08 (Table 7.8). The results of the model goodness-of-fit indices suggest that the current model has a poor fit, which means that there is an issue with the questionnaire

construct validity. Consequently, items with weak estimation values, below 0.70, were removed in order to improve the model fit.

In Table 7.9 , the measurement level result is presented. All item loadings were significant ($p < .001$) on the positive direction. The item loadings were shown under the β values. It appears that all but nine items had an estimation power exceeding the 0.70 cut-off point (highlighted in bold). These included:

- **two items** from the attitude scale (Attitude 3 "1.c. If I use electronic devices to report information about my health it will help doctors to monitor me more closely" and Attitude 5 "1.f. For me, using an electronic device to report information about my health is a waste of my time".
- **three items** from the subjective norms scale (SN5 "5.Your family (e.g. partners, parents and children)", SN6 "6. Your friends" and SN7 "7. Celebrities"). As the SN scale involved seven items of motivation to comply and seven items of normative beliefs, the actual number of items with issues in the questionnaire is **six**.
- **three items** from the computer anxiety scale (CAnxiety1 "1.e. I am worried I will make mistakes I cannot correct if I use an electronic device to report information about my health", CAnxiety2 "1.g. I am worried that the information I provide via electronic devices would be seen by the wrong people (e.g. unauthorised doctors/nurses or other individuals)" and CAnxiety4 "2.e. I would feel uncomfortable using any electronic device to report information about my health").
- **one item** from the BI scale (BIntention5 "3.f. I would never report information about my health using electronic devices").

Table 7.8. Fit indices of the full-version questionnaire

Fit indices	Recommended value	Model 1
χ^2/d.f.	≤3	967.6/314 = 3.1
CFI	≥ 0.90 is acceptable and ≥ 0.95 is excellent	0.841
TLI	≥ 0.90 is acceptable and ≥ 0.95 is excellent	0.822
RMSEA (CI=90%)	<0.08 is acceptable and ≤0.05 is excellent	0.095
SRMR	<0.08 is acceptable and ≤0.05 is good	0.091

Table 7.9. Items loading of the full-version questionnaire

Construct	Items	B	β	S.E.	RV
Attitude	Attitude1	1.00	0.74***	0.05	0.46
	Attitude2	0.95	0.79***	0.04	0.37
	Attitude3	**0.89**	**0.68*** **	**0.07**	**0.53**
	Attitude4	0.98	0.76***	0.04	0.43
	Attitude5	**0.95**	**0.67*** **	**0.07**	**0.56**
	Attitude6	1.22	0.87***	0.04	0.24
	Attitude7	1.17	0.74***	0.05	0.46
Perceived behavioural control	PBcontrol1	1.00	0.85***	0.05	0.27
	PBcontrol2	1.11	0.82***	0.04	0.32
	PBcontrol3	0.99	0.70***	0.07	0.51
Subjective Norms (Motivation to comply x normative beliefs)	SN1	1.00	0.94***	0.02	0.11
	SN2	0.99	0.96***	0.01	0.09
	SN3	0.97	0.96***	0.01	0.08
	SN4	0.84	0.83***	0.03	0.31
	SN5	**0.61**	**0.61*** **	**0.05**	**0.63**
	SN6	**0.48**	**0.49*** **	**0.07**	**0.76**
	SN7	**0.13**	**0.17** **	**0.06**	**0.97**
Computer anxiety	**CAnxiety1**	**1.00**	**0.58*** **	**0.08**	**0.67**
	CAnxiety2	**0.97**	**0.56*** **	**0.11**	**0.69**
	CAnxiety3	1.33	0.78***	0.07	0.39
	CAnxiety4	**1.17**	**0.68*** **	**0.08**	**0.53**
	CAnxiety5	1.38	0.81***	0.07	0.35
Behavioural intention	BIntention1	1.00	0.96***	0.01	0.08
	BIntention2	0.96	0.95***	0.02	0.10
	BIntention3	0.94	0.94***	0.02	0.12
	BIntention4	0.96	0.90***	0.02	0.18
	BIntention5	**0.66**	**0.56*** **	**0.08**	**0.69**

Note: (B)= unstandardised estimation, (β) = standardised estimation, (S.E.) = standard error and (RV) = residual variance.

*p < .05. **p < .01. ***p < .001.

b. Discriminant validity

Discriminant validity was tested using two methods. Starting with the correlation methods, spearman's rank order correlation test was conducted as the distribution of the constructs was not normally distributed (Table 7.10 and see Appendix D for more information). From Table 7.11, it appears that all constructs are medium to highly correlated with each other. However, the correlation estimation between the questionnaire constructs are less than the recommended value of 0.85 (Kline, 2011).

Moreover, from investigating the confidence interval it was revealed that the constructs are distinct. This supports the existence of discriminant validity within the study questionnaire.

Table 7.10. Descriptive statistics of the main model constructs: full-version of the questionnaire

		Subjective Norms scale	Perceived Behavioural Control scale	Computer Anxiety scale	Attitude scale	Behavioural Intention scale
N	Valid	223	230	230	230	231
	Missing	8	1	1	1	0
Mean		4.4	5.6	3.3	5.4	5.3
Std. Deviation		1.2	1.3	1.3	1.2	1.4
Skewness		-0.77	-1.6	0.4	-1.3	-1.4
Std. Error of Skewness		0.16	0.16	0.16	0.16	0.16
Kurtosis		0.43	3.0	-0.26	2.1	1.8
Std. Error of Kurtosis		0.32	0.32	0.32	0.32	0.32
Minimum		1	1	1	1	1
Maximum		6.7	7	7	7	7

Table 7.11. Correlations between the study constructs

	Spearman's rho correlation coefficient	**N**	**95% Confidence intervals**	
			lower	**Upper**
SN <--> At	0.43**	222	0.32	0.53
SN <--> PBC	0.37**	222	0.25	0.48
SN <--> CA	- 0.35**	222	-0.46	-0.23
SN <--> BI	0.43**	223	0.32	0.53
PBC <--> At	0.68**	230	0.6	0.7
PBC <--> CA	-0.55**	229	-0.63	-0.45
PBC <--> BI	0.73**	230	0.66	0.79
CA <--> At	-0.53**	229	-0.62	-0.43
CA <--> BI	-0.58**	230	-0.66	-0.49
At <--> BI	0.83**	230	0.79	0.87

Note: (**)= Correlation is significant at the 0.01 level (2-tailed).

The other method is through subjecting a pair of constructs to two models (constrained and unconstrained) and evaluating the chi-square differences. If the chi-square difference value is significant, discriminant validity exists. Table 7.12 presents the chi-square differences of the paired constructs. It appears that all the chi-squares are statistically significant ($p < .001$) for all of the paired constructs. This finding also justifies the differences between the questionnaire constructs, which also supports the existence of discriminant validity.

Table 7.12. Chi-square differences of the paired constructs to measure discriminant validity

Paired constructs [1]	Constrained model		Unconstrained model		Chi-square differences	
	χ^2	d.f.	χ^2	d.f.	χ^2	d.f.
At × SN	1183.6***	77	451.1***	76	732.5***	1
At × PBC	321.2***	35	265.6***	34	55.7***	1
At × CA	421.6***	54	272.4***	53	149.2***	1
At × BI	319.4***	54	231.3***	53	88.1***	1
PBC × CA	192.6***	20	103.6***	19	89.0***	1
PBC × SN	594.1***	35	331.7***	34	262.4***	1
PBC × BI	130.3***	20	52.6***	19	77.7***	1
SN × CA	686.3***	54	340.9***	53	345.3***	1
SN × BI	1464.0***	54	339.6***	53	1124.3***	1
CA × BI	287.8***	35	149.6***	34	138.1***	1

Note. (1) At= attitude, SN= subjective norms, PBC= perceived behavioural control, CA= computer anxiety and BI= behavioural intention.

*p < .05. **p < .01. ***p < .001.

7.4.3.2 Questionnaire reliability: internal consistency

Table 7.13 shows the results of the questionnaire reliability (internal consistency). All the constructs have Cronbach's alpha above 0.8 and below 0.95 which is considered a good reliability value (Streiner and Norman, 2008; DeVellis, 2011). In addition, all the inter-item correlation values exceeded 0.3 (except for the subjective norms construct). Subjective norms items are not expected to correlate highly because the construct subjective norms is a formative construct and so do not necessarily correlate with each other (Diamantopoulos and Winklhofer, 2001). On the other hand, all item-to-total correlation values exceeded 0.5 (except for one item in the subjective norms construct [**SN7**]) which raise an issue with the internal consistency of the construct (see Appendix D for more details).

Table 7.13. The Cronbach's alpha coefficient, inter-item correlation and item-total correlation of the full-version questionnaire (N=231)

Construct	Cronbach's α	Inter-item correlation	Item-to-total correlation
Attitude	0.90	0.41 - 0.75	0.63 – 0.81
Perceived behavioural control	0.82	0.56 – 0.72	0.61- 0.72
Subjective norms	0.90	0.13 – 0.92	0.29 – 0.87
Computer anxiety	0.81	0.306 – 0.630	0.53 - 0.78
Behavioural Intention	0.93	0.49 – 0.91	0.54 – 0.91

7.4.3.3 Summary of the first round of psychometric properties

Although the full-version questionnaire had good discriminant validity, it appeared to have an issue with its convergent validity and internal consistency. The model fit indices were either above or below the recommended values. Consequently, reducing the number of items may improve the model fit which might then improve the convergent validity.

Although all constructs in Cronbach's alpha were above the recommended value, which justifies the reliability of this version of the questionnaire, at the item level, and when measuring the correlation between the items, one of the subjective norms items [SN7] appeared to have an issue with correlation with other items and with the item total. The weak correlation between this item and the other items could be due to the nature of the construct (i.e. formative construct). However, the item to total correlation was still problematic. Consequently, removal of this item could improve the internal consistency of the SN construct.

Therefore, based on the psychometric properties finding, a modified version of the questionnaire was produced. All items below the recommended value of 0.7 were removed. Although an estimation power of 0.6 was considered an acceptable value (Hair et al., 1998), the need to remove items below 0.7 aimed to improve the overall model-fit, which is a main indicator of construct validity in the CFA. However, for the computer anxiety category, item CAnxiety4 was kept for two reasons: (1) to ensure the recommended level of the number of predictors, three predictors per latent variable (Hoyle, 2011) and (2) because this item has an estimation power of 0.68, which is considered an acceptable level of factor loading (Hair et al., 1998). Accordingly, the number of items within the modified version reduced to 23 questionnaire items (19 analysis items) instead of 34 questionnaire items (27 analysis items). The reduced version was then tested in another round against the psychometric properties. Construct validity and reliability were re-evaluated and the results shown in the next section.

7.4.4 Psychometric properties: reduced-version

The construct validity, including convergent and discriminant validity, and the internal consistency reliability were tested for the reduced-version questionnaire. The results showed that the validity and the reliability were improved after removing the items with low estimation power.

7.4.4.1. Construct validity

a. Convergent validity

In this version, the questionnaire included 19 items measuring five main constructs. The goodness-of-fit indices of the reduced version were χ^2/d.f. = 1.89, CFI = 0.96, TLI = 0.95, RMSEA = .06 (90% CI = 0.051/0.074) and SRMR = 0.042) (see Table 7.14). All fit indices exceeded the recommended values (χ^2/d.f. ≤3, CFI and TLI ≥ 0.90 and RMSEA and SRMR < 0.08). In fact, the majority had excellent fit values (the exception was RMSEA that had a value close to the excellent level).

In Table 7.15, the measurement level result was shown. All of the item loadings were significant (p < .001) on the positive direction. In addition, all items had an estimation power (β) above the recommended value of 0.7. The exception was an item within computer anxiety which had a value of β=0.68. However, this value is still acceptable to allow the item to predict the construct.

Table 7.14. Fit indices of the modified questionnaire

Fit indices	Recommended value	Model 2
χ^2/d.f.	≤3	(268.7/142)=1.9
CFI	≥ 0.90 is acceptable and ≥ 0.95 is excellent	0.96
TLI	≥ 0.90 is acceptable and ≥ 0.95 is excellent	0.95
RMSEA (CI=90%)	<0.08 is acceptable and ≤0.05 is excellent	0.06 (90% CI=0.051/0.074)
SRMR	<0.08 is acceptable and ≤0.05 is good	0.04

Table 7.15. Items loading of the modified questionnaire

Construct	Items	B	β	S.E.	RV
Attitude	Attitude1	1.00	0.74***	0.05	0.45
	Attitude2	0.93	0.78***	0.04	0.39
	Attitude4	0.94	0.73***	0.04	0.47
	Attitude6	1.21	0.87***	0.04	0.25
	Attitude7	1.16	0.74***	0.05	0.46
Perceived behavioural control	PBcontrol1	1.00	0.86***	0.05	0.27
	PBcontrol2	1.10	0.82***	0.04	0.33
	PBcontrol3	0.98	0.70***	0.07	0.51
Subjective norms (Motivation to comply x normative beliefs)	SN1	1.00	0.94***	0.02	0.11
	SN2	0.99	0.96***	0.01	0.09
	SN3	0.98	0.96***	0.01	0.07
	SN4	0.84	0.83***	0.03	0.32
Computer anxiety	CAnxiety3	1.00	0.68***	0.05	0.56
	CAnxiety4	1.07	0.71***	0.07	0.50

Construct	Items	B	β	S.E.	RV
	CAnxiety5	1.27	0.85***	0.05	0.28
Behavioural intention	BIntention1	1.00	0.96***	0.01	0.08
	BIntention2	0.96	0.95***	0.02	0.10
	BIntention3	0.94	0.94***	0.02	0.13
	BIntention4	0.96	0.90***	0.02	0.18

Note: (B)= unstandardized estimation, (β) = standardised estimation, (S.E.) = standard error and (RV) = residual variance.

*p < .05. **p < .01. ***p < .001.

b. Discriminant validity

Again, discriminant validity was measured using two methods. Starting with the correlation methods, all construct scales were not normally distributed, so Spearman's Rank Order correlation test was conducted (Table 7.16 and see Appendix D for more information) from Table 7.17, it appears that all constructs are medium to highly correlated with each other. However, the correlation estimation between the questionnaire constructs does not exceed the maximum recommended value of 0.85 (Kline, 2011). Moreover, when investigating the confidence interval it was revealed that the constructs are distinct. This supports the existence of discriminant validity within the study questionnaire.

Table 7.16. Descriptive statistics of the main model constructs: reduced version of the questionnaire

		Subjective Norms scale	Perceived Behavioural Control scale	Computer Anxiety scale	Attitude scale	Behavioural Intention scale
N	Valid	231	230	231	230	231
	Missing	0	1	0	1	0
Mean		5.0	5.6	3.1	5.4	5.3
Std. Deviation		1.4	1.3	1.4	1.2	1.4
Skewness		-0.91	-1.6	0.65	-1.3	-1.4
Std. Error of Skewness		0.16	0.16	0.16	0.16	0.16
Kurtosis		0.57	3.0	-0.14	2.1	1.5
Std. Error of Kurtosis		0.32	0.32	0.32	0.32	0.32
Minimum		1	1	1	1	1
Maximum		7	7	7	7	7

Table 7.17. Correlations between the study constructs

	Spearman's rho correlation coefficient	N	95% Confidence intervals	
			lower	Upper
SN <--> At	0.38**	230	0.27	0.49
SN <--> PBC	0.29**	230	0.17	0.4
SN <--> CA	-0.32**	231	-0.43	-0.2

SN <--> BI	0.37**	231	0.25	0.48
PBC <--> At	0.68**	230	0.6	0.7
PBC <--> CA	0-.58**	230	-0.66	-0.49
PBC <--> BI	0.68**	230	0.6	0.74
CA <--> At	-0.58**	230	-0.66	-0.49
CA <--> BI	-0.64**	231	-0.71	-0.56
At <--> BI	0.82**	230	0.77	0.86

Note: (**)= Correlation is significant at the 0.01 level (2-tailed).

Using a CFA method, a pair of constructs were subjected to two models (constrained and unconstrained). The significance level of the chi-square differences is shown in Table 7.18. It appears that all chi-squares were statistically significant ($p < .001$) for all paired constructs. This reveals that the constructs are distinct from each other.

Table 7.18. Chi-square differences of the paired constructs to measure discriminant validity.

Paired constructs [1]	Constrained model		Unconstrained model		Chi-square differences	
	χ^2	d.f.	χ^2	d.f.	χ^2	d.f.
At × SN	548.943***	27	42.61***	26	506.333***	1
At × PBC	160.792***	20	115.658***	19	45.134***	1
At × CA	137.046***	20	73.30***	19	63.746***	1
At × BI	120.29***	27	72.55***	26	47.74***	1
PBC × CA	66.398***	9	22.746***	8	43.652***	1
PBC × SN	288.063***	14	24.069***	13	263.994***	1
PBC × BI	97.704***	14	17.946***	13	79.758***	1
SN × CA	183.683***	14	5.159***	13	178.524***	1
SN × BI	1077.528***	20	28.727***	19	1048.801***	1
CA × BI	80.065***	14	23.111***	13	56.954***	1

Note: (1) At= attitude, SN= subjective norms, PBC= perceived behavioural control, CA= computer anxiety and BI= behavioural intention.

*p < .05. **p < .01. ***p < .001.

7.4.4.2 Questionnaire reliability: internal consistency

All constructs in the modified questionnaire showed good internal consistency reliability (see Table 7.19). For Cronbach's α, all constructs had a value greater than the 0.7 cut-off value. However, subjective norms and behavioural intention exceeded the 0.95 which might indicate item redundancy. On the other hand, when the item correlation was tested, it appears that all item-to-total correlation values were greater than the recommended value 0.50. Moreover, all inter-item correlation values were also above the recommended value of 0.30 (see Appendix D for more details).

Table 7.19. The Cronbach's alpha coefficient, inter-item correlation and item-total correlation of the modified version questionnaire (N=231)

Construct	Cronbach's α	Inter-item correlation	Item-to-total correlation
Attitude	0.87	0.46 - 0.67	0.63 – 0.81
Perceived behavioural control	0.82	0.56– 0.72	0.61- 0.72
Subjective norms	0.96	0.78– 0.92	0.81 – 0.93
Computer anxiety	0.80	0.49– 0.60	0.60 - 0.67
Behavioural Intention	0.97	0.83– 0.91	0.88 – 0.94

7.5 Discussion and conclusion

The aim of this part of the study was to test the psychometric properties of the developed questionnaire. This was conducted using the CTT method. In the CTT method, questionnaire psychometric properties, including validity and reliability, need to be evaluated. In addition to the content and face validity discussed earlier in Chapter 6, this chapter includes the process of testing the psychometric properties through evaluating the construct validity and questionnaire reliability (i.e. internal consistency).

7.5.1 Reflection on participant characteristics findings

The study included 231 young adult, cancer survivors, aged between 18 and 54 and recruited from Leeds Teaching Hospitals NHS Trust. The number of males was slightly greater than females, 53% and 47% respectively. Moreover, the majority had college/certificate/diploma as the highest educational level. In this study, almost all participants, around 96%, had experience with the Internet, including 54% of males and 46% of females. This aligns well with the UK population's use of the Internet, where more than 94% of people aged between 18 and 54 use the Internet, and where the number of male Internet users exceed female users by 4% (Office for National Statistics., 2014a). However, because the study was restricted to younger adults and Internet experienced participants, the questionnaire might have different validity and reliability results if tested on a wider range of age groups and Internet experience. This will affect the generalisability of the questionnaire validity and reliability. Consequently, further research is needed involving a more heterogeneous sample.

Consistent with the UK national survey finding, the mobile phone was the most commonly used device to access the Internet for those aged between 18 and 54, and home is the most desirable place (Office for National Statistics., 2013; Dutton et al., 2013). Thus, providing patients with access to complete e-PROMs at home,

presumably, would be a preferable option. Moreover, the majority of participants revealed that the main reason for accessing the Internet was to use e-mail and social networking. This would suggest that providing personal or sensitive information through the Internet is not considered an issue that would hinder the use of e-PROMs, as the use of e-mail and social networks also require providing personal information.

When participants were asked about the importance of facilities to facilitate reporting health information electronically, it appears that e-PROM accessibility was the most important facility, whether completing e-PROMs at home or in the clinic, compared to other facilities that involve help by another individual (e.g. family member or health team). In addition, a training session was not chosen as an important facility required by the participants. This was expected, as the study participants were young adults familiar with using the Internet. Those people have very different characteristics compared with other groups (e.g. older people) in terms of their beliefs and abilities. For example, older people are likely to have more anxiety, lower efficacy, lower control over technologies and other constraints, including motor limitations and general health limitations (Czaja et al., 2006; Fisk and Rogers, 2001; Rogers et al., 1998). Consequently, they might find having someone to complete e-PROMs for them really important, an option not selected as important by the study participants.

7.5.2 Reflection on the questionnaire validity and reliability

As the aim of this chapter was to test the psychometric properties of the study questionnaire, construct validity, including convergent and discriminant validity, was evaluated through applying confirmatory factor analysis. CFA was selected because the current questionnaire was informed by a theoretical framework. Moreover, internal consistency was measured using Cronbach's alpha and item correlation scores.

The initial version of the questionnaire contained 34 items representing five main constructs. After testing the psychometric properties, it appears that this version had an issue with construct validity (convergent validity) and internal consistency. Therefore, a modified version of the questionnaire was produced by reducing the number of items. All items with estimation power less than 0.70 or an item-to-total correlation score below 0.50 were removed. Although a factor loading of 0.60 was considered an acceptable value, the decision to remove items below 0.70 aimed to improve the overall model-fit, which is the main indicator of the construct convergent validity in the CFA. The exception was an item within computer anxiety. This item was retained to keep the number of items per construct within the recommended number (a minimum of three items per construct) which will help to achieve reliable results (Hoyle, 2011).

Moreover, the item had an estimation power of 0.68 which is an acceptable value within CFA results (Hair et al., 1998).

The modified version of the questionnaire included 23 items representing five constructs. This version was assessed again against the psychometric properties. It appears that the modified version has better construct validity (convergent validity). Moreover, the discriminant validity of the questionnaire was also good. However, when measuring the internal consistency reliability it appears that two scales exceeded the recommended value of 0.95, these were subjective norms and behavioural intention. Although subjective norms is a formative measure where we expect low internal consistency reliability, the extremely high value found in this version of the questionnaire could be because all individuals listed were relevant to healthcare teams, which makes this construct very narrow-banded, and it has been shown with a narrow construct, where an internal consistency above average is expected and required (Clark and Watson, 1995). Behavioural intention is also considered to be a narrow construct where high internal consistency is expected (Campbell, 2008). The high internal consistency of BI has been shown in previous researches that studied different types of behaviour (Scott et al., 2007; Hrisos et al., 2009; Peters and Templin, 2010; Dwivedi, 2008). Actually, even though a very high Cronbach's alpha, above 0.95, is shown to be problematic, as discussed earlier, other scholars have argued on the virtues of having a very high Cronbach's alpha value. For example, Nunnally (1978) said "*a reliability of 0.90 is the minimum that should be tolerated and a reliability of 0.95 should be considered the desirable standard*" in many applied settings where there is a need to make important decisions (p246). Moreover, Hinton et al. (2004) suggested a cut-off point of 0.90, where anything above means excellent reliability. Consequently, this high value of internal consistency is expected and accepted. Thus, based on the study finding, the questionnaire now is a valid and reliable measure of acceptance and can be used to collect data to understand the factors behind patient acceptance of e-PROMs.

Although the study revealed some evidences on the questionnaire validity and reliability, it had some limitations. One limitation is the difficulty in measuring criterion validity. Criterion validity evaluates the developed questionnaire against a criterion variable (or a gold standard) (DeVon et al., 2007; Friedman and Wyatt, 2006). The gold standard is often considered to be the direct measure of the examined behaviour. However, due to an absence of this gold standard, measurement of criterion validity was not possible. Consequently, further research needs to be conducted to evaluate this type of validity.

The evaluation of questionnaire reliability also had some limitations. As only eight participants completed and returned the second version of the questionnaire (second point), it was difficult to evaluate the stability of the developed questionnaire. In addition, due to the absence of another equivalent questionnaire, equivalent (parallel-form) reliability was also impossible to measure. Thus, further research is also needed to test these two types of reliability.

The third limitation relates to sample characteristics. In addition to the issue of homogeneity of the sample with regards to participant ages and experience with the Internet, the questionnaire was evaluated within a sample recruited from one context. People within another context might have issues in understanding some items, as well as older populations or people with no Internet experience. Consequently, more studies need to be conducted to measure the validity and reliability within different contexts. This would also facilitate generalisability of the study results.

7.6 Summary

1- This study aimed to measure the psychometric properties of the study questionnaire using Classical Test Theory (CTT).
2- Confirmatory factor analysis (CFA) was used to evaluate the construct validity of the study questionnaire as the questionnaire was informed by a theoretical framework.
3- The internal consistency reliability was measured using the values of Cronbach's alpha and item correlations.
4- Although the discriminant validity of the questionnaire developed in Chapter 6 was good, the results revealed that the questionnaire had an issue with its convergent validity and internal consistency.
5- To improve the validity and the reliability of the questionnaire, items with weak estimation power or those causing a significant reduction in internal consistency were removed.
6- Eight items were removed and the new questionnaire included 19 items measuring five constructs.
7- After removing the items, the second version of the study questionnaire revealed good construct validity results (including both discriminant and convergent validity).
8- Moreover, the internal consistency reliability values of all scales were equal or above the recommended value for both Cronbach's alpha and the item correlations, which indicate good internal consistency reliability.

CHAPTER 8. Factors Influencing Patient Acceptance of Electronic Patient-Reported Outcome Measures: Testing the Conceptual Model

8.1 Introduction

In the current study, behavioural intention is used as the main study outcome, as e-PROMs have not been implemented yet within the clinic, which makes measuring the actual use of e-PROMs impossible. Although behavioural intention is not usually a good predictor of actual behaviour, for the present study it will form proximal measure of behaviour (Marinos and Askoxylakis, 2013). Thus, e-PROM acceptance was measured through understanding the participants' plan (i.e. whether they plan to use or reject the technology).

In Chapter 7, the psychometric properties of the study questionnaire were tested, including internal consistency reliability and construct validity. The results did not support the construct validity of the full-version questionnaire. Consequently, items with low estimation power for each construct were removed. The modified version, including 23 questionnaire items (19 analysis items), demonstrated good construct validity results and good internal consistency results.

Within the previous chapter, CFA, through SEM, was used to test the construct validity of the questionnaire. In this chapter, the construct association results from the SEM will be used to test the conceptual model of the study questionnaire. This will help to understand the relationships between the main factors (attitude, subjective norms, perceived behavioural control, computer anxiety and the patient characteristics factors) and behavioural intention. An understanding of the association between these factors and BI will help to articulate the main barriers behind the rejection of e-PROMs.

8.1.1 Chapter aim

The aim of this chapter is to understand the significant determinants influencing patient acceptance of e-PROMs.

8.1.2 Chapter objectives

I. To investigate the correlation of the participants' characteristics (i.e. age, gender and education level) with the behavioural intention, in addition to the association measured earlier in Chapter 7 between the study constructs and BI.

II. To investigate the significant predictors of e-PROM acceptance through testing the structural/conceptual model using a structural equation model.
III. To determine the level of variance in behavioural intention explained by the assigned predictors.

8.2 Testing the conceptual model

The Theory of Planned Behaviour has been selected to understand acceptance in the context of e-PROMs. Through TPB, acceptance (behavioural intention) is influenced by three factors; attitude, subjective norms and perceived behavioural control. In addition to the TPB constructs it has been found from patient feedback within the previous e-PROM implementation studies, that computer anxiety and demographic characteristics (i.e. age, gender and education level) might differentiate those who will accept e-PROMs from those who will not (Basch et al., 2007; Wilson et al., 2002; Ashley et al., 2013). Consequently, the current study is empirically testing the influence of those factors on the acceptance of e-PROMs.

To test the conceptual model, structural equation modelling (SEM) can be used (Hair et al., 2005). It can investigate the association between several dependent and independent variables. SEM includes three main techniques: regression analysis, path analysis and confirmatory factor analysis (CFA) (Hair et al., 2005). In the previous chapter, the CFA results (measurement level results) helped to evaluate the questionnaire construct validity. However, the results from the multiple regression and path analysis can be used to examine the construct relationships and the ability of the independent variables to predict the study outcome. This level of testing is called the conceptual (or structural) level of the model (Kline, 2011).

By comparing SEM with other multivariate analysis techniques, SEM has more advantages (Byrne, 2013). First, it can estimate the error variance parameters that are neglected in the other techniques (e.g. multivariate regression). The procedure of analysing data using SEM includes both the observed and unobserved (i.e. error) variables. While within other multivariate approaches, data is analysed based on the observed variables only (Byrne, 2013). Second, SEM has the power of confirmation rather than exploration, although it includes some exploratory power (Schumacker and Lomax, 2004). However, other multivariate techniques, such as exploratory factor analysis, are exploratory in nature which makes their use for hypothesis testing difficult. Third, the use of SEM can help in estimating both direct and indirect effects and there

is no other method that can be easily used to do so (Byrne, 2013). Consequently, the use of SEM to test a conceptual model such as TPB, which includes indirect associations, is appropriate.

8.3 Methods

This chapter tests the conceptual framework of the study questionnaire to understand the factors influencing patient acceptance of e-PROMs.

8.3.1 Data analysis strategy

The data analysis was conducted in three stages: (1) descriptive data analysis, (2) correlation analysis and (3) conceptual model testing.

8.3.1.1 Descriptive data analysis

In addition to the descriptive results presented in Chapter 7, this chapter includes more descriptive results about (i) two general questions about the use of e-PROMs and (ii) the study constructs.

The first stage of the descriptive data analysis involved analysing responses from two general questions. These two questions asked (i) Q.1 whether patients would prefer a choice between paper and electronic PROMs, and (ii) Q.2 whether they would prefer to use electronic PROMs rather than paper-based PROMs. Responses were collected using a 7-point Likert scale. The Wilcoxon-Mann-Whitney test was used to examine the differences between males and females with regards to the responses to both questions (Field, 2007). Additionally, the Kruskal Wallis test was used to examine the association between the age groups and education level with with regards to the responses to both questions (Field, 2007). These tests were selected as the data relating to the main dependent variables, Q.1 and Q.2, were not normally distributed (see Appendix E for more details). However, before conducting these two tests, the homogeneity of the responses between the groups was tested within the three demographic factors through conducting a one-way ANOVA test. This is because the Kruskal Wallis test has a similar assumption to the Wilcoxon-Mann-Whitney test, which is that both tests assume the homogeneity of variance between the groups (Field, 2007).

In Chapter 7, the gender balance of respondents was significantly different between the two modes of questionnaire distribution (i.e. the clinic and the post). This finding raises a concern in terms of differences between the responses of the two groups, with

regards to the main construct scale. If differences exist, the responses from postal questionnaires need to be excluded, otherwise the study findings can be biased. Thus, and as the main constructs within the modified version of the questionnaire were not normally distributed (see Chapter 7 for more details), the Wilcoxon-Mann-Whitney test was conducted to compare the two groups (Field, 2007). If the homogeneity test shows significant differences, the Wilcoxon-Mann-Whitney test needs to be conducted on the mean rank of the scores instead of the median (see Appendix E for more details of the homogeneity tests).

8.3.1.2 Correlation analysis

After analysing the data for descriptive results, the correlations between the main constructs (subjective norms, perceived behavioural control, computer anxiety and attitude) and the demographic data (including age, gender and education level) with the main study outcome (behavioural intention) were examined. From the previous chapter, the correlation between the main study constructs and BI was conducted using spearman's rank order correlation (Field, 2007). The current chapter tests the association between the three demographic characteristics and the BI. As the BI scale was not normally distributed, non-parametric tests were used. The Wilcoxon-Mann-Whitney test was used to examine the differences between males and females with regards to BI (Field, 2007). Additionally, the Kruskal Wallis test was used to examine the association between the age groups and the education level with behavioural intention (Field, 2007). As discussed earlier, a homogeneity test needs to be conducted before running the Wilcoxon-Mann-Whitney test and the Kruskal Wallis test through conducting a one-way ANOVA test (Field, 2007).

8.3.1.3 Conceptual model testing

Although the correlation can show the association between the variables, it does not assume the causality (Field, 2007). The aim of this study is to understand the acceptance of e-PROMs through testing the influence of the proposed factors (TPB constructs, computer anxiety and demographic characteristics) on BI. In order to achieve this, a structural equation modelling (SEM) technique was used.

Through the SEM, the study model (conceptual model) is statistically tested against the data. If the model-fit indices are not adequate, the data does not reflect the conceptual model. However, if the model-fit indices are adequate, the data shows a good fit with the conceptual model. Then the association between the main predictors and the outcome can be examined (Byrne, 2013). The recommended values for the model-fit indices are the same for both CFA and SEM, as shown in Table 8.1. After evaluating

the model fit, the amount of variance (R^2) in behavioural intention explained by the study factors can be examined (Schumacker and Lomax, 2004). Moreover, SEM shows the significant factors and how much variance they share with the main outcome (i.e. BI) (Byrne, 2013).

In the current study three models were analysed. The first model included the TPB constructs only (attitude, perceived behavioural control and subjective norms) as the main predictors of acceptance/behavioural intention. Then, in the second model, computer anxiety was added. Finally, in the third model, the demographic characteristics factors were added to the second model (age, gender and educational level). The R^2 of the three models were compared to try to understand whether the additional factors predict the acceptance better than the TPB constructs alone, or not.

Table 8.1. Gold standard criteria for the goodness-of-fit indices values for both CFA and SEM.

Fit indices	Recommended value	Reference
χ^2/d.f.	≤3	(Byrne, 2013)
CFI	≥ 0.90 is acceptable and ≥ 0.95 is excellent	(Hu and Bentler, 1999)
TLI	≥ 0.90 is acceptable and ≥ 0.95 is excellent	(Hu and Bentler, 1999)
RMSEA (CI=90%)	<0.08 is acceptable and ≤0.05 is excellent	(Browne and Cudeck, 1993; Reeve et al., 2007)
SRMR	<0.08 is acceptable and ≤0.05 is good	(Kline, 2011; Hu and Bentler, 1999)

8.4 Results

8.4.1 Descriptive data results

8.4.1.1 Demographic data

See Section 7.4.2 in Chapter 7 for more details of the demographic characteristics.

8.4.1.2 General questions

Two general questions were asked in order to learn whether patients would prefer to have a choice between paper and electronic PROMs and whether they would prefer to use electronic PROMs rather than paper-based PROMs.

The results show that around 77% of the participants would prefer to have a choice between paper and electronic PROMs, 18.3% were not sure and only 4.3% (n=10) would prefer not to have a choice between the two modes. This high preference for a choice might be because e-PROMs have not been implemented yet, and participants do not know what they will look like (e.g. whether they are easy or complicated platforms). The association between responses to this question and the demographic characteristics was conducted after testing homogeneity of the different groups within the demographic factors (i.e. gender, age and education level) (see Appendix E for more details). The results show that there is no association between participant response to this question for gender (*z = - 0.39, p= 0.70*), age (*H(3)= 3.9, p= 0.28*) or education level (*H(5)= 2.2, p= 0.82*).

When participants were asked about their preference for using paper-based PROMs or e-PROMs, around half of the participants showed no interest in (13%) or were uncertain (31%) about using e-PROMs. This high percentage supports the need to understand the reasons behind their decisions to reject e-PROMs. After testing the homogeneity between the groups, the association between the responses to this question and demographic characteristics (i.e. age, gender and education level) was tested. It appears that participant responses to this question were not associated with gender (*z = - .64, p>0.56*), nor with education level (*H(5)= 7.2, p= 0.20*) (see Appendix E for more details). However, age seems to be significant factor associated with responses to this question (*H(3)= 7.7, p= 0.05*) with a small effect size (eta^2=0.03) (Field, 2007). This means that older adults seem to have lower scores for this question than younger adults, where a lower score means that they are more likely to prefer paper PROMs than e-PROMs. However, the effect size justified that only 3% of the variability in rank was shown by age groups. It is important to note that there were only six participants in the age group 45-54 which might have affected these results. But, still this direct measure of user preference and its association with age may justify the need to test one of the assumptions behind this study, which is whether age is an influential factor of BI or not. This will be investigated later in this chapter.

8.4.1.3 Study constructs

From the descriptive analysis of the modified questionnaire, it was found that all study constructs were not normally distributed, as they were either skewed positively or negatively (see Chapter 7 for more details). The constructs were measured using a 7-point Likert scale where 1 = disagree strongly and 7 = agree strongly. The results show that the majority of participants considered what other people would think about their use of e-PROMs (*Mean = 5, SD = 1.4*) and agreed on their ability to control the

behaviour (*Mean = 5, SD = 1.4*). Moreover, the data shows that the participants had a positive attitude toward e-PROMs (*Mean = 5.4, SD = 1.2*). Finally, participants seemed to have moderately low computer anxiety (*Mean = 3.1, SD = 1.4*). Overall, the results show that the majority of participants had a positive behavioural intention toward using the technology (*Mean = 5.4, SD = 1.2*).

To compare the distribution of the study dependent variable (BI) within the two modes (i.e. postal questionnaires vs. clinic questionnaires), the Wilcoxon-Mann-Whitney test was conducted after ensuring homogeneity of the BI distribution within the two groups. The results show that the distribution of BI was not significantly different between the two modes (*z = -1.2, p = 0.22*) (see Appendix E for more details). This means that BI is not biased by the method of distribution as there were no differences in BI between the postal questionnaires and clinic questionnaires..

8.4.2 Association of the main factors with behavioural intention

The correlation between the study constructs was tested earlier in Chapter 7 to examine the discriminant validity of the measure. Here we examine the association between the TPB constructs and behavioural intention (Table 8.2).

a. Attitude and behavioural intention

The analysis showed a large positive association between attitude and behavioural intention (r_s *(230) = 0.82, p<0.001*). This finding suggests that an increase in the participants' attitude toward using e-PROMs is associated with an increase in the technology (e-PROM) acceptance.

b. Perceived behavioural control and behavioural intention

The second association investigated in this study was between perceived behavioural control and behavioural intention. The results showed a large positive association between the two variables (r_s *(230) = 0.68, p<0.001*). This means that more control over the behaviour is associated with an increasing level of e-PROM acceptance.

c. Subjective norms and behavioural intention

The relationship between subjective norms and behavioural intention was also investigated using Spearman's rho. There was a medium positive correlation between the two variables (r_s *(231) = 0.37, p< 0.001*). This means that greater patient consideration of what other people would think about his/her use of e-PROMs is associated with a greater acceptance level of e-PROMs.

d. Computer anxiety and behavioural intention

Fourth is the association tested between computer anxiety and behavioural intention. the results showed a large negative association between computer anxiety and behavioural intention (r_s *(231) = -0.64, p<0.001*). This means that low computer anxiety is associated with an increased level of e-PROM acceptance.

Table 8.2. Spearman's correlation results of the main factors and behavioural intention (N=231)

			SN	At	PBC	CA	BI
Spearman's rho	SN	Correlation Coefficient	1.000				
		Sig. (2-tailed)	.				
		N	231				
	At	Correlation Coefficient	.38**	1.000			
		Sig. (2-tailed)	.000	.			
		N	230	230			
	PBC	Correlation Coefficient	.29**	.68**	1.000		
		Sig. (2-tailed)	.000	.000	.		
		N	230	230	230		
	CA	Correlation Coefficient	-.32**	-.58**	-.58**	1.000	
		Sig. (2-tailed)	.000	.000	.000	.	
		N	231	230	230	231	
	BI	Correlation Coefficient	.37**	.820**	.68**	-.64**	1.000
		Sig. (2-tailed)	.000	.000	.000	.000	.
		N	231	230	230	231	231

Note: (**)= Correlation is significant at the 0.01 level (2-tailed). (*)= Correlation is significant at the 0.05 level (2-tailed).

e. Demographic variables and behavioural intention

In addition to the associations between the four model constructs and BI, demographic characteristics were also tested to see whether there were any associations between age, gender and education level and BI. The homogeneity of variance was tested first showing that there was no difference in the distribution of BI with the groups (see Appendix E for more details).

The results showed no significant differences between the distribution of behavioural intention within female and male participants (*z = -.310, p> 0.05*). Moreover, there was no significant differences of the BI scores for the different age groups (*H (3) = 5.4, p>0.05*), nor for the different education level categories (*H (5) = 6.8, p>0.05*) (see Appendix E for more details).

8.4.3 Analysis of the conceptual model

To analyse the conceptual model, structural equation modelling (SEM) was conducted. As discussed earlier, the model goodness-of-fit indices, produced by the SEM analysis, are important values in order to understand whether the current model actually fits the expected model. In this study, three models were tested (Table 8.3). The first model included only the TPB constructs: attitude, subjective norms and perceived behavioural

control as predictors, and behavioural intention as an outcome. The results show a ratio of chi-square to degree of freedom (χ^2/d.f.) of 2.1, comparative fit index (CFI) of 0.96, TLI of 0.95, root mean square error of approximation (RMSEA) of 0.07, and SRMR of 0.04 meaning that the study data have a good fit with the hypothesised conceptual model. Unexpectedly, the TPB model estimated around 85.8% of the variance in behavioural intention, which seems to be a very high value, as will be deliberated later in the discussion section. When looking to the influences of the three constructs, only one construct feeds directly into BI which is attitude ($\beta=0.79$, $p<0.001$) (Figure 8.1). This means that patients with a positive attitude toward e-PROMs are more likely to accept it. However, the association between perceived behavioural control ($\beta=0.14$, $p=0.36$) and subjective norms ($\beta=0.08$, $p=0.08$) with behavioural intention were not found to be significant in this study. This might suggest that TPB was not a good model for attempting to understand acceptance of e-PROMs. The implication of this will be discussed later in Chapter 9.

The second model included one additional construct to the TPB constructs: computer anxiety. The second model had a slightly better model fit than the first model. The ratio of chi-square to degree of freedom (χ^2/d.f.) was 1.9, CFI of 0.96, TLI of 0.95, RMSEA of 0.06, and SRMR of 0.04. Again, this means that the data have a good fit with the hypothesised conceptual model. The second model estimated around 87.9% of the variance in behavioural intention. In this model, two factors influenced acceptance including attitude ($\beta=0.72$, $p< 0.001$) and computer anxiety ($\beta=-0.26$, $p< 0.05$), with attitude having the larger prediction power of BI (Figure 8.2). It also showed that attitude and computer anxiety appear to have some shared variance, and the variance explained by attitude dropped by 7%. Similar to the previous model, the significance prediction of attitude means that patients with a positive attitude toward e-PROMs were more likely to accept it. In addition, the second model suggested that people with high computer anxiety would be more likely to reject e-PROMs.

The third model integrates demographic characteristics, including age, gender and education level, to the previous model. The results show the ratio of chi-square to degree of freedom (χ^2/d.f.) as being 1.9, CFI as 0.95, TLI as 0.94, RMSEA as 0.06, and SRMR as 0.07. Although this model had worse model fit values compared with the first and second model, the goodness-of-fit values still show an acceptable model fit. Moreover, the variance in BI slightly increased to 88.8%. The third model showed that there are three factors that significantly predict acceptance (Figure 8.3): attitude ($\beta=0.73$, $p <0.001$), computer anxiety ($\beta= -0.22$, $p< 0.05$) and gender ($\beta=0.062$, $p< 0.05$). Attitude is still the largest predictor compared with the other constructs, followed

by computer anxiety and then gender. It shows around 50% of the BI intention variance. In general, this finding means that patients who have a positive attitude toward using e-PROMs, and have low computer anxiety are those more likely to accept it. Although none of the demographic factors showed any association with BI when the correlation was tested in the previous section and when there was no control over the other factors, the finding from the third conceptual model shows that females are more likely to accept the technology than males.

Contrary to what was expected, the Theory of Planned Behaviour did not explain the reason behind acceptance as only attitude was found to significantly influence behavioural intention. On the other hand, the addition of computer anxiety and gender slightly improved the model fit. Although the increase with R^2 was only 0.03, or 3% of the total variance, this is 29 percent of the remaining 0.14 left to explain in the first mode (1- 0.86).

Table 8.3. Goodness-of-fit indices of three conceptual models

Fit indices	Recommended value	Model 1 (TPB)	Model 2 (TPB + CA)	Model 3 (TPB + CA + demographic factors)
χ^2/d.f.	≤3	(202.6/98)= 2.1	(268.7/142)= 1.9	(365.8/196)= 1.9
CFI	≥ 0.90 is acceptable and ≥ 0.95 is excellent	0.96	0.96	0.95
TLI	≥ 0.90 is acceptable and ≥ 0.95 is excellent	0.95	0.95	0.94
RMSEA (CI=90%)	<0.08 is acceptable and ≤0.05 is excellent	0.07 (90% CI=0.06/0.08)	0.06 (90% CI=0.05/0.07)	0.06 (90% CI=0.05/0.07)
SRMR	<0.08 is acceptable and ≤0.05 is good	0.04	0.04	0.07

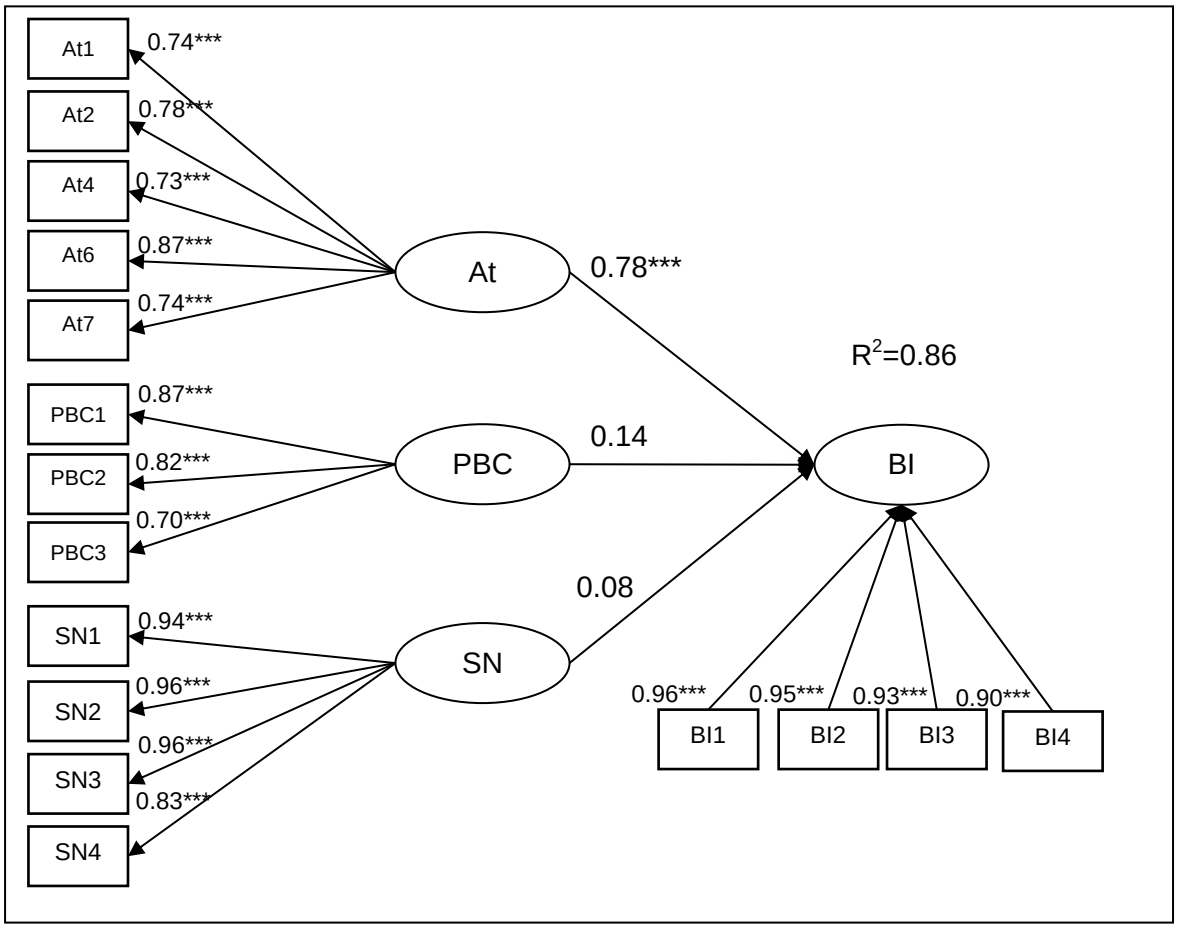

Figure 8.1. First conceptual model including TPB constructs

Note: At = attitude, CA = computer anxiety, PBC = perceived behavioural control, SN = subjective norms, EL = education level and NA = not applicable.*p < 0.05. **p < 0.01. ***p < 0.001.

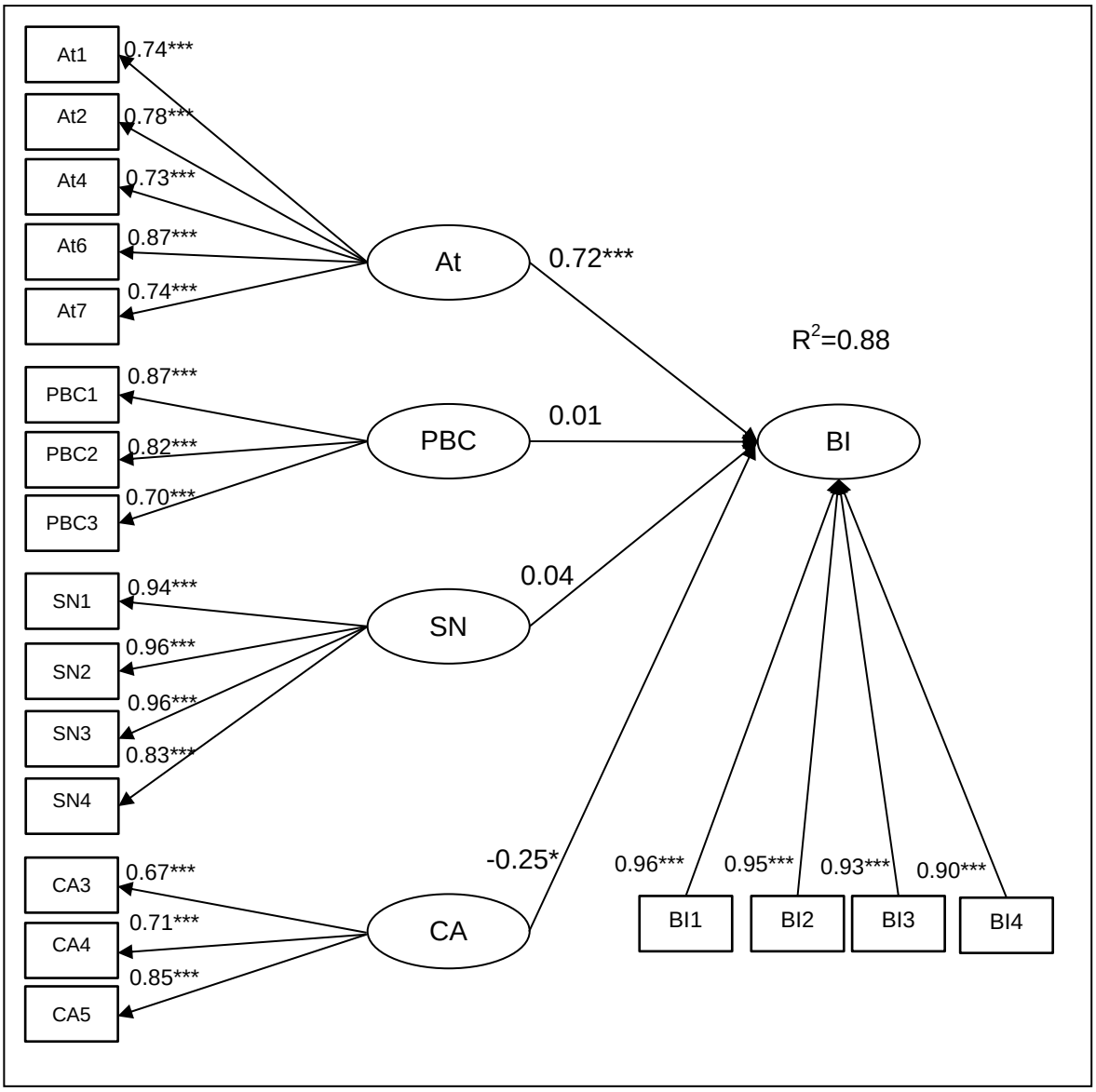

Figure 8.2. Second conceptual model including TPB constructs

Note: At = attitude, CA = computer anxiety, PBC = perceived behavioural control, SN = subjective norms, EL = education level and CA = computer anxiety. *p < 0.05. **p < 0.01. ***p < 0.001.

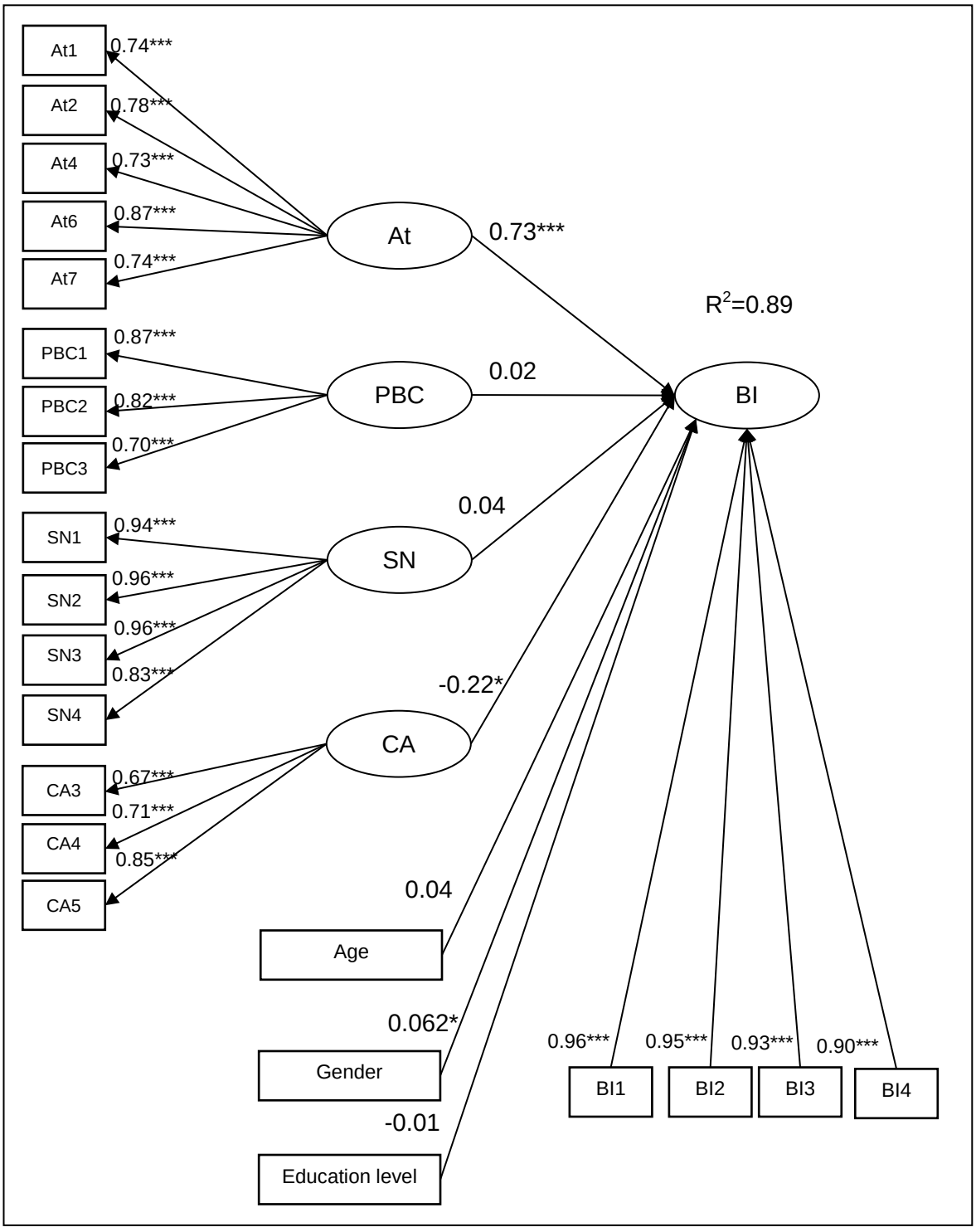

Figure 8.3. Third conceptual model including TPB constructs

Note: At = attitude, CA = computer anxiety, PBC = perceived behavioural control, SN = subjective norms, EL = education level and CA = computer anxiety. *p < 0.05. **p < 0.01. ***p < 0.001.

8.5 Discussion and conclusion

This chapter aimed to complement the previous chapter and included a second stage of data analysis. In Chapter 7, the psychometric properties of the study questionnaire were tested through interpreting the CFA part within the SEM and conducting additional analysis techniques. However, in this chapter, the regression and path analysis part of the SEM was reported and interpreted to test the conceptual model of the study, as the aim of this part of the study was to understand the different factors influencing patient acceptance toward using e-PROMs.

The study questionnaire was developed based on the Theory of Planned Behaviour (TPB) which included behavioural intention (BI) as the direct predictor of behaviour, which is by itself influenced by attitude (At), subjective norms (SN) and perceived behavioural control (PBC). In addition to the indirect association between the actual behaviour and PBC through BI, PBC directly influences the actual behaviour (Ajzen, 1985; Ajzen, 1991). This theory was used widely in the behavioural science literature and the information technology literature, where it successfully predicted behavioural intention and actual behaviour (Baker et al., 2007; Shih and Fang, 2004; Scott et al., 2007; Povey et al., 2000; Godin et al., 1992b; Schifter and Ajzen, 1985; Parker et al., 1992; Parker et al., 1995; Godin et al., 1992a; Basen-Engquist and Parcel, 1992). The questionnaire included additional factors which might also influence behavioural intention (i.e. computer anxiety and demographic characteristics). From the current study results, it appears that attitude, computer anxiety and gender were the only predictors of BI. Two of the TPB factors did not predict behavioural intention. These were subjective norms and perceived behavioural control. The reason behind this might be (1) the homogeneity of participants with regards to age group, as these two factors showed a stronger impact for elderly people (Morris and Venkatesh, 2000; Xue et al., 2012), and/or (2) item cross loading within the questionnaire, which can be tested through running exploratory factor analysis before confirmatory factor analysis (Fabrigar and Wegener, 2012). Consequently, further research is needed to confirm these findings. Chapter 9 includes a detailed discussion of the current study findings.

In addition, neither participant age nor computer education level have an influence over BI, even though it has been shown that these factors have some effects over acceptance (Czaja and Sharit, 1998; Parasuraman and Igbaria, 1990; Morris and Venkatesh, 2000; Or and Karsh, 2009). This might be due to the homogeneity of the sample (young adult where around 50% have college/certificate/diploma as higher education level), as will be discussed later in Chapter 9.

Although actual use is the main outcome of TPB, behavioural intention was used in the current study as the main dependent variable. This was due to several reasons. First, it has been shown that BI has a major influence on actual behaviour as it mediates the effect of the main TPB constructs on the actual behaviour (Ajzen, 1991). Second, the study is cross-sectional, and as measuring BI and actual use requires a longitudinal study, the use of BI as the main dependent variable instead of actual use avoids the need for retrospective analysis (Fichman, 1992; Mun et al., 2006). Finally, and most importantly, the actual use of e-PROMs within the study context has not occurred yet, making measurement of actual use of the system impossible. Although BI was the main outcome in the current study, measurement of actual use and continuing use are really important to further understand the reasons behind system rejection (Venkatesh et al., 2003; Hu et al., 1999).

8.6 Summary

1. The aim of this chapter was to understand the significant predictors of behavioural intention based on the Theory of Planned Behaviour and the additional findings from the review in Chapter 4 (i.e. computer anxiety and patient characteristics).
2. Data was collected from 231 cancer survivors at St. James's University Hospital in Leeds. Around 53% of the participants were male and 47% were female.
3. The majority (around 96%) had Internet experience.
4. When correlating the study factors and the main outcome (BI), it appears that attitude, subjective norms, perceived behavioural control and computer anxiety were significantly correlated with BI. However, none of the patient characteristics factors (i.e. age, gender, education level) correlated with the BI.
5. To understand the significant predictors of BI, an SEM analysis was conducted and three conceptual models were tested. The first model included only the TPB constructs, the second model included the TPB constructs and the computer anxiety construct, and the third model included all constructs that were in the second model and the demographic characteristics factors (i.e. age, gender, education level).
6. The data showed good model fit with the three conceptual models, however the third model was the best model in justifying the variance of BI (showing up to 88.8% of the BI variance).
7. From the findings, it appears that the only three predictors of BI were attitude, followed by computer anxiety, then gender.

8. Contrary to what was expected, TPB constructs were not able to justify the reason behind acceptance, as the prediction of BI through subjective norms and perceived behavioural control was not shown in the study findings.

CHAPTER 9. Discussion and Conclusion

9.1 Introduction

The aim of this work was to understand the factors influencing e-PROM acceptance, taking a theoretically informed approach. The empirical and theoretical literature was examined and an appropriate theoretical framework selected to understand acceptance. A generic questionnaire was then developed to measure and understand patient acceptance of e-PROMs based on the Theory of Planned Behaviour (TPB). The study was conducted in four different phases. This chapter includes a summary of the key findings of the thesis and how these link to the available literature. It also discusses the contribution of this research to the health informatics literature. In addition, it discusses the main strengths and limitations of the empirical studies developing and validating the questionnaire and for using this questionnaire to understand patient acceptance of e-PROMs. Finally, the chapter concludes with some recommendations for practice and future research.

9.1.1 Key findings of the research

The use of patient-reported outcome measures has become widespread in different healthcare contexts to report symptoms and quality of life. They have been used for clinical trials, evaluating hospital performance and more importantly in clinical practice to improve healthcare delivery (e.g. symptoms management) and to improve efficiency (Bennett et al., 2012). However, one of the key issues in using data from these PROMs has been the difficulty of transforming these paper-based PROMs into a source of instantly accessible information (Bennett et al., 2012). Now, with the availability of an alternative electronic mode, it is possible to provide wider access and develop a survey system which captures a broad range of data (Ashley et al., 2011b). Additionally, e-PROMs have several other advantages such as providing immediate access to patients who live abroad to report their health, reducing the number of errors associated with typing in results of paper-based PROMs and providing actionable links to clinical care (e.g. e-mail alerts to providers when acute needs are reported by a patient) (see Chapter 2) (Gwaltney et al., 2008; Deshpande et al., 2011; Bennett et al., 2012).

However, from the available literature, it has been shown that some patients fail to engage with the e-PROMs, but the specific obstacles to their use are not yet clear (Lohr, 2011; Greenhalgh et al., 2010a; Ashley et al., 2011a). Understanding the factors

influencing e-PROM acceptance could help save healthcare organisation resources (e.g. time and money) and identify those patients who need help in using e-PROMs to increase the system use in the future. Thus, this research aimed to fill this literature gap and to measure and understand e-PROM acceptance.

As explained in Chapter 2, technology acceptance can be measured in three stages (pre-implementation, post-implementation use and continuing use of the technology) (Venkatesh et al., 2003). Although measuring acceptance before implementation does not include any evidence of actual use, it can increase the chance of system success (Davis and Venkatesh, 2004). But, this should be followed by studying the acceptance in early and continuing use after system implementation. In the current study context, actual use of the e-PROMs has not occurred yet, so the research presented in this thesis focuses on understanding the barriers influencing pre-implementation acceptance using a cross-sectional study design. However, further research is still needed to understand e-PROM actual use.

Studies of acceptance can be conducted theoretically or empirically. Combining these two methods is more powerful as it helps to ensure that the factors reported by the theory are in fact reflected in the empirical findings and therefore convey far more information than when using one method alone (Streiner and Norman, 2008). Thus, the current study applied both methods to understand e-PROM acceptance.

There are different behavioural theories in the psycho-social and information technology literature that can be used to facilitate our understanding of patient acceptance and actual use, e.g. Technology Acceptance Model (TAM), Theory of Reasoned Action (TRA) and Theory of Planned Behaviour (TPB). The majority of these theories explain that behavioural intention (BI) is the main predictor of actual behaviour. BI is defined as the "*behavioural plans that ... enable attainment of a behavioural goal*" (Ajzen, 1996). So, based on this definition, BI could be used to measure pre-implementation acceptance, as this is also about the individual plans for using the technology (Or et al., 2011; Venkatesh et al., 2003; Shroff et al., 2011; Agarwal et al., 2013; Tzeng, 2010; Foy et al., 2007). Thus, BI was used in the current study to measure e-PROM pre-implementation acceptance (see Chapter 2 for more details).

To understand e-PROM acceptance theoretically, it was important first to investigate whether a valid and reliable questionnaire is available in the literature and to investigate the most appropriate theory for measuring e-PROM acceptance. A review of the theoretically informed questionnaires tested and an assessment of their reliability and validity was presented in Chapter 3. The chapter also contained an assessment of

the response rate within the reviewed studies and analysed the main predictors of response. The review concluded that although there were 34 questionnaires measuring consumer health information-technology acceptance and use, none of them was appropriate for use for the current study purpose (i.e. understanding e-PROM acceptance). This is because the questionnaires were inaccessible or very context-relevant. Thus, there was a need to develop a new questionnaire. In Chapter 4, a further review was presented of the available theories that could predict acceptance and actual use. This review identified 13 theories that have been used to understand information technology acceptance. The majority of the studies in health informatics literature use TAM as a theoretical framework to measure patient acceptance of consumer health information technologies. However, following Taylor and Todd's (1995a) criteria, the review suggested that the best theory to predict acceptance in the e-PROM context was the Theory of Planned Behaviour. This is because (1) TPB is a user-based theory that explores the influence of BI over the actual behaviour, (2) it was developed to understand non-volitional behaviour such as the use of e-PROMs where the individual has no control over the behaviour, (3) it is a parsimonious theory, (4) it is appropriate to measure patient acceptance as it does not include any factor relevant to another context (e.g. job fit) and (5) it has been validated widely and in different contexts (see Chapter 4 for more details). In addition, factors such as computer anxiety and patient characteristics were expected to influence e-PROM acceptance, as mentioned by patients in empirical studies (Olmsted et al., 2006; Basch et al., 2007; Rolfson et al., 2011; Andikyan et al., 2012; Bennett et al., 2012; Ashley et al., 2013; Salaffi et al., 2013). Thus, the study questionnaire needed to include some other items to measure these factors, as well as the TPB factors.

The development of the study questionnaire was conducted in three main phases. The first phase was to design the first draft of the study questionnaire based on available guidelines (Rattray and Jones, 2007; Streiner and Norman, 2008). This phase concluded with a draft questionnaire consisting of thirty-five items used to measure five constructs (behavioural intention, attitude, subjective norms, perceived behavioural control and computer anxiety), in addition to general questions including demographic characteristics and Internet experience. The second phase tested the face and content validity of the developed questionnaire. The results of this phase showed that some items have issue with clarity, relevancy or/and response options. This phase concluded with a shortened revised version of the study questionnaire. The third phase investigated the construct validity and the reliability of the study questionnaire through field-testing. The analysis indicated that there were issues with construct validity and

reliability. Removal of the items with weak estimation power helped to improve the validity and reliability. The final version revealed good construct validity and good internal consistency reliability. The positive results for the validity and reliability of the questionnaire was consistent with DeVellis (2011), who acknowledged that development of a questionnaire based on a theoretical framework would increase its validity and reliability.

Analysis of the data to test the questionnaire in the third phase using Structural Equation Modelling (SEM) provided more information about testing the conceptual framework. This helped to understand the factors influencing e-PROM pre-implementation acceptance in the study context. The majority of participants reported a positive behavioural intention toward using e-PROMs. They had moderately low computer anxiety and a positive attitude toward using e-PROMs. In addition, most agreed on their ability to control their behaviour (i.e. using e-PROMs) and took into consideration what other people think (including the clinical staff).

Based on the TPB, it was expected that attitude, subjective norms and perceived behavioural control would be predictors of e-PROM acceptance. Moreover, from the empirical studies, it was proposed that computer anxiety and patient characteristics (i.e. age, gender and education level) could also influence acceptance. However, the findings revealed that the only significant predictors were attitude (explained around 50% of BI variance), followed by computer anxiety (explained around 5% of BI variance) then gender (explained around 0.4% of BI variance). This mean the patients with positive attitude and low computer anxiety are more likely accepting the e-PROMs. In addition, the results revealed that females are also more likely accepting the e-PROMs comparing to males. TPB alone was able to predict 85.6% of the acceptance variance. However, when computer anxiety and patient characteristics factors were added, the model predicted up to 89% of the acceptance variance. The high prediction power of behavioural intention has been shown previously in the information technology context (Venkatesh et al., 2003). However, the main cause of this high prediction could be the low variability in the BI (more details will be shown in Section 9.3.2).

9.2 Contribution of this research to the Health Informatics field

This study addresses the following gaps in health informatics including: (1) The study was conducted to understand the main barriers towards e-PROM acceptance and use based on a theoretical framework, as there was no previous study in the worldwide

literature to investigate this issue, (2) The questionnaire was developed to evaluate patient acceptance of e-PROMs where there was no questionnaire available for this purpose, (3) The selection of the theoretical framework was systematic and informed by empirical findings of the patients' experience with e-PROMs, (4) The study includes the detailed process of the questionnaire development and validation and does not only focus on the questionnaire demonstration and (5) The study includes detail on the process of the pre-testing phase to evaluate face and content validity through an expert review method and cognitive interviews.

9.2.1 Practical implications

a. Factors influencing e-PROM acceptance

Although the majority of participants said they would accept the technology, the aim of this study was to understand the factors influencing the acceptance of e-PROMs. When a correlation analysis was conducted between the main factors and the study outcome (i.e. behavioural intention), the three TPB constructs (i.e. attitude, subjective norms and perceived behavioural control) and computer anxiety had medium to large correlations with the main study outcome. This means that higher positive attitude, higher influence by the healthcare team, higher perceived control over e-PROM use and lower computer anxiety are all associated with higher intention toward using e-PROMs. On the other hand, none of the three demographic factors (i.e. age, gender and education level) were associated with the study outcome, although the results from the participants' preference question showed that older participants were less likely to prefer using e-PROMs. However, as there was no balanced distribution of the sample by age (the majority were young adults), this result might be biased and further investigation is needed. Even though correlations between some factors and the study outcome are shown, this does not show causality (Field, 2007). Consequently, further analysis was conducted to understand the ability of these factors to predict the main outcome.

Analysis of the study data using SEM explained the prediction power of the study factors. Three conceptual models were tested here. The first model included the TPB constructs, the second model added the computer anxiety factor to the first model and the third model added the demographic factors, age, gender and education level, to the second model. Of the three models tested, the third model showed the highest prediction power of behavioural intention; around 89% of the BI variance was identified. Although studies in behavioural science do not tend to predict such high variances, many studies within the information technologies have reported similarly high variances

of BI (Venkatesh et al., 2003; Xue et al., 2012). In the current study, the impressive variance of behavioural intention could be due to the distribution of the BI scale. As the BI scale is negatively skewed and has low variability, the variance shown was only for those with positive behavioural intention. Consequently, it is expected that this low variability of the outcome will be accompanied by a very high R^2 value (Frost, 2013). However, this means that our results do not help us to understand the reason behind e-PROM acceptance for the patients who have a negative behavioural intention toward using e-PROM. Consequently, further research is needed to validate the study model within a more heterogeneous sample (e.g. wider range of age groups) which would generate increased variability of the BI toward using e-PROMs.

In the third model, the only significant and direct predictors of BI were attitude, followed by computer anxiety, then by participant gender. Attitude and BI with respect to e-PROMs were directly and positively associated, which means that patients who believe in the importance and the benefits of e-PROMs and have positive attitudes toward using e-PROMs are more likely to accept them. Indeed, the model revealed that attitude is the strongest predictor of e-PROMs compared with computer anxiety and participant gender. This finding is consistent with previous findings in the information technology literature that identified attitude as the strongest predictor of BI (Shih and Fang, 2004; Yousafzai et al., 2010; Taylor and Todd, 1995a; Daim et al., 2013). In fact, the high association between attitude and BI was reported also in the behavioural science literature (Ghahremani et al., 2012; Thirlaway and Upton, 2009; Arnold et al., 2006; Hasbullah et al., 2014; Nejad et al., 2005). However, when computer anxiety was integrated within the model, the variance explained by attitude slightly reduced. This means that there is some shared variance between attitude and computer anxiety due to correlation with each other. The individuals with a more positive attitude toward using e-PROMs are the same individuals with lower computer anxiety. Consequently, it can be inferred that addressing people's anxiety toward these technologies might improve the individual's attitude and then increase the level of acceptance.

The fact that attitude is the strongest influential factor needs careful attention. It has been shown that attitude has a social function as people influence each other's attitude by encouraging or discouraging others through interactions (Yang and Yoo, 2004). Although subjective norms has no influence over BI in this study, justifying the advantages and the importance of e-PROM use for those who live around the patient would have a positive impact on patient's attitude. Second, the association between attitude and behaviour is influenced by the strength of the attitude (i.e. a stronger attitude might predict behaviour better than a weaker attitude), and the nature of the

behaviour (e.g. uncontrollable behaviour if there is no alternative or people are under threat, where they would show that behaviour even if they had low enthusiasm) (Breckler et al., 2005). Thus, the high association between attitude and BI does not necessarily mean a high association with the behaviour, especially because this behaviour (i.e. e-PROM use) is not under the complete control of the users as it initiated by the clinician.

Although computer anxiety was not part of the TPB, adding this construct improved the predictive power of the model. In addition to the shared variance with attitude, computer anxiety and BI with respect to e-PROMs were directly and negatively associated. This means that people with high computer anxiety are more likely to reject the technology. The direct influence of computer anxiety over behavioural intention is consistent with the findings of Yang et al. (2006). However, it contradicts previous research showed computer anxiety as having no direct association with BI, rather they were associated indirectly (Chang and Im, 2014; Xue et al., 2012). This contradictory finding could be due to the theoretical framework used. Xue et al. (2012) and Chang and Im (2014) used the Technology Acceptance Model (TAM), which assumes that BI is influenced by two factors: perceived ease of use and perceived usefulness. Then, the influence of computer anxiety was over the beliefs of these two main factors.

Previously, computer anxiety was assumed to be an age-specific factor (i.e. older people demonstrated more anxiety than younger people) (Xue et al., 2012; Laguna and Babcock, 1997). However, contrary to what was expected, these results showed that younger people also reported some computer anxiety, despite their interaction with the Internet. Consequently, we cannot assume that the issue of high computer anxiety is confined to the older population, younger people may also reject technology because of high computer anxiety and fears of using the technology, which was consistent with the findings of Yang et al. (2006). One solution to reduce the level of anxiety would be for clinicians to offer training sessions and provide some system support (Bennett et al., 2012). The advantage of providing help was acknowledged in a previous study that demonstrated that elderly patients with limited computer skills can use consumer health information technologies when there are sufficient instructions provided on how to use the technology (Evangelista et al., 2006). Indeed, it has been shown that adequate training and availability of support is considered a reason to lead patients to accept such technology (Or and Karsh, 2009). Even though the provision of training for patients will have upfront costs, electronic formats for PROMs are more economical, both in terms of time and resources, compared with paper formats, especially if these measures need to be collected repeatedly (Smith et al., 2014; Zbrozek et al., 2013;

Bennett et al., 2012; Chang et al., 2014; Coons, 2013; Holzner et al., 2012; Ashley et al., 2011b). Consequently, the offer of training and system support maybe beneficial and should increase e-PROM use, although the cost effectiveness of such training would need to be considered on a case by case basis.

The third factor influencing BI in this study was participant gender. This factor also improved the predictive power of the tested model. Participant gender and BI with respect to e-PROMs were positively and significantly associated, which means females are more likely to accept e-PROMs. This is consistent with a previous study where it was found that females more frequently use web-based communication systems than males (Hassol et al., 2004). Indeed, females are more concerned about their health than males (Radius et al., 1980). However, previous research has also shown that females are more prone to socially desirable responses (Bernardi, 2006). Put another way, females are more likely to over-report behaviour they view as being favourable or socially accepted than males. So we cannot determine if this effect is real, or an artefact of gendered forms of responding. However, as the addition of gender added very little to the variance and it is impossible to change, this finding is not as important as the findings relating to the other factors in the theory. But, it still useful to highlight for clinical practice, as if females are more likely to accept a technology, clinicians may need to target more training towards men.

In contrast, in this study, neither patient age or education level had any influence on BI, although the influence of these factors has been shown in previous studies (Czaja and Sharit, 1998; Parasuraman and Igbaria, 1990; Morris and Venkatesh, 2000; Or and Karsh, 2009). This could be due to the relatively narrow age range and the educational distribution of the study sample. Participants were all adults below 54 years of age. Moreover, around 50% of the participants were between 18 and 24 and around 50% had college/certificate/diploma as their higher education level.

This study also examined participant preferences toward having an option between paper and electronic PROMs and whether they would prefer to use e-PROMs rather than paper PROMs. Previous literature has shown that resistance to change is a critical issue hindering the implementation and use of new information technologies (Gibson, 2004; Kim and Kankanhalli, 2009; Lapointe and Rivard, 2005). Even so, the finding that 77% of the quite young participants preferred access to both systems at the same time was unexpected. Similarly, the high percentage (44%) of people who rejected e-PROMs and were unsure whether they preferred this system over the traditional paper method was consistent with the findings of Ashley et al. (2011a), who showed that only

some cancer survivors were interested in using e-PROMs. As a search of the literature revealed no studies that aimed to investigate the reason for e-PROM rejection, this finding also supported the need for the current study to understand the reasons behind the rejection of e-PROMs.

b. Usefulness of e-PROM acceptance questionnaire

The literature highlighted the need to understand theoretically the factors influencing patient acceptance toward using CHITs, to optimise new system use and to increase the chance of system success (Or and Karsh, 2009). The new questionnaire has great potential as it helps measure the main predictors of acceptance and actual use. As shown earlier, it was able to show 89% of the BI variance. This questionnaire was developed and tested in the United Kingdom, and no other questionnaires were found that have been developed to measure patient acceptance of CHITs in an NHS population. All existing measures identified in the literature were developed to understand a specific technology or a type of CHIT, but not e-PROMs. The questionnaire developed here was designed to be a generic measure to understand the acceptance of e-PROMs within any context.

This questionnaire can help clinicians understand which patients might be likely to use e-PROMs in the future. It can also help to show the reasons behind rejection and may guide clinicians to find ways to optimise the system use. Decision makers and information technology staff could also use this questionnaire to establish the feasibility of e-PROM implementation before actual implementation work begins. Furthermore, they can also use this questionnaire to understand the barriers to use after e-PROM implementation.

9.2.2 Theoretical implications

As shown earlier, the literature has employed a range of theories to understand IT and CHIT acceptance. The current study applied TPB as the theoretical framework to measures BI. Although attitude was predictive, the model in this context did not do well with the other two constructs. Contrary to what was expected, subjective norms and perceived behavioural control had no significant influence over BI in this study. Subjective norms relates to what the patient thinks the clinical team (including GPs, nurses, doctors and hospital administrative staff) would want them to do, and the patients' motivation to comply with these beliefs in terms of e-PROM use. Consistent with findings from Or et al. (2011), the study participants were not influenced by peer pressure. Absence of the influence of subjective norms could be because of the

participant ages, as both studies, the current study and the one by Or et al. (2011), were conducted in the younger population. A contrasting result was found when the acceptance was measured in an elderly population, where was a direct effect of subjective norms on behavioural intention (Xue et al., 2012). So, testing this model in a wider age group is necessary to test the robustness of this finding.

Perceived behavioural control (PBC), as defined by Ajzen (1991), is "*the perceived ease or difficulty of performing the behaviour*". In TPB, it has been shown that PBC is a direct predictor for both BI and actual behaviour (Ajzen, 1991). However, our results showed no direct influence of PBC over BI, which was again consistent with the results of Or et al. (2011). Similar to subjective norms, PBC has been shown to be a stronger predictor of behaviour in older people compared with younger users (Morris and Venkatesh, 2000). Age may be the reason behind the absence of an association between PBC and BI in the current study and that by Or et al. (2011). As explained earlier, TPB proposed there to be a direct effect of PBC over the use of technology. This association was shown in different studies (Terry and O'Leary, 1995; Venkatesh et al., 2003). However, as the system has not been implemented yet, measurement of actual use within the current study was impossible. Consequently, TPB has not been tested fully in the current study. An important part of the model needs to be tested in follow-up research, which considers the association of these factors with the actual use of the system. As explained earlier in this thesis, measurement of early acceptance is not enough to increase the chance of system success, rather a researcher needs to study the actual and continuing use of the system (Venkatesh et al., 2003; Hu et al., 1999). The influence of these factors might change at each stage (Venkatesh et al., 2003). So, it is worth knowing the most crucial factor influencing each stage to motivate patients to use the system and studying the pre-implementation adoption is the first step.

The homogeneity of the sample studied may have affected the findings of the present study. This is because attitude and what drives the behaviour of older people and those with no prior experience with the Internet might be very different to younger people and those with internet experience. Older people have very different characteristics to younger people, as they are more likely to have computer anxiety, lower efficacy and lower control over technologies (Czaja et al., 2006; Fisk and Rogers, 2001; Rogers et al., 1998; Wild et al., 2012). Consequently, what hinders their use of the system may be different. The differences in the main drivers of behaviour, with regards to age differences, have been discussed previously in the psychology and information technology literature (Zhang et al., 1998; Nigg et al., 2009; Venkatesh and Morris,

2000). So, further research is needed to understand what drives the use of e-PROMs within a wider age range.

On the other hand, prior experience has been considered a characteristic differentiating those who may accept or reject a technology in different studies (Igbaria et al., 1989; Zmud, 1979; Chang and Im, 2014). It was shown that past experience of using a similar technology greatly influences the individual is attitude towards using new technology (Dickerson and Gentry, 1983; Dabholkar, 1992; Lu et al., 2003). Consequently, as use of the Internet is similar to the use of e-PROMs, experience with Internet use is considered in this study as a characteristic that could drive the use of e-PROMs. Additionally, empirical evidence has shown that Internet experience moderates the association between subjective norms and behaviour (Karahanna et al., 1999). With the increased level of experience, the subjective norms become less important. As there were only 10 participants out of 231 without Internet experience, it was difficult to gain a good understanding of the beliefs of the non-Internet user group. Consequently, there is also a need to understand what drives the use of e-PROMs for people with no previous Internet experience in a follow-up research project.

From the previous discussion, it appears that TPB constructs were not good enough to justify the reason behind acceptance, although TPB was shown to be a very good fit with the data. This could be due to the homogeneity of the sample, as discussed earlier. Also, it could be due to the high correlations between the TPB constructs that predict BI. This means that these constructs have quite large amounts of shared variance, which might be due to the items cross-loading between the constructs (Fabrigar and Wegener, 2012). Although we were able to show the discrimination between the constructs in the previous chapter, the use of exploratory factor analysis (EFA) would help to ensure the unique loading of each item per construct (Fabrigar and Wegener, 2012; Field, 2007; Reis and Judd, 2014). Running EFA to understand the nature of item loading between the constructs might suggest different modifications than those suggested by the CFA. However, to conduct both EFA and CFA a minimum of 400 participants would be needed, as these need to be split into two groups to run these tests independently (Reis and Judd, 2014). The limitation of recruiting a large enough sample to conducted both EFA and CFA obstructed the possibility to check the nature of item loading across the constructs through EFA. Consequently, it is considered a study limitation that needs to be improved in future research.

In Chapter 3, it was found that the technology acceptance model (TAM) largely dominates the literature base of CHIT acceptance. The findings of the current study

help us to understand the reason for TAM's success. Both TAM constructs, perceived usefulness and perceived ease of use, salient beliefs of attitude in TAM, by itself showed the largest effect size in this study over BI (Davis, 1985; Davis, 1989). However, the decision not to use TAM in the current study is because clinicians were more interested in understanding patient's beliefs rather than technical problems. Additionally, TAM was developed to study volitional behaviour.

Adding the factor computer anxiety reduced the variance explained by attitude over BI. The practical implication of this result was discussed in the previous section. However, this also has a theoretical implication. The current theory tested the direct influence of computer anxiety over BI as concluded from reviewing the empirical studies (Cook et al., 2004; Wilson et al., 2002). The finding was consistent with the findings of Lai et al. (2008), when a direct association between computer anxiety and BI was shown. But, the reduction of the attitude predictive power might suggest that computer anxiety has an indirect influence on BI through attitude. To put it another way, computer anxiety could be an antecedent factor to attitude. The indirect influence of this factor over BI through attitude was shown in previous research studying acceptance of technology (Davis et al., 1992; Igbaria et al., 1994).

9.2.3 Methodological implications

The work accomplished in this thesis is a significant addition to the health informatics field as it has emphasised the need for measurement studies. The methodologies used in this research provide guidelines for further research in this area. This includes the method of recruiting participants, the methods of questionnaire design, the methods of testing questionnaire validity and reliability and the method of testing the conceptual model. Within the study, it was difficult to survey all of the cancer survivors in the clinic as some of them had telephone consultations. The strategy of distributing the survey through mail attached with the appointment letter via the clinic secretary was helpful. The response rate from the telephone clinic was very low, but with the help of nurses reminding patients in the telephone consultation, the response rate was increased. Additionally, the use of the available guidelines for questionnaire development help to minimise some types of questionnaire bias (i.e. systematic bias) which is associated with poorly designed questionnaires. Also, the use of SEM is recommended to provide results for construct validity and the conceptual model of the factors influencing CHIT acceptance.

9.3 Research strengths and limitations

In this section, the overall strength, internal and external study limitations with regards to the validity and generalisability of the results are discussed.

9.3.1 Research strengths

This study developed a new generic questionnaire to understand e-PROM acceptance, and is the first health informatics study that has been explicit in the development and testing of this type of questionnaire. As shown earlier, this process was conducted in three different phases, and included qualitative and quantitative methods. Questionnaire validity and reliability are important to ensure that the developed questionnaire is measuring what it is intended to measure. The research combined two methodological approaches to develop and validate this measure. These included qualitative and quantitative methods (i.e. psychometric assessment of the study questionnaire). This approach worked well in improving the study questionnaire and generating a valid and reliable questionnaire at the end. Using different qualitative methods (i.e. expert review and cognitive interview) to test face and content validity highlighted more issues with the questionnaire, as recommended by Streiner and Norman (2008). On the other hand, testing questionnaire construct validity (including discriminant validity) is important as this highlights the items that have an issue with regards to their relevance to the constructs and notes whether there is a shared variance between different constructs. The results help in deleting the items with issues, which then improves the data fit with the conceptual model.

9.3.2 Research limitations

9.3.2.1 Internal validity issues

Sample size is one of the limitations in this study. Although there were 231 responses, a greater sample size would provide a more stable model. Moreover, it has been recommended that if the confirmatory factor analysis (CFA) results do not show good model fit, exploratory factor analysis (EFA) can be performed to understand the nature of relationship between items and constructs (Suhr, 2006). However, running EFA would have required a second group of participants with a sample size greater than 200. If the sample size had been large enough, it would have been possible to split the data into two data sets and run the two tests: EFA and CFA. However, in this research the model fit was improved by deleting items with low estimation power from the first CFA test, and testing the model fit again using another round of CFA.

Another limitation involved the difficulty in measuring actual use of the e-PROMs. The study attempts to measure behavioural intention as pre-implementation acceptance, and its association with the attitude, subjective norms, perceived behavioural control, computer anxiety and socio-demographic factors. The association between pre-implementation acceptance and actual use has not been tested. A strength of the study is that data were collected to link participant responses on the questionnaire and their behaviour (use or not use the technology) using a linkage code. As implementation of the system has not occurred yet, (which obstructed measurement of actual use), the study collected data which can be used post-implementation to measure the actual use and to understand the association between behavioural intention and actual use.

Within surveys, social desirability bias is a concern that can influence the study findings (Nederhof, 1985). Social desirability bias refers to "*the tendency of an individual to convey an image in keeping with social norms and to avoid criticism in a 'testing' situation*" (Hebert et al., 1995, p389). Although the study put in place steps to reduce socially desirable responding, such as the use of anonymised questionnaires, the study context and the way data were collected in a clinic, might still encourage this type of error. So this is a study limitation. A worthwhile addition to a future study to overcome this problem would be to incorporate more than one data source, such as collecting more data using postal questionnaires, in addition to the data collected in clinic.

In addition to the previous limitations, contamination might also threaten the internal validity of the questionnaire results as some of the questionnaires were collected in the clinic while participants were waiting for the physician consultation. Contamination occurs when information about the study is communicated between participants (Shaughnessy et al., 2011). So, they might influence each other's responses. This kind of effect can b controlled by recruiting one participant per day per clinic. However, there were no significant differences on BI scores between those who responded in clinic and those who responded from home, suggesting that there was little contamination of this type.

9.3.2.2 External validity issues

In addition to the internal limitations, there are also external limitations that could influence the generalisability of the study finding. Although the sample size was discussed as an internal limitation for the validity of the questionnaire, it is also an external limitation. The homogeneity of the participants (young adults) and the setting for recruitment are limitations. It has been shown that the homogeneity of the sample, with regards to age and Internet experience might bias the findings in this study (see

discussion sections of Chapter 7 and Chapter 8). Moreover, recruitment of the whole sample from one site (e.g. one clinic in one city during one year) also limits participant variability and affects the generalisability of the developed e-PROM acceptance questionnaire. In fact, this low variability can generate selection bias issues which can occur when the selection of participants leads to a result that is different from what the researcher would have found if the whole population or a random sample had been enrolled (Cortes et al., 2008). Consequently, more validation work should be carried out to test the questionnaire in different populations (e.g. older age groups), different contexts, and widely diverse cultures. However, this was beyond the scope of this PhD study and should be addressed in further research.

The majority of the participants reported positive behavioural intention. As the majority were young adults with Internet experience, they might have been more motivated and concerned towards the use of electronic devices. However, although the questionnaire distributed in the clinic had a high response rate (83%), the mail distributed survey had a significantly lower response rate, and it is not known how many people chose not to take part, or the characteristics of those groups (participants and non-participants). It is also important to remember that there was difficulty in accessing the demographic characteristics for those who did not participate in the study. Thus, volunteer bias might threaten the generalisability of the study results (Krishna et al., 2010; Jordan et al., 2013).

9.4 Direction for future research

For further research, this study could be developed further to investigate two main areas: further psychometric testing and demonstration of the study questionnaire.

9.4.1 Further psychometric testing

As discussed earlier in the limitations section, the e-PROM acceptance questionnaire was tested in young adults recruited from one clinic and the majority had Internet experience. Thus, it is still necessary to test it with a wider age group, in different contexts and to include those with no prior experience with the Internet to check whether the psychometric findings were robust. This wider testing will then test the generalisability of the study finding.

Although the current study questionnaire showed good construct validity and reliability results, further validation work needs to be conducted. The limitation in measuring the test-retest reliability reveals that there is currently no evidence demonstrating the

stability (test-retest reliability) of the study questionnaire (Streiner and Norman, 2008). Furthermore, testing of criterion validity would confirm how well this questionnaire measures the study outcome (Streiner and Norman, 2008; Friedman and Wyatt, 2006). Consequently, further steps need to be taken in validating the study questionnaire through conducting test-retest reliability and criterion validity.

In addition to the previous gaps, the current research applied CFA as the analysis technique to refine the number of items and remove those with weak estimation power for the relevant construct (Maruyama, 1997; Suhr, 2006). This technique was selected because there was moderate sample size and because the questionnaire used was informed by a theoretical framework (Suhr, 2006). However, as discussed earlier in this chapter, it would be better if EFA had been conducted first. This is because EFA would provide insight into the items that have cross-loading (load into more than one construct). Removal of those items first is a better way to reduce the number of items and improve the construct validity of the questionnaire (Rummel, 1988). Consequently, further research is needed with more participants to test the questionnaire items using EFA, then to confirm item association with the constructs using CFA.

It is highly recommended to use the full-version questionnaire for the future psychometric testing. This will give researchers chance to compare their findings with the current study findings. Moreover, running EFA before CFA might generate different results than those found here in this study. It is also suggested to have a trial version of the e-PROMs in clinic, so patients can know what type of software is the e-PROMs.

9.4.2 Further questionnaire use

Use of the e-PROM acceptance questionnaire tested the conceptual framework (TPB and the additional factors, including computer anxiety and demographic factors). This conceptual model needs to be tested in other contexts, including different clinical settings, different countries, for different applications of e-PROMs, and with more heterogynous group of participants (especially a wider range of ages) to check whether the findings are robust.

Another literature gap was seen in the effect of demographic characteristics. The current study tested the direct association of these factors (i.e. age, gender and education level) with behavioural intention. However, further research could test these factors as moderators, rather than main predictors and measure the model fit between the groups (e.g. female vs. male), as this does not appear to have been considered in the literature.

It is important to understand the factors behind actual use of e-PROMs and to test the TPB association between BI and PBC with the actual use. Thus, future research is needed on this. This should not be limited to whether the patient uses or does not use e-PROMs once, but also should include their continuing use of e-PROMs over a period of time.

9.5 Conclusion

A better understanding of CHIT acceptance is needed to increase the chance of system success (Or and Karsh, 2009). Different questionnaires are available to help us understand the reason behind the acceptance and use of different types of CHITs. Yet, none of these questionnaires were adequate to be used within the e-PROM context. Consequently, this research aimed to develop and validate a questionnaire to measure e-PROM acceptance. The work contained in this thesis provides detailed information relating to measuring questionnaire validity and reliability. The questionnaire passed through three different phases and was refined to ensure adequate validity and reliability. Then, this valid and reliable questionnaire was used to understand cancer survivor e-PROM acceptance. The results showed that the theoretical framework behind this questionnaire was able to predict 89% of behavioural intention. However, the only predictors were attitude, followed by computer anxiety then age. Female patients with positive attitude and low computer anxiety are more likely going to use the e-PROMs. So, clinician needs to encourage their male patient to use the e-PROMs and to train them to reduce the computer anxiety. The developed questionnaire should now be further validated and tested in other contexts.

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APPENDIX A. First Literature Review Supplementary Documents

A.1 Methods supplementary documents

A.1.1 Inclusion exclusion criteria

The following tables explains the literature searching process (Table A.1 and Table A.2).

Table A.1. Databases search

Web of knowledge (limited to English language only)	Number of records identified = 1,275	Number of records saved after title search = 99	Number of records saved after abstract search = 42	Number of records saved after full text search = 14
Web of science (1900-present)	**1,275 (**refined by publication date 1990 to date and research domains)	**87**	**38**	**14** (16 duplicated articles with Ovid search, 10 not relevant based on criteria and 2 were abstract only)
Medline – (1950—present)		**12**	**4**	

Table A.2. Ovid database review results

Medline database (limited to English language only)	No. of records identified	No. of records identified (No duplicates) = 784	No. of records saved after title search = 74	No. of records saved after abstract search = 52	No. of records saved after full text search = 20
AMED (Allied and Complementary Medicine) <1985 to October 2014>	943	0	0	0	**20** (5 duplicated articles, 24 not relevant based on the inclusion/exclusion criteria and 4 were abstract only as they are presented for a conference or for a degree thesis)
BIOSIS Previews <1969 to 2014 Week 48>		7	4	1	
EBM Reviews - Cochrane Database of Systematic Reviews <2005 to September 2014>		48	2	0	
EBM Reviews - ACP Journal Club <1991 to October 2014>		0	0	0	
EBM Reviews - Database of Abstracts of Reviews of Effects <3rd Quarter 2014>		1	0	0	
EBM Reviews - Cochrane Central Register of Controlled Trials <September 2014>		4	0	0	
EBM Reviews - Cochrane Methodology Register <3rd Quarter 2012>		0	0	0	
EBM Reviews - Health Technology Assessment <3rd Quarter 2014> (0)		0	0	0	
EBM Reviews - NHS Economic Evaluation Database <3rd Quarter 2014> (		0	0	0	
Embase <1996 to 2014 Week 43>		148	44	33	
Global Health <1973 to 2014 Week 43>		5	0	0	

HMIC Health Management Information Consortium <1983 - present> (		6	2	0	
Ovid MEDLINE(R) <1996 to October Week 4 2014>		4	2	2	
Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations <October 30, 2014>		17	9	9	
PsycARTICLES Full Text		464	2	0	
PsycINFO <2002 to October Week 5 2014>		80	9	7	

A.1.2 Data extraction forms

Table A.3. The first data extraction form

No.	Study	Population	N	Responses (Response rate)	Mean age	Type of CHITs	Generalis-ability level	Questionnaire reliability and validity	Number of items	Implementation mode	Place	Follow-up reminder?	Theoretical framework	Country

Table A.4. The second data extraction form

No.	Study	Population	Questionnaire reliability and validity	N	Reliability		Construct validation		Content validity
					Internal consistency	Test-retest	Convergent	Discriminant	

A.2 Results supplementary documents

A.2.1 Normality of the response rate

Table A.5 and Figure A.1 explain the normality test for response rate.

Table A.5. Descriptive results for response rates

N		Mean	Median	Mode	S.D	Variance	Skewness	Std. E of skew.	Kurtosis	Std. E of Kurtosis	Min	Max	Percentiles 100
Valid	Missing												
30	4	70.03	73.32	100	29.56	873.8	-.66	.43	-.65	.83	9	100	100

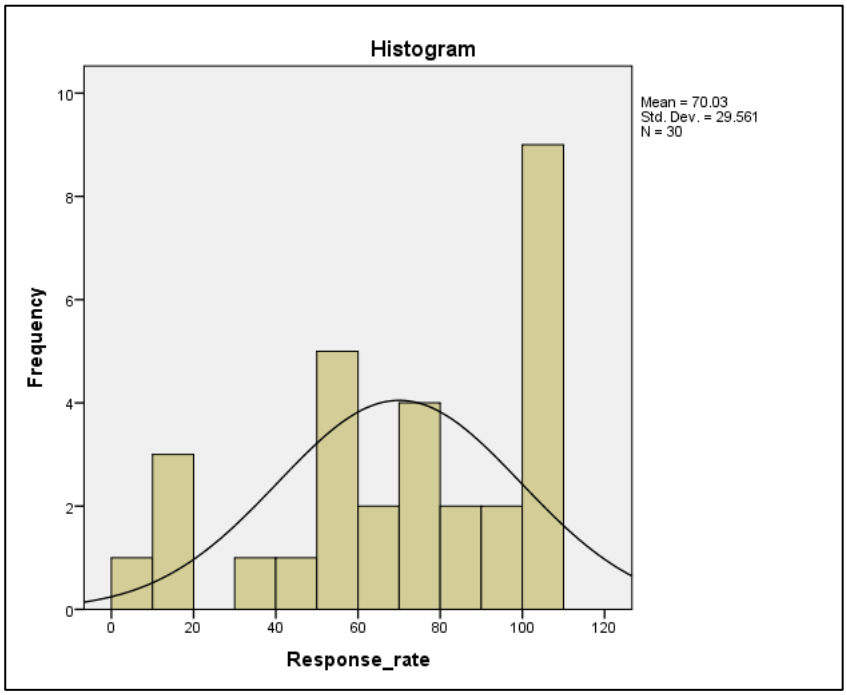

Figure A.1. Histogram and normality curve of the response rates

A.2.2 . Independent t-test results

Results from the Independent t-test analysis are shown in the following tables.

Table A.6. Independent sample t-test to test the association between response rate and the availability of reminder

Reminder	N	Mean	Std. Deviation (SD)	t	df	Sig.	Mean Difference	95% Confidence Interval of the Difference	
								Lower	Upper
No reminder	5	48.06	28.379	.856	8	.417	14.099	-23.900	52.098
With reminder(s)	5	33.96	23.502						

Table A.7. Independent sample t-test to test the association between response rate and the distribution method

Reminder	N	Mean	Std. Deviation (SD)	t	df	Sig.	Mean Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Directly administered	19	84.91	28.379	5.19	27	.000	43.905	26.551	61.260
Non-directly administered	10	41.01	23.502						

Table A.8. Independent sample t-test to test the association between response rate and mode of distribution

Mode	N	Mean	Std. Deviation (SD)	t	df	Sig.	Mean Difference	95% Confidence Interval of the Difference	
								Lower	Upper
(Electronic /online) questionnaires	5	25.17	22.289	-4.95	27	.000	- 53.89	-76.252	-31.537
Paper based questionnaire	24	79.06	22.144						

APPENDIX B. Second Literature Review Supplementary Documents

Table B.1. Summary of the theories used to measure acceptance and usage of ITs.

Model/theory	Background/ context	Theoretical underpinning	assumptions	Theory limitations	Volitional vs. non-volitional	Innovation-based Vs. user-based
IDT (Rogers, 1962)	Sociology	How an innovation, weather it is new technology or new technique, moves from creation to use	Innovation communicates through different channels over a time among the members of social system. • knowledge (exposure to its existence, and understanding of its functions); • persuasion (the forming of a favourable attitude to it); • decision (commitment to its adoption); • implementation (putting it to use); • Confirmation (reinforcement based on positive outcomes from it).	The direct determinants of decision to adopt is the persuasion which is consist of five innovation characteristics	Volitional	Innovation-based
NPM (May, 2006)	Sociology/ healthcare context	Grounded theory from medical sociology and science and technology studies Formative (secondary) and summative (tertiary) analysis of qualitative data	This theory focus on the social process behind embedding an innovation in health context. It focus on the relationships between actors, objects and context	This model helps decision makers to decide whether implement or not implement a technology It is focuses on the interaction within and between practice's process Focus of behaviour of every-day user rather than early adopters	Non-volitional	Innovation-based
TRA (Ajzen and Fishbein, 1975)	Social-psychology/ learning theory and human behaviour	Grounded in different theories (learning theories, expectancy-value theories, consistency theories, and attribution theory) If a person intends to do a behaviour then he/she likely will do it	Person's behaviour is predicted by his/her attitude and the opinion of the relevant people. Attitude and subjective norms together forming behavioural intention	It is not measuring non-volitional behaviour (e.g. availability of skills, resources and opportunities)	Volitional	user-based
SCT (Bandura, 1977)	Sociology/ learning theory and human behaviour	People learn by observing others either do or not do	The dynamic and reciprocal interaction of the person, environment, and behaviour will allow learning	- It is difficult to be operationalized as it could be very broad-reaching. - All the three	Volitional	user-based

Model/theory	Background/ context	Theoretical underpinning	assumptions	Theory limitations	Volitional vs. non-volitional	Innovation-based Vs. user-based
				constructs assumed to influence each other however it is not mandatory changes in environment should influence person factors		
TPB (Ajzen, 1985; Ajzen, 1991)	Social-psychology	TRA and self-efficacy theory (Bandura, 1977)	Behavioural intention is not the only determinants if an individual has Incomplete control over behaviour	It is not suitable for health-related behaviour as it is limited in explaining the emotional variables	non-volitional	user-based
TAM (Davis, 1985; Davis, 1989)	Social-psychology/ IS context (Business)	Based on TRA, if a person intends to do behaviour then he/she will do it.	Acceptability of the system (behavioural intention) could be determined by two main factors; perceived usefulness and perceived ease of use.	It is very parsimonious model It is about the beliefs forming the attitude and neglecting the effect of subjective norms and the availability of facilities It do not explain which person think that this system is useful or easy to use (salient beliefs)	Volitional	user-based
MPCU Thompson et al. (1991)	Social-psychology/ IS business context (Business)	Theory of behaviour (Triandis, 1977)	MPCU depict the affect, perceived consequence, social factors, facilitating conditions, and habits are the main determinants of behaviour	- The model explained some context relevant factors (IS worker context) complexity, job fit and long-term consequences - Not been validated or tested widely which limits its generalizability	volitional	user-based
MM Davis et al. (1992)	Social-psychology/ IS context (Student)	Motivation theories (e.g. cognitive evaluation theory)	Usefulness (extrinsic motivation) and enjoinment (intrinsic motivation) are influencing the behavioural intention.	The model tested in a voluntarily sitting, the effect of these will be different in other contexts (mandatory use of system). Potential usage should use the system before providing their feedback using this model (judgment based on trial)	Volitional	user-based
DTPB (Taylor and Todd, 1995a)	Social-psychology/ IS context /student	TPB, TAM, TRA and IDT	Decomposing the beliefs structure in the TPB from the IDT concept.	The model tested in a voluntarily sitting and user has another options	Volitional	user-based

Model/theory	Background/ context	Theoretical underpinning	assumptions	Theory limitations	Volitional vs. non-volitional	Innovation-based Vs. user-based
C-TAM-TPB (Taylor and Todd, 1995b)	Social-psychology/ IS context /student	TAM and extended to have more construct from TPB	TAM constructs, social influences and perceived behavioural control will predict behavioural intention and actual behaviour	The model tested in a voluntarily sitting Their assessment of additional factors influencing experience (age, academic year) were not measured	Volitional	user-based
TAM2 (Venkatesh and Davis, 2000)	Social-psychology/ IS context (Business)	Extension of TAM and drown on three theoretical paradigms; work motivation theory, action identification theory, and behavioural decision theory.	In the case of mandatory settings, a subjective norm is additional predictor for the BI. Perceived usefulness is determined be the cognitive instrumental processes (job relevance, output quality, result demonstrability, and perceived ease of use)	It measure the behaviour in an environment which includes users that has an experience with the technologies neglecting the perceived behavioural control (e.g. skills and resources)	Volitional	user-based
UTAUT (Venkatesh et al., 2003)	Social-psychology/ IS context (Business)	Extension of 9 models (TRA, TAM, TAM2, TPB, DTPB, C-TPB-TAM, IDT, MPCU and MM)	Performance expectancy, effort expectancy, social influences and facilitating conditions directed the usage intention and the use of system	As this model tested in a business context the effects of self-efficacy and anxiety were low Actually the model presents around 41 items and 9 variables predicting behavioural intention and actual behaviour respectively (Bagozzi, 2007)	non-volitional/Volitional	user-based
TAM3 (Venkatesh and Bala, 2008)	Social-psychology/ IS context (Business)	Combine TAM2 and model of the determinants of perceived ease of use (Venkatesh, 2000)	How various interventions can influence the known determinants of IT use.	It measure the behaviour in an environment which includes users that has an experience with the technologies neglecting the perceived behavioural control (e.g. skills and resources)	Non-volitional/volitional	user-based

APPENDIX C. Questionnaire Design Supplementary Documents

C.1 Methodology supplementary documents

C.1.1 Expert review evaluation form

Questionnaire Evaluation Form

Constructs and items	Agree	Disagree	Comment
(A) Behavioural Intention			
Definition: "An individual's motivation or willingness to exert effort to perform the target behaviour" (Holden and Karsh, 2010). **NB.** Response scale will be 7 point Likert scale (disagree strongly= 1, agree strongly =7)			
1. I would use the electronic devices to record my health information.			
2. I expect to use the electronic devices to record my health information.			
3. I want to use electronic devices to record my health information.			
4. I'm very interested in using the electronic devices to record my health information.			
Additional items			
(B) Attitude			
Definition: "an individual's positive or negative feelings (evaluative affect) about performing the target behaviour" (Fishbein and Ajzen, 1975) **NB.** Response scale will be 7 point Likert scale (disagree strongly= 1, agree strongly =7)			
1. I like the idea of using electronic devices to record my health information.			
2. I would find the electronic devices a bad way to record my health information.			
3. Using the electronic devices to record my health information will be quicker than on paper.			
4. Using the electronic devices will help me to record my health information from wherever I am.			
5. Using the electronic devices to record my health information is a waste of my time.			
Additional items			
(C) Subjective norms			
Definition: "The person's perceptions that most people who are important to him think he should or should not perform the behaviour in question" (Fishbein and Ajzen, 1975)			
1. My family (e.g. partners, parents and children) would be happy if I use the Internet to record information about my current health.			
2. My friends would think that I should use the Internet to record information			
3. about my current health.			
4. I will use the Internet to record information about my current health if I read about its benefits from Media personalities, newspapers and articles.			
5. If the Hospital Administrative Staff (e.g. clerks and receptionists) asks me to use the Internet to record information about my current health, I will do so.			
6. If the Nurses ask me to use the Internet to record information about my current health, I will do so.			
7. If the GP asks me to use the Internet to record information about my current health, I will do so.			
8. If the Consultant Doctor asks me to use the Internet to record information about my current health, I will do so.			
Additional items			

(D) Perceived behavioural control			
Definition: "The perceived ease or difficulty of performing the behaviour" (Ajzen, 1991). It is also defined as "perceptions of internal and external constraints on behaviour" in the information systems contexts (Taylor and Todd, 1995a)			
1. How important are the availability of the following facilities for you to use the Internet to record information about current health? a. Broadband (Internet) access.			
b. Access to computer and smart phone/tablets at home (e.g. I Phone, I Pad, galaxy phone, etc.).			
c. Training sessions to learn how to use it.			
d. Previous knowledge and skills necessary to use it.			
e. Computer access in the hospital.			
f. Availability of help function.			
g. Someone to help with any Internet difficulties.			
2. If I wanted to, I could easily use the electronic devices to record my health information.			
3. It would be difficult for me to use the electronic devices to record my health information.			
4. I am confident that I would be able to use the Internet to record information about my current health unaided.			
Additional items			
(E) Computer Anxiety			
Definition: Emotional reactions when it comes to performing a behaviour (Compeau and Higgins, 1995b)			
1. I feel worried about using the electronic devices to record my health information.			
2. I am scared I will loose information by doing something wrong if I use the electronic devices to record information about my current health.			

3. I fear I will make mistakes I cannot correct if I use the Internet to record information about my current health.			
4. Using the electronic devices to record my health information will be somewhat uncomfortable to me.			
5. I am worried that the information I provide via the electronic devices would be accessed by wrong people.			
(F) Demographic information			
1. What is your gender? (Male, Female)			
2. Please specify which age group you fall into (18-24, 25-34, 35-44, 45-54, 55-64, 65-74, 75-84, 85+)			
3. Please tell us what your educational background is (secondary school or below, College/Certificate/Diploma, Trade/ technical/ vocational training, Bachelor degree, Post-graduate degree, Professional degree (e.g. MD or LLB))			
4. Do you use Internet for your everyday? (Yes, No) if yes answer the following questions			
4.1. Please tell me **where** do you access the Internet in your everyday. (At home, At work, In the Cafe, In the Library, All of them, Other .....)			
4.2. Please tell me **what** do you access the Internet in your everyday. (e-mail exchange, Online game, Internet banking, Online shopping, Internet browsing, Other .....)			
Additional items			

AJZEN, I. 1991. The theory of planned behavior. *Organizational behavior and human decision processes,* 50, 179-211.
COMPEAU, D. R. & HIGGINS, C. A. 1995b. Computer self-efficacy: Development of a measure and initial test. *MIS quarterly*, 189-211.
FISHBEIN, M. & AJZEN, I. 1975. *Belief, attitude, intention, and behavior: an introduction to theory and research*, Addison-Wesley Pub. Co.
HOLDEN, R. J. & KARSH, B. T. 2010. The technology acceptance model: its past and its future in health care. *Journal of biomedical informatics,* 43, 159-172.
TAYLOR, S. & TODD, P. A. 1995a. Understanding information technology usage: A test of competing models. *Information systems research,* 6, 144-176.

C.1.2 Expert review invitation e-mail

Dear (Expert name),

My name is Saja Al-Rayes. I am a PhD student in Leeds Institute of Health Sciences at the University of Leeds. I am developing a questionnaire as part of my doctoral degree requirement and I would like to invite you to support me with your experience and to participate in my research. You were recommended to be part of the expert panel to criticise the study questionnaire.

My research aimed at understanding the different factors influencing patient acceptance of electronic patient reported outcome measures (e-PROMs). E-PROMs are used electronically to collect disease consequences and/or its treatment as reported by the patient, including symptom experience and treatment satisfaction.

What you need to do is to inform me whether you agree or disagree on the questionnaire items and whether you think additional items is required. An hour meeting will be excellent to get your feedback and you do not need to do anything before. However, I am attaching the study questionnaire and the evaluation form I will use for your consideration.

Please let me know if you are happy to participate and you have free time within the coming two weeks.

Thank you in advance

Best wishes,

Saja

C.1.3 Expert review information sheet (did not require ethical approval)

Information Sheet for participants

UNIVERSITY OF LEEDS

Research title: Development of questionnaire measuring patient acceptance toward using e-PROMs based on the theory of planned behaviour
Version: 7.0
Last revision: 16/08/2013
Chief investigator: Saja Al-Rayes (ml08saar@leeds.ac.uk)
Supervisors: Dr. Susan Clamp (s.clamp@leeds.ac.uk)
Prof. Jeremy Wyatt
Dr. Maureen Twiddy
Address: Leeds Institute of Health Sciences,
101 Clarendon Rd,
University of Leeds,
Leeds, LS2 9LJ
Contact details: E-mail: ml08saar@leeds.ac.uk
Telephone: 01133430896

I am a PhD student at the University of Leeds, sponsored by the Government of Saudi Arabia. I would like to invite you to take part in this PhD research project. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. 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 this research?
This research is aimed to develop a questionnaire that helps in understanding the different factors influencing patients' acceptance toward using an electronic patient reported outcome measures (e-PROMs). E-PROMs are used electronically to collect the consequences of disease and/or its treatment as reported by the patient, including perceptions of health, well-being, symptom experience, functioning, and treatment satisfaction. These are used potentially to enhance communication of patient and healthcare provider, to enhance the clinical decision support processes, to detect the patients' problems frequently and much more. Consequently, by understanding patient perceptions, the clinicians will understand how to increase level of acceptance and usage.

Why Have I been chosen?
Because you have experience in questionnaire design and development, you are recommended to be part of the expert panel to criticise the study questionnaire.

Do I have to take part?
It is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep.

What do I have to do? /what will happen to me if I take part?
If you agree to participate, I will send you another e-mail to arrange a convenient meeting time within one to two weeks. The e-mail will include the study questionnaire and the questionnaire evaluation form which I will use to get your feedback. The meeting will take an hour to discuss the questionnaire items. Basically, you will be asked to give your feedback on *items difficulty* (i.e. whether respondents find an item difficult to endorse and understand), *items structure* (i.e. whether there is any problem with item's wording), *items relevance to specific construct* (i.e. the extent to which each item was related to the intended measured construct), *construct representativeness* (i.e. whether the overall items were representing the constructs or there is missing aspects), *items clarity* (i.e. if there were multiple response options which makes the item ambiguous to respondents). Additionally, you will be asked to provide your feedback on the appropriateness of the *response format* of each item. The chief investigator will use the Questionnaire Evaluation Form to record your comments within the meeting. Then, your feedback will be used to modify the questionnaire items.

What are the possible disadvantages or risks of taking part?
Taking part in this research will not subject you to any risks of physical or psychological harm.

What are the possible benefits of taking part?
It is thought that participating on the research will entails opportunity for you to reflect in improving the questionnaire that would be used to reach research aim. In addition, if you would like to have a report of the final results, you are welcomed to contact the researcher to get a copy of the report.

Will my taking part in this project be kept confidential? / what will happen to the results of the research project?
Through this research, there is no need for participants' identifications including you as an expert. Your recorded feedback within the Questionnaire Evaluation Sheet will be used to improve the study questionnaire only. Then, the modified questionnaire will go through another evaluation process with 10 participants from the general public.

What type of information will be sought from me and why is the collection of this information relevant for achieving the research project's objectives?
Your way of thinking about the questionnaire will be helpful to improve the quality of the questionnaire. After the modification, it will be clearer and the participants later on will understand the questions easily.

C.1.4 Structured coding scheme to analyse cognitive interview data

Cognitive Interview Charting Scheme

Question #	**1. issue with objective - unclear objective - question /objective mis-match**	**2. item specified issues**					**3. question or section ordering issues**	**4. overall length issue**	**5. visual layout issue**
		2a. cognitive				2b. logical/structural			
		2a (i). comprehension - comprehension issue with individual words - comprehension issue with overall task	2a (ii). Recall Difficulties with recall	2a (iii). Judgment Judgement shortcuts	2a (iv). Response Socially sensitive Problems with answer categories				

C.1.5 Ethical approval letter

UNIVERSITY OF LEEDS

Faculty of Medicine and Health Research Office
School of Medicine Research Ethics Committee (SoMREC)

Room 10.110, level 10
Worsley Building
Clarendon Way
Leeds, LS2 9NL
United Kingdom

✆ +44 (0) 113 343 4361

12 November 2013

Saja Al-Rayes
PhD Student
Room G.02 PhD student offices
Charles Thackrah Building
101 Clarendon Road
University of Leeds
LS2 9LJ

Dear Saja

Ref no: **HSLTLM/13/001**

Title: **Development of a questionnaire measuring patient acceptance toward using e-PROMs based on the Theory of Planned Behaviour**

Your research application has been reviewed by the School of Medicine Ethics Committee (SoMREC) and we can confirm that ethics approval is granted based on the documentation received at the date of this letter and subject to the following condition(s):

- **The researcher asks the contact at each organisation about the reasons for choosing a particular person and record it as contextual data to be considered when reviewing the significance of the findings. For example, it is likely that the contact may choose the person they think of as a computer whizz rather than a typical computer user-and he needs to know how typical the participants are or are not.**
- **For " Leeds Involving People", after the potential participant has contacted the researcher they should be sent a copy of the information sheet so they have a chance to read in their own time and before the interview appointment.**

Document	*Version*	*Date Submitted*
Ethical_Review_Form_Saja_Al-Rayes 2nd v	1	29.08.13
Information Sheet for interviewer - HAMARA center	1	29.08.13
Information Sheet for interviewer - Leeds involving people	1	29.08.13
Interviewer_consent_form	1	29.08.13
questionnaire 5th version	1	29.08.13
Research_Protocol- Saja Al-Rayes	1	29.08.13
Saja-Al-Rayes-fieldwork-assessment-form-low-risk-2013	1	29.08.13
HSLTLM13001 Reviewer 1 comments *(response)*	1	20.09.13
Information Sheet for interviewer - HAMARA center v2	2	20.09.13
Information Sheet for interviewer - Leeds involving people v2	2	20.09.13
Interviewer_consent_form v2	2	20.09.13
questionnaire 2nd version	2	20.09.13
HSLTLM13001 Reviewer 2 comments *(response)*	1	20.09.13
Committee feedback by email	1	05.11.13
instruction for interviwer and interviwee	1	05.11.13
questionnaire 4th version	3	05.11.13

Please notify the committee if you intend to make any amendments to the original research ethics application or documentation. All changes must receive ethics approval prior to implementation. Please contact the Faculty Research Ethics Administrator for further information (fmhuniethics@leeds.ac.uk)

Ethics approval does not infer you have the right of access to any member of staff or student or documents and the premises of the University of Leeds. Nor does it imply any right of access to the premises of any other organisation, including clinical areas. The committee takes no responsibility for you gaining access to staff, students and/or premises prior to, during or following your research activities.

Please note: You are expected to keep a record of all your approved documentation, as well as documents such as sample consent forms, and other documents relating to the study. This should be kept in your study file, which should be readily available for audit purposes. You will be given a two week notice period if your project is to be audited.

It is our policy to remind everyone that it is your responsibility to comply with Health and Safety, Data Protection and any other legal and/or professional guidelines there may be.

We wish you every success with the project.

Yours sincerely

Dr Roger Parslow
Co-Chair, SoMREC, University of Leeds

Dr John Sandars
Co-Chair, SoMREC, University of Leeds

(Approval granted by Dr John Sandars on behalf of SoMREC Co-Chairs)

SoMRECApproval letter v2_0 September 2013

C.1.6 Copy of the consent form

[School of Medicine / Faculty of Medicine and Health]

UNIVERSITY OF LEEDS

Consent to take part in "Development of questionnaire measuring patient acceptance toward using e-PROMs based on the theory of planned behaviour"

	Add your initials next to the statements you agree with
I confirm that I have read and understand the information sheet dated [__-__-201__] explaining the above research project and I have had the opportunity to ask questions about the project.	
I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without there being any negative consequences. In addition, should I not wish to answer any particular question or questions, I am free to decline. For any enquiry do not hesitate to contact the lead researcher (Saja Al-Rayes): - Telephone number. 01133430896 - E-mail address: ml08saar@leeds.ac.uk	
I give permission for members of the research team to have access to my anonymised responses. I understand that my name will not be linked with the research materials, and I will not be identified or identifiable in the report or reports that result from the research. I understand that my responses will be kept strictly confidential.	
I agree for the data collected from me to be used in relevant future research.	
I understand the interview will be audio-recorded but this will be destroyed after revising the questionnaire (maximum of three months of the interview date).	

Name of participant	
Participant's signature	
Date	
Name of lead researcher	Saja Al-Rayes
Signature	
Date*	

*To be signed and dated in the presence of the participant.

Once this has been signed by all parties the participant should receive a copy of the signed and dated participant consent form, the letter/ pre-written script/ information sheet and any other written information provided to the participants. A copy of the signed and dated consent form should be kept with the project's main documents which must be kept in a secure location.

Project title	*Document type*	*Version #*	*Date*
Development of questionnaire measuring patient acceptance tow ard using e-PROMs based on the theory of planned behaviour	consent form for think aloud interviewees	Version 2	

C.1.7 Copy of the participant information sheets

Information Sheet for participants

UNIVERSITY OF LEEDS

Research title: Development of questionnaire measuring patient acceptance toward using e-PROMs based on the theory of planned behaviour
Version: 1.1
Last revision: 20/09/2013
Chief investigator: Saja Al-Rayes (ml08saar@leeds.ac.uk)
Supervisors: Dr. Susan Clamp (s.clamp@leeds.ac.uk)
Prof. Jeremy Wyatt
Dr. Maureen Twiddy
Address: Leeds Institute of Health Sciences,
101 Clarendon Rd,
University of Leeds,
Leeds, LS2 9LJ
Contact details: E-mail: ml08saar@leeds.ac.uk
Telephone: 01133430896

I am a PhD student at the University of Leeds, sponsored by the Government of Saudi Arabia. I would like to invite you to take part in this PhD research project. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. 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 this research?

Electronic patient reported outcome measures (e-PROMs) are used electronically to collect disease consequences and/or its treatment as reported by the patient, including symptom experience and treatment satisfaction. These can also be used potentially to enhance communication of patient and healthcare provider, enhance the clinical decision support processes, to detect new patients' problems and much more. This research is aimed at developing a questionnaire to help understand the different factors influencing patients' acceptance of e-PROMs. Consequently, by understanding patient perceptions, clinicians will understand how to increase level of e-PROMs acceptance and usage.

Why Have I been chosen?

You are recommended by **[name of the centre and the centre representative staff]**, to take part in this research with another 5 interviewees. We are looking for English speakers aged 18 and over with different experience on computers usage.

Do I have to take part?

It is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep (and be asked to sign a consent form) and you can still withdraw at any time before analysing the interviews without it affecting any benefits that you are entitled to in any way. You do not have to give a reason.

What do I have to do? /what will happen to me if I take part?

You will be interviewed at **[the centre name]**. Basically, you will have a version of questionnaire and you will need to normally fill in the questionnaire. If there are parts you would normally read, please read them. If there are parts you would normally skim, please skim them. While you are completing the questionnaire, I would like you to say out loud whatever you are thinking and reading. The interview will not take more than an hour of your valuable time. By conducting the interview a method used "think aloud" would be accomplished. From your feedback on the questionnaire, a modification will take place to make this questionnaire clear and easy to be used by the questionnaire participants.

Will I be recorded, and how will the recorded media be used?

The interview will be recorded in a digital audio recording device and the audio records will be installed in a secured server at the University of Leeds. The digital audio records of your feedback made during this research will be used only for analysis. No other use will be made of them without your written permission, and no one outside the research will be allowed to access the original recordings. The audio records will be permanently destroyed after revising the questionnaire (maximum of three months of the interview date).

What are the possible disadvantages or risks of taking part?

Taking part in this research will not subject you to any risks of physical or psychological harm.

What are the possible benefits of taking part?

Participating in the research will give you the opportunity to reflect on improving the questionnaire. In addition, if you would like to have a report of the final results, you are welcomed to contact the researcher to get a copy.

Will my taking part in this project be kept confidential?

Through this research, there is no need for participants' identification. The audio records will be later anonymous, transcribed and saved electronically in a secured server and protected with password at the University of Leeds. The anonymous paper-based transcripts will be stored in a locked filing cabinet within a locked office at the University of Leeds. It will be accessed by the researcher only and if required the academic supervisors.

What type of information will be sought from me and why is the collection of this information relevant for achieving the research project's objectives?

Your way of thinking through completing questionnaire will be helpful to improve the quality of the questionnaire. It will be clearer after the modification and the participants will understand the questions better as a result.

C.2 Results supplementary documents

C.2.1 Items list for the first questionnaire draft

Table C.1. Item list for the first questionnaire draft

Main constructs[1]	Items	Response category	Source
(BI)	1. I would use electronic devices to record my health information.	Disagree strongly – agree strongly	From (Taylor and Todd, 1995a)
	2. I expect to use electronic devices to record my health information.	Disagree strongly – agree strongly	From (Herrero and Rodríguez Del Bosque, 2008)
	3. I want to use electronic devices to record my health information.	Disagree strongly – agree strongly	From (Armitage and Conner, 1999)
	4. I'm very interested in using electronic devices to record my health information.	Disagree strongly – agree strongly	Developed by the study researcher
	5. I would never record my health information using electronic devices	Disagree strongly – agree strongly	From (Herrero and Rodríguez Del Bosque, 2008)
(At)	1. I like the idea of using electronic devices to record my health information.	Disagree strongly – agree strongly	From (Herrero and Rodríguez Del Bosque, 2008)
	2. I would find electronic devices a bad way to record my health information.	Disagree strongly – agree strongly	From (Venkatesh et al., 2003).
	3. Using electronic devices to record my health information will be quicker than on paper.	Disagree strongly – agree strongly	From (Herrero and Rodríguez Del Bosque, 2008)
	4. Using an electronic device will help me to record my health information from wherever I am.	Disagree strongly – agree strongly	From (Herrero and Rodríguez Del Bosque, 2008)
	5. Using electronic devices to record my health information is a waste of my time.	Disagree strongly – agree strongly	Generated by the researcher
(SN)	How much will the following individuals influence whether or not you would use electronic devices to record your health information? 1. *Your family* (e.g. partners, parents and children) 2. *Your friends.* 3. *Celebrities* or *newspaper/magazine* 4. *Hospital administrative staff* (e.g. clerks and receptionists) 5. *The nurses*. 6. *The GP* 7. *The consultant*	Not at all influential = 1 – Extremely influential = 7	From (Ajzen and Madden, 1986)
	8. People who influence my behaviour would think that I should use electronic devices to record my health information.	Disagree strongly – agree strongly	From (Taylor and Todd, 1995a)
	9. People who are important to me think that I should use electronic devices to record my health information.	Disagree strongly – agree strongly	From (Taylor and Todd, 1995a)

Main constructs[1]	Items	Response category	Source
(PBC)	How important are the availability of the following facilities for you to use electronic devices to record your health information? 1. Computer and Broadband (Internet) access at home. 2. Access smart phone or tablet computers at home (e.g. iPhone, iPad, Android phones). 3. Training sessions to learn how to use IT. 4. Previous knowledge and skills necessary to use IT. 5. Computer and Broadband (Internet) access in the hospital. 6. Availability of online help (e.g. a help function). 7. Someone to help me with any electronic device difficulties. 8. Families/friends to do it for me.	Not at all important = 1 – Very important = 7	From (Ajzen and Madden, 1986)
	9. If I wanted to, I could easily use electronic devices to record my health information.	Disagree strongly – agree strongly	From (Conner and McMillan, 1999)
	10. It would be difficult for me to use electronic devices to record my health information.	Disagree strongly – agree strongly	From (Ajzen and Madden, 1986)
	11. I am confident that I would be able to use an electronic device to record my health information unaided.	Disagree strongly – agree strongly	From (Netemeyer et al., 1991)
(CA)	1. I feel worried about using electronic devices to record my health information.	Disagree strongly – agree strongly	From (Venkatesh et al., 2003).
	2. I am scared I will lose information by doing something wrong if I use an electronic device to record information about my current health	Disagree strongly – agree strongly	From (Venkatesh et al., 2003).
	3. I fear I will make mistakes I cannot correct if I use an electronic device to record information about my current health.	Disagree strongly – agree strongly	From (Venkatesh et al., 2003).
	4. Using electronic devices to record my health information makes me somewhat uncomfortable.	Disagree strongly – agree strongly	From (Venkatesh et al., 2003).
	5. I am worried that the information I provide via electronic devices would be accessed by the wrong people.	Disagree strongly – agree strongly	Developed by the study researcher
(DI)	1. What is your gender?	Male - Female	Developed by the study researcher
	2. Please specify which age group you fall into	1- (18 – 24), 2-(25 – 34), 3-(35 – 44), 4-(45 – 54), 5-(55 – 64), 6-(65 – 74), 7-(75 – 84) and (85+)	Developed by the study researcher
	3. Please tell us what your educational background is	1 - Secondary school or below, 2 - College/ Certificate/Diploma, 3- Trade/ technical/ vocational training, 4- Bachelor degree, 5- Post-graduate degree and 6- Professional degree (e.g. MD or LLB)	Developed by the study researcher
(IE)	1. Do you use the Internet?	Yes – No	Developed by the

Main constructs[1]	Items	Response category	Source
			study researcher
	2. Please tell me how you access the Internet.	1 - Personal computer or laptop, 2 - Mobile phones, 3 - Tablet computers (e.g. iPad, Android tablet) 4 - All of the above	Developed by the study researcher
	3. Please tell me how often you access the Internet.	1 – Daily, 2 - Frequently (2- 6 days/week), 3 - Weekly (1 day/ week) and 4 - Infrequently (less than once a month)	Developed by the study researcher
	4. Please tell me where you access the Internet.	1 - At home, 2 - At work, 3 - In the cafe, 4 - in the library, 5 - All of the above and 6 - Other	Developed by the study researcher
	5. Please indicate what you use the internet for.	1- E-mail, 2 - Online game, 3 - Internet banking, 4 - Social networking (e.g. Facebook or Twitter), 5 - Online shopping , 6 - Internet browsing, 7 – Searching and 8 - Other	Developed by the study researcher

Note: 1- (BI) = behavioural intention, (At)= attitude, (SN)= subjective norms, (PBC)= perceived behavioural control, (CA)= computer anxiety, (DI) = demographic information, (IE)= Internet experience.

C.2.2 First questionnaire draft

UNIVERSITY OF LEEDS

Patients' opinions about using the electronic devices to record their healthcare information.

The National Health Services (NHS) encourages the use of technology to improve the quality of healthcare. Patients are increasingly being asked to provide information about their health using paper based surveys. This hospital plans to use **electronic devices** (e.g. touch screens, computers, mobile phones, laptops or tablet computers) to collect this information electronically. These devices give patients the opportunity to complete online surveys inside the clinic or outside (e.g. at home or in the cafe)

This questionnaire is designed to help us to understand how you feel about use of **electronic devices** to record health information. It also includes some questions about you (background information). Your responses will guide us to make the use of the electronic devices better and easier for you to use.

This project is part of my PhD research and the University of Leeds is supporting me in doing this. By completing and returning this questionnaire you are consenting to take part in this research. Your responses will be treated in confidence and will be anonymous. Your name must not appear on any part of this questionnaire. Please try to answer all the questions.

Thank you for your time. Please complete this questionnaire and return it by hand to me in the clinic or post it to the following address: **Saja AL-Rayes**, room G.02 Charles Thackrah Building, University of Leeds, 101 Clarendon Road, Leeds, **LS2 9LJ**

It will take less than 10 minutes to complete.

Thanks,

Saja Al-Rayes

1. Here are some things that other people have said about <u>their feelings</u> towards using electronic devices to record their health information. Please tell me how much you agree or disagree with each one.

Please select **ONE** option only in each row.

Disagree strongly	Disagree	Disagree slightly	Neither agree nor disagree	Agree slightly	Agree	Agree strongly
B.1. I like the idea of using electronic devices to record my health information.						
B.2. I would find electronic devices a bad way to record my health information.						
E.1. I feel worried about using electronic devices to record my health information.						
E.4. Using electronic devices to record my health information will be somewhat uncomfortable to me.						
D.2. If I wanted to, I could easily use electronic devices to record my health information.						
D.3. It would be difficult for me to use electronic devices to record my health information.						
D.4. I am confident that I would be able to use an electronic device to record my health information unaided.						

2. Here are some things that other people have said about <u>the advantages and disadvantages</u> of using electronic devices to record their health information. Please tell me how much you agree or disagree with each one

Please select **ONE** option only in each row.

Disagree strongly	Disagree	Disagree slightly	Neither agree nor disagree	Agree slightly	Agree	Agree strongly
E.2. I am scared I will lose information by doing something wrong if I use an electronic device to record information about my current health.						
E.3. I fear I will make mistakes I cannot correct if I use an electronic device to record my health information.						

Disagree strongly	Disagree	Disagree slightly	Neither agree nor disagree	Agree slightly	Agree	Agree strongly
E.5. I am worried that the information I provide via electronic devices would be accessed by the wrong people.						
B.3. Using electronic devices to record my health information will be quicker than on paper.						
B.4. Using an electronic device will help me to record my health information from wherever I am.						
B.5. Using electronic devices to record my health information is a waste of my time.						

3. Now, I am going to show you some things that other people have said about <u>using</u> electronic devices to record their health information. Please tell me how much you agree or disagree with each one.

Please select **ONE** option only in each row.

Disagree strongly	Disagree	Disagree slightly	Neither agree nor disagree	Agree slightly	Agree	Agree strongly
A.1. I would use electronic devices to record my health information.						
A.2. I expect to use electronic devices to record my health information.						
A.3. I want to use electronic devices to record my health information						
A.4. I'm very interested in using electronic devices to record my health information.						
A.5. I would never record my health information using electronic devices.						
C.2. People <u>who influence my behaviour</u> would think that I should use electronic devices to record my health information.						
C.3. People <u>who are important to me</u> think that I should use electronic devices to record my health information.						

4. How much will the following individuals influence whether or not you would use electronic devices to record your health information?

Please score where 1 = Not at all influential and 7 = Extremely influential

Please select **ONE** option only in each row.

	1	2	3	4	5	6	7
Your family (e.g. partners, parents and children)							
Your friends.							
Celebrities or *newspaper/magazine.*							
Hospital Administrative Staff (e.g. clerks and receptionists).							
The Nurses.							
The GP							
The Consultant.							

5. How important are the availability of the following facilities for you to use the Internet to record information about current health?

Please score where 1 = Not at all important and 7 = Very Important

Please select **ONE** option only in each row.

	1	2	3	4	5	6	7
Computer and broadband (Internet) access at home							
Access to smart phone or tablets at home (e.g. iPhone, iPad, Android phones)							
Training sessions to learn how to use it							
Previous knowledge and skills necessary to use it.							
Computer and broadband (Internet) access in the hospital							
Availability of online help (e.g. help function).							
Someone to help with any electronic device difficulties							
Families or friends to do it for me.							

About you

5. What is your gender?

Please select **ONE** option only.

Male	
Female	

6. Please specify which age group you fall into

Please select **ONE** option only.

18 – 24		55 – 64	
25 – 34		65 – 74	
35 – 44		75 – 84	
45 – 54		85 +	

7. Please tell us what your educational background is

Please select **ONE** option only.

secondary school or below		Bachelor degree	
College/Certificate/Diploma		Post-graduate degree	
Trade/ technical/ vocational training		Professional degree (e.g. MD or LLB)	

8. Do you use the Internet?

Please select **ONE** option only.

Yes *	
No	

* If **yes** please answer the following questions

8.1. Please tell me **how** do you access the Internet.

Put (√) in the box near your answer and you can choose **more than one** option.

Personal computer or laptop		Tablet computers (e.g. iPad, Android tablet)	
Mobile phones		All of them	

8.2. Please tell me **how often** do you access the Internet.

Put (√) in the box near your answer and please select **ONE** option only

Daily		Weekly (1 day/ week)	
Frequently (2 – 6 days/week)		Infrequently (less than once a month)	

8.3. Please tell me **where** do you access the Internet.

Put (√) in the box near your answer and you can choose **more than one** option.

At home		In the Library	
At work		All of them	
In the Cafe		Other	

8.3.1. If you answered other, please specify in the box below:

8.4. Please indicate **what** you use the internet for.

Put (√) in the box near your answer and you can choose **more than one** option.

e-mail		Online shopping	
Online game		Internet browsing	
Internet banking		Searching	
Social networking (e.g. Facebook or Twitter)		Other	

8.4.1. If you answered other, please specify in the box below:

Thank you for your time to complete this questionnaire

If you have any comments regarding the survey do not hesitate to contact me on this e-mail: MI08saar@leeds.ac.uk

C.2.3 Expert review

Table C.2. Results of the main issues with the items based on experts feedback.

Research constructs	Item no.	Agreement score (%)	Main issue (R, C or RO)[a]
Behavioural intention (BI)	Item 1	100	
	Item 2	100	
	Item 3	100	
	Item 4	80	R
	Item 5	100	
Attitude (At)	Item 1	100	
	Item 2	40	C
	Item 3	100	
	Item 4	100	
	Item 5	100	
Subjective norms (SN)	Item 1	100	
	Item 2	100	
	Item 3	60	C
	Item 4	100	
	Item 5	40	C
	Item 6	40	C
	Item 7	40	C
	Item 8	20	R and C
	Item 9	100	
perceived behavioural control (PBC)	Item 1	80	R
	Item 2	80	R
	Item 3	40	R and C
	Item 4	40	R and C
	Item 5	80	R
	Item 6	40	R and C
	Item 7	60	R and C
	Item 8	60	R and C
	Item 9	100	
	Item 10	100	
	Item 11	100	
Computer anxiety (CA)	Item 1	100	
	Item 2	80	C
	Item 3	60	C
	Item 4	20	C
	Item 5	100	
Demographic information (DI)	question 1	100	
	question 2	100	
	question 3	20	C
Internet experience (IE)	question 1	100	
	question 2	60	RO
	question 3	80	R
	question 4	40	C and RO
	question 5	60	C and RO

Table C.3. Results of the items modified based on the expert review.

Main constructs [1]	Item no.	Original question	Agreement score	Reviewer comments [2]	Decision (remove/modified)
BI	Item 4	I'm very interested in using electronic devices to record my health information.	80%	"it is more like an attitude question" (An expert on TPB and behavioural theories) - n=1	Removed
At	Item 2	I would find electronic devices a bad way to record my health information.	40%	"this was worded weirdly "bad" general word. "Poor or inefficient" can be used." (An expert on the questionnaire design and development) - n=3	Modified "Using electronic devices to report my health information does not appeal to me."
SN	Item 3	Celebrities or newspaper/magazine.	60%	"double-barrelled questions celebrities is one option and newspaper/magazine is another" (An expert on the questionnaire design and development) - n=2	Modified "Celebrities"
	Item 5	The Nurses	40%	"use (YOUR) instead of (THE)" (An expert on the questionnaire design and development) - n=3	Modified "Your Nurses"
	Item6	The GP	40%	"use (YOUR) instead of (THE)" (An expert on the questionnaire design and development) - n=3	Modified "Your GP"
	Item7	The Consultant	40%	"use (YOUR) instead of (THE)" (An expert on the questionnaire design and development) - n=3	Modified "Your Consultant"
	Item 8	People who influence my behaviour would think that I should use electronic devices to record my health information.	20%	"Very bad wording, we don't like people who influence our behaviour it's too controlling" (An expert on patient researches and e-PROM implementation) - n=4	Removed
PBC	Item 1	Computer and broadband (Internet) access at home.	80%	"they are not phrased in a way like if you are doing self-efficacy or control beliefs" (An expert on TPB and behavioural theories) - n=1	Removed
	Item 2	Access to smart phone or tablets at home (e.g. iPhone, iPad, Android phones)	80%	"they are not phrased in a way like if you are doing self-efficacy or control beliefs" (An expert on TPB and behavioural theories) - n=1	Removed
	Item 3	Training sessions to learn how to use it.	40%	"they are not phrased in a way like if you are doing self-efficacy or control beliefs" (An expert on TPB and behavioural theories) - n=1 "what do you mean by it" (An expert on the questionnaire design and development) - n=2	Removed
	Item 4	Previous knowledge and skills necessary to use it.	40%	"they are not phrased in a way like if you are doing self-efficacy or control beliefs" (An expert on TPB and behavioural theories) - n=1 "what do you mean by it" (An expert on the questionnaire design and development) - n=2	Removed
	Item 5	Computer and broadband (Internet) access	80%	"they are not phrased in a way like if you are doing self-efficacy or control beliefs" (An expert on TPB	Removed

Main constructs [1]	Item no.	Original question	Agreement score	Reviewer comments [2]	Decision (remove/modified)
		in the hospital.		and behavioural theories) - n=1	
	Item 6	Availability of online help (e.g. help function).	40%	"they are not phrased in a way like if you are doing self-efficacy or control beliefs" (An expert on TPB and behavioural theories) - n=1 "What about telephones help?" (An expert on the questionnaire design and development) - n=1	Removed
	Item 7	Someone to help with any electronic device difficulties	60%	"they are not phrasing is a way like if you doing self-efficacy or control beliefs" - n=1 "you need to re-phrase it. it is to broad do you mean someone in the hospital or at home?" (An expert on the questionnaire design and development) - n=1	Removed
	Item 8	Families or friends to do it for me.	60%	"they are not phrased in a way like if you are doing self-efficacy or control beliefs" (An expert on TPB and behavioural theories) - n=1 "people do it for them and sometimes people help me to do it." (An expert on the questionnaire design and development) - n=1	Removed
CA	Item 2	I am scared I will lose information by doing something wrong if I use electronic devices to record information about my current health.	80%	"(Scared) is a strong word use worry/concern." (An expert on patient researches and e-PROM implementation and on the questionnaire design and development) - n=1	Modified to "I am concerned I will lose information by doing something wrong if I use electronic devices to report my health information."
	Item 3	I fear I will make mistakes I cannot correct if I use electronic devices to record my health information.	60%	"(fear) is a strong word use worry/concern." (An expert on patient researches and e-PROM implementation and on the questionnaire design and development) - n=2	Modified to "I am worried I will make mistakes I cannot correct if I use electronic devices to report my health information."
	Item 4	Using electronic devices to record my health information will be somewhat uncomfortable to me.	20%	"I would not put somewhat if I have all these seven categories" (An expert on patient researches and e-PROM implementation) - n=2 "(for me) not (to me)" (An expert on the questionnaire design and development) - n=2	Modified to "I would feel uncomfortable using electronic devices to report my health information"
	Item 5	I am worried that the information I provide via electronic devices would be accessed by wrong people.	60%	"instead of (accessed by wrong people) it is better to say (seen by some of the wrong people) ore (seen by the wrong people)" (An expert on the questionnaire design and development) - n=2	"I am worried that the information I provide via electronic devices would be seen by the wrong people."
DI	Question 3	Please tell us what your educational background is	20%	"you want to ask them what is the highest educational level." (An expert on patient researches and e-PROM implementation) - n=4	Modified to "What is your highest educational level you have?"

Main constructs [1]	Item no.	Original question	Agreement score	Reviewer comments [2]	Decision (remove/modified)
IE	Question 2	Please tell me how do you access the Internet? (personal computers or laptops, Mobile phones, Tablets computers (e.g. iPad or Android tablets), All of them)	60%	"You can think about rating responses it will give you interesting results" (An expert on the questionnaire design and development) - n=2	Modified to "Please tell me how often you access the Internet using the following? (personal computers or laptops, Mobile phones, Tablets computers (e.g. iPad or Android tablets), All of them) (NB. Response scale will be 7 point Likert scale (Never =1, more than 1/day =7)"
	Question 3	Please tell me how often do you access the Internet?	80%	"You don't need this question when you use rating categories" (An expert on the questionnaire design and development) - n=2	Removed
	Question 4	Please tell me where do you access the Internet?(At home, At work, In the Cafe, In the Library, All of them, Other…..)	40%	"add at family houses" (An expert on patient researches and e-PROM implementation and on the questionnaire design and development) - n=1 "You can think about rating responses it will give you interesting results" (An expert on the questionnaire design and development) - n=2	Modified to "Please tell me how often you access the Internet from the following places? (At home, At work, At family houses, In the Cafe, In the Library, All of them, Other …..) ((NB. Response scale will be 7 point Likert scale (Never =1, more than 1/day =7)"
	Question 5	Please tell me what do you access the Internet in your everyday. (e-mail, Online game, Internet banking, Online shopping, Internet browsing, searching, social networking (e.g. Facebook or Twitter), Other .....)	60%	"use categories from national statistics" (An expert on the questionnaire design and development) - n=1 "You can think about rating responses it will give you interesting results" (An expert on the questionnaire design and development) - n=1	Modified to "Please tell me how often you access the Internet for the following purposes. (sending/receiving e-mail, Internet banking, social networking (e.g. Facebook or Twitter), Online shopping, seeking health related information, "reading or downloading online news, news paper or magazines", using services related to travel or travel accommodation, downloading software (other than games software), telephoning or making video over the Internet, finding information about goods or services and Other .....) (NB. Response scale will be 7 point Likert scale (Never =1, more than 1/day =7)"

Note: 1- (BI)= behavioural intention, (At)= attitude, (SN)= subjective norms, (PBC)= perceived behavioural control, (CA)= computer anxiety, (DI) demographic information, (IE)= Internet experience. 2- (n)= the number of experts agreed on the comment .

C.2.4 cognitive interviews

Table C.4.Cognitive interviews results of the overall questionnaire design (1st round)

original layout	Reported problems	Modified layout
The original questions order was Q1. General feelings and beliefs Q.2. advantages and disadvantages of the electronic devices	It appear that when the questionnaire asked about more general things about electronic devices, people asked about specific issues of the category e.g. one participant commented on the first general question "the other thing is how *safe* it is electronically .. whether who else can read your data" (Male aged 65+ and computer literate)	Changes in the questions orders specific questions first (e.g. Q2) then more general questions (e.g. Q1).
Items order started with more general items to more specific once.	One of the participants thought about the more specific issues when reading more general items.	Changes in the items orders, specific items first then more general items.
Q4. Below are list of people who may be influential in your life. Please indicate: a. First, how much they would think that you should use electronic devices to report your health information. b. Second, how much you will do what they want you to do. 1. Your family (e.g. partners, parents and children). 2. Your friends. 3. Celebrities. 4. Hospital Administrative Staff (e.g. clerks and receptionists). 5. Your nurses. 6. Your GP. 7. Your doctor/consultant.	1. Items order needs improvement as three participants prefer to fill the hospital staff first then going back to families and finally celebrities. 2. Another layout issue is that the two sections were presented in one table. This led to that all participants filled section a. first then move to the next question, and forgetting to fill section b.	Below are list of people who may be influential in your life. Please indicate: a. First, how much they would think that you should use electronic devices to report your health information. 1. Your doctor/consultant. 2. Your nurses. 3. Your GP. 4. Hospital Administrative Staff (e.g. clerks and receptionists). 5. Your family (e.g. partners, parents and children). 6. Your friends. 7. Celebrities. b. Second, how much you will do what they want you to do 1. Your doctor/consultant. 2. Your nurses. 3. Your GP. 4. Hospital Administrative Staff (e.g. clerks and receptionists). 5. Your family (e.g. partners, parents and children). 6. Your friends. 7. Celebrities.
Q5. How important is the availability of the following supports for you to use the electronic devices to report your health information? 1.Computer and broadband (Internet) access at home. 2.Access to smart phone or tablets at home (e.g. iPhone, iPad, Android phones). 3.Computer and broadband (Internet) access in the hospital. 4.Previous knowledge and skills necessary to use electronic devices. 5.Training sessions to learn how to use electronic devices. 6.Availability of online helps	One participant was confused with the options as they seems similar	5. How important is the availability of the following supports for you to use the electronic devices to report your health information? a. To do it at home 1. Computer and broadband (Internet) access at home. 2. Access to smart phone or tablets at home (e.g. iPhone, iPad, Android phones). 3. Someone to help with any electronic device difficulties at home (e.g. family member or clinical staff). 4. Families or friends to do it for me. b. To do it in clinic 1. Computer and broadband (Internet) access in the hospital.

(e.g. help function). 7.Availability of telephone help. 8.Someone to help with any electronic device difficulties in the hospital. 9.Someone to help with any electronic device difficulties at home. 10.Families or friends to do it for me.		2. Someone to help with any electronic device difficulties in the hospital (e.g. clinical staff). c. General support 1. Availability of online helps (e.g. help function) for any electronic device difficulties. 2. Availability of telephone help for any electronic device difficulties. 3. To have computer skills. 4. Training sessions to learn how to use electronic devices.
Q9. Do you use the Internet?	This question should appear with the following question in one page as it is guide the answers of the subsequent questions	Q9 moved to the next page
Negative and positive items ordered randomly in the questionnaire.	All participant got confused to move between negative and positive questions which leads to difficulty on choosing the appropriate category for negative sentences	Grouping negative and positive items within each question. All positive items came first then all negative items.
The items background colour.	The background colour of the questions make it illegible	The colour changed to be lighter.

C.2.5 The final (fourth) questionnaire version

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Patients' opinions about using the electronic devices to report their healthcare information.

The National Health Service (NHS) encourages the use of technology to improve the quality of healthcare. Patients are increasingly being asked to provide information about their health using paper based questionnaires. This hospital is beginning to use **electronic devices** (e.g. touch screens, computers, mobile phones, laptops or tablet computers) to collect this information. These **electronic devices** give patients the opportunity to report their health feedback anywhere inside the clinic or outside (e.g. at home or in the cafe) at anytime they preferred. Moreover, the electronic patients' health information could help the hospital to improve the quality of care.

This is new but we don't know how people are going to respond to it. We know that some people may like the idea of using **electronic devices** for reporting their health information. Other people may be more hesitant about it. Therefore, we are trying to find out more about this to make the process as easy as possible in the future.

This questionnaire is designed to help us to understand how you feel about use of **electronic devices** to report health information. It also includes some questions about you (background information). Your responses will guide us to make the use of the electronic devices better and easier for you to use.

This project is part of my PhD research and the University of Leeds, the clinical team and the hospital are supporting me in doing this. Your responses will be treated in confidence and any published results will be anonymous. Please do not write your name on any part of this questionnaire. Many of the questions are similar please read them carefully and answer all the questions asked.

Thank you for your time. Please complete this questionnaire and return it by hand to me in the clinic or post it in the stamped addressed envelope provided to the following address: **Saja AL-Rayes**, room G.02 Charles Thackrah Building, University of Leeds, 101 Clarendon Road, Leeds, **LS2 9LJ**

It will take about 15 minutes to complete.

Thanks,

Saja Al-Rayes

Version 8 – 28nd November 2013

1. Using electronic devices (e.g. touch screens, computers, mobile phones, laptops or tablet computers) to report information about health may have different advantages and disadvantages. Here are some things that other people have said about this. Please tell me how much you agree or disagree with each one.

Please select **ONE** option only in each row.

Disagree strongly	Disagree	Disagree slightly	Neither agree nor disagree	Agree slightly	Agree	Agree strongly
1.a. For me, using electronic devices to report information about my health will be quicker than on paper.						
1.b. Using an electronic device will help me to report information about my health from wherever I am (i.e. in the hospital, at home or outside the country).						
1.c. If I use electronic devices to report information about my health it will help doctors to monitor me more closely.						
1.d. If I use electronic devices to report information about my health it will help hospital services to improve.						
1.e. I am worried I will make mistakes I cannot correct if I use an electronic device to report information about my health.						
1.f. For me, using electronic device to report information about my health is a waste of my time.						
1.g. I am worried that the information I provide via electronic devices would be seen by the wrong people (e.g. unauthorised doctors/nurses or other individuals).						
1.h. I am concerned I will lose information by doing something wrong if I use an electronic device to report information about my health.						

2. People may have different opinions towards the idea of reporting their health information using electronic devices. Please tell me how much you agree or disagree with each sentence.

Please select **ONE** option only in each row.

Disagree strongly	Disagree	Disagree slightly	Neither agree nor disagree	Agree slightly	Agree	Agree strongly
2.a. I like the idea of using electronic devices to report information about my health.						
2.b. If I wanted to, I could easily use any electronic device (i.e. touch screens, computers, mobile phones…etc.) to report information about my health.						

Disagree strongly	Disagree	Disagree slightly	Neither agree nor disagree	Agree slightly	Agree	Agree strongly
2.c. I am confident that I would be able to use any electronic device to report information about my health at the first time unaided.						
2.d. I think, hospitals should offer me a choice between paper questionnaires and electronic devices to report information about my health.						
2.e. I would feel uncomfortable using any electronic device to report information about my health.						
2.f. Using electronic devices to report information about my health does not appeal to me.						
2.g. It would be difficult for me to use electronic devices to report information about my health.						
2.h. I feel worried about using electronic devices to report information about my health.						

3. Some people want to use electronic devices, others do not. The following are what people have said about using electronic devices to report their health information. Please tell me how much you agree or disagree with each one.

Please select **ONE** option only in each row.

Disagree strongly	Disagree	Disagree slightly	Neither agree nor disagree	Agree slightly	Agree	Agree strongly
3.a. I intend to use an electronic device to report information about my health once it is available to me.						
3.b. I expect that I will use electronic devices to report information about my health.						
3.c. I would use electronic devices to report information about my health.						
3.d. I want to use electronic devices to report information about my health.						
3.e. I prefer to use electronic devices rather than paper to report information about my health.						
3.f. I would never report information about my health using electronic devices.						

4. Below is a list of people who may be influential in your life. Imagine that you have discussed the idea of electronic devices with them, please indicate:

a. First, imagine how much <u>they</u> approve of you using electronic devices to report information about your health.

Please select **ONE** option only in each row.

	Not at all	rarely	occasionally	sometimes	often	Almost every time	A great deal
1. Your GP.							
2. Your nurses.							
3. Your doctor/consultant.							
4. Hospital Administrative Staff (e.g. clerks and receptionists).							
5. Your family (e.g. partners, parents and children).							
6. Your friends.							
7. Celebrities (i.e. TV and film stars).							

b. Second, in general, how much <u>you</u> will follow their advice.

Please select **ONE** option only in each row.

	Not at all	rarely	occasionally	sometimes	often	Almost every time	A great deal
1. Your GP.							
2. Your nurses.							
3. Your doctor/consultant.							
4. Hospital Administrative Staff (e.g. clerks and receptionists).							
5. Your family (e.g. partners, parents and children).							
6. Your friends.							
7. Celebrities (i.e. TV and film stars).							

5. How important is the availability of the following support for you to use electronic devices to report information about your health?

Please score where 1 = Not at all important and 7 = Very Important

Please select **ONE** option only in each row.

		1	2	3	4	5	6	7
a. To report information at home	1. Access to electronic devices at home to report information about your health.							
	2. Someone to help with any electronic device difficulties at home (e.g. family member or clinical staff).							
	3. Families or friends to do it for me.							
b. To report information in clinic	1. Access to electronic devices in the hospital to report information about your health.							
	2. Someone to help with any electronic device difficulties in the hospital (e.g. clinical staff).							
	3. Families or friends to do it for me in clinic.							
c. General support	1. Availability of online support (e.g. help function) for any electronic device difficulties.							
	2. Availability of telephone support for any electronic device difficulties.							
	3. Having computer skills myself.							
	4. Training sessions to learn how to use electronic devices.							

About you

6. What is your gender?

Please select **ONE** option only.

Male	
Female	

7. Please specify which age group you fall into.

Please select **ONE** option only.

18 – 24		55 – 64	
25 – 34		65 – 74	
35 – 44		75 – 84	
45 – 54		85 +	

8. What is the highest educational level you have?

Please select **ONE** option only.

secondary school or below		Bachelor degree	
College/Certificate/Diploma		Post-graduate degree	
Trade/technical/vocational training		Professional degree (e.g. MD or LLB)	

9. Have you used the Internet in the last few months?

Please select **ONE** option only.

Yes *	
No	

* If **YES** please answer the following questions, if **NO** go to question **10**

9.1. Please tell me **how often** you access the Internet using the following?

Please select **ONE** option only in each row.

	Never	Rarely (when needed)	Monthly (1-3/ month)	Weekly (1/week)	Frequently (2-6 /week)	Daily (1/day)	Extensively Many times/ day
Personal computers or laptops							
Mobile phones							
Tablets computers (e.g. iPad or Android tablets)							

9.2. Please tell me **how often** you access the Internet for the following purposes?

Please select **ONE** option only in each row.

	Never	Rarely (when needed)	Monthly (1-3/ month)	Weekly (1/week)	Frequently (2-6 /week)	Daily (1/day)	Extensively Many times/ day
sending/receiving e-mail							
Internet banking							
Social networking (e.g. Facebook or Twitter)							
Online shopping							

	Never	Rarely (when needed)	Monthly (1-3/ month)	Weekly (1/week)	Frequently (2-6 /week)	Daily (1/day)	Extensively Many times/ day
Seeking health related information							
Reading or downloading online news, newspaper or magazines							
Using services related to travel or travel accommodation							
Downloading software (other than games software)							
Telephoning or making video over the Internet							
Finding information about goods or services							
Other (please specify here)							

9.3. Please tell me **how often** you access the Internet from the following places?

Please select **ONE** option only in each row.

	Never / Not applicable	Rarely (when needed)	Monthly (1-3/ month)	Weekly (1/week)	Frequently (2-6 /week)	Daily (1/day)	Extensively Many times/ day
At home							
At work							
At college / university							
At the house of a friend or family member							
In the Cafe							
In the Library							
Other (please specify here)							

10. If you have any other comments to help us understand more about why people may or may not choose to use electronic devices to report information about their health.

Please would you add them here?

Thank you for your time to complete this questionnaire

If you have any comments regarding the survey do not hesitate to contact me on this e-mail: MI08saar@leeds.ac.uk

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C.2.6 List of the items in the final version

Table C.5. Items list of the five study constructs.

Construct	Item number	Item sentence
Attitude	Attitude1	1.a. For me, using electronic devices to report information about my health will be quicker than on paper.
	Attitude2	1.b. Using an electronic device will help me to report information about my health from wherever I am (i.e. in the hospital, at home or outside the country).
	Attitude3	1.c. If I use electronic devices to report information about my health it will help doctors to monitor me more closely.
	Attitude4	1.d. If I use electronic devices to report information about my health it will help hospital services to improve.
	Attitude5	1.f. For me, using electronic device to report information about my health is a waste of my time. *
	Attitude6	2.a. I like the idea of using electronic devices to report information about my health.
	Attitude7	2.f. Using electronic devices to report information about my health does not appeal to me. *
Perceived behavioural control	PBcontrol1	2.b. If I wanted to, I could easily use any electronic device (i.e. touch screens, computers, mobile phones…etc.) to report information about my health.
	PBcontrol2	2.c. I am confident that I would be able to use any electronic device to report information about my health at the first time unaided.
	PBcontrol3	2.g. It would be difficult for me to use electronic devices to report information about my health.*
Subjective norms	SN1	1. Your GP.
	SN2	2. Your nurses.
	SN3	3. Your doctor/consultant.
	SN4	4. Hospital Administrative Staff (e.g. clerks and receptionists).
	SN5	5. Your family (e.g. partners, parents and children).
	SN6	6. Your friends.
	SN7	7. Celebrities (i.e. TV and film stars).
Computer anxiety	CAnxiety1	1.e. I am worried I will make mistakes I cannot correct if I use an electronic device to report information about my health.
	CAnxiety2	1.g. I am worried that the information I provide via electronic devices would be seen by the wrong people (e.g. unauthorised doctors/nurses or other individuals).
	CAnxiety3	1.h. I am concerned I will lose information by doing something wrong if I use an electronic device to report information about my health.
	CAnxiety4	2.e. I would feel uncomfortable using any electronic device to report information about my health.
	CAnxiety5	2.h. I feel worried about using electronic devices to report information about my health.
Behavioural intention	BIntention1	3.a. I intend to use an electronic device to report information about my health once it is available to me.
	BIntention2	3.b. I expect that I will use electronic devices to report information about my health.
	BIntention3	3.c. I would use electronic devices to report information about my health.
	BIntention4	3.d. I want to use electronic devices to report information about my health.
	BIntention5	3.f. I would never report information about my health using electronic devices.*

Note: (*) negative item

APPENDIX D. Questionnaire Testing Supplementary Documents

D.1 Methodology supplementary documents

D.1.1 Participant Information Sheet: Medical and nurses clinic

Participant Information Sheet

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Research title:	Development of a questionnaire measuring patient acceptance toward using electronic patient reported outcome measures (e-PROMs).
Phase:	1.B.
Version:	3.0
Last revision:	02/04/2014
Protocol version:	2.0
Chief investigator:	Saja Al-Rayes (ml08saar@leeds.ac.uk)
Supervisors:	Prof. Jeremy Wyatt (J.C.Wyatt@leeds.ac.uk) Dr. Maureen Twiddy (M.Twiddy@leeds.ac.uk) Dr. Susan Clamp (s.clamp@leeds.ac.uk)
Address:	Leeds Institute of Health Sciences, 101 Clarendon Rd, University of Leeds, Leeds, LS2 9LJ
Contact details:	E-mail: ml08saar@leeds.ac.uk Telephone: 01133431688

I am a PhD student at the University of Leeds, sponsored by the Government of Saudi Arabia. I would like to invite you to take part in my PhD research project. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask me 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 this research?

This research aims to develop a questionnaire that will help healthcare providers and researchers understand the different barriers that might face patients when using electronic devices to report information about their health. Traditionally, patients use paper-based measures in the clinic to report the consequences of disease and/or its treatment (e.g. perceptions of health, well-being, symptoms, functioning, and treatment satisfaction). These are used to enhance communication between patient and healthcare provider and to detect the patients' health problems. Providing this information electronically has potential benefits for patients and healthcare providers. It provides patients with the opportunity to complete the measure at home, or anywhere they can access the Internet (e.g. using a personal computer, mobile phone). The information provided by patients in this way can also help their healthcare provider to monitor them more closely. This study will provide us with information which will help the NHS understand what patients feel about providing information about their health in this way, and will help the NHS to design better health data collection systems and improve patient care.

Why Have I been chosen?

In the next few years increasing numbers of NHS patients will be asked to record information about their health electronically. Before these systems are introduced we need to know what patients feel about them and address any barriers and concerns patients may have. You are being asked to help with this research because as a patient you are likely to be one of the people asked to provide information about your health in this way. We have designed a

Page **1** of **3**

questionnaire to give to patients to assess their views, but before we use it more widely we need to make sure it is an effective questionnaire. You have been approached because we would like your help testing out this questionnaire.

Do I have to take part?

It is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep and be asked to sign a consent form. You can withdraw from the study at any time before returning the questionnaire to the researcher. If you wish to withdraw your questionnaire after you have submitted it, you will be able to do so up to (September 2014) when the data analysis will begin. Withdrawing from the study will not affect your care in any way. You do not have to give a reason.

What do I have to do? /what will happen to me if I take part?

If you are interested in participating in the study the clinic nurse will introduce you to the researcher who will be able to answer any questions you have. After they have answered your questions, you will be asked to sign two consent forms, one of which you will retain, the other will be kept by the researcher. You will then be given a questionnaire to fill in. You will be asked to complete the questionnaire while you are waiting in the clinic for your appointment. It is expected that the questionnaire will take around 15 minutes to complete. The questionnaire is designed to help us understand the different factors that might enhance the usage of the electronic devices to report your health information. Then, the completed questionnaire should be given to the researcher.

What are the possible disadvantages or risks of taking part?

Taking part in this research will not subject you to any risks of physical or psychological harm.

What are the possible benefits of taking part?

There are no specific benefits from taking part in the study, although some people find participating in research interesting and enjoy having the opportunity to improve patient care.

Will my taking part in this project be kept confidential? / what will happen to the results of the research project?

Your questionnaire responses, and any information we collect about you will be kept confidential and will be handled strictly in accordance with the consent that you have given and the 1998 Data Protection Act. All data will be shredded (permanently destroyed) 3 years after the submission of the thesis (termination of study May 2015). The data will be accessed by the chief investigator only and if necessary the academic supervisors. The results of this study will be published in a PhD thesis and in peer reviewed journals. However, only aggregated data will be published and no patient identifiable data will be published.

What type of information will be sought from me and why is the collection of this information relevant for achieving the research project's objectives?

The questionnaire will ask you for your views on using electronic devices, such as computers, smartphones and laptops to report information to health professionals about your health. It will ask about your attitudes towards technology, whether you currently use these technologies, and the availability of these to you. We will collect data from a lot of people to find out what factors are most closely associated with later usage. The results will help the clinicians to improve the system based on your feedback. More widely, it will provide any system developers or clinicians, who are intending to develop a system for the patients, with information about what could enhance the usage.

Who has reviewed the study?

All the research in the NHS is looked at by independent group of people, called a Research Ethics Committee, to protect your interests. This study has been reviewed and approved by 14/WA/0048 NHS and R&D Research Ethics Committee.

Who to contact if I have further enquiries?

If you want to know more about the study, please feel free to contact the chief investigator
Name: Saja Al-Rayes
E-mail address: ml08saar@leeds.ac.uk
Telephone number: 01133431688

D.1.2 Participant Information Sheet: telephone

Information Sheet for participants

UNIVERSITY OF LEEDS

Research title:	Development of a questionnaire measuring patient acceptance toward using electronic patient reported outcome measures (e-PROMs)
Phase:	1.A.
Version:	3.0
Last revision:	02/04/2014
Protocol version:	2.0
Chief investigator:	Saja Al-Rayes (ml08saar@leeds.ac.uk)
Supervisors:	Prof. Jeremy Wyatt (J.C.Wyatt@leeds.ac.uk) Dr. Maureen Twiddy (M.Twiddy@leeds.ac.uk) Dr. Susan Clamp (s.clamp@leeds.ac.uk)
Address:	Leeds Institute of Health Sciences, 101 Clarendon Rd, University of Leeds, Leeds, LS2 9LJ
Contact details:	E-mail: ml08saar@leeds.ac.uk Telephone: 01133431688

I am a PhD student at the University of Leeds, sponsored by the Government of Saudi Arabia. I would like to invite you to take part in my PhD research project. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask me 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 this research?

This research aims to develop a questionnaire that will help healthcare providers and researchers understand the different barriers that might face patients when using electronic devices to report information about their health. Traditionally, patients use paper-based measures in the clinic to report the consequences of disease and/or its treatment (e.g. perceptions of health, well-being, symptoms, functioning, and treatment satisfaction). These are used to enhance communication between patient and healthcare provider and to detect the patients' health problems. Providing this information electronically has potential benefits for patients and healthcare providers. It provides patients with the opportunity to complete the measure at home, or anywhere they can access the Internet (e.g. using a personal computer, mobile phone). The information provided by patients in this way can also help their healthcare provider to monitor them more closely. This study will provide us with information which will help the NHS understand what patients feel about providing information about their health in this way, and will help the NHS to design better health data collection systems and improve patient care.

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In the next few years increasing numbers of NHS patients will be asked to record information about their health electronically. Before these systems are introduced we need to know what patients feel about them and address any barriers and concerns patients may have. You are

Page **1** of **3**

being asked to help with this research because as a patient you are likely to be one of the people asked to provide information about your health in this way. We have designed a questionnaire to give to patients to assess their views, but before we use it more widely we need to make sure it is an effective questionnaire. You have been approached because we would like your help testing out this questionnaire.

Do I have to take part?

It is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep and be asked to sign a consent form. You can withdraw from the study at any time before returning the questionnaire to the researcher. If you wish to withdraw your questionnaire after you have submitted it, you will be able to do so up to (September 2014) when the data analysis will begin. Withdrawing from the study will not affect your care in any way. You do not have to give a reason.

What do I have to do? /what will happen to me if I take part?

This information sheet provides you with the researcher contact details who will be able to answer any questions you have about participation. If you are willing to participate in the study, please sign the two consent forms, retaining one, and returning the other to the researcher using the stamped envelope available in the package. Please complete the questionnaire, and return the completed questionnaire and consent form in the stamped addressed envelope provided. It is expected that completing the questionnaire will take around 15 minutes to complete. The questionnaire is designed to help us understand the different factors that might enhance the usage of the electronic devices to report your health information.

What are the possible disadvantages or risks of taking part?

Taking part in this research will not subject you to any risks of physical or psychological harm.

What are the possible benefits of taking part?

There are no specific benefits from taking part in the study, although some people find participating in research interesting and enjoy having the opportunity to improve patient care.

Will my taking part in this project be kept confidential? / what will happen to the results of the research project?

Your questionnaire responses, and any information we collect about you will be kept confidential and will be handled strictly in accordance with the consent that you have given and the 1998 Data Protection Act. All data will be shredded (permanently destroyed) 3 years after the submission of the thesis (termination of study May 2015). The data will be accessed by the chief investigator only and if necessary the academic supervisors. The results of this study will be published in a PhD thesis and in peer reviewed journals. However, only aggregated data will be published and no patient identifiable data will be published.

What type of information will be sought from me and why is the collection of this information relevant for achieving the research project's objectives?

The questionnaire will ask you for your views on using electronic devices, such as computers, smartphones and laptops to report information to health professionals about your health. It will ask about your attitudes towards technology, whether you currently use these technologies, and the availability of these to you. We will collect data from a lot of people to find out what factors are most closely associated with later usage. The results will help the clinicians to improve the system based on your feedback. More widely, it will provide any system developers or clinicians, who are intending to develop a system for the patients, with information about what could enhance the usage.

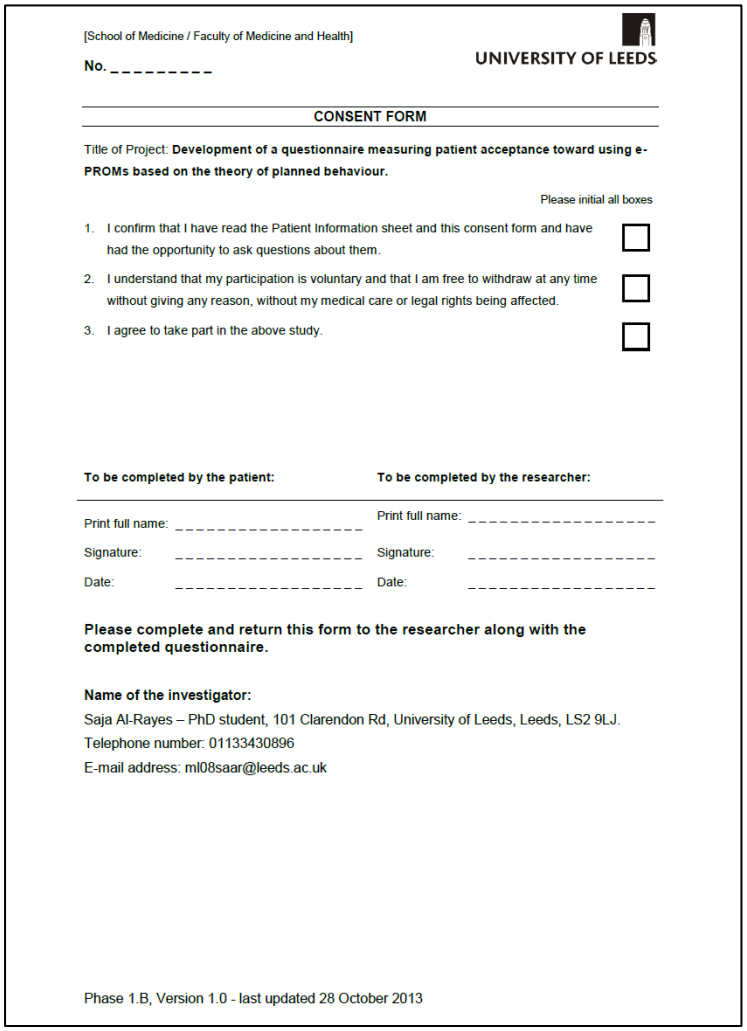
Who has reviewed the study?

All the research in the NHS is looked at by independent group of people, called a Research Ethics Committee, to protect your interests. This study has been reviewed and approved by 14/WA/0048 NHS and R&D Research Ethics Committee.

Who to contact if I have further enquiries?

If you want to know more about the study, please feel free to contact the chief investigator
Name: Saja Al-Rayes
E-mail address: ml08saar@leeds.ac.uk
Telephone number: 01133431688

D.1.3 Participant consent form: medical and nurses clinic



[School of Medicine / Faculty of Medicine and Health]

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No. _ _ _ _ _ _ _ _ _

CONSENT FORM

Title of Project: **Development of a questionnaire measuring patient acceptance toward using e-PROMs based on the theory of planned behaviour.**

Please initial all boxes

1. I confirm that I have read the Patient Information sheet and this consent form and have had the opportunity to ask questions about them. ☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my medical care or legal rights being affected. ☐
3. I agree to take part in the above study. ☐

To be completed by the patient:		**To be completed by the researcher:**	
Print full name:	_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _	Print full name:	_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
Signature:	_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _	Signature:	_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
Date:	_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _	Date:	_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Please complete and return this form to the researcher along with the completed questionnaire.

Name of the investigator:

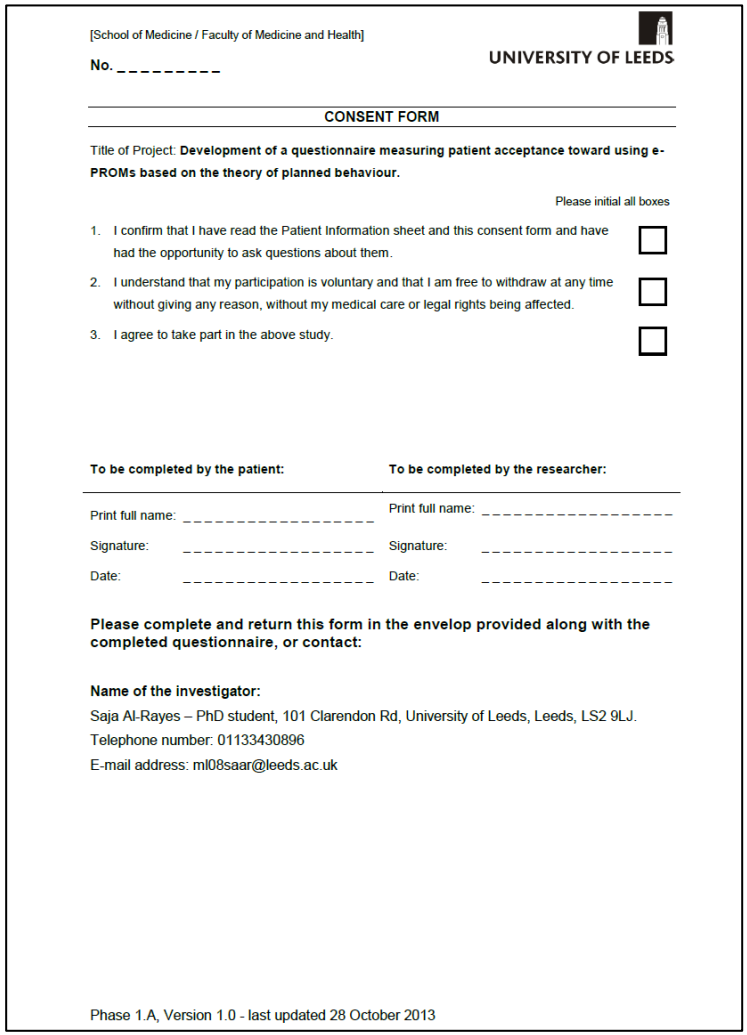
Saja Al-Rayes – PhD student, 101 Clarendon Rd, University of Leeds, Leeds, LS2 9LJ.

Telephone number: 01133430896

E-mail address: ml08saar@leeds.ac.uk

Phase 1.B, Version 1.0 - last updated 28 October 2013

D.1.4 Participant consent form: medical and nurses clinic



[School of Medicine / Faculty of Medicine and Health]

UNIVERSITY OF LEEDS

No. _ _ _ _ _ _ _ _ _

CONSENT FORM

Title of Project: **Development of a questionnaire measuring patient acceptance toward using e-PROMs based on the theory of planned behaviour.**

Please initial all boxes

1. I confirm that I have read the Patient Information sheet and this consent form and have had the opportunity to ask questions about them. ☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my medical care or legal rights being affected. ☐
3. I agree to take part in the above study. ☐

To be completed by the patient:		**To be completed by the researcher:**	
Print full name:	_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _	Print full name:	_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
Signature:	_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _	Signature:	_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
Date:	_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _	Date:	_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Please complete and return this form in the envelop provided along with the completed questionnaire, or contact:

Name of the investigator:

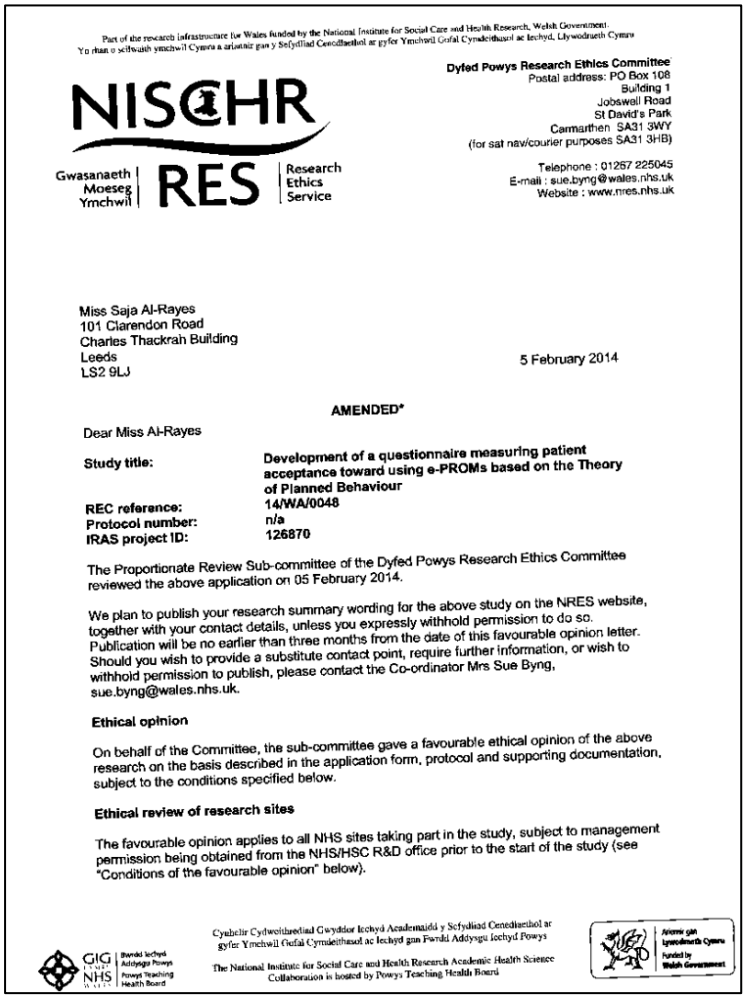
Saja Al-Rayes – PhD student, 101 Clarendon Rd, University of Leeds, Leeds, LS2 9LJ.

Telephone number: 01133430896

E-mail address: ml08saar@leeds.ac.uk

Phase 1.A, Version 1.0 - last updated 28 October 2013

D.1.5 Ethical approval: RES



Part of the research infrastructure for Wales funded by the National Institute for Social Care and Health Research, Welsh Government.
Yn rhan o seilwaith ymchwil Cymru a ariannir gan y Sefydliad Cenedlaethol ar Iechyd, Llywodraeth Cymru

NISCHR
Gwasanaeth Moeseg Ymchwil | RES | Research Ethics Service

Dyfed Powys Research Ethics Committee
Postal address: PO Box 108
Building 1
Jobswell Road
St David's Park
Carmarthen SA31 3WY
(for sat nav/courier purposes SA31 3HB)

Telephone : 01267 225045
E-mail : sue.byng@wales.nhs.uk
Website : www.nres.nhs.uk

Miss Saja Al-Rayes
101 Clarendon Road
Charles Thackrah Building
Leeds
LS2 9LJ

5 February 2014

AMENDED*

Dear Miss Al-Rayes

Study title:	**Development of a questionnaire measuring patient acceptance toward using e-PROMs based on the Theory of Planned Behaviour**
REC reference:	**14/WA/0048**
Protocol number:	**n/a**
IRAS project ID:	**126870**

The Proportionate Review Sub-committee of the Dyfed Powys Research Ethics Committee reviewed the above application on 05 February 2014.

We plan to publish your research summary wording for the above study on the NRES website, together with your contact details, unless you expressly withhold permission to do so. Publication will be no earlier than three months from the date of this favourable opinion letter. Should you wish to provide a substitute contact point, require further information, or wish to withhold permission to publish, please contact the Co-ordinator Mrs Sue Byng, sue.byng@wales.nhs.uk.

Ethical opinion

On behalf of the Committee, the sub-committee gave a favourable ethical opinion of the above research on the basis described in the application form, protocol and supporting documentation, subject to the conditions specified below.

Ethical review of research sites

The favourable opinion applies to all NHS sites taking part in the study, subject to management permission being obtained from the NHS/HSC R&D office prior to the start of the study (see "Conditions of the favourable opinion" below).

GIG NHS | Bwrdd Iechyd Addysgu Powys | Powys Teaching Health Board

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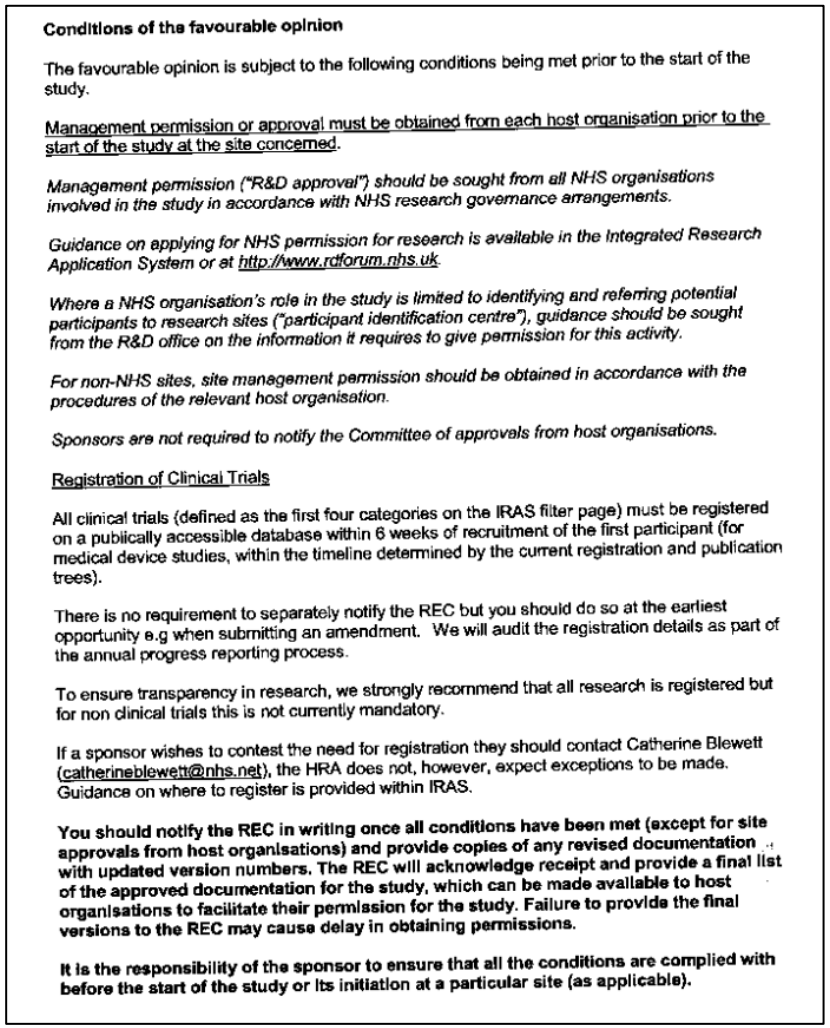
The National Institute for Social Care and Health Research Academic Health Science Collaboration is hosted by Powys Teaching Health Board

Ariennir gan Lywodraeth Cymru | Funded by Welsh Government



Conditions of the favourable opinion

The favourable opinion is subject to the following conditions being met prior to the start of the study.

Management permission or approval must be obtained from each host organisation prior to the start of the study at the site concerned.

Management permission ("R&D approval") should be sought from all NHS organisations involved in the study in accordance with NHS research governance arrangements.

Guidance on applying for NHS permission for research is available in the Integrated Research Application System or at http://www.rdforum.nhs.uk.

Where a NHS organisation's role in the study is limited to identifying and referring potential participants to research sites ("participant identification centre"), guidance should be sought from the R&D office on the information it requires to give permission for this activity.

For non-NHS sites, site management permission should be obtained in accordance with the procedures of the relevant host organisation.

Sponsors are not required to notify the Committee of approvals from host organisations.

Registration of Clinical Trials

All clinical trials (defined as the first four categories on the IRAS filter page) must be registered on a publically accessible database within 6 weeks of recruitment of the first participant (for medical device studies, within the timeline determined by the current registration and publication trees).

There is no requirement to separately notify the REC but you should do so at the earliest opportunity e.g when submitting an amendment. We will audit the registration details as part of the annual progress reporting process.

To ensure transparency in research, we strongly recommend that all research is registered but for non clinical trials this is not currently mandatory.

If a sponsor wishes to contest the need for registration they should contact Catherine Blewett (catherineblewett@nhs.net), the HRA does not, however, expect exceptions to be made. Guidance on where to register is provided within IRAS.

You should notify the REC in writing once all conditions have been met (except for site approvals from host organisations) and provide copies of any revised documentation with updated version numbers. The REC will acknowledge receipt and provide a final list of the approved documentation for the study, which can be made available to host organisations to facilitate their permission for the study. Failure to provide the final versions to the REC may cause delay in obtaining permissions.

It is the responsibility of the sponsor to ensure that all the conditions are complied with before the start of the study or its initiation at a particular site (as applicable).

Approved documents

The documents reviewed and approved were:

Document	*Version*	*Date*
Evidence of insurance or indemnity		19 September 2013
CV : Miss Saja Al-Rayes		07 November 2013
Letter from Sponsor	email	20 January 2014
CV: Professor J Wyatt		
CV: Dr S Clamp		
CV: Dr M Twiddy		25 November 2013
Participant Consent Form: Phase 1A	1	28 October 2013
Participant Consent Form: Phase 1B	1	28 October 2013
Participant Consent Form: Phase 2A	1	28 October 2013
Participant Consent Form: Phase 2B	1	28 October 2013
Participant Information Sheet: Phase 1A	2	15 December 2013
Participant Information Sheet: Phase 1B	2	15 December 2013
Participant Information Sheet: Phase 2A	2	15 December 2013
Participant Information Sheet: Phase 2B	2	15 December 2013
Protocol	2	06 January 2014
Questionnaire	8	28 November 2013
REC application	1	11 November 2013
Personal Information Form: Phase 2*	1	28 October 2013

Membership of the Proportionate Review Sub-Committee

The members of the Sub-Committee who took part in the review are listed on the attached sheet.

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

After ethical review

Reporting requirements
The attached document "After ethical review – guidance for researchers" gives detailed guidance on reporting requirements for studies with a favourable opinion, including:

- Notifying substantial amendments
- Adding new sites and investigators
- Notification of serious breaches of the protocol
- Progress and safety reports
- Notifying the end of the study

The NRES website also provides guidance on these topics, which is updated in the light of changes in reporting requirements or procedures.

Feedback

You are invited to give your view of the service that you have received from the National Research Ethics Service and the application procedure. If you wish to make your views known please use the feedback form available on the website.
information is available at National Research Ethics Service website > After Review

14/WA/0048 **Please quote this number on all correspondence**

We are pleased to welcome researchers and R & D staff at our NRES committee members' training days – see details at http://www.hra.nhs.uk/hra-training/

With the Committee's best wishes for the success of this project.

Yours sincerely

pp Sue Byrd

Dr Gareth Davies
Chair

Enclosures: *List of names and professions of members who took part in the review*

"After ethical review – guidance for researchers"

Copy to: *Clare Skinner, University of Leeds*
Anne Gowing, The Leeds Teaching Hospital

Dyfed Powys Research Ethics Committee

Attendance at PRS Sub-Committee of the REC meeting on 05 February 2014

Committee Members:

Name	*Profession*	*Present*	*Notes*
Dr John Buchan	Retired General Practitioner	Yes	Vice-Chair
Dr Gareth Davies	Principal Public Health Intelligence Analyst	Yes	Chair
Mrs Rosemary Whittemore	Lay member	Yes	

Also in attendance:

Name	*Position (or reason for attending)*
Mrs Sue Byng	REC Coordinator

Part of the research infrastructure for Wales funded by the National Institute for Social Care and Health Research, Welsh Government.
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NISCHR RES Gwasanaeth Moeseg Ymchwil | Research Ethics Service

~~Dyfed Powys Research Ethics Committee~~
Postal address: PO Box 108
Building 1
Jobswell Road
St David's Park
Carmarthen SA31 3WY
(for sat nav/courier purposes SA31 3HB)

Telephone : 01267 225045
E-mail : sue.byng@wales.nhs.uk
Website : www.nres.nhs.uk

***WALES REC 7**

Miss Saja Al-Rayes
101 Clarendon Road
Charles Thackrah Building
Leeds
LS2 9LJ

2 April 2014

Dear Miss Al-Rayes

Study title: **Development of a questionnaire measuring patient acceptance toward using e-PROMs based on the Theory of Planned Behaviour**

REC reference: **14/WA/0048**
Amendment number: **1**
Amendment date: **2 April 2014**
IRAS project ID: **126870**

I acknowledge the email of 2 April 2014 from the Chief Investigator notifying the Committee of the above minor amendment.

The Committee does not consider this to be a "substantial amendment" as defined in the Standard Operating Procedures for Research Ethics Committees. The amendment does not therefore require an ethical opinion from the Committee and may be implemented immediately, provided that it does not affect the approval for the research given by the R&D office for the relevant NHS care organisation.

Documents received:

The documents received were as follows:

Document	Version	Date
Participant Information Sheet: Phase 1A	3	02 April 2014
Participant Information Sheet: Phase 1B	3	02 April 2014
Participant Information Sheet: Phase 2A	3	02 April 2014
Participant Information Sheet: Phase 2B	3	02 April 2014

GIG NHS Bwrdd Iechyd Addysgu Powys Powys Teaching Health Board

Cynhelir Cydweithrediad Gwyddor Iechyd Academaidd y Sefydliad Cenedlaethol ar gyfer Ymchwil Gofal Cymdeithasol ac Iechyd gan Fwrdd Addysgu Iechyd Powys
The National Institute for Social Care and Health Research Academic Health Science Collaboration is hosted by Powys Teaching Health Board

Ariannir gan Lywodraeth Cymru Funded by Welsh Government

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

14/WA/0048 : Please quote this number on all correspondence

Yours sincerely

Sue Byng

Ms Sue Byng
REC Manager
WALES REC 7

Copy to: Clare Skinner, University of Leeds
Anne Gowing, The Leeds Teaching Hospital

Part of the research infrastructure for Wales funded by the National Institute for Social Care and Health Research, Welsh Government.
Yn rhan o seilwaith ymchwil Cymru a ariennir gan y Sefydliad Cenedlaethol ar gyfer Ymchwil Gofal Cymdeithasol ac Iechyd, Llywodraeth Cymru

NISCHR RES Research Ethics Service
Gwasanaeth Moeseg Ymchwil

WALES REC 7
PO Box 108
Building 1
Jobswell Road
St David's Park
Carmarthen SA31 3WY
(for sat nav/courier purposes SA31 3HB)

Telephone : 01267 225045
E-mail : sue.byng@wales.nhs.uk
Website : www.hra.nhs.uk

Miss Saja Al-Rayes
101 Clarendon Road
Charles Thackrah Building
Leeds
LS2 9LJ

15 April 2014

Dear Miss Al-Rayes

Study title: **Development of a questionnaire measuring patient acceptance toward using e-PROMs based on the Theory of Planned Behaviour**
REC reference: **14/WA/0048**
Amendment number: **2**
Amendment date: **10 April 2014**
IRAS project ID: **126870**

I acknowledge the email of 10 April 2014 from the Chief Investigator notifying the Committee of the above minor amendment.

The Committee does not consider this to be a "substantial amendment" as defined in the Standard Operating Procedures for Research Ethics Committees. The amendment does not therefore require an ethical opinion from the Committee and may be implemented immediately, provided that it does not affect the approval for the research given by the R&D office for the relevant NHS care organisation.

Documents received:

The documents received were as follows:

Document	Version	Date
Covering email		10 April 2014
Letter of invitation	1.0	10 April 2014

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The National Institute for Social Care and Health Research Academic Health Science Collaboration is hosted by Powys Teaching Health Board

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Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

14/WA/0048 : Please quote this number on all correspondence

Yours sincerely

Sue Byng

Ms Sue Byng
REC Manager
WALES REC 7

Copy to: Clare Skinner, University of Leeds
Anne Gowing, The Leeds Teaching Hospital

D.1.6 Ethical approval: R&D

The Leeds Teaching Hospitals NHS
NHS Trust

Josephine Cuxton

Research & Development

Leeds Teaching Hospitals NHS Trust
34 Hyde Terrace
Leeds
LS2 9LN

Tel: 0113 392 2878
Fax: 0113 392 6397

r&d@leedsth.nhs.uk
www.leedsth.nhs.uk

06/03/2014

Dr Adam Glaser
Consultant Paediatric Oncologist
Yorkshire Regional Centre for
Paediatric Oncology and Haematology
St. James's University Hospital

Dear Dr Adam Glaser

Re: NHS Permission at LTHT for: Development of a questionnaire measuring patient acceptance toward using e-PROMs based on the Theory of Planned Behaviour
LTHT R&D Number: PO14/11075
REC: 14/WA/0048

I confirm that *NHS Permission for research* has been granted for this project at The Leeds Teaching Hospitals NHS Trust (LTHT). NHS Permission is granted based on the information provided in the documents listed below. All amendments (including changes to the research team) must be submitted in accordance with guidance in IRAS. Any change to the status of the project must be notified to the R&D Department.

Permission is granted on the understanding that the study is conducted in accordance with the *Research Governance Framework for Health and Social Care*, ICH GCP (if applicable) and NHS Trust policies and procedures available at http://www.leedsth.nhs.uk/academic/research-development/

This permission is granted only on the understanding that you comply with the requirements of the *Framework* as listed in the attached sheet "Conditions of Approval".

If you have any queries about this approval please do not hesitate to contact the R&D Department on telephone 0113 392 2878.

Indemnity Arrangements

The Leeds Teaching Hospitals NHS Trust participates in the NHS risk pooling scheme administered by the NHS Litigation Authority 'Clinical Negligence Scheme for NHS Trusts' for: (i) medical professional and/or medical malpractice liability; and (ii) general liability. NHS Indemnity for negligent harm is extended to researchers with an employment contract (substantive or honorary) with the Trust. The Trust only accepts liability for research activity that has been managerially approved by the R&D Department.

The Trust therefore accepts liability for the above research project and extends indemnity for negligent harm to cover you as investigator and the researchers listed on the Site Specific Information form. Should there be any changes to the research team please ensure that you inform the R&D Department and that s/he obtains an appropriate contract, or letter of access, with the Trust if required.

Yours sincerely

Dr D R Norfolk
Associate Director of R&D

Approved documents
The documents reviewed and approved are listed as follows

Document	*Version*	*Date of document*
NHS R&D Form	3.5	11/11/13
SSI Form	3.5	06/03/14
REC Letter confirming favourable opinion		05/02/14
Patient information sheet – Phase 1 A&B	2	15/12/13
Patient information sheet – Phase 2 A&B	2	15/12/13
Consent form - Phase 1 A&B	1	28/10/13
Consent form - Phase 2 A&B	1	28/10/13
Protocol	2	06/01/14
Personal Information form phase 2	1.0	28/10/13

Conditions of NHS Permission for Research:

- Permission from your Directorate must be obtained before starting the study.
- Favourable Opinion of the appropriate Research Ethics Committee, where necessary, must be obtained before starting the study.
- Arrangements must be made to ensure that all members of the research team, where applicable, have appropriate employment contracts or letter of agreement to carry out their work in the Trust.
- Agreements must be in place with appropriate support departments regarding the services required to undertake the project and arrangements must be in place to recompense them for the costs of their services.
- Arrangements must be in place for the management of financial and other resources provided for the study, including intellectual property arising from the work.
- Priority should be given at all times to the dignity, rights, safety and well being of participants in the study
- Healthcare staff should be suitably informed about the research their patients are taking part in and information specifically relevant to their care arising from the study should be communicated promptly.
- Each member of the research team must be qualified by education, training and experience to discharge his/her role in the study. Students and new researchers must have adequate supervision, support and training.
- The research must follow the protocol approved by the relevant research ethics committee. Any proposed amendments to or deviations from the protocol must be submitted for review by the Research Ethics Committee, the Research Sponsor, regulatory authority and any other appropriate body. The R&D Department should be informed where the amendment has resource implications within the Directorate and the Directorate research lead/clinical director notified.
- Adverse Events in clinical trials of investigational medicinal products must be reported in accordance with the Medicines for Human Use (Clinical Trials) Regulations 2004.
- Complete and return Study Status Reports, when requested, to the R&D Department within 28 days of receipt as requested. (NB Failure to comply to such request with the requirement will lead to suspension of NHS Permission.)
- Procedures should be in place to ensure collection of high quality, accurate data and the integrity and confidentiality of data during processing and storage.
- Arrangements must be made for the appropriate archiving of data when the research has finished. Records must normally be kept for 15 years.
- All data and documentation associated with the study must be available for audit at the request of the appropriate auditing authority. Projects are randomly selected for audit by the R&D Department. You will be informed by letter if your study is selected.
- Findings from the study should be disseminated promptly and fed back as agreed to research participants.
- Findings from the study should be exposed to critical review through accepted scientific and professional channels.
- All members of the research team must ensure that the process of informed consent adheres to the standards GCP outlined in the UK Clinical Trials Regulations. Investigators are directed to the R&D website for further information and training availability.
- Where applicable, this NHS Permission includes aspects of the study previously covered by the NRES Site Specific Assessment (SSA) process.
- Appropriate permissions must be in place for studies which are covered by the Human Tissue Act.
- Patient Information Sheet and Consent form must be on The Leeds Teaching Hospitals headed paper and include local contact details.

NIHR Benchmarks for Performance in Initiating & Delivering Clinical Research

- Provide recruitment information when requested by R&D on the Clinical Trial Tracker (available on Trust Sharepoint)
- Work with R&D to resolve blocks and delays on trials to ensure that LTHT meets the NIHR benchmarks.

If you are not able to comply with these requirements, NHS permission to conduct the research in LTHT will be suspended.

Commercially Sponsored Trials

If the study is commercially sponsored, NHS Permission is given subject to provision of the following documents.

- Clinical Trials Agreement - agreed and signed off by the R&D Department (on behalf of the Leeds Teaching Hospitals NHS Trust) and the Sponsor. Investigators do not have the authority to sign contract on behalf of the Trust.

- Indemnity agreement, if not included in the Clinical Trials Agreement- (standard ABPI no fault arrangements apply) signed by the R&D Department and the Sponsor

It is essential that all the responsibilities set out in the Research Governance Framework, including those outlined above are fulfilled. The Trust reserves the right to withdraw NHS Permission where the above criteria are not being met. The Trust will not accept liability for any activity where NHS Permission has not been granted.

NEW* Condition of Approval *NEW

Clinical Trials Performance Management

NIHR Benchmarks for Performance in Initiating & Delivering Clinical Research

LTHT clinical trial performance is now measured against 2 national benchmarks to improve the initiation and delivery of clinical trials approved by the Trust. From April 2013 NIHR funding to the Trust will be conditional on meeting these benchmarks.

- **Initiation** – it should take no more than 70 days from receipt of a valid research application (signed SSI form) by the R&I Department to the recruitment of (ie consenting) the 1st patient to the trial

- **Delivery** – for all commercial trials hosted by the Trust the agreed number of patients must be recruited within the agreed recruitment period

The Trust now has to submit quarterly performance reports to the Department of Health setting out our performance.

NHS permission for this project to be carried out in the Trust is therefore granted on the understanding that you:

- **Provide recruitment information when requested by R&D on the Clinical Trial Tracker (available on Trust Sharepoint)**

- **Work with R&D to resolve blocks and delays on trials to ensure that LTHT meets the NIHR benchmarks.**

If you are not able to comply with these requirements, NHS permission to conduct the research in LTHT will be suspended. These new conditions of approval are in addition to the "conditions of approval" listed in the attached NHS permission letter.

For more information about the new benchmarks and the work we are doing to support clinical trial management please see the R&D website.
http://www.leedsth.nhs.uk/academic/research-development/

D.2 . Results supplementary documents

D.2.1 Comparing demographic characteristics differences of the two distribution modes

Table D.1. Chi-square test of the association between modes of distribution and age.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.208[a]	3	.240
Likelihood Ratio	3.146	3	.370
Linear-by-Linear Association	.003	1	.955
N of Valid Cases	231		

Note: 1 cells (12.5%) have expected count less than 5. The minimum expected count is .62.

Table D.2. Chi-square test of the association between modes of distribution and education level.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.919[a]	5	.161
Likelihood Ratio	8.049	5	.154
Linear-by-Linear Association	2.251	1	.134
N of Valid Cases	230		

Note: 5 cells (41.7%) have expected count less than 5. The minimum expected count is .73.

Table D.3. Chi-square test of the association between modes of distribution and Internet experience.

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.002[a]	1	.967		
Continuity Correction[b]	.000	1	1.000		
Likelihood Ratio	.002	1	.967		
Fisher's Exact Test				1.000	.722
Linear-by-Linear Association	.002	1	.967		
N of Valid Cases	231				

Note: 1 cells (25.0%) have expected count less than 5. The minimum expected count is 1.04. (b) = Computed only for a 2x2 table

D.2.2 Demographic characteristics

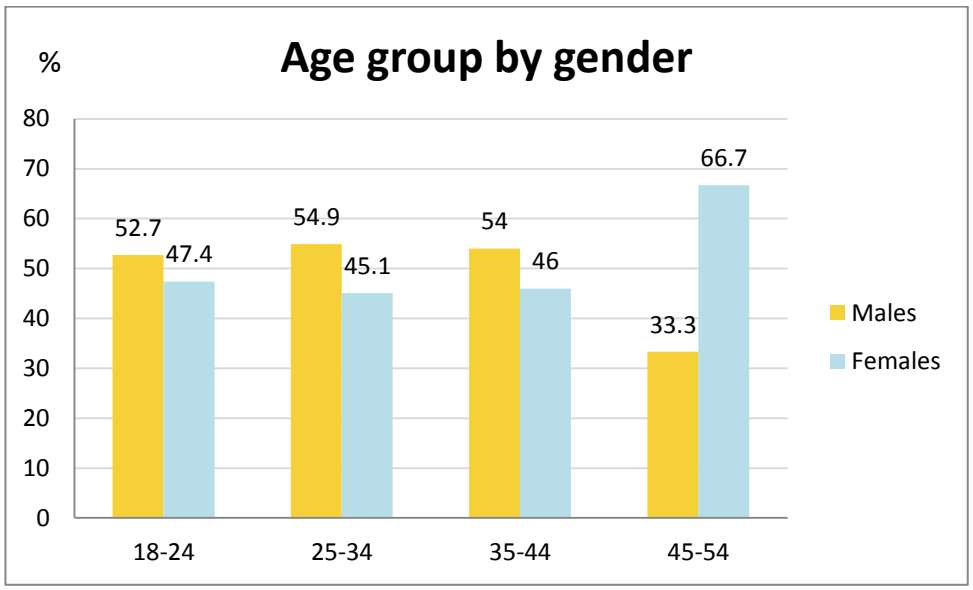


Figure D.1. Percentages of age groups per gender (females and males)

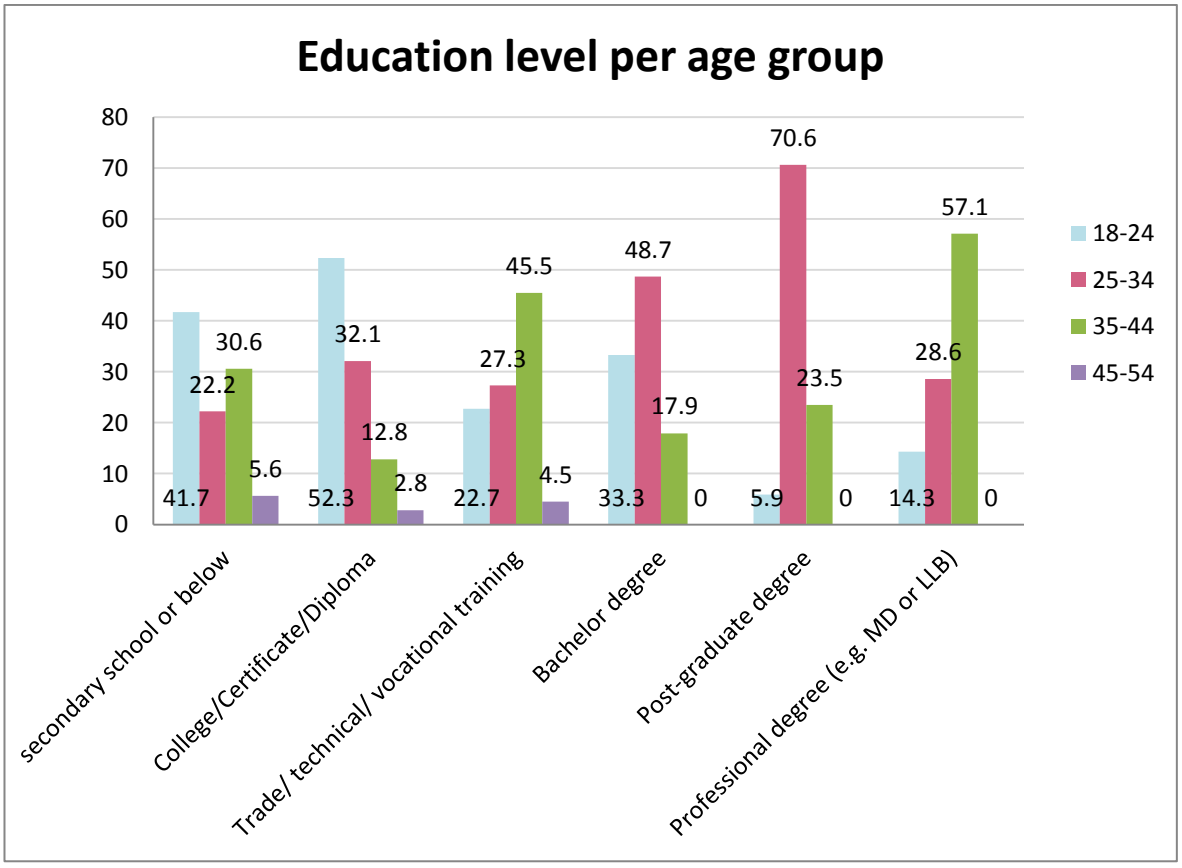
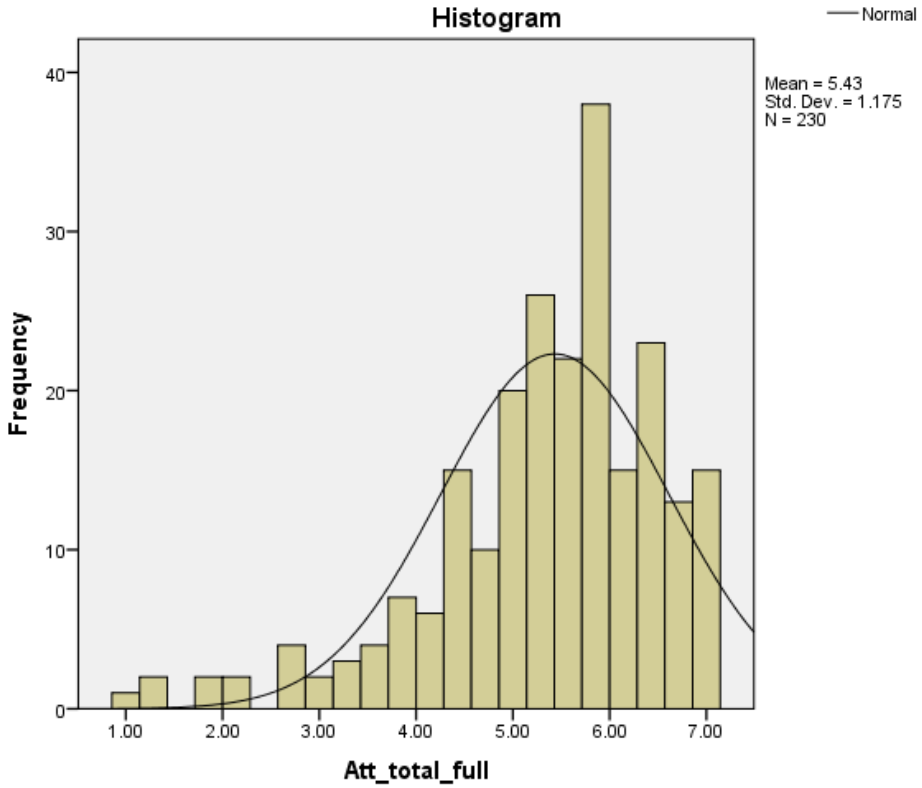


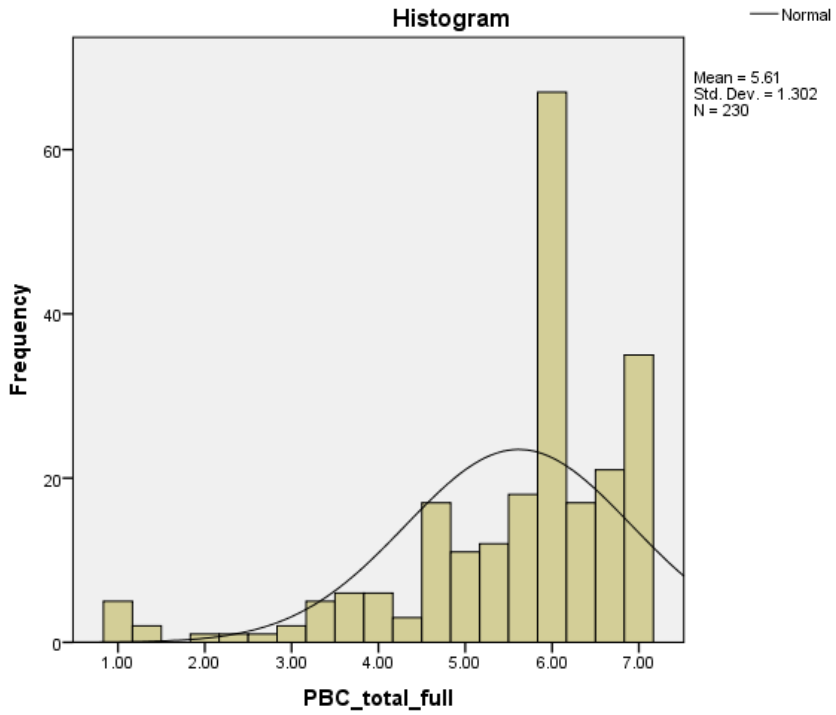
Figure D.2. Percentages of education level per age group.

D.2.3 Construct normality histogram: full-version

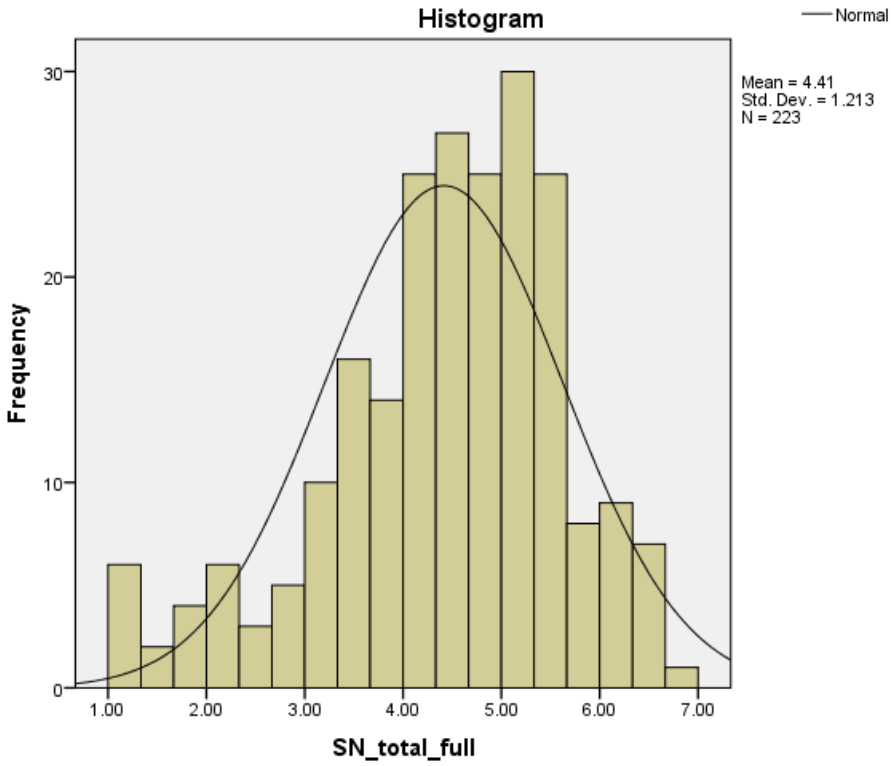
- Distribution of attitude



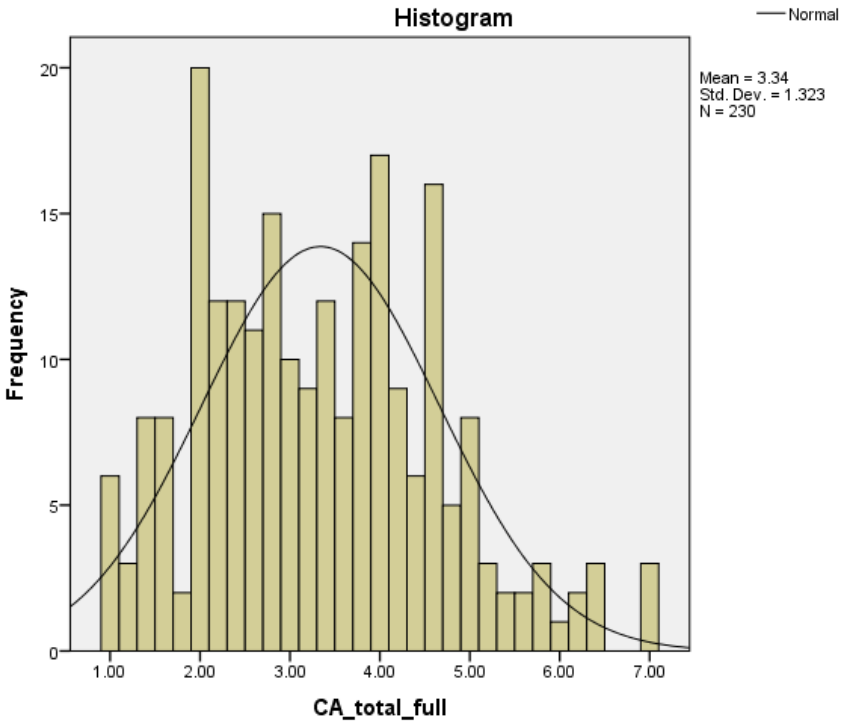
- Distribution of perceived behavioural control



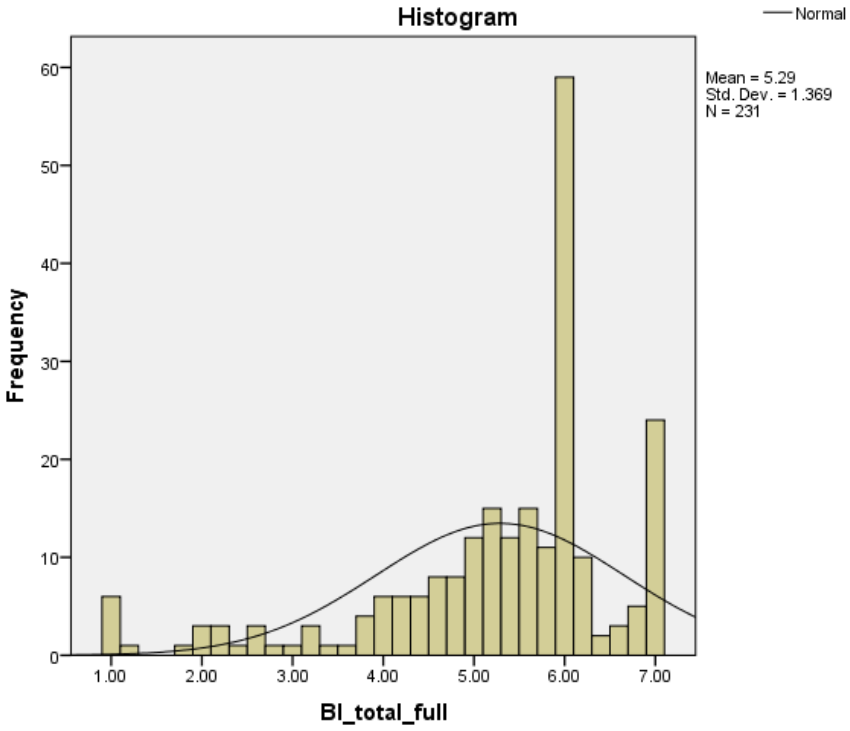
- Distribution of subjective norms



- Distribution of computer anxiety

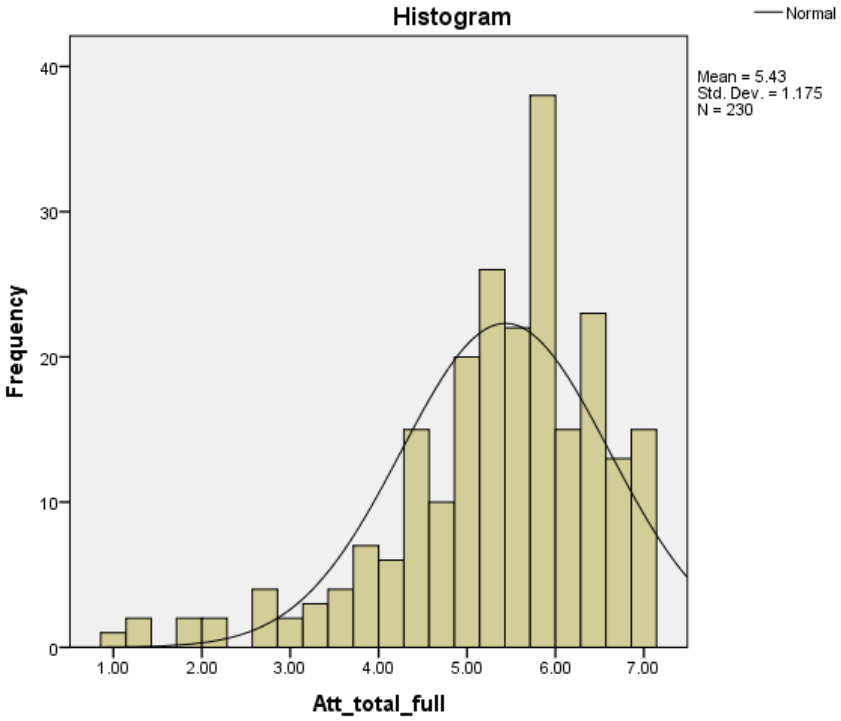


- Distribution of behavioural intention

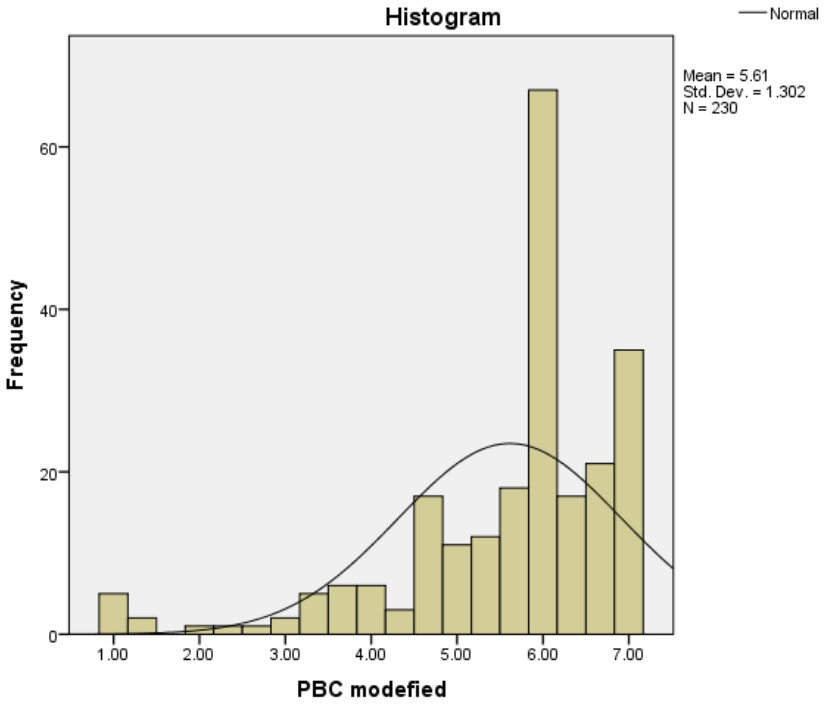


D.2.4 Construct normality histogram: reduced-version

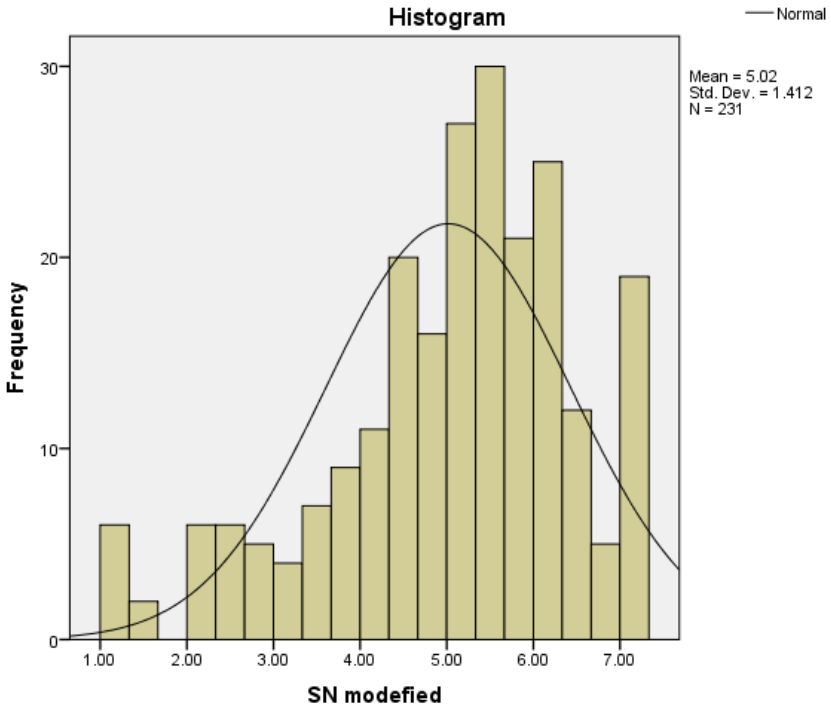
- Distribution of attitude



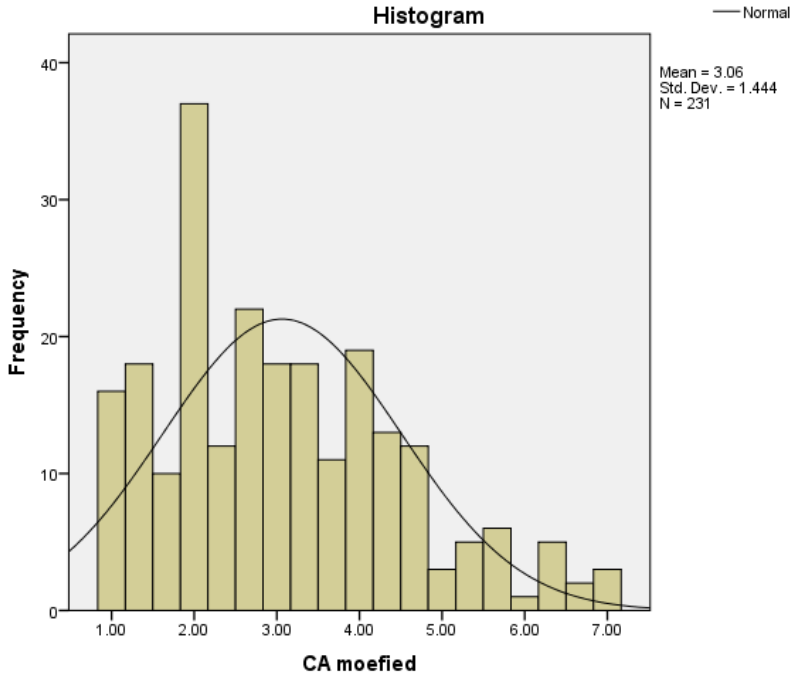
- Distribution of perceived behavioural control



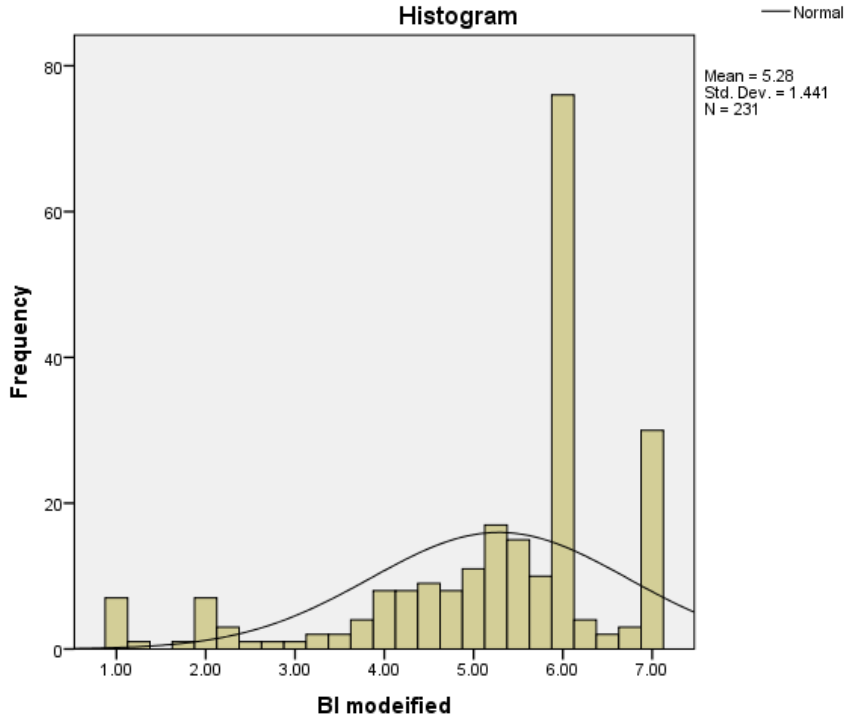
- Distribution of subjective norms



- Distribution of computer anxiety



- Distribution of behavioural intention



D.2.5 Reliability results

Table D.4. The Cronbach's alpha coefficient, inter-item correlation and item-total correlation of the full version questionnaire (N=231).

Constructs	Items[1]	Cronbach's α	Inter-item correlation	Item-to-total correlation	Cronbach's α if item deleted
At	1.a. For me, using electronic devices to report information about my health will be quicker than on paper. [**Attitude1**]	0.90	0.41 - 0.75	0.67	0.88
	1.b. Using an electronic device will help me to report information about my health from wherever I am (i.e. in the hospital, at home or outside the country). [**Attitude2**]			0.74	0.88
	1.c. If I use electronic devices to report information about my health it will help doctors to monitor me more closely. [**Attitude3**]			0.66	0.88
	1.d. If I use electronic devices to report information about my health it will help hospital services to improve. **[Attitude4]**			0.73	0.88
	* 1.f. For me, using electronic device to report information about my health is a waste of my time. [**Attitude5**]			0.63	0.89
	2.a. I like the idea of using electronic devices to report information about my health. [**Attitude6**]			0.81	0.87
	* 2.f. Using electronic devices to report information about my health does not appeal to me. [**Attitude7**]			0.66	0.89
PBC	2.b. If I wanted to, I could easily use any electronic device (i.e. touch screens, computers, mobile phones…etc.) to report information about my health. [**PBcontrol1**]	0.823	0.56–0.72	0.720	0.73
	2.c. I am confident that I would be able to use any electronic device to report information about my health at the first time unaided. [**PBcontrol2**]			0.723	0.71
	* 2.g. It would be difficult for me to use electronic devices to report information about my health. [**PBcontrol3**]			0.608	0.83
SN	1. Your GP. [**SN1**]	0.90	0.13–0.92	0.87	0.87
	2. Your nurses. [**SN2**]			0.87	0.87
	3. Your doctor/consultant. [**SN3**]			0.83	0.87
	4. Hospital Administrative Staff (e.g. clerks and receptionists). [**SN4**]			0.79	0.88
	5. Your family (e.g. partners, parents and children). [**SN5**]			0.72	0.88
	6. your friends [**SN6**]			0.64	0.89
	7. celebrities [**SN7**]			0.29	0.92
CA	1.e. I am worried I will make mistakes I cannot correct if I use an electronic device to report information about my health. [**CAnxiety1**]	0.818	0.306 – 0.630	0.56	0.80
	1.g. I am worried that the information I provide via electronic devices would be seen by the wrong people (e.g. unauthorised doctors/nurses or other individuals). [**CAnxiety2**]			0.57	0.80
	1.h. I am concerned I will lose information by doing something wrong if I use an electronic device to report information about my health. [**CAnxiety3**]			0.78	0.73
	2.e. I would feel uncomfortable using any electronic device to report information about my health. [**CAnxiety4**]			0.53	0.81
	2.h. I feel worried about using electronic devices to report information about my health. [**CAnxiety5**]			0.63	0.78
BI	3.a. I intend to use an electronic device to report information about my health once it is available to me. [**BIntention1**]	0.927	0.49–0.91	0.91	0.98
	3.b. I expect that I will use electronic devices to report information about my health. [**BIntention2**]			0.90	0.89
	3.c. I would use electronic devices to report information about my health. [**BIntention3**]			0.90	0.89
	3.d. I want to use electronic devices to report information about my health. [**BIntention4**]			0.86	0.90
	* 3.f. I would never report information about my health using electronic devices. [**BIntention5**]			0.54	0.97

Note: (1) the name between [ ] is the item name in the data sheet.

Table D.5. The Cronbach's alpha coefficient, inter-item correlation and item-total correlation of the modified version questionnaire (N=231).

Constructs	Items[1]	Cronbach's α	Inter-item correlation	Item-to-total correlation	Cronbach's α if item deleted
At	1.a. For me, using electronic devices to report information about my health will be quicker than on paper. [**Attitude1**]	0.87	0.46 - 0.67	0.69	0.85
	1.b. Using an electronic device will help me to report information about my health from wherever I am (i.e. in the hospital, at home or outside the country). [**Attitude2**]			0.73	0.84
	1.d. If I use electronic devices to report information about my health it will help hospital services to improve. **[Attitude4]**			0.69	0.85
	2.a. I like the idea of using electronic devices to report information about my health. [**Attitude6**]			0.81	0.82
	* 2.f. Using electronic devices to report information about my health does not appeal to me. [**Attitude7**]			0.63	0.87
PBC	2.b. If I wanted to, I could easily use any electronic device (i.e. touch screens, computers, mobile phones…etc.) to report information about my health. [**PBcontrol1**]	0.82	0.56–0.72	0.72	0.73
	2.c. I am confident that I would be able to use any electronic device to report information about my health at the first time unaided. [**PBcontrol2**]			0.72	0.71
	* 2.g. It would be difficult for me to use electronic devices to report information about my health. [**PBcontrol3**]			0.61	0.83
SN	1. Your GP. [**SN1**]	0.96	0.78–0.92	0.92	0.94
	2. Your nurses. [**SN2**]			0.93	0.94
	3. Your doctor/consultant. [**SN3**]			0.93	0.93
	4. Hospital Administrative Staff (e.g. clerks and receptionists). [**SN4**]			0.81	0.97
CA	1.h. I am concerned I will lose information by doing something wrong if I use an electronic device to report information about my health. [**CAnxiety3**]	0.80	0.49–0.60	0.62	0.72
	2.e. I would feel uncomfortable using any electronic device to report information about my health. [**CAnxiety4**]			0.60	0.75
	2.h. I feel worried about using electronic devices to report information about my health. [**CAnxiety5**]			0.67	0.66
BI	3.a. I intend to use an electronic device to report information about my health once it is available to me. [**BIntention1**]	0.97	0.83–0.91	0.94	0.95
	3.b. I expect that I will use electronic devices to report information about my health. [**BIntention2**]			0.93	0.95
	3.c. I would use electronic devices to report information about my health. [**BIntention3**]			0.92	0.96
	3.d. I want to use electronic devices to report information about my health. [**BIntention4**]			0.88	0.97

Note: (1) the name between [ ] is the item name in the data sheet.

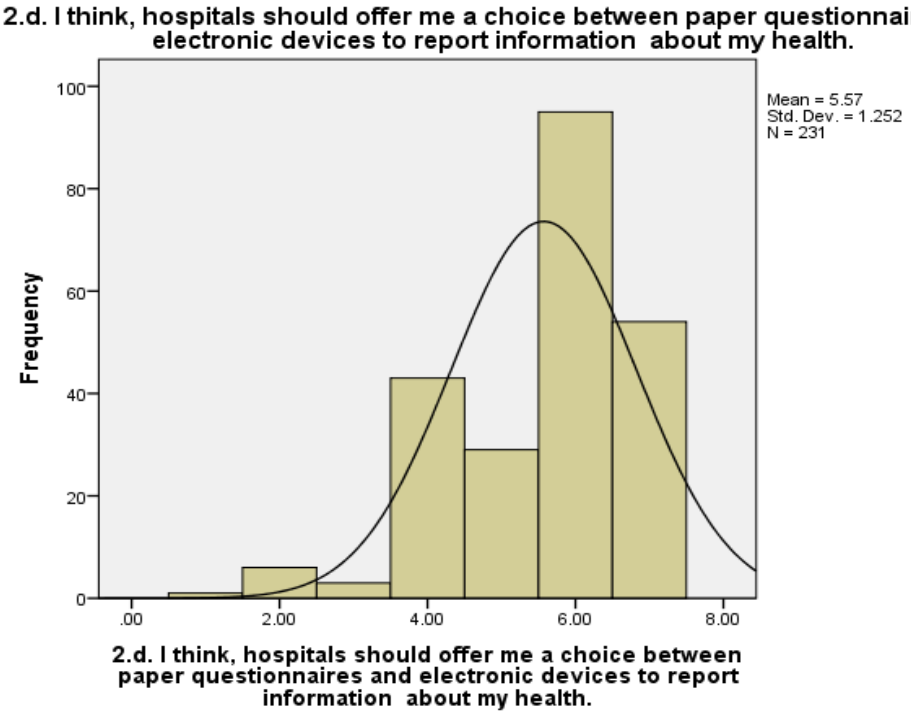
APPENDIX E. Conceptual Model Testing Supplementary Documents

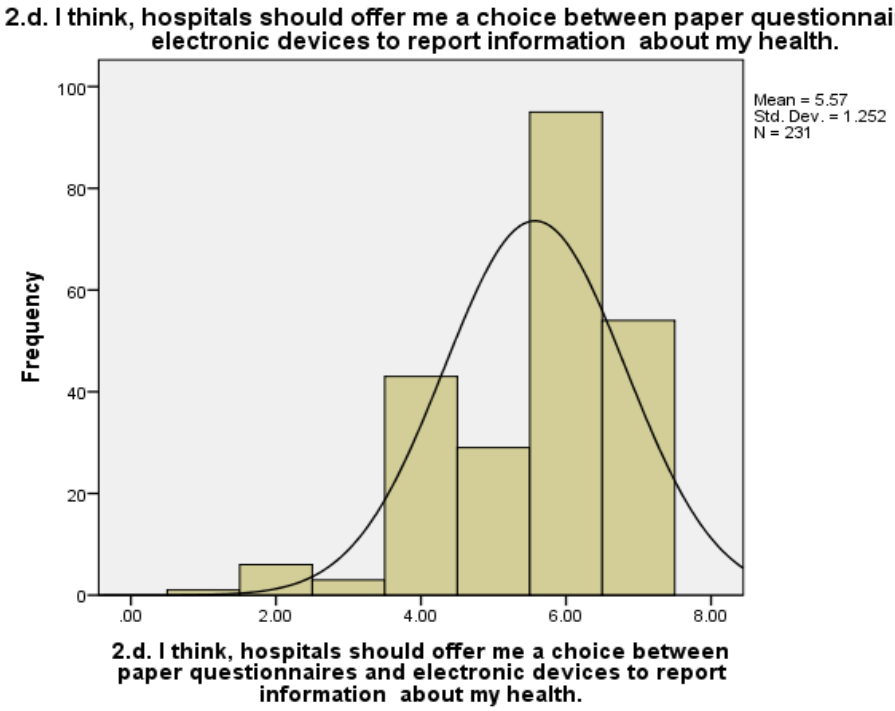
E.1 Results supplementary documents

E.1.1 Distribution of the two general questions

Table E.1. Descriptive data of the two general questions

		2.d. I think, hospitals should offer me a choice between paper questionnaires and electronic devices to report information about my health.	3.e. I prefer to use electronic devices rather than paper to report information about my health.
N	Valid	231	231
	Missing	0	0
Mean		5.5714	4.9004
Median		6.0000	5.0000
Mode		6.00	4.00
Std. Deviation		1.25208	1.57799
Variance		1.568	2.490
Skewness		-0.955	-0.638
Std. Error of Skewness		0.160	0.160
Kurtosis		0.660	-0.102
Std. Error of Kurtosis		0.319	0.319
Minimum		1.00	1.00
Maximum		7.00	7.00





a. Association between demographic characteristics and participants opinion of having a choice between paper based and e-PROMs

Table E.2. ANOVA test to evaluate the homogeneity of demographic groups with regards to Q1

		Sum of Squares	Df	Mean Square	F	Sig.
Gender	Between Groups	703.277	1	703.277	0.173	0.677
	Within Groups	928461.649	229	4054.418		
	Total	929164.926	230			
Age	Between Groups	14991.842	3	4997.281	1.241	0.295
	Within Groups	913770.663	227	4025.421		
	Total	928762.505	230			
Education level	Between Groups	8758.706	5	1751.741	0.430	0.828
	Within Groups	913435.133	224	4077.835		
	Total	922193.838	229			

Table E.3. Wilcoxon-Mann-Whitney test: gender is the grouping variable

	participants opinion of having a choice between paper and e-PROMs
Mann-Whitney U	6453.000
Wilcoxon W	14079.000
Z	-0.391
Asymp. Sig. (2-tailed)	0.696

Table E.4. Kruskal Wallis Test: grouping variables are age and education level

		participants opinion of having a choice between paper and e-PROMs
Age	Chi-Square	3.878
	df	3
	Asymp. Sig.	0.275
Education level	Chi-Square	2.234
	df	5
	Asymp. Sig.	0.816

b. Association between demographic characteristics and participants preference whether to use e-PROMs rather than papers

Table E.5. ANOVA test to evaluate the homogeneity of demographic groups with regards to Q2

		Sum of Squares	df	Mean Square	F	Sig.
Gender	Between Groups	1562.467	1	1562.467	0.371	0.543
	Within Groups	963819.752	229	4208.820		
	Total	965382.219	230			
Age	Between Groups	30361.880	3	10120.627	2.461	0.063
	Within Groups	933389.476	227	4111.848		
	Total	963751.356	230			
Education level	Between Groups	28893.163	5	5778.633	1.388	0.230
	Within Groups	932499.903	224	4162.946		
	Total	961393.067	229			

Table E.6. Wilcoxon-Mann-Whitney test: gender is the grouping variable

	participants preference whether to use e-PROMs rather than papers
Mann-Whitney U	6330.000
Wilcoxon W	12216.000
Z	-0.635
Asymp. Sig. (2-tailed)	0.525

Table E.7. Kruskal Wallis Test: grouping variable is education level.

	participants preference whether to use e-PROMs rather than papers
Chi-Square	7.235
Df	5
Asymp. Sig.	0.204

E.1.2 Distribution of the BI scale between the two distribution modes

Table E.8. ANOVA test to evaluate the homogeneity of BI distribution within the two methods of distribution (mail vs. clinic)

		Sum of Squares	df	Mean Square	F	Sig.
Mode	Between Groups	6323.453	1	6323.453	1.483	0.225
	Within Groups	976657.127	229	4264.878		
	Total	982980.580	230			

Table E.9. Wilcoxon-Mann-Whitney test of BI: method is the grouping variable

	BI
Mann-Whitney U	2110.000
Wilcoxon W	23638.000
Z	-1.231
Asymp. Sig. (2-tailed)	0.218

E.1.3 The association between demographic characteristics and BI

Table E.10. ANOVA test to evaluate the homogeneity of demographic groups with regards to BI

		Sum of Squares	df	Mean Square	F	Sig.
Gender	Between Groups	324.563	1	324.563	0.076	0.784
	Within Groups	983090.817	229	4292.973		
	Total	983415.381	230			
Age	Between Groups	21968.741	3	7322.914	1.730	0.162
	Within Groups	960951.869	227	4233.268		
	Total	982920.610	230			
Education level	Between Groups	27261.708	5	5452.342	1.287	0.270
	Within Groups	948825.749	224	4235.829		
	Total	976087.457	229			

Table E.11. Wilcoxon-Mann-Whitney test: gender is the grouping variable

	BI
Mann-Whitney U	6488.000
Wilcoxon W	12374.000
Z	-0.310
Asymp. Sig. (2-tailed)	0.757

Table E.12. Kruskal Wallis Test: grouping variables are age and education level

		BI
Age	Chi-Square	5.376
	df	3
	Asymp. Sig.	0.146
Education level	Chi-Square	6.762
	df	5
	Asymp. Sig.	0.239