

Patient perceptions of eHealth interventions in surgery-

A multi-method study

Chik Wai Ho MBChB MRCS

Institute of Global Health Innovation
Department of Surgery and Cancer

Imperial College London

A thesis submitted for the degree of Doctor of Medicine
MD (Res)

February 2025

Declaration of originality:

I declare that the work within this thesis is my own and represents the findings of research undertaken during the study period at Imperial College. Work which is not my own is appropriately referenced.

Declaration of Copyright:

“The copyright of this thesis rests with the author. Unless otherwise indicated, its contents are licensed under a Creative Commons Attribution-Non Commercial 4.0 International Licence (CC BY-NC).

Under this licence, you may copy and redistribute the material in any medium or format. You may also create and distribute modified versions of the work. This is on the condition that: you credit the author and do not use it, or any derivative works, for a commercial purpose.

When reusing or sharing this work, ensure you make the licence terms clear to others by naming the licence and linking to the licence text. Where a work has been adapted, you should indicate that the work has been changed and describe those changes.

Please seek permission from the copyright holder for uses of this work that are not included in this licence or permitted under UK Copyright Law”

Chik Wai Ho

3rd February 2025

Acknowledgements

My time at St Mary's London has been a surreal, challenging, yet rewarding experience. I would not have reached the finish line without the support, guidance, and encouragement of many incredible people. I would like to express my deepest gratitude to my supervisors: Prof. Ara Darzi, for giving me the opportunity to embark on this journey and for sharing your vision; Dr. Emma Carrington, you have been more than a mentor—you have been a friend. Your unwavering support, guidance, and belief in me, especially during moments when I struggled to believe in myself, have meant the world. I would like to thank Dr. Stephanie Archer for your nurturing approach and well-timed encouragement throughout this project, and Dr. Simon Dryden for your invaluable advice and support in preparing this thesis. I am also incredibly grateful to my fellow clinical research fellows on the 10th floor—Yasmin, Nigel, Dhurka, Ravi, and many others who shared this journey with me. Thank you to Jesus Tapia Amador and Kerrisa Khan for always being there and for your encouragement. Finally, I thank my mum and dad for your love and patience.

Thesis abstract

Introduction

eHealth plays a pivotal role in modern healthcare, providing patients with greater access to information, new methods of receiving care, and enhanced communication with healthcare providers. The way individuals perceive eHealth is influenced by demographic factors, life experiences, and cultural beliefs, all of which shape motivations and potential barriers to adoption. Understanding these key factors is essential for improving the uptake and acceptance of eHealth.

Aims

The principle aims of this thesis were to:

1. evaluate surgical patients' internet usage patterns, eHealth experiences, and preferences
2. assess the impact of eHealth literacy and individual patient factors on eHealth acceptance
3. explore the perceptions of patients and clinicians regarding eHealth technologies
4. identify key enablers and barriers to eHealth implementation

Methods

The following methods were used:

1. a systematic review
2. a patient survey assessing eHealth literacy and technology use
3. focus groups with surgical patients
4. in-depth interviews with clinicians

Results

Surgical patients are increasingly engaged with digital technologies but primarily for basic tasks. Higher eHealth literacy is associated with greater acceptance of digital health tools, yet significant disparities remain, particularly among older patients and those with lower educational attainment. Patients valued eHealth for empowerment and convenience but expressed concerns about accessibility, digital literacy, and privacy. Clinicians recognised the potential of eHealth but highlighted challenges related to IT infrastructure, integration into clinical workflows, and the need for clear implementation strategies.

Conclusion

Understanding patient factors and customising eHealth implementation and support are essential for its utilisation and acceptance. Enhancing clinician involvement and tackling infrastructure barriers are vital for optimising eHealth implementation in surgical care.

Abbreviations

AI	Artificial Intelligence
COPD	Chronic Obstructive Pulmonary Disease
COVID	Coronavirus Disease
CT	Computerised Tomography
DHLI	Digital Health Literacy Instrument
DHT	Digital Health Technologies
DTAC	Digital Technology Assessment Criteria
ECG	Electrocardiogram
EHEALS	eHealth Literacy Scale
EHLF	eHealth Literacy Framework
EHLQ	eHealth Literacy Questionnaire
ENT	Ear, Nose and Throat
ESF	Evidence Standards Framework
GDP	Gross Domestic Product
GDPR	General Data Protection Regulation
GP	General Practitioner
HIV	Human Immunodeficiency Virus
MDT	Multidisciplinary Team
NHS	National Health Service
NRS	National Readership Survey
PALS	Patient Advice and Liaison Service
PC	Personal Computer
PDF	Portable Document Files
PIN	Personal Identification Number
SHO	Senior House Officer
TA	Thematic Analysis
TFA	Theoretical Framework of Acceptability
UTAUT	Unified Theory of Acceptance and Use of Technology
WHO	World Health Organisation

Table of Contents

1	<i>Introduction</i>	1
1.1	The Digital Revolution	1
1.2	eHealth	1
1.2.1	The rise of eHealth	1
1.2.2	Telehealth	3
1.2.3	Mobile Health	3
1.2.4	Clinical information systems	4
1.2.5	The demand for eHealth	5
	WHO initiatives	5
	UK government initiatives	5
	Private investments	6
1.2.6	The impact of eHealth	6
1.3	eHealth in Surgery	9
1.4	Impact of COVID pandemic	10
1.5	Barriers to eHealth	10
1.5.1	Systemic and organisational barriers	10
1.5.2	Technical and design factors	11
1.5.3	Clinician factors	11
1.5.4	Individual factors	12
1.6	eHealth literacy	13

1.6.1	Description	13
1.6.2	eHealth literacy assessment tools	13
	eHealth Literacy Scale (eHEALS) 2006	13
	Digital Health Literacy Instrument (DHLI) 2017	14
	eHealth Literacy Questionnaire (eHLQ) 2018	14
1.7	Rationale for thesis	15
1.8	Hypothesis	17
1.9	Aim of the thesis	17
1.10	Objectives of the thesis.....	17
1.11	Overview of the thesis	18
2	<i>Research design underpinning the thesis</i>	20
2.1	Background	20
2.2	Phase 1: The researcher as a multicultural subject	21
2.2.1	The perspectives and experiences I bring to the research	21
2.3	Phase 2: Interpretive Paradigms.....	22
2.3.1	The beliefs that guide my actions as a researcher	22
2.4	Phase 3: Research strategies and approaches.....	24
2.4.1	The philosophical and theoretical frameworks that informed my choice of research approaches	
	24	
2.5	Phase 4: Methods of collection and analysis.....	27
2.6	Phase 5: The art, practice, and politics of interpretation and evaluation.....	30

2.7	Conclusion	31
3	<i>Patients' perceptions of eHealth use during surgical treatments- a systematic review and thematic synthesis of qualitative research.....</i>	34
3.1	Introduction	34
3.2	Methods	35
3.2.1	Search Strategy	35
3.2.2	Eligibility criteria and study selection	35
3.2.3	Data analysis and synthesis.....	36
3.2.4	Quality assessment	36
3.2.5	Ethical considerations	36
3.3	Results	36
3.5	Reminder	51
3.4	Discussion	53
3.5	Limitations	55
4	<i>Digital Health Survey</i>	65
4.1	Rationale.....	65
4.2	Aims.....	66
	Ethics	66
4.3	Methods	66
4.3.1	Setting and participants.....	66
4.3.2	Data collection	66

4.3.3	Statistical analysis	68
4.4	Results	69
	Responses and Demographics	69
	Internet access and digital device usage	70
	Use of social media	70
	Health advice preference.....	70
	Trustworthiness of Health Information Sources.....	71
	Future use of digital technology	71
	eHealth literacy.....	72
	Perceptions of face-to-face consultations, remote consultations, and mobile health applications	75
4.5	Discussion	78
4.6	Conclusion	81
5	<i>Factors influencing surgical patients' acceptance and use of eHealth technologies- a focus group study</i>	83
5.1	Introduction.....	83
5.2	Methods	83
5.2.1	Study Design	83
5.2.2	Participant Approach, Information Provision, Consent, and Assessment Procedures	84
5.2.3	Procedure for Conducting Focus Groups	84
5.2.4	Ethical Considerations.....	84
5.2.5	Confidentiality and Management of Group Dynamics	85
5.2.6	Inclusivity and Impact of In-Person Format	85

5.2.7	Data Handling and Security.....	85
5.2.8	Data Analysis.....	85
5.3	Results	86
5.3.1	Overview	86
5.3.2	Themes.....	87
5.4	Discussion	102
6	<i>Factors influencing healthcare professionals acceptance and use of eHealth technologies- an interview study.....</i>	109
6.1	Introduction	109
6.2	Methods	110
6.2.1	Study Design	110
6.2.2	Data Collection.....	110
6.2.3	Ethical Considerations.....	111
6.2.4	Data Analysis.....	111
6.3	Results	112
6.3.1	Overview	112
6.3.2	Themes.....	113
6.4	Discussion	130
6.5	Conclusion	133
7	<i>Discussion and conclusion.....</i>	137
7.1	Thesis aims.....	137

7.2	Summary of findings	138
7.3	Implications for research, clinical practice and health policy	142
7.4	Thesis limitations	148

Index of figures

Figure 1-1 eHealth categories	2
Figure 1-2 eHealth Literacy Questionnaire (eHLQ) 2018	15
Figure 1-3 Overview of thesis	18
Figure 2-1 Qualitative and quantitative research methods continuum (Newman and Benz, 1998)	20
Figure 2-2 Levels of theories (Pope and Mays, 2020)	24
Figure 2-3 Model 1 – United Theory of Acceptance and Use of Technology (2012)	25
Figure 2-4 Model 2 – Theoretical Framework of Acceptability (2017)	26
<i>Figure 3-1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses Diagram</i>	<i>37</i>
Figure 3-2 Thematic map - Themes characterising the expectations of surgical patients when using eHealth	53
Figure 4-1 Flowchart of the participant recruitment process	69
Figure 4-2 Overall eHLQ scores among participants	72
Figure 4-3 eHLQ scores and education levels	73
Figure 4-4 eHLQ scores and socioeconomic status	74
Figure 4-5 eHLQ scores and age	75
Figure 4-6 Composite acceptance score and socioeconomic status	76
Figure 4-7 Composite acceptance score and education level	76
Figure 5-1 Thematic map	102
Figure 6-1 Thematic map	129
Figure 7-1 Acceptability checklist infographic	147

Index of tables

Table 1 mHealth functional categories	4
Table 3-1 A summary of the facilitating factors and barriers identified within each theme	39
Table 3 Summary of key findings	57
Table 4 Summary of included studies	59
Table 4-1 Participants' demographic details.....	Error! Bookmark not defined.
Table 4-2 Seven dimensions of eHLQ scores and different participant characteristics	73
Table 4-3 Composite acceptance scores and different participant characteristics.....	77
Table 4-4 Correlation between perception score and eHealth scores.....	78
Table 9 Summary of key findings	107
Table 10 Summary of key findings	134

Chapter 1

1 Introduction

1.1 The Digital Revolution

In the era of the Fourth Industrial Revolution, high-speed, internet-connected devices have drastically changed how we live, work, and communicate. Many people now use smartphones to access news, stay in touch with loved ones, and order goods. In 2020, 96% of UK households had internet access (Office for National Statistics, 2020), and eight in ten adults aged 16 and over used smartphones (Ofcom, 2020). Notably, smartphone usage among older age groups has grown significantly, with adoption rates increasing from 60% to 90% among 45-54-year-olds and from 40% to 80% among 55-75-year-olds since 2012 (Deloitte, 2019).

The rapid expansion of digital technologies has not only transformed our lives but also brought significant economic benefits on a global and societal scale. The digital economy now makes up 15.5% of the global GDP and is growing at a rate two and a half times faster than the overall economy (Oxford Economics, 2017). According to the World Economic Forum, the digital revolution reduces the costs associated with trade, communication, and transportation, thereby improving efficiency and productivity. This revolution is expected to raise global income levels and enhance the quality of life for people worldwide (World Economic Forum, 2016).

The incorporation of artificial intelligence (AI) into healthcare continues to reshape the ways in which health information is produced, accessed, and interpreted. In particular, generative AI platforms such as ChatGPT, Claude, and other large language models are increasingly utilised by both patients and clinicians to obtain, clarify, or cross-check medical information (Thirunavukarasu et al., 2023, Neha et al., 2024). Although these technologies have the capacity to enhance information accessibility and support improvements in health literacy, their unsupervised use presents important ethical, safety, and quality concerns. These risks are especially pronounced among populations with limited digital literacy, who may be insufficiently equipped to assess the reliability, accuracy, or potential bias of AI-generated outputs (Witkowski et al., 2024, Kim et al., 2023). As the availability and influence of such systems expand, there is a pressing need to strengthen critical digital literacy and to establish frameworks for the responsible integration of AI tools within patient education and clinical decision-making contexts.

1.2 eHealth

1.2.1 The rise of eHealth

The World Health Organisation defines eHealth as “the use of information and communication technologies (ICT) for health” (WHO, 2019a). The widespread use of the internet and mobile phones has transformed how we seek health information, resources and services. These technologies allow

vast amounts of new and existing information to be easily accessible through computers and handheld devices. People often use online resources to look up symptoms, find answers to medical queries, and discover medication and treatment information (Heaton-Shrestha et al., 2023; Leigh et al., 2021). Recent systematic reviews have demonstrated that patients increasingly use online resources to manage health conditions, including heart diseases (McIntyre et al., 2023), diabetes (Woolley et al., 2019), orthopaedics (Dekkers et al., 2018), cardiothoracic (van Steenbergen et al., 2022), and gastrointestinal surgeries (Olivia et al., 2023).

A systematic review of worldwide eHealth practices by de Fonseca et al. 2021 categorised eHealth into three main categories (Figure 1-1eHealth categories): 1. Telehealth, 2. Mobile health, and 3. Technology (da Fonseca et al., 2021).

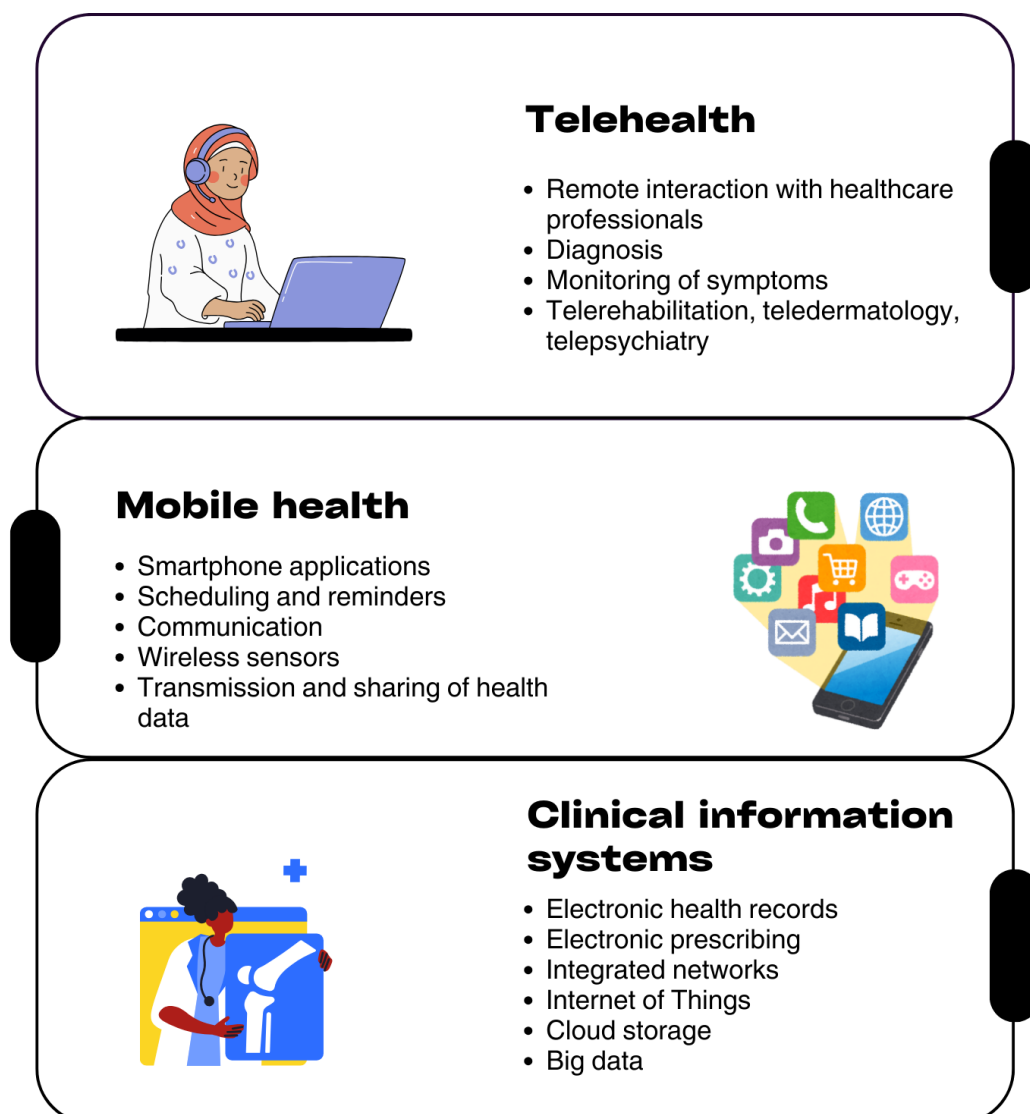


Figure 1-1eHealth categories

1.2.2 Telehealth

Telehealth encompasses telecommunications technology to deliver healthcare for patients who are geographically distant from the service provider (NEJM Catalyst, 2018). Initially developed to meet the needs of rural and underserved communities, telehealth has rapidly expanded to include a broad range of applications (Roh, 2008). Healthcare providers can now use telehealth to provide patient consultation, remote monitoring, patient education, and sharing imaging and medical reports. Telehealth services are delivered through various technologies, including telephones, electronic mail, and video conferences, all of which can be accessed via internet-connected devices such as smartphones, tablets, and computers (Balestra, 2018, Gajarawala and Pelkowski, 2021). A notable application is telehealth in surgery, where patients receive post-operative follow-up and rehabilitation at home (Uppal et al., 2022). Telerehabilitation enables physiotherapists to monitor progress and adjust treatment plans without requiring patients to travel to a clinic (Cottrell et al., 2017). Another prominent telehealth use is teledermatology, which allows dermatologists to diagnose and treat skin conditions by analysing images sent by patients or primary care providers, thereby reducing wait times and the need for in-person visits (Campagna et al., 2017). Telepsychiatry is a rapidly growing field in telehealth that provides remote mental health services, offering quick access to therapy and medication management. This reduces pressure on emergency care and improves continuity of care (Sharma and Devan, 2023).

1.2.3 Mobile Health

A major category under the umbrella of eHealth is mobile health (mHealth), which refers to the use of mobile devices, such as smartphones, tablets, and wearable sensors, to access healthcare services, manage health conditions, and promote well-being (World Health Organization, 2011). This contrasts with telehealth, which encompasses a range of remote healthcare services, including video consultations, remote monitoring, and telemedicine (Khairat et al., 2019b). The World Health Organisation and various literature reviews classified mHealth technologies into distinct functional categories, as summarised below in Table 1 (WHO, 2018b, Labrique et al., 2013, Byambasuren et al., 2018).

mHealth Category	Common technologies	Examples
Patient-centred applications	Apps and tools designed to support individual self-management, behaviour change, and disease monitoring.	Fitness trackers, glucose-monitoring apps, medication-reminder systems, CBT-based mental-health apps.
Provider-focused tools	Applications aimed at assisting clinicians with diagnosis, clinical documentation, and workflow management.	Mobile access to EHRs, clinical-reference apps, teleconsultation platforms, remote monitoring dashboards.
Public-health and community messaging systems	Mobile technologies used for health promotion, disease surveillance, and population outreach.	SMS vaccination reminders, outbreak alerts, smoking-cessation campaigns.

mHealth Category	Common technologies	Examples
Diagnostic and decision-support tools	Mobile platforms using algorithms to aid diagnosis or guide treatment decisions.	Symptom checkers, triage systems, portable ultrasound or ECG analysis apps.
Operational and administrative tools	Apps that enhance healthcare logistics and system efficiency.	Appointment scheduling, supply-chain tracking, digital consent systems.

Table 1 mHealth functional categories

Patient-centred mobile applications allow individuals to engage in their healthcare by providing the technology to access health records, data, and applications to help in disease treatment, identification, and support (Silva et al., 2015, Larsen et al., 2016). At its basic level, these apps include functionalities such as medication reminders, appointment scheduling, and health information retrieval. These tools help individuals adhere to treatment plans and stay informed about their health. However, mHealth also encompasses more advanced technologies, such as wireless sensors and mobile applications that monitor vital signs in real-time. For instance, wearable devices can continuously track heart rate, body temperature, and blood glucose levels, transmitting this data to healthcare professionals for ongoing monitoring and intervention (Silva et al., 2015, Malasinghe et al., 2019).

An example of mHealth is mobile apps for managing chronic diseases like diabetes and chronic obstructive pulmonary disease (COPD). These apps allow patients to log their blood glucose levels, lung functions, and activity levels. They also provide personalised feedback and facilitate communication with healthcare providers to adjust treatment plans (Blythin et al., 2023, Davies et al., 2023). Another significant application of mHealth is in mental health. Mobile apps offer features such as cognitive behavioural therapy (CBT), mood tracking, and crisis intervention support, which contribute to making mental health resources more accessible and empowering individuals to take an active role in their management (Torous et al., 2017, Marshall et al., 2020). Furthermore, mHealth has proven effective in public health initiatives. For instance, text messaging campaigns and mobile health apps have been utilised to promote smoking cessation and improve vaccination rates (Abroms et al., 2012, Regmi et al., 2017, Kim et al., 2017).

1.2.4 Clinical information systems

Clinical information systems are another component of eHealth, designed to electronically collect, store, and transfer medical information (Tun & Madanian, 2023). While these systems play a key role in the eHealth infrastructure, they generally focus on the management of health data rather than direct patient interaction. Therefore, they will only be described briefly in this thesis. These systems provide patients and healthcare providers with rapid access to a vast array of clinical data, such as electronic health records that allow users to review medical history and laboratory results, order investigations, and facilitate electronic prescribing (Islam et al., 2018). While these systems are widely recognised, there is a broad spectrum of less visible technologies within the eHealth ecosystem. One of these technologies

is the Internet of Things (IoT), which creates a network of interconnected medical devices and sensors that communicate through encrypted data exchanges. IoT enables the secure and instant relay of medical data from patient monitoring devices to clinical systems. This allows for continuous monitoring and real-time updates on patient health status through the mHealth devices previously described (Islam et al., 2015). Cloud storage is another important component, offering secure data storage and facilitating rapid information sharing across various healthcare providers and institutions without physical storage limitations (Mehrtak et al., 2021).

Moreover, big data analytics in eHealth can process large volumes of health data to support machine learning and artificial intelligence (AI) applications. These technologies facilitate predictive analytics, early diagnosis, and personalised treatment plans by examining patterns and correlations within the data (Ristevski and Chen, 2018). For example, AI-driven algorithms can aid in diagnosing diseases such as cancer or predicting patient outcomes based on historical data (Hunter et al., 2022).

1.2.5 The demand for eHealth

WHO initiatives

The World Health Organisation recognises the crucial role of eHealth in promoting public health. In the 2018 World Health Assembly, member states agreed on a resolution to accelerate the development and adoption of digital health, harnessing the potential of eHealth to advance universal health coverage and sustainably develop global health initiatives (WHO, 2018c).

Specifically, the WHO urges member states to utilise eHealth to improve their citizens' access to health services, especially for hard-to-reach populations. It advocates for monitoring and sharing data for disease surveillance and enhancing global health security. Additionally, countries should use eHealth to enhance the safety and quality of patient-centred care through advanced information technology. (WHO, 2018a)

However, the WHO also acknowledges challenges in scaling up the use of eHealth. These challenges include integrating new technology into existing systems and infrastructure, addressing inequality in access to services among disadvantaged groups and low-income countries, and ensuring long-term implementation. To address these challenges, the WHO advocates for establishing collaborative regional hubs to share best practices, generate evidence, and provide guidance on eHealth implementation. (WHO, 2019b)

UK government initiatives

In 2019, NHS England launched an ambitious Long-Term Plan that outlines the priorities of the UK health system in the next ten years (Alderwick and Dixon, 2019). The plan renewed focus on preventing

poor health, managing capacity and demand, and tackling health inequalities (NHS England, 2019). It proposes increased funding for primary and community health services, aiming to improve access to personalised care, provide support for individuals to have more control over their own health, and enable the public to stay healthy for longer. These measures can, in turn, relieve the immense pressure on acute hospital services (Health Foundation, 2019).

To help achieve these goals, a 'digital first' approach is being adopted across the continuum of care in the NHS (Alderwick and Dixon, 2019). Electronic health records are being integrated across the NHS to enable the sharing of patient data between GPs, hospitals, and other care providers. Mobile applications for health promotion and self-care are being introduced to empower patients in managing their health, for example, the 'myCOPD' app helps patients manage chronic obstructive pulmonary disease, reducing hospital visits through personalised care (Davies et al., 2023). Telehealth services are also introduced to support vulnerable groups, such as frail patients, by enabling remote consultations and continuous monitoring (Alderwick and Dixon, 2019). These initiatives aim to enhance the efficiency and effectiveness of health services, ensuring that high-quality care is readily accessible.

Private investments

The growing interest and demand for eHealth from developed and developing countries have led to significant investment from the private health sector (Webster, 2019, GSMA Development, 2021). The global eHealth market is projected to reach US\$549.7 billion by 2028, up from \$69.5 billion in 2020 (MarketsandMarkets, 2020). Mobile health applications and telemedicine are the fastest-growing products and services, with projected growth rates of 30% and 22%, respectively, in the coming decade (Global Market Insights, 2021, Grand View Research, 2021). Currently, an estimated 350,000 health apps are available on the market (Lagan et al., 2020).

Private health industries are capitalising on this opportunity by developing various devices and services to help individuals manage their health and well-being. Examples of digital health technologies targeted at patients include mobile health applications, electronic health records, wearable devices and sensors, and telemedicine (Kasoju et al., 2023). In the United States, national surveys estimate that 58% of smartphone owners use at least one mobile health app (Krebs and Duncan, 2015), and 30% of adults use wearable health devices (Chandrasekaran et al., 2020). UK data indicated that 23% of the general public used a mobile health application (Fernandes, 2023).

1.2.6 The impact of eHealth

Impact on health outcomes

eHealth can be shown to improve health outcomes (Penedo et al., 2020, Tebeje and Klein, 2020). The advancement of eHealth technologies such as telemedicine and mobile health applications has

significantly improved the management of chronic diseases (Renzi et al., 2022). These technologies offer various features including remote consultations and monitoring, real-time data sharing, tailored patient education, and treatment programs. As a result, the need for hospital visits has been reduced (Talboom-Kamp et al., 2016, Rohde et al., 2021). In diabetes care, a systematic review of 25 studies demonstrated improved glycaemic control and reduced HbA1c levels in patients using mobile health apps to support self-management and lifestyle modifications (Stevens et al., 2022). Another review of 24 randomised controlled trials involving over 9000 heart failure patients indicated that eHealth self-management programs reduced mortality and readmissions (Liu et al., 2022). Additionally, a review of 13 studies found that a combination of eHealth strategies improved medication adherence for patients with COPD or asthma. These strategies included telemonitoring of symptoms and medication adherence, education, and self-support modules (Schulte et al., 2021). This shift alleviates the strain on healthcare facilities and ensures that patients receive timely care and avoid emergency admissions.

Impact on health equality

eHealth has the potential to reduce health inequalities by bridging the gap between urban and rural healthcare access. Telehealth and mobile health applications allow patients in remote and underserved areas to connect with specialists and receive care that was previously inaccessible due to geographic barriers (Khairat et al., 2019a). Additionally, eHealth initiatives can improve health literacy by providing educational resources and self-management tools, empowering individuals from different socio-economic backgrounds to take control of their health (Kim and Xie, 2017, Jacobs et al., 2014).

However, it is important to recognise that the digital divide, which refers to disparities in access to and proficiency with digital technologies, still presents challenges to achieving health equality (Saeed and Masters, 2021). Indeed, systematic reviews on social health inequalities and digital health technologies showed that eHealth and mobile-health deployment can widen disparities when access, literacy, infrastructure and systemic support are not addressed (Latulippe et al., 2017, Yao et al., 2022).

For instance, patients living with diabetes in Norway from higher education and income are more likely to use eHealth apps and search engines, meaning lower-socioeconomic groups may be left behind (Hansen et al., 2019). In another UK national study, populations living in areas of greater deprivation had significantly lower utilisation of digital services. This highlights the risk eHealth benefits may disproportionately favour already advantaged groups (Zhang et al., 2023).

With the increased use of AI and generative tools such as ChatGPT, there is an added risk of exacerbating health inequalities if algorithms are trained on non-representative data or implemented without consideration of digital access and literacy gaps. (Leslie et al., 2021).

Impact on patient experience

eHealth technologies can improve the patient experience by improving service delivery and quality of care (Dodson et al., 2024). For example, electronic health records make it easier for patients to access their personal health information and become more involved in their care (Lyles et al., 2020). Additionally, telehealth services reduce travel time and associated costs, making it easier for patients to attend appointments (Kruse et al., 2017). The personalised nature of mobile health apps, such as mobile apps for chronic disease management, also contributes to a more tailored and responsive healthcare experience, enhancing patient satisfaction and outcomes (Alqahtani and Orji, 2020, Mendiola et al., 2015).

Impact on the economy

The economic impact on eHealth offers both cost-saving opportunities and challenges. On the one hand, eHealth can reduce healthcare costs by reducing hospital admissions, shortening hospital stays, and improving preventive care, as demonstrated by a systematic review of 20 studies by Elbert et al. incorporating eHealth in the management of diabetes, cardiovascular diseases, COPD, acute and chronic pain (Elbert et al., 2014). Furthermore, processing administrative tasks through electronic health records and other digital tools enhances operational efficiency within healthcare systems (Elbert et al., 2014, Negro-Calduch et al., 2021). On the other hand, the initial investment in eHealth infrastructure can be substantial, including technology development, training, and maintenance. Despite these costs, the long-term economic benefits of eHealth, such as reduced healthcare spending, increased healthcare efficiency and workforce productivity can be significant (Bronsoler et al., 2021, Ossebaard and Van Gemert-Pijnen, 2016).

Impact on the scaling of medicine

eHealth has made it easier to expand medical services by helping healthcare providers reach larger populations with fewer resources. Through telemedicine, a single specialist can offer consultations to patients across multiple locations, greatly expanding access to expertise (Haimi, 2023, Tan et al., 2002). Additionally, digital platforms and mobile health apps can support the provision of disease-specific treatment pathways, such as those for diabetes and mental health (Bonoto et al., 2017, Payne et al., 2015), as well as public health programs aimed at improving diet, physical activity, and reducing sedentary behaviour (Schoeppe et al., 2016). eHealth tools ensure consistent quality across different settings and enable the low-cost dissemination of best practices (Byambasuren et al., 2018). This scalability is particularly valuable in managing public health crises, such as the COVID-19 pandemic, where rapid response and widespread access to care are crucial (Bokolo, 2021, Fagherazzi et al., 2020).

1.3 eHealth in Surgery

Although there is less extensive research on the direct impact of eHealth in the surgical arena, many of the benefits seen in other medical fields, such as chronic disease management and mental health, likely extend to surgical patients.

Incorporating eHealth technologies into the surgical patient journey has shown improvement in outcomes in various clinical settings. For example, web-based patient education has improved post-surgical outcomes in cardiac patients by enhancing their understanding of pain management (Martorella et al., 2014) and supported symptom management for patients undergoing upper gastrointestinal cancer surgery (Richards et al., 2021). These digital tools allow patients to better manage their recovery, leading to greater satisfaction and fewer complications. Similarly, mobile health (mHealth) applications have been employed in colorectal and gynecological surgeries, allowing post-discharge patients to monitor activity levels and encouraging them to engage more actively with their rehabilitation programs (den Bakker et al., 2019). In another trial, a mobile app for symptom tracking after pancreatic surgery helped patients report symptoms more effectively and offered real-time self-care guidance (Gustavell et al., 2020). These examples highlighted the growing role of mHealth in facilitating patient engagement and empowering self-management in post-surgical care.

Telemedicine has also emerged as an invaluable tool in surgical follow-up, particularly in specialities such as plastic surgery (Brown-Johnson et al., 2021), orthopaedics (Dunphy and Gardner, 2020), and head and neck surgery (Triantafillou et al., 2021). These studies have shown that telemedicine consultations improve accessibility, reduce patient travel times, and lower healthcare costs without compromising care quality. Moreover, wearable sensors for continuous postoperative monitoring have been trialled in surgical wards. These sensors offer real-time data on patients' vital signs, enabling early detection of clinical deterioration. This technology provides reassurance for both staff and patients and allows for more timely interventions when complications arise (Areia et al., 2022, Downey et al., 2018).

In brief, eHealth is transforming healthcare by improving access, efficiency, and patient outcomes. Global and national health organisations, including the WHO and NHS, are actively promoting digital health strategies, driving innovation in mobile health, telemedicine, and digital tools. eHealth enhances the management of a broad range of conditions, reduces hospital visits and improves healthcare equity by reaching underserved populations. Economically, it lowers costs while increasing efficiency. Though research is still emerging in surgery, the available evidence suggests that eHealth can significantly enhance various aspects of surgical care, from preoperative education to postoperative monitoring, and potentially improve patient outcomes.

1.4 Impact of COVID pandemic

The COVID-19 pandemic presented significant challenges for delivering healthcare. Measures such as isolation and social distancing greatly reduced in-person visits to healthcare facilities (Brørs et al., 2020). As a result, global health communities quickly turned to eHealth strategies to provide virtual care and maintain access to health services while minimizing physical contact (Webster, 2020, Whaley et al., 2020). Review studies on eHealth solutions during COVID-19 showed a significant rise in the use of mobile applications and video conferencing for tasks like screening, triage, and remote patient monitoring (Pappot et al., 2020, Anthony Jnr, 2021).

Patients generally responded positively to eHealth technologies during the pandemic. For example, a study of over 22,000 patients who experienced telemedicine and virtual care in a Canadian cancer centre reported an equal or higher level of satisfaction than face-to-face visits (Berlin et al., 2021). Similarly, a survey of 620 urology patients attending video visits at a US quaternary centre also reported high satisfaction (Ramaswamy et al., 2020).

Looking to the future, researchers are exploring the continued growth of eHealth beyond COVID-19. They emphasised the need for full integration into existing health systems, regulatory approval, reimbursement, public awareness, improved access to eHealth services (Contreras et al., 2020), and optimisation of technology based on experiences during the pandemic to ensure sustained growth (Bashshur et al., 2020).

1.5 Barriers to eHealth

Although eHealth technologies hold considerable promise, their implementation across healthcare settings has been uneven. Adoption has historically been slow in primary care (Peeters et al., 2016), inpatient care (Hennemann et al., 2017) and surgery (Nilsson et al., 2021, Kelly et al., 2021). Many innovations fail to progress beyond pilot phases into sustainable clinical integration (Jung and Berthon, 2009, Shortliffe, 2005). Because healthcare is complex and context-specific, successful adoption depends not only on technology but also on organisational readiness, workforce engagement, and patient acceptance (Granja et al., 2018, Wilson et al., 2021, Schreiweis et al., 2019). The following sections outline key barriers at systemic, technical, professional, and individual levels.

1.5.1 Systemic and organisational barriers

Organisational and system-level factors remain among the most persistent obstacles to digital transformation. Insufficient and unstable funding limits the ability of healthcare providers to invest in and maintain eHealth infrastructure (Doshi et al., 2020). Additionally, there is often a lack of a concerted approach to integrating new technologies into existing systems, resulting in different departments or

units within an organisation adopting technologies that do not communicate effectively with each other (Desveaux et al., 2019).

In the UK, a lack of joined-up digital infrastructure within the NHS further compounds these problems. Many trusts continue to operate with legacy software and inconsistent data-sharing standards (Price et al., 2019, Hendy et al., 2005). These interoperability issues reduce efficiency, create administrative duplication, and can compromise patient safety. (Fazakarley et al., 2023) and (Li et al., 2025) note that clinicians identify poor system integration and data quality as major deterrents to using emerging tools such as artificial intelligence. Without cohesive national digital architecture and organisational support for change management, the benefits of technological innovation cannot be fully realised.

1.5.2 Technical and design factors

The usability of eHealth technologies also represent substantial barriers to widespread adoption. Poor interface design, slow performance, complex authentication steps, or unreliable connectivity discourage both patients and clinicians (Leite et al., 2020, Cajita et al., 2018, van Middelaar et al., 2018). Users frequently cite a lack of technical support and inadequate training as major frustrations (Hirst et al., 2013, Harmon Still et al., 2018).

Accessibility remains another challenge. Limited internet coverage, particularly in rural areas, and the financial burden of purchasing suitable digital devices reduce inclusivity (Gutierrez et al., 2021, Bommakanti et al., 2020, Yao et al., 2022). These shortcomings emphasise the importance of user-centred design, adequate infrastructure, and sustained technical assistance throughout implementation.

1.5.3 Clinician factors

Clinicians play a pivotal role in eHealth adoption as both users and gatekeepers. Although many recognise its potential to enhance efficiency and patient outcomes, uptake remains inconsistent. Reported barriers include increased workload, medico-legal uncertainty, and inadequate digital training (Greenhalgh et al., 2017, Shaw et al., 2021b). During the COVID-19 pandemic, clinicians rapidly adapted to telemedicine and virtual consultation models. However, sustaining this digital momentum post-pandemic requires long-term workforce development and integration of digital tools into everyday workflows (Carlqvist et al., 2021, Scott et al., 2020).

Moreover, fragmented information systems and the absence of interoperable platforms hinder clinical efficiency and trust in digital processes. Addressing these issues requires institutional leadership, realistic workload planning, and continuous engagement with clinicians during technology design and rollout.

1.5.4 Individual factors

Several individual-level factors influence the adoption of eHealth technologies. A significant barrier is the varying digital and health literacy required to effectively engage with these tools (Schreiweis et al., 2019, Triana et al., 2020). Bautista (2015) introduced the concept of digital health literacy or eHealth literacy, which refers to the interplay of individual and social factors in using digital technologies to search for, comprehend, appraise, and apply health information to improve or maintain their quality of life (Bautista JR., 2015). This concept has become particularly relevant during the COVID-19 pandemic, where individuals were required to critically evaluate vast amounts of online health information. The World Health Organization (WHO) described this overwhelming surge of health information as an "infodemic", marked by widespread misinformation, disinformation, and rumours (United Nations, 2020).

As an emerging field, the relationship between eHealth literacy, patient factors, and health outcomes is still under investigation. Existing research suggests that individuals with higher levels of eHealth literacy often experience better health outcomes, improved communication with healthcare providers, and greater confidence in managing their health (Mitsutake et al., 2012, Neter and Brainin, 2012, Knapp et al., 2011). Several demographic factors have been associated with higher eHealth literacy, including younger age, higher education, greater digital proficiency (Xesfingi and Vozikis, 2016, Shiferaw et al., 2020), employment status, and better overall health (Shiferaw et al., 2020). However, the extent to which eHealth literacy influences perceptions and acceptance of eHealth interventions remains underexplored.

Beyond eHealth literacy, life experiences and cultural beliefs significantly shape eHealth adoption. Individuals with chronic illnesses often engage more with digital health tools for self-monitoring and virtual consultations (Morton et al., 2017). Past healthcare experiences, including dissatisfaction with traditional services, can also drive the adoption of eHealth solutions (Shaw et al., 2021a). Conversely, a lack of motivation to engage with eHealth systems often stems from unclear user benefits or limited personal experience with technology (Ross et al., 2016).

Trust in technology and the broader healthcare system plays a crucial role in digital health adoption. Concerns regarding data privacy, misinformation, and past negative healthcare experiences can significantly reduce patient engagement (Adjekum et al., 2018). Furthermore, cultural beliefs influence how different populations perceive digital healthcare. For example, some individuals may prioritise in-person consultations due to a strong cultural emphasis on direct physician-patient relationships (Jabour, 2024, Lindberg and Lundgren, 2022). Language barriers and limited multilingual support in eHealth platforms can further discourage use, particularly among ethnic minorities (Zibrik et al., 2015).

Importantly, the inappropriate implementation of eHealth interventions can exacerbate health inequalities. Vulnerable populations, including older adults, low-income groups, and ethnic minorities,

often face greater challenges in accessing and effectively using digital health services (Huxley et al., 2015). Limited access to broadband infrastructure in rural areas (Khairat et al., 2019a), financial constraints in purchasing smart devices, and lower levels of eHealth literacy all contribute to disparities in eHealth adoption (Nouri et al., 2020a). While eHealth has the potential to bridge healthcare gaps, its success in promoting equitable access depends on addressing these demographic, experiential, and cultural barriers.

1.6 eHealth literacy

1.6.1 Description

Bautista has introduced a new dimension of health literacy called digital health literacy or eHealth literacy. It is defined as the ‘interplay of individual and social factors in the use of digital technologies to search, acquire, comprehend, appraise, communicate and apply health information in all contexts of health care to maintain or improve the quality of life throughout the lifespan’ (Bautista JR., 2015). This concept is particularly relevant during the COVID-19 pandemic, as it requires critical evaluation of vast amounts of health information. The WHO used the term “Infodemic” to describe ‘the excessive amount of health information that led to misinformation, disinformation, and rumours during a health emergency.’ (United Nations, 2020).

As an emerging area of research, the relationship between patient factors, eHealth literacy and health outcomes has not been studied extensively. Existing literature suggests that individuals with high eHealth literacy often have better access to health information (Knapp et al., 2011), improved communication with healthcare providers, increased use of medical insurance, improved self-management of health needs and improved understanding of disease (Mitsutake et al., 2012, Neter and Brainin, 2012).

Patient factors positively associated with eHealth literacy include younger age, higher education level, higher levels of computer and information literacy (Xesfingi and Vozikis, 2016, Shiferaw et al., 2020), higher employment, and better health status (Shiferaw et al., 2020). However, the influence of eHealth literacy on perceptions and acceptance of eHealth interventions remains underexplored.

1.6.2 eHealth literacy assessment tools

eHealth Literacy Scale (eHEALS) 2006

Since the early 2000s, several assessment tools for eHealth literacy have been developed. The first tool published was the eHealth Literacy Scale (eHEALS) developed by Norman and Skinner in 2006. It employs the Lily model concept of eHealth literacy, which encompasses six distinct skills: traditional literacy, computer literacy, media literacy, information literacy, science literacy, and health literacy. (Norman and Skinner, 2006). The eHEALS questionnaire consists of 8 self-assessment items that

evaluate an individual's perceived competency in using information technology for health. The responses are rated on a 5-point Likert scale ranging from "strongly agree" to "strongly disagree". The tool gained popularity in research due to its brevity, ease of use, and translations into languages such as Japanese, Dutch, Swedish, and Arabic. The questionnaire was validated in various populations, including school children, older adults, and patients with chronic diseases (Chung and Nahm, 2015, Koo, 2012, Richtering et al., 2017).

Digital Health Literacy Instrument (DHLI) 2017

The DHLI was developed in response to the need for objective measures of eHealth literacy (van der Vaart and Drossaert, 2017). This tool was designed to evaluate an individual's operational and navigational skills on the internet, search for information online, ability to evaluate the reliability of the information, determine relevance, add self-generated content, and protect privacy. The seven skill sets are measured through a set of 21 self-report items and seven performance-based items on the following domains. The authors suggest the inclusion of performance-based items reduces bias from respondents over or underestimating their eHealth literacy skills.

eHealth Literacy Questionnaire (eHLQ) 2018

The eHLQ contains a 37-item questionnaire to measure seven dimensions of the eHealth Literacy Framework (eHLF) (Figure 1-2) (Kayser et al., 2018):

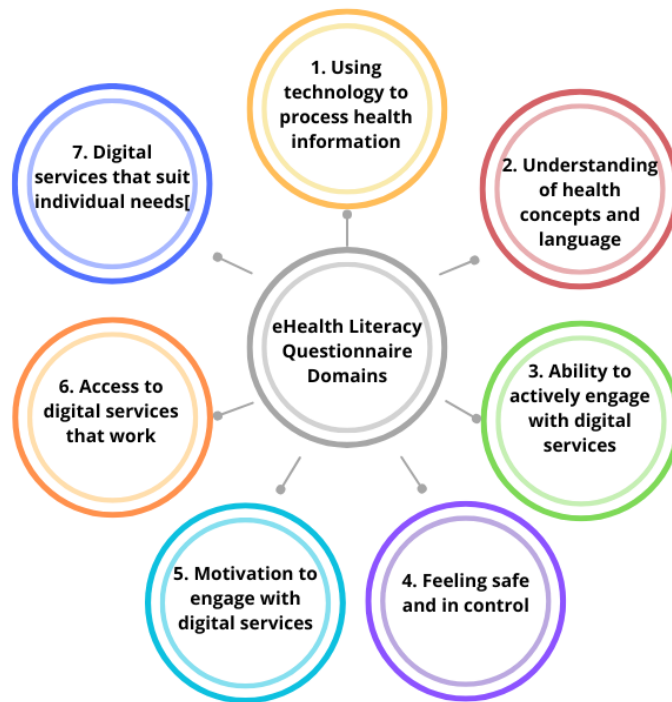


Figure 1-2 eHealth Literacy Questionnaire (eHLQ) 2018

eHLQ has been used in recent national research projects into eHealth literacy including the WHO national health literacy demonstration project in the European region (Bakker, 2019). As eHealth literacy tests are still in early development, researchers agree that no single test encompasses all domains of eHealth literacy. It is suggested that a combination of these tests can provide a more holistic assessment (van der Vaart et al., 2011, Neter and Brainin, 2017).

I employed this multi-dimensional eHLQ questionnaire to measure participants' eHealth literacy level in this study.

1.7 Rationale for thesis

Over the past century, healthcare provision has evolved from a one-sided doctor-patient relationship to one that emphasises shared decision-making and patient empowerment. Numerous studies have demonstrated that patients actively engaged in their health experience better health outcomes (Marzban et al., 2022, Krist et al., 2017, Hickmann et al., 2022). Since the 1990s, research on health literacy has highlighted that individuals with low health literacy often have poorer understanding, use of health services, and overall health (Institute of Medicine Roundtable on Health Literacy, 2013). Consequently, various health literacy assessment tools have been developed and utilised by health organisations and governments to evaluate the competency levels of individuals and populations, aiding in the design of tailored health intervention programs and health policies.

With the rise of the digital revolution, the demand for eHealth services such as internet-based health information, personal digital health devices, and remote consultations is expected to grow. However, this trend introduces challenges that healthcare researchers must address to ensure the safe and effective use of these new technologies.

One challenge is the rapid proliferation of digital health information and technologies. Individuals and private companies are freely uploading a plethora of new health information and health applications. While this allows for rapid dissemination of information and provides consumers with more choices, it also demands users to evaluate the information they obtain critically. Failure to identify appropriate sources can lead to misinformation and mistrust, as observed during the COVID-19 pandemic. Although several studies investigate the public perception of eHealth, there is a lack of in-depth studies focusing on specific patient groups, such as surgical patients (Sounderajah et al., 2021, Health Zhang et al., 2023).

To fully benefit from digital health innovations, a different skill set is needed to navigate and process electronic information for addressing health problems and interacting in the digital world.

eHealth literacy is now being studied with the same rigorous standards as health literacy was two decades ago. As a relatively new area of research, only a handful of eHealth literacy assessment tools are available. Further studies involving different population groups and specific diseases are required to establish a gold standard test. Assessing eHealth literacy using appropriate, validated tools will help us better understand the needs of different groups and facilitate tailoring information and services to their specific needs. Examples of these adjustments include tutorials on digital navigation and alternative methods of information delivery.

As the future of healthcare encourages the use of electronic information and digital connectivity, clinicians need to understand the factors influencing the use of digital health by patients from diverse backgrounds to reduce the risk of health disparities due to differential access to eHealth. It is also crucial to investigate the individual factors that influence the acceptance and use of eHealth in surgery. The current literature predominantly focuses on clinical trials evaluating patient outcomes and satisfaction scores, often overlooking patient factors at a more granular level (Nouri et al., 2020b). Contemporary thinking in eHealth development and implementation emphasises patient empowerment, digital inclusion, and clinician engagement (Risling et al., 2017, Carlqvist et al., 2021). Funding agencies and health regulators increasingly emphasise the importance of qualitative analyses of patient acceptance and usability of eHealth interventions. Understanding the motivational factors behind patient and clinician engagement, such as personal beliefs about health and technology, is key to designing interventions that resonate with diverse populations (Skivington et al., 2021, Unsworth et al., 2021).

The perception of health technology is dynamic and can change over time and according to specific health circumstances. For instance, many individuals have gained experience using digital technology

due to various restrictions since the beginning of the COVID-19 pandemic. The impact of these new digital experiences on the acceptability and uptake of eHealth remains unknown.

1.8 Hypothesis

Individual surgical patient factors, demographics, eHealth literacy, life experiences, and cultural beliefs influence the adoption and use of eHealth.

1.9 Aim of the thesis

The aim of this thesis is to investigate and comprehend the perceptions, experiences, and eHealth literacy of surgical patients regarding eHealth technologies.

By identifying the key barriers and facilitators that affect both patients' and healthcare professionals' engagement with and acceptance of eHealth, this research seeks to provide the evidence base for planning the successful integration of eHealth interventions within perioperative care. This study will help develop eHealth interventions tailored to the needs of diverse patient groups while ensuring that the technology is accessible, effective, and sustainable for the future of healthcare.

1.10 Objectives of the thesis

The specific objectives are:

1. To evaluate patterns of technology and eHealth use
Investigate current internet and digital technology usage patterns among surgical patients, including their preferences and experiences with eHealth tools.
2. To measure eHealth literacy levels
Assess surgical patients' eHealth literacy using a validated tool, identifying variations across demographics and patient backgrounds.
3. To analyse factors influencing eHealth engagement
Explore how patient characteristics, including eHealth literacy, prior experience with digital tools, and demographic factors, impact the acceptability, usability, and outcomes of eHealth interventions.
4. To compare modalities of healthcare delivery
Examine patients' perceptions and experiences with telemedicine, mobile health applications, and traditional face-to-face consultations, highlighting differences in satisfaction, usability, and effectiveness.

5. To assess the influence of the COVID-19 pandemic
Investigate how the pandemic has shaped perceptions, acceptance, and utilisation of eHealth among both patients and clinicians.
6. To identify enablers and barriers to implementation
Analyse the perspectives of patients and clinicians on the practical challenges and opportunities for integrating eHealth technologies into surgical care, offering recommendations for improved engagement and integration.

1.11 Overview of the thesis

This thesis comprises seven chapters, with each of the objectives highlighted in Figure 1-3.

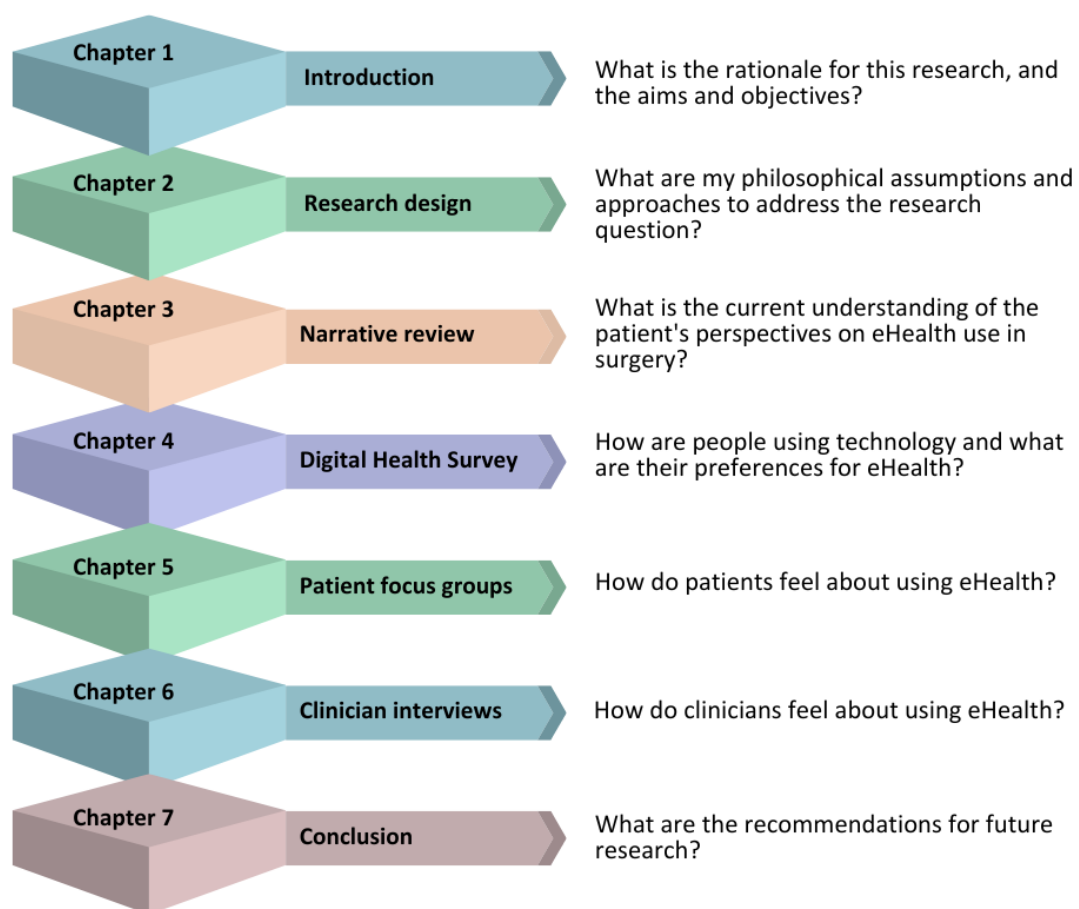


Figure 1-3 Overview of thesis

Chapter 2

2 Research design underpinning the thesis

2.1 Background

The purpose of this chapter is to outline the philosophical assumptions that form the basis of this thesis and to explain the approach taken to address the research questions.

In traditional research paradigms, methodologies are often classified as quantitative or qualitative. Quantitative research focuses on identifying relationships between variables to support or refute hypotheses and theories. This involves measuring numerical data and analysing it statistically. Typically, the goal of quantitative studies is to produce objective results that minimise biases and generate findings that are generalisable across larger populations Davidson and Tolich (2003).

In contrast, qualitative research aims to understand the meanings that social and human phenomena hold for individuals in their natural settings. This approach involves gathering textual, verbal and visual data, and using in-depth narratives from participants to explore different perspectives and patterns. The outputs of qualitative research accommodate the subjectivity and reflexivity of the researcher, enabling the generation of new knowledge, understandings and theories (Creswell, 2015, Davidson and Tolich, 2003).

Newman and Benz challenge the rigid categorisation of research methods into qualitative and quantitative, proposing a more flexible view where these approaches exist on a continuum. This perspective encourages researchers to position their studies within this spectrum, guided by their foundational philosophical beliefs (Newman and Benz, 1998) (Figure 2-1).

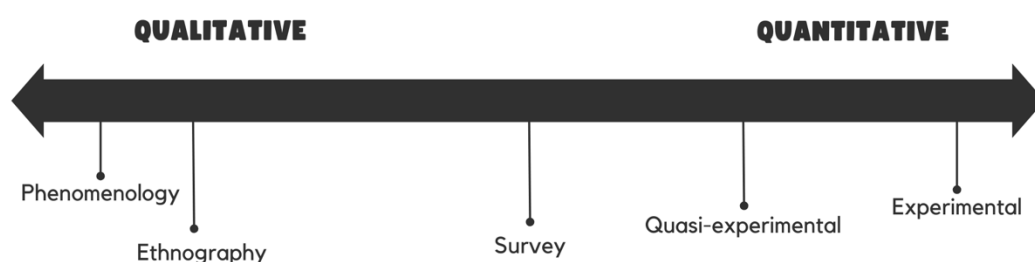


Figure 2-1 Qualitative and quantitative research methods continuum (Newman and Benz, 1998)

Philosophical perspectives in research are described as “a basic set of beliefs that guide action”(Guba, 1990). These perspectives, also referred to as paradigms (Guba and Lincoln, 2005, Mertens, 2004), epistemologies and ontologies (Crotty, 1998), outline the researcher's beliefs regarding the nature of

knowledge and the paths to its acquisition. Such perspectives influence both the research process and the choice of methodology and method (Creswell and Plano Clark, 2011). Although often implicit in published studies, it is crucial to recognise and articulate these philosophical stances (Slife and Williams, 1995). In planning this research, I have adopted the approach outlined by Denzin and Lincoln, which involves situating philosophical and interpretive frameworks within the research through methodical steps (Denzin and Lincoln, 2008).

2.2 Phase 1: The researcher as a multicultural subject

2.2.1 The perspectives and experiences I bring to the research

In formulating the research approach, I begin by reflecting on my own perspectives and experiences, considering how I view the nature of reality (ontology).

With a background in medicine and basic sciences, my inclination leans towards a realist ontology. Realists assert that reality exists independently of human consciousness; the physical world is objective, and knowledge is derived from empirical observations and experiments (Crotty, 1998). In my clinical practice as a senior surgical trainee in gastrointestinal surgery, I often engage with patients undergoing cancer treatment. I routinely discuss treatment options based on the latest evidence from research trials. In my experience, patients generally embrace the treatment recommendations provided by the multidisciplinary panel. While I prioritize a holistic and patient-centric approach, the focus of consultations primarily revolves around explaining the treatment rather than an in-depth exploration of patients' perspectives. This is because the common goal is clear: an attempt to provide a cure and prolong life.

Conversely, as a health researcher with a keen interest in digital health technology, I am well-versed in the literature and studies on digital health interventions and their potential impact on patient outcomes and experiences. My aim is to promote engagement and adoption of technology. Politically, my inclinations align with the left, as I strive to ensure that health technology benefits patients while being inclusive and equitable. However, it is essential to consider the common goals in this context. How do patients perceive these goals? Do my clinical colleagues share the same perspective? What challenges are commonly encountered? What external pressures influence these?

In this context, it is essential to consider not just a singular objective reality but the subjective realities shaped by individual experiences and perspectives.

Idealism offers a contrasting ontological stance, suggesting that reality exists within the mind, constructed through consciousness, and is therefore subjective and multifaceted (Crotty, 1998). Reconciling my realist inclinations with this idealist perspective leads me to adopt an "ideal realist" stance, as described by (Braun and Clarke, 2013). This position acknowledges the existence of a physical reality while appreciating the diverse realities co-created by collective consciousness. This

approach aligns with my research focus: exploring how patients and clinicians perceive digital health technology in the post-pandemic era and understanding the meaning behind their lived experiences. Recognising the coexistence of different realities enables me to balance the objective foundations of my clinical background with the subjective richness of qualitative inquiry.

Reflexivity and Researcher Power

Given my dual role as both a clinician and a researcher, I was acutely aware of the potential for implicit power dynamics and bias to influence data collection and interpretation. To mitigate this, I made it clear to all participants at the outset that my role in this project was solely that of a researcher, and not as a clinician or in any professional capacity related to their care. I explicitly stated that their participation, responses, or decisions regarding involvement would have no impact on their clinical management or relationship with the healthcare team. This distinction was reiterated in both the participant information sheet and during the consent process.

During focus groups and interviews, I also established ground rules to create a safe and open environment for discussion. Participants were informed that all contributions would remain confidential and that any views expressed would not be shared outside the research context. This approach aimed to minimise any perceived hierarchy or professional influence that might otherwise constrain honest dialogue.

In analysing the data, I maintained reflexive awareness of my own professional background and how it might shape interpretation. I engaged in regular supervision and peer debriefing to check potential assumptions arising from my clinical experience and to ensure interpretations remained grounded in participants' perspectives rather than my own. This process strengthened the credibility and confirmability of the analysis and helped to balance the inherent researcher-participant power relationship.

2.3 Phase 2: Interpretive Paradigms

2.3.1 The beliefs that guide my actions as a researcher

After reflecting on my position regarding the nature of reality, I considered the methodology that best aligns with my beliefs while remaining open to approaches that might challenge or expand my perspective. The research questions, which focus on understanding the perceptions of surgical patients and clinicians regarding digital health technology in a post-pandemic context, naturally suggest a qualitative methodological approach for capturing rich, varied data. However, addressing the broader context and practical implications of the study also requires incorporating a quantitative component to gather data on existing patterns of technology use. This multi-method approach enables a more comprehensive exploration of the research topic, balancing subjective insights with measurable trends.

Crotty emphasises that a researcher's epistemological beliefs determine their theoretical perspective and influence their chosen methodology (Crotty, 1998). Accordingly, I outline four major epistemological assumptions (Creswell and Creswell, 2018):

Postpositivist

The postpositivist view is a philosophical assumption commonly embedded in scientific experiments. It begins with a hypothesis or theory that can be tested by empirical observation and measurement to support or refute the theory. Postpositivists are interested in studying causes and effects by reducing big ideas into smaller, discrete elements that need to be verified. Objectivity is key in this inquiry, and steps are taken to minimise bias to ensure the conclusions are valid and reliable, as presented in most quantitative literature (Phillips and Burbules, 2000).

Constructivism

Constructivists believe that social actors construct social phenomena. People develop subjective meanings of their experiences and understand the world in their natural settings. Constructivist research focuses on gathering different perspectives and constructing research with the participants rather than using participants for research. It involves understanding multiple complex meanings based on social and historical perspectives and generating theory from these human interactions (Crotty, 1998).

Transformative

Transformative researchers advocate for research that not only investigates but also creates change. Their research has strong ethical and political functions and aims to fight for social justice and power imbalance. This gives voice to marginalised groups, and the research outcomes are collaborative and change-oriented (Mertens, 2010).

Pragmatist

The pragmatist worldview is not tied to a particular philosophy or reality. Instead, it focuses on the research topic and utilises all approaches best fitted to address the research question, as often seen in mixed-method research. Pragmatists believe that research occurs in diverse social, political, and historical contexts and do not dwell on the debate about the duality between reality and consciousness and whether it is created within our consciousness or independent of the mind. Pragmatist research accommodates different worldviews and methods and uses different forms of data collection and analysis (Cherryholmes, 1992, Morgan, 2007).

In qualitative health research, Green and Thorogood described qualitative methods as a tool “to investigate health, illness, or health services from the perspective of the communities and individuals affected, or the professionals who provide health services for them”(Green and Thorogood, 2013). This

definition has influenced my epistemological stance as that of a pragmatist-constructivist. In my research, I acknowledge that individuals construct diverse meanings based on their experiences, and I should use research methods that are most suitable to address the research questions.

2.4 Phase 3: Research strategies and approaches

2.4.1 The philosophical and theoretical frameworks that informed my choice of research approaches

Grant and Osanloo explained the importance of theoretical frameworks in shaping researchers' thinking about the research topic and methodology. They compared theoretical frameworks to the blueprint of a house, providing a structure in which concepts and theories help researchers understand, explain, and predict different phenomena. (Grant and Osanloo, 2015). Theory operates on three levels (Pope and Mays, 2020) (Figure 2-2):

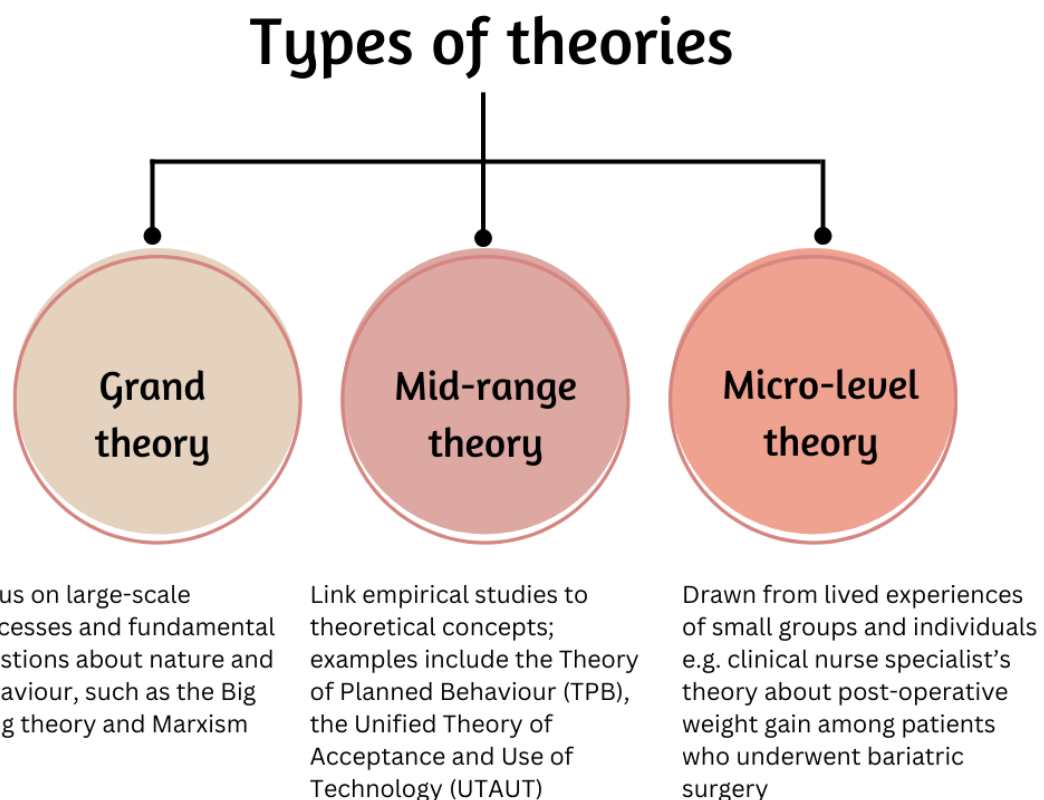


Figure 2-2 Levels of theories (Pope and Mays, 2020)

I used two middle-range theories as the foundation for this thesis. The United Theory of Acceptance and Use of Technology and the Theoretical Framework of Acceptability.

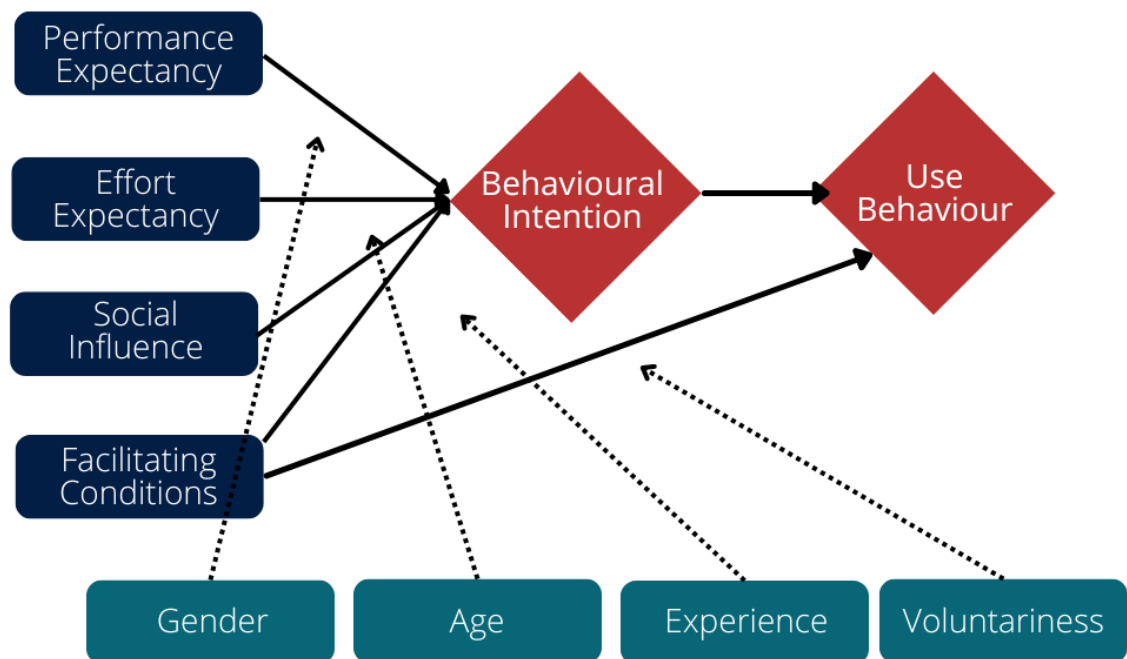


Figure 2-3 Model 1 – United Theory of Acceptance and Use of Technology (2012)

The United Theory of Acceptance and Use of Technology (UTAUT) is a theoretical model that explains the various factors influencing user acceptance of technology (Venkatesh et al., 2012). It is empirically tested and integrates determinants of intention and usage of information technology from eight existing models of technology acceptance and user behaviour. These models include the Theory of Reasoned Action (Fishbein and Ajzen, 1975), the Technology Acceptance Model (Davis and Davis, 1989), the Motivational model (Deci and Ryan, 1985), the Theory of Planned Behaviour (Ajzen, 1991), the model of PC utilisation (Thompson et al., 1991), the innovation diffusion theory (Rogers, 2003), and the social cognitive theory Bandura (1986). The underlying concept is derived from the Technology Acceptance Model, which states that users are more likely to use technology if they perceive it to be easy to use and useful for their needs (Davis, 1989).

According to UTAUT, three main factors directly influence an individual's intention to use technology (Figure 2-3).

1. Performance expectancy- the extent to which a person believes that utilising the system will assist them in enhancing job performance.
2. Effort expectancy – the level of difficulties associated with using the technology.

3. Social influence- the extent to which a person perceives their significant others would agree they should use the new system

This model suggests that behavioural intentions, along with the appropriate facilitating conditions, which are defined as the extent to which a person believes that adequate organizational and technical infrastructure exists to facilitate the use of technology, lead to the actual use of the technology. In this unified model, an additional four moderators were found to significantly influence the use of technology; these included the users' age, gender, prior experience with technology, and voluntary usage. The UTAUT has been used previously as a framework to analyse healthcare professionals' adoption of mobile electronic health records (Kim et al., 2016), acceptance of telemedicine during COVID (Shiferaw et al., 2021), and patients' acceptance of video consultation for cancer care (Nurtsch et al., 2024).

The UTAUT aligns with a constructivist worldview, which seeks to understand the different dimensions that impact a user's decision-making process. My analysis seeks to explore the different perceptions surrounding technology usage, focusing on factors such as the perceived effort required and anticipated outcomes. This theoretical perspective guided the design and analysis of the narrative review and digital survey chapters.



Figure 2-4 Model 2 – Theoretical Framework of Acceptability (2017)

The Theoretical Framework of Acceptability is used to assess the acceptability of novel healthcare interventions (Sekhon et al., 2017) (Figure 2-4). This framework helps explore the perspectives of both healthcare providers and recipients to analyse the constructs of acceptability. It provides a conceptual definition of acceptability as "a multi-faceted construct that reflects the extent to which people delivering or receiving a healthcare intervention consider it appropriate, based on anticipated or experienced cognitive and emotional responses to the intervention."

The development of this framework involved inductive theorising of conceptual and operational definitions of acceptance and assessments of acceptability, which were based on data generated through a systematic literature review. Following this, deductive theorising was conducted based on existing frameworks and models explaining health-related behaviours to identify the constructs to be included in the final theoretical framework.

Examples of studies that applied the TFA include patients' acceptance of complex surgical interventions (Paynter et al., 2023), mixed reality behavioural intervention for patients with asthma (Sharrad et al., 2023), and technology-assisted Intervention for sedentary behaviour (Huang et al., 2023).

In my research, I use this comprehensive framework of acceptance to gain detailed insights into individual perceptions of new medical interventions. This approach allows for a more thorough analysis of the factors influencing the adoption and implementation of eHealth solutions. The framework guides the design and analysis of patient focus groups and clinician interviews in my thesis.

2.5 Phase 4: Methods of collection and analysis

Guided by the theoretical frameworks, the studies involved in this thesis employ a multi-method approach, integrating both quantitative and qualitative methods for data collection and analysis.

Chapter 3: Systematic Review and Thematic Synthesis

Chapter 3 involved a systematic review to identify existing publications on patients' perceptions of eHealth in surgery. This chapter used thematic analysis to identify recurring themes and patterns from qualitative data from included studies. Thematic synthesis adopted techniques from meta-ethnography and grounded theory (Thomas and Harden, 2008), allowing inductive, constant comparison coding, similar to grounded theory, and reciprocal interpretation across studies, which is a feature of meta-ethnography. I first conducted free coding of the data line-by-line. The codes are organised into descriptive themes and finally transformed into analytical themes. Thematic analysis is particularly useful in review studies addressing the effectiveness and acceptability of interventions in qualitative healthcare research (Barnett-Page and Thomas, 2009). This systematic review involved a rigorous search strategy, screening, data extraction, and analysis to generate a conceptual framework for existing understanding of eHealth perceptions in surgical settings.

Chapter 4: Digital Health Survey

Chapter 4 involves a cross-sectional survey that examines surgical patients' existing patterns and experiences of general technology use, their experiences with eHealth interventions, and their eHealth literacy levels. The survey also explores pertinent social and demographic facilitating factors. The analysis involved statistical measurement of both nominal and continuous data to identify trends and correlations, which is described in detail within the chapter. This study evaluated the impact of various factors on patients' engagement with eHealth, including the objective measurement of eHealth literacy using the validated eHLQ questionnaire described in chapter 1.

Chapters 5 and 6: In-Depth Focus Groups and Interviews

Chapters 5 and 6 involved in-depth patient focus groups and clinician interviews using a semi-structured topic guide. The focus groups and interviews were audio-recorded and transcribed for analysis. The dataset was analysed using Braun and Clarke's thematic analysis (TA) approach.

Thematic analysis

Braun and Clarke proposed thematic analysis (TA) as a qualitative research method for “identifying, analysing and reporting patterns” of meaning within the dataset (Braun and Clarke, 2006). The advantage of thematic analysis is that it is not confined to a particular epistemological assumption and can be adopted across different types of research and to the researcher's philosophical stance (Clarke and Braun, 2013). This flexibility made TA particularly suitable for my study, as it aligns with my epistemological position as a pragmatist-constructivist in approaching the analysis within my qualitative studies. There are several variations of thematic analysis techniques, including: 1. Coding reliability TA – an approach focused on reliability and consensus among different coders in the research team. The accuracy of the codes can then be measured using Cohen's Kappa in keeping with a positivist stance. It is described as a small q technique as this method generates data summaries rather than developing the deep meaning (Braun and Clarke, 2019). Another form of thematic analysis is 2. Codebook TA - considered a Big Q method, employing an organic and interpretive approach to data analysis. In codebook TA, themes are developed early in the analysis process and subsequent coding follows the constructed framework (Byrne, 2022). 3. Reflexive TA – Reflexivity in data analysis implies that the researcher's perspectives and contexts are essential to the analysis process. This approach allows researchers to utilise their own expertise and personal experiences to interpret and engage with the data (Braun and Clarke, 2019).

For this research, I have chosen to apply a simple thematic analysis approach following Braun and Clarke's six-phase process (Braun and Clarke, 2006):

1. Familiarisation with the Data

Reading and re-reading the interview transcripts and outlining initial ideas.

2. Generating Initial Codes

Systematically coding across the entire dataset, collating data pertinent to each code.

3. Searching for Themes

Organising codes into potential themes, gathering all data relevant to each theme.

4. Reviewing Themes

Checking the themes against the coded extracts to create a thematic map of the analysis.

5. Defining and Naming Themes

Ongoing analysis to refine the topics of each theme and generate clear definitions and names for each theme.

6. Producing the Report

Reporting of themes with representative quotes and relating back to the research question.

This approach was selected for several reasons. First, it provides the flexibility to explore latent meanings within the data, enabling me to identify underlying ideas and assumptions, which is particularly valuable for addressing the complexities of healthcare provision in the digital era.

Thematic analysis aligns well with this study's theoretical models- the Unified Theory of Acceptance and Use of Technology (UTAUT) and the Theoretical Framework of Acceptability (TFA), as described previously. These theories provide a broad, overarching framework for exploring the determinants of technology and healthcare intervention acceptance, whilst a flexible thematic analysis approach allows new ideas to emerge organically from the data, capturing nuanced insights that might otherwise be constrained by a more rigid, predefined coding framework, as seen in a codebook or coding reliability TA.

Meanwhile, reflexive TA emphasises the importance of the researcher's subjectivity and critical engagement with the data, I decided against this approach due to my relative inexperience with complex thematic analysis technique and the time limitations of the study. Reflexive TA requires advanced reflective skills and a deeper engagement with interpretive processes, which I believe could compromise the quality of analysis in this context.

Peer Debriefing and Participant Feedback

Ideally, peer debriefing would have been incorporated into the research process to enhance reflexivity and ensure the credibility of data interpretation. Engaging peers in reviewing the coding process and thematic development could have provided an additional layer of analytical scrutiny, helping to identify potential biases or blind spots arising from my dual role as clinician and researcher. However, this was not feasible within the doctoral research timeframe due to time constraints and limited resources to coordinate feedback sessions effectively. Similarly, returning interview transcripts to participants (both patient and clinician groups) for comment or verification was considered but not implemented for the same practical reasons. I recognise that including these steps could have enriched the rigour of the study, encouraged greater participant engagement, and contributed to a more transparent and collaborative analytic process. These aspects are acknowledged as limitations of the present study but offer valuable direction for future research designs.

2.6 Phase 5: The art, practice, and politics of interpretation and evaluation

Ensuring the study's trustworthiness is crucial to its credibility and the utility of its findings. Trustworthiness, as defined by Lincoln and Guba (1985), involves establishing four key criteria: credibility, dependability, confirmability, and transferability (Lincoln and Guba, 1985). These criteria guide the research process and contribute to the robustness of the study's conclusions.

Credibility

Credibility refers to confidence in the truth of the findings and is analogous to internal validity in quantitative research. Several strategies were employed in this study to enhance credibility. First, regular research meetings were held with a second researcher and my supervisors. These meetings served as a platform for discussing data interpretation and ensuring that different perspectives were considered, reducing the risk of researcher bias and ensuring that the findings accurately reflected the participants' experiences. Additionally, an audit was conducted by the college research governance and integrity team, which involved a review of the study's methodology and data collection (Shenton, 2004). These steps help ensure that the study's findings are credible and reflective of the participants' realities.

Dependability

Dependability is concerned with the consistency of the research process over time. To establish dependability, this study followed a rigorous protocol for qualitative synthesis, which included the use of a standard topic guide during interviews to ensure consistency across all participants. This approach allowed for a systematic exploration of the research questions while accommodating the flexibility needed to capture the richness of participants' responses (Miles et al., 2013).

Confirmability

Confirmability refers to the extent to which the participants influence the study's findings, rather than being shaped by researcher bias, motivation, or interest. I reflected upon and articulated my personal perceptions and assumptions in the researcher's biography at the outset of this research journey. This reflective approach recognises that my role as a healthcare professional can enrich the research while also introducing potential biases. Furthermore, all interviews were audio-recorded, and transcripts were meticulously checked against the recordings to ensure accuracy. Triangulation was also employed, comparing results from the perspectives of patients and healthcare professionals to validate the findings from multiple viewpoints (Lincoln and Guba, 1985, Korstjens and Moser, 2018).

Transferability

Transferability involves the extent to which the study's findings can be applied to other contexts or settings. In qualitative research, this is achieved by providing a rich description of the participants' contexts, allowing readers to determine the applicability of the findings to their own situations. In this study, I provided detailed descriptions of the participants' demographics, clinical contexts, and experiences. This helps to understand the specific circumstances under which the findings were derived. Additionally, qualitative quotes were used extensively throughout the analysis to illustrate the themes and provide concrete examples of the phenomena under study. This level of detail supports the transferability of the findings by offering insights that can be considered in similar contexts (Creswell and Poth, 2017, Merriam and Tisdell, 2015).

2.7 Conclusion

This chapter provides an overview of the research design that forms the foundation of this thesis. It includes a detailed examination of the philosophical assumptions, theoretical frameworks, and methodological approaches used. By considering both realist and idealist perspectives, I positioned myself within an ideal realist ontology. This acknowledges the existence of an objective reality while also recognising the diverse subjective experiences of patients and clinicians interacting with digital health technologies. This dual perspective informed the choice of a pragmatist-constructivist epistemology, guiding the use of qualitative methods to capture the nuanced perceptions of eHealth in surgical contexts.

The integration of middle-range theories, such as the Unified Theory of Acceptance and Use of Technology (UTAUT) and the Theoretical Framework of Acceptability (TFA), provided a structured approach to analysing the factors influencing technology adoption and acceptability. These frameworks were essential in designing and interpreting the various research phases, from the systematic review to the thematic analysis of focus groups and interviews.

This sets the foundation for the subsequent chapters, where the findings from patient and clinician perspectives will be explored in-depth, providing a rich understanding of the challenges and opportunities associated with eHealth adoption in surgical settings.

Chapter 3

3 Patients' perceptions of eHealth use during surgical treatments- a systematic review and thematic synthesis of qualitative research

3.1 Introduction

The integration of eHealth has been shown to improve patient care. Studies have highlighted that eHealth tools, such as remote monitoring devices, telemedicine, and mobile health applications, can enhance the quality of care and patient satisfaction. For instance, a randomised controlled trial involving 641 patients on the use of telehealth for high-risk cardiovascular disease management showed improved treatment adherence, access to care and patient satisfaction (Salisbury et al., 2016). Another study on using an app-based diabetes management programme in 950 patients with type 2 diabetes demonstrated significant improvement in glycaemic control and reduction in HbA1c levels (Zimmermann et al., 2021).

A national survey of over two thousand United Kingdom residents indicated that the UK general public does not yet feel prepared to use eHealth technology for healthcare purposes (Sounderajah et al., 2021). The adoption rates of these technologies vary among different patient groups, and it remains uncertain whether universal implementation of eHealth solutions may exacerbate existing health inequalities, particularly affecting individuals from disadvantaged backgrounds who may lack the necessary access or skills to use these technologies effectively (Sounderajah et al., 2021, Litchfield et al., 2021).

Most existing literature reporting the use of eHealth technologies among surgical patients were clinical trials or case series, focusing on a single type of technology or a specific condition. Patients' perceptions and opinions were reported as a secondary outcome or as additional findings using data collected via questionnaires (O'Connor et al., 2016). These secondary data lack the breadth and depth required to understand the lived experience of patients who used these technologies during their treatment and how this may have impacted their lives from diagnosis to recovery.

As described in Chapter 2, the unified technology acceptance and use of technology (UTAUT) model is a commonly used theoretical framework to investigate the components of users' acceptance of technology. This model proposed four main domains of acceptance, including performance expectancy, effort expectancy, social influence, and facilitating conditions (Venkatesh et al., 2012). Therefore, a comprehensive literature review focusing on the rich qualitative description of the patients' experience involving multiple, complex eHealth interactions is essential. Existing reviews of qualitative studies of eHealth in surgery are narrow in scope, for example, investigating the use of smartphone applications to enhance communications (De La Cruz Monroy and Mosahebi, 2019), and the application of eHealth strategies for bariatric patients (Messiah et al., 2020). To address this knowledge gap, this study aims

to provide an overarching review of qualitative studies reporting contemporary eHealth technologies along the patient surgical journey.

The review examined patients' views on their experiences with eHealth technologies post-treatment, highlighting the needs and expectations of surgical patients when choosing eHealth technologies during their care.

3.2 Methods

The review protocol was registered and deposited on PROSPERO, the International Register of Systematic Reviews (CRD42022314316).

3.2.1 Search Strategy

A literature search was conducted on three electronic databases, MEDLINE, EMBASE, and Health Management Information Consortium (HMIC), following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The search included studies published in English from database inception to 14 September 2024. Reference lists of included studies were searched for additional studies that met the inclusion criteria. The search terms included three main categories: (1) eHealth interventions, (2) Surgery and perioperative care, (3) Qualitative studies (see Appendix 1).

3.2.2 Eligibility criteria and study selection

Studies fulfilling the following criteria were included: (1) an original qualitative study or a mixed-method study containing a substantial amount of qualitative data, for example, interviews, focus groups, observations, and open-ended questionnaires; (2) implemented an eHealth intervention accessed through a computer, phone or tablet, other handheld or wearable device, involving an internet-connected application or programme designed for patients as the primary user during surgical care; (3) reported patients' perceptions or experience of the eHealth intervention.

Studies were excluded if they (1) contained minimal qualitative data or lacked any representative quotes, (2) involved the paediatric population, or (3) reported opinions of health care professionals only.

Studies involving paediatric patients were excluded. The paediatric population spans a broad range of ages and developmental stages, making comparisons with adult data unreliable. For younger children, data often reflect parents' or carers' views rather than those of the patients themselves. In addition, paediatric surgical care pathways differ substantially from adult services in structure, consent processes, and clinical context. Excluding paediatric studies therefore ensured a coherent focus on adult surgical care and maintained the relevance of findings to the review's aims.

3.2.3 Data analysis and synthesis

Two reviewers (CWH- the doctoral candidate, and YG- fellow doctoral student) applied the inclusion and exclusion criteria at the title/abstract screening and full-text review stage. Covidence systematic review software was used to collate article references, remove duplicated publications, and keep track of decision-making throughout the selection process. Microsoft Excel was used to record extracted data, including authors' names, year of publication, title, study design, demographic information, setting, intervention and qualitative outcome data. We extracted all qualitative data (primary and secondary constructs) regarding patients' views on eHealth interventions in surgery.

The findings from each included study were analysed using a thematic analysis approach (Braun and Clarke, 2019). As a novice qualitative researcher, I utilised the unified technology acceptance and use of technology (UTAUT) model as a theoretical lens to guide my analysis i.e. performance expectancy, effort expectancy, social influence, and facilitating conditions. However, the analysis was not restricted to this framework, and additional coding was generated inductively to allow broad themes and de novo themes to be identified from this underexplored surgical patient population (Boyatzis, 1998).

The two authors independently undertook line-by-line coding and analysis, then discussed and compared their findings to develop a coding frame. The codes were organised into broader themes to capture their meaning regarding patients' acceptability and utility of eHealth interventions. Coding meetings were held with the thesis supervisor to review coding consistency and reconcile coding disagreements. Synthesised data were presented in a conceptual map.

3.2.4 Quality assessment

Quality assessment was performed using the Critical Appraisal Skills Programme (CASP) criteria. Studies were not excluded based on quality to allow the comprehensive exploration of themes from published qualitative data (see Appendix 2).

3.2.5 Ethical considerations

Ethics approval was not required for this systematic review as it involves data synthesis from published works only.

3.3 Results

The literature search generated 10951 records, of which 372 full-text articles were screened and 60 were included in the review (see Fig. 3.1). This review was carried out following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Moher et al., 2009).

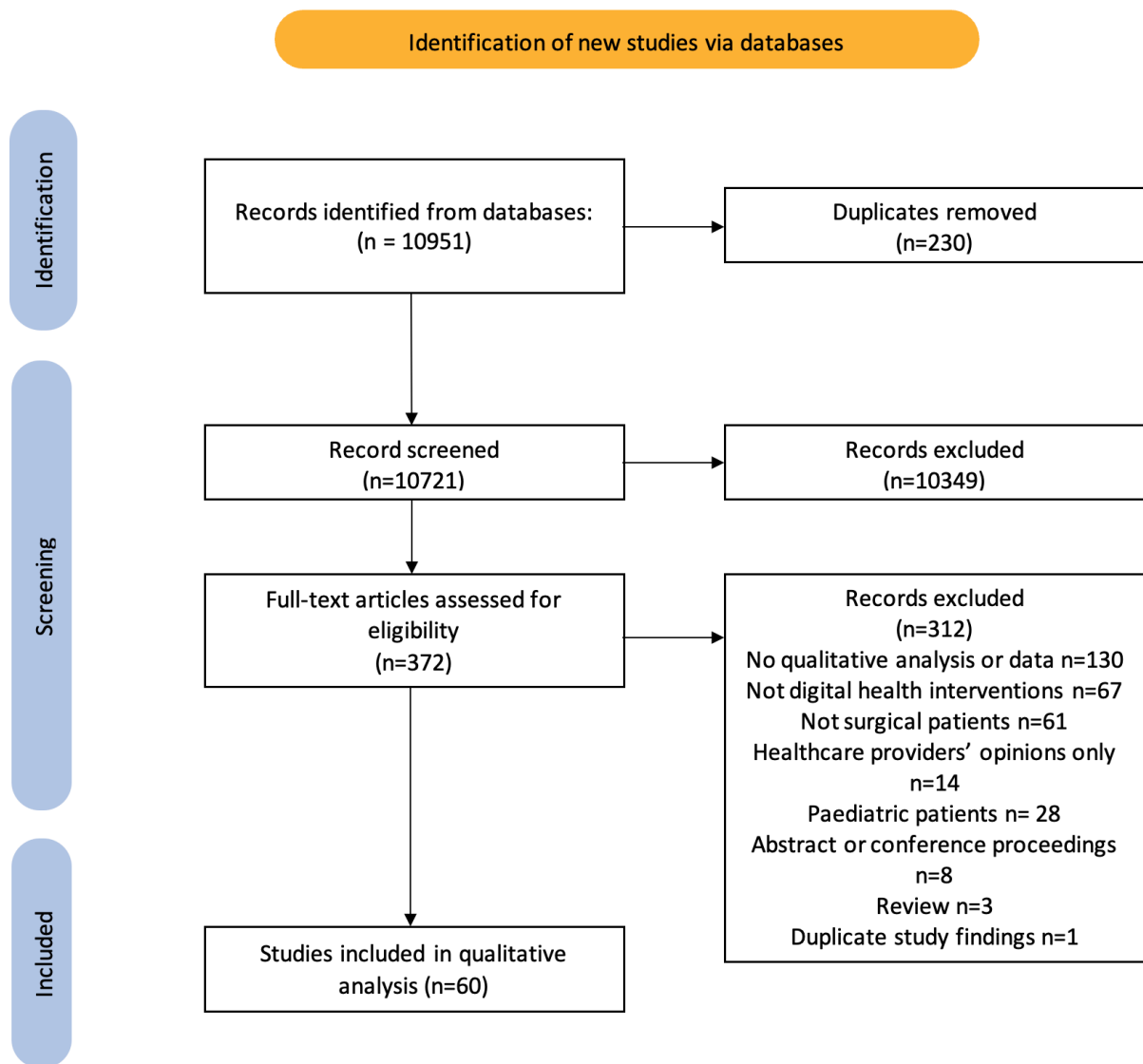


Figure 3-1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses Diagram

Characteristics of included studies

This systematic review included 60 qualitative studies for final analysis. Table 4 at the end of the chapter summarises the characteristics of all included studies. The studies represent a broad range of geographic locations, surgical specialities, types of eHealth interventions, and research objectives.

Geography

The studies were conducted across various countries, including eighteen from the United States, eleven from the United Kingdom, eight from the Netherlands, six from Canada, five from Sweden, four from Australia, three from Denmark, and one each from Ireland, Belgium, France, Norway and China.

Surgical specialities

The most represented specialities include gastrointestinal surgery (15 studies) and orthopaedic surgery (10 studies). Other specialities covered include gynaecological (5 studies), cardiac (3 studies), vascular (3 studies), plastic (1 study), transplant (1 study), maxillofacial (1 study), breast (1 study), urology (1 study), ENT (1 study), Thoracic (1 study), Trauma (1 study), Neurosurgery (1 study), and a mixed group of specialities (15 studies).

Type of Intervention

Mobile health applications were the most studied intervention, featured in 27 studies. Other interventions included wearable sensors (6 studies), telemedicine (5 studies), web-based tools or resources (12 studies), and digital programs combining multiple interventions (8 studies). Additionally, there was one study each focusing on animation and electronic health records.

Year of Publication:

The studies were published between 2014 and 2024. 43 out of 60 studies were published after 2020.

Objectives of Included Studies:

The included studies' primary objectives varied but centred around understanding and improving the patient experience with eHealth interventions. The key objectives included: 1. Establishing patients' perceptions of eHealth tools, 2. Identifying barriers and facilitators to adopting and using these technologies, 3. Evaluating the acceptability and feasibility of interventions, 4. Exploring patient experiences and needs, 5. Assessing usability and identifying design, functionality, and usability issues, and 6. Conducting process evaluations to inform future implementation.

Theme 1- Reaching my full potential for recovery

The first identified theme highlighted how patients used eHealth to enhance their preparation for surgery and recovery. A summary of the facilitating factors and barriers identified within each theme is presented in Table 3-1, which also indicates the types of technology to which these factors apply.

Table 3-1 A summary of the facilitating factors and barriers identified within each theme

Facilitators		Barriers	
Theme 1: Reaching my full potential for recovery			
Facilitator Subtheme 1.1: Reassurance (a,b,c,d,e)	Feel assured knowing what to expect, knowing how to ask for help if something is wrong, sense of security, feeling safe and looked after	Barrier Subtheme 1.1: Reassurance	Do not want to think about technology when in pain or feeling sick Rely on others to determine causes of concern
Facilitator Subtheme 1.2: Motivation (a,b,c,d,e)	Willing to engage knowing being monitored and have to report progress, ability to visualise progress from eHealth	Barrier Subtheme 1.2: Motivation	Concerns with not achieving predetermined goals Fatigue with frequent logging
Facilitator Subtheme 1.3: Mental wellbeing (a,b,c,d,e)	Less isolating, peace of mind Alleviate anxiety and worry	Barrier Subtheme 1.3: Mental wellbeing	Stress and anxiety from using eHealth
Facilitator Subtheme 1.4: Empowerment (a,d,e)	More aware of own body and recovery, confident to ask questions and express concerns	Barrier Subtheme 1.5: Empowerment	Information overload causing anxiety and fear to have surgery
Theme 2: Getting help easily			
Facilitator Subtheme 2.1: Convenience (a,b,c,d,e)	Save time and travel, easy access with eHealth	Barrier Subtheme 2.1: Convenience	Time-consuming to connect to and navigate eHealth, logging data
Facilitator Subtheme 2.2: Communication (a,b,c,d,e,f)	eHealth serves as an effective communication channel, enhances interaction with clinicians and peers	Barrier Subtheme 2.2: Communication	Clinicians not responding or takes too long to respond

Facilitator Subtheme 2.3: Extended support (a,b,c,d,e)	More frequent monitoring and out of hours monitoring Prevent sudden deterioration once discharged		
Facilitator Subtheme 2.4: Clinician involvement (a,d,e)	Promote patient use of technology with clinician endorsement	Barrier Subtheme 2.4: Clinician involvement	Lack of clinician involvement led to sense of frustrations and hopelessness when using DHT
Facilitator Subtheme 2.5: Face-to-face interaction/ Hybrid interaction (a,b,c,d,e,f)	More personable experience with face-to-face interactions, opportunity to talk to staff, discussion their conditions and needs High fidelity video link offers credibility to remote consultation	Barrier Subtheme 2.3: Face-to-face interaction	Lack of direct supervision and personal contact slow progress Cannot replace clinical examination
Facilitator Subtheme 2.6 Accessibility and Inclusivity (a,b,d)	Adjustment for people with disabilities, support for the elderly, support other languages Provide alternatives for those not using eHealth or lack internet access	Barrier Subtheme 2.5: Digital difficulty and hesitancy	Elderly and less computer literate being excluded or receive inferior care
Theme 3: Technology that works for me			
Facilitator Subtheme 3.1: Information giving (a,b,c,d,e,f)	Enhance delivery and understanding of health information Revisit resources at own pace Aid shared decision making	Barrier Subtheme 3.1: Clinical endorsement	Cannot cope with too much information, will not read if too much information
Facilitator Subtheme 3.2: Technical ability (a,b,c)	Provide appropriate IT support and awareness of different technical abilities	Barrier Subtheme 3.2: Technical ability	Some patients do not feel confident to use technology, require non- digital alternatives
Facilitator Subtheme 3.3: User Friendliness (a,b,d,e)	Simple and intuitive design, clear instructions	Barrier Subtheme 3.3: User Friendliness	Frustration from technical glitches, complex installation process, sensors can be irritating and uncomfortable, difficulty with internet connection

			incompatibility with different devices and operating systems
Facilitator Subtheme 3.4: Customisation and Tailoring (a,c,d,e)	Adjustable recovery plan to accommodate different recovery speed Tailor the reading materials to own pace and requirements		
Facilitator Subtheme 3.5: Reminder (a,d)	Reinforce adherence to recommendations Memory aid when busy or forgetful	Barrier Subtheme 3.5: Reminder	Need consent and ability to change frequency of reminders
Facilitator Subtheme 3.6: Trust and security (a.b.c)	Trust in the safety of the system promote use of technology	Barrier Subtheme 3.6: Trust and security	Concerns regarding leaking of personal information, tracking of health behaviours not intended for the benefits of the patient

Letters in parentheses (a, b, c, etc.) are used in the table to denote the various types of eHealth technology and the themes these refer to.

a. Mobile health applications, b. wearable sensors, c. telemedicine d. web-based tools or resources, e. digital programs combining multiple interventions, f. electronic health records.

Theme 1- Reaching my full potential for recovery

The first identified theme highlighted how patients used eHealth to enhance their preparation for surgery and recovery.

1.1 Reassurance

Patients sought reassurance from eHealth technology during their treatment. Specifically, some have found it reassuring to have a reliable source of information about their surgery through perioperative health applications (Ke et al., 2019, Van Der Horst et al., 2023). These applications often include informative videos that help patients recognise signs of wound infection and provide instructions for rehabilitation exercises. (Robinson et al., 2021, Saunders et al., 2022).

Dunphy et al. focused on an application that offers a range of features, including rehabilitation plans, exercise logs, and messaging functions for support. Some of these apps are integrated with sensors that provide real-time feedback to users, ensuring that they perform their exercises correctly. Patients appreciate these apps as they help them gain confidence in independently completing their exercises (Argent et al., 2019).

Many individuals used recovery tracking applications to monitor symptoms, recording their frequency and duration. These apps offer feedback based on the information entered by the patients and provide recommendations regarding the anticipated recovery progress. If the patient's recovery deviates from the expected trajectory, the apps send notifications to prompt them to seek further assessments from healthcare professionals.(den Bakker et al., 2019, van der Meij et al., 2018, Kettle et al., 2017, Richards et al., 2021, Scott et al., 2017, Stern et al., 2022).

“A feeling of confidence, whether I am going in the right direction. Naturally, you do not continuously call a doctor or the hospital to check whether it is going okay, or I feel this or I feel that. Because of this app you know, you have to meet these requirements, so it is all right.”(den Bakker et al., 2019)

Within the hospital settings, patients found having continuous monitoring with wearable sensors gives them a sense of security, particularly during the night and when nursing staff are busy (Joshi et al., 2021, Areia et al., 2022).

Moreover, patients found it reassuring that clinicians have direct access to information about their recovery via digital platforms (Dawes et al., 2015, Sanger et al., 2014, Robinson et al., 2021, Robinson et al., 2022, Sreedharan et al., 2022, Toft et al., 2024).

Others raised concerns about the adverse impact of using technology while unwell. Some individuals preferred not to use technology or access any programs while experiencing pain or sickness (Abelson et al., 2017, Low et al., 2020, Woollen et al., 2016). Additionally, there were reservations about

surrendering autonomy and depending on others to assess potential issues during the recovery process.(Gustavell et al., 2020)

1.2 Motivation

Patients benefitted from using mobile health apps to adhere to their post-operative guidance and rehabilitation programs at home. They found that being monitored and reporting progress motivated them to exercise daily (Dunphy et al., 2017, Dunphy and Gardner, 2020, Argent et al., 2019, Dawes et al., 2015, Saunders et al., 2022, Robinson et al., 2021, Low et al., 2020, Sohl et al., 2024, Toft et al., 2024, Van Der Horst et al., 2023, Wright et al., 2023b). In addition, some patients thought using an activity tracker helped them visualise their progress over time, boosting their confidence and push themselves further each day (van der Meij et al., 2018, Robinson et al., 2022).

“I would use tele-rehab daily, because having a program that measures your progress and fulfilment of daily goals is more encouraging than a doctor’s note that tells you to do ‘x’ repetitions of some exercise, which I would be less likely to do regularly.” (Dunphy and Gardner, 2020)

However, some patients had concerns about not being able to achieve their set goals due to programs not considering the varying abilities of users or allowing them to progress at their own pace, which can lead to a lack of motivation. Also, frequent requests for data logging by the app can be discouraging, especially when there are no significant changes in symptoms or progress.(Harder et al., 2017, Nilsson et al., 2020a, Toft et al., 2024)

1.3 Mental Wellbeing

Patients recognised the role of eHealth in putting their minds at ease. By interacting with relevant information in the eHealth tools, patients found it easier to manage their expectations, anticipate postoperative symptoms and reduce anxiety (Russ et al., 2020, Kayler et al., 2020, Ke et al., 2019, Kim et al., 2021, Dunphy et al., 2017, Mikkelsen et al., 2022, Robinson et al., 2022, Stern et al., 2022, Van Der Horst et al., 2023, Wu et al., 2023). Some studies highlighted that patient utilising eHealth tools after hospital discharge reported feeling less isolated, which helped them transition from hospital to self-care (Richards et al., 2021, Gustavell et al., 2020).

“I had major surgery and this app helped to calm my nerves as I knew what to expect, I found the information very useful and it made me feel less worried about what was going to happen” (Russ et al., 2020)

Some patients have reported the benefits of using the app to monitor their emotional well-being. They found it helpful in tracking changes in their mental well-being and receiving feedback following surgery (Harder et al., 2017, Robinson et al., 2021, Gill et al., 2024, Houwen et al., 2022).

On the other hand, there were cases where the use of eHealth had adverse psychological effects. One study found that patients became nervous when checking their vital signs, which heightened anxiety (Weenk et al., 2020). Additionally, continuous monitoring and tracking can also cause anxiety in some patients. For instance, monitoring alarms may induce fear and uncertainty about potential health issues (Areia et al., 2022), while frequent surveys could evoke memories of unpleasant experiences (O’Leary et al., 2024). There have also been reports of distress caused by including quizzes in some apps aimed at improving learning (Reid et al., 2021).

1.4 Empowerment

Patients reported that using perioperative apps and web-based programs increased their awareness of the recovery process and gave them a sense of control over their care (Dawes et al., 2015, Gustavell et al., 2020, Robinson et al., 2022, Stern et al., 2022). They find it helpful to keep a digital diary to track wound healing or stoma output, and to receive advice on how to care for the wound or increase fluid intake. By consistently using these tools, patients gained confidence in their ability to care for themselves. They felt more equipped to deal with setbacks and more prepared to contact healthcare professionals when they assistance is required (Dawes et al., 2015, Wu et al., 2023).

“Sometimes you feel you shouldn’t ring your nurse, you know” PT 1242 “If you read that [ePRO advice] first... that it’s normal for a bit, but if it lasts you’ve got to get in touch with somebody” (Richards et al., 2021)

Some patients used the app to share their data with healthcare professionals or as a resource for discussing their health, which makes them more confident to ask questions (Russ et al., 2020, Richards et al., 2021, Kim et al., 2021).

Additionally, some people found using the app before their consultation helpful, as it allows them to enhance their knowledge and make informed decisions about surgery and recovery (Russ et al., 2020, Van Der Horst et al., 2023). Electronic health records also allowed patients to access their data, including laboratory test results and medication details, giving them a sense of ownership over their health information (Woollen et al., 2016).

However, some participants cautioned about the burden of processing too much information during the perioperative period. Information overload can trigger anxiety, leading some patients to rethink their treatment (Russ et al., 2020).

“I did not like it, information made me scared to have operation” (Russ et al., 2020)

Theme 2- Getting help easily

The second identified theme illustrates how patients prefer using technology to access the care they need more easily.

2.1 Convenience

Patients reported that telemedicine provided convenience by saving time and travel costs (Triantafillou et al., 2021, Drummond et al., 2022). They appreciated the efficiency of remote consultations, as they eliminated the need to travel long distances for a brief preoperative visit or a rehabilitation session (Brown-Johnson et al., 2021, Lew et al., 2023). Individuals with minor health issues preferred the convenience of virtual consultations over in-person attendance (Graetz et al., 2018). Additionally, some patients found it helpful to use a perioperative app to interact with clinicians for remote review, such as submitting photos of surgical wounds, allowing more frequent and easier follow-up (Huynh et al., 2021, Sreedharan et al., 2022, Wu et al., 2023). Others considered having these applications available on mobile phones more convenient than using a computer (van der Meij et al., 2017, Gill et al., 2024, Trang et al., 2024).

On the contrary, some patients found eHealth inconvenient due to technical difficulties such as non-intuitive designs and slow connections. The next theme will discuss these issues in more detail.

“Again at the beginning I was inputting few things but it was adding half an hour onto my gym session. Trying to get a connection and all that.” (Dunphy et al., 2017)

2.2 Communications

Patients suggested eHealth tools provided alternative methods of contacting healthcare professionals and improved communication. They reported that sending direct messages using mobile health applications was more convenient and efficient than waiting on the phone, and they received faster responses (Dahlberg et al., 2018, Saunders et al., 2022, Nilsson et al., 2020a, Wathne et al., 2023). Patients found it comforting that healthcare professionals initiated contact when they provided information indicating potential problems in the app. (Graetz et al., 2018, Gustavell et al., 2020, Robinson et al., 2022, Sreedharan et al., 2022, O’Leary et al., 2024, Lurbe i Puerto et al., 2023). Patients also found it valuable when clinicians could review their data and photos directly from the app, leading to more meaningful conversations (Sanger et al., 2014). Some suggested eHealth benefited patients in rural areas where access to doctors is less readily available (Abelson et al., 2017). eHealth also facilitated communication and peer support between patients.

Additionally, some patients found it beneficial to connect with other patients to share their experiences and for encouragement (Harder et al., 2017, Robinson et al., 2021, Abrahamsen et al., 2023, Gill et al.,

2024, Houwen et al., 2022, Robinson et al., 2022, Van Der Horst et al., 2023, Wright et al., 2023b, Wright et al., 2023a).

The studies also reported the disadvantages of using digital communications. Some patients indicated that messaging is only appropriate in limited circumstances, such as when they have straightforward queries (Woollen et al., 2016). Some patients claimed that certain apps took away their autonomy as the technology decided when to connect them with medical professionals. (Gustavell et al., 2020) Another concern highlighted was the slow responsiveness of medical staff, as delays or no response negated the benefits of digital communications (van der Meij et al., 2017, Robinson et al., 2021). Clinician involvement will be discussed in detail below.

2.3 Extended support

Patients noted that eHealth offered more frequent and out-of-hour monitoring, even after they had been discharged from the hospital (Joshi et al., 2021, van der Meij et al., 2018, Sohl et al., 2024). For instance, these technologies enabled early detection of clinical deterioration by sending photos of infected wounds through perioperative health apps, facilitating timely interventions (Dawes et al., 2015). In addition, feedback features allowed accurate symptom reporting and alerted healthcare providers to potential issues (Graetz et al., 2018, Abelson et al., 2017, Drummond et al., 2022). Home monitoring systems, such as wearable sensors, provided continuous support by identifying concerning symptoms (Joshi et al., 2021). Patients appreciated these technological capabilities in preventing sudden discontinuation of care post discharge (Dunphy and Gardner, 2020, Dunphy et al., 2017, O'Leary et al., 2024, Wathne et al., 2023, Sreedharan et al., 2022, Robinson et al., 2022, Timmers et al., 2022).

2.4 Clinician support and involvement

Patients expressed their willingness to use technology decreased when healthcare providers did not respond or experienced significant delays with digital communication channels. Several studies revealed that patients felt hopeless when unable to make urgent contact, leading some to seek help at emergency departments. They suggested the need for clear response times for non-urgent inquiries and clear guidance on emergency contacts (Dahlberg et al., 2018, Dunphy et al., 2017, van der Meij et al., 2017, den Bakker et al., 2019).

“in terms of communication ... I write a couple of messages in the contact us section and I never received anything back. It kind of killed the point of the website for me... to a degree.” (Dunphy et al., 2017)

Furthermore, patients called for healthcare providers to consider the availability and capabilities of the eHealth technologies they offer. They found confidence in using these technologies when healthcare

professionals endorsed and integrated them into their practice, thus encouraging patients to do the same.(Russ et al., 2021, Sanger et al., 2014, Russ et al., 2020).

2.5 Face-to-face interaction/ Hybrid interaction

Patients mentioned that using eHealth affected their interactions with healthcare providers. Those who had positive experiences with telemedicine felt that the quality of the consultation was comparable to that of in-person visits. They appreciated being able to see their clinicians via video and share screens of reports and images, which they believed added credibility compared to telephone consultations. Patients using standalone perioperative applications or remote consultation also felt supported and confident that human assistance would be available when needed (Brown-Johnson et al., 2021, Downey et al., 2018, Robinson et al., 2021, Robinson et al., 2022).

Some were concerned about not being examined physically using remote consultation, which some individuals viewed as a crucial part of their clinical assessment and treatment decision-making. They also commented that face-to-face clinic visits allowed them to observe their clinicians' body language and expressions, which helped build trust (Brown-Johnson et al., 2021, Woollen et al., 2016, Wathne et al., 2023).

“Because of the intricate and also intimate nature of it (breast reconstruction)... I want to be absolutely sure that every decision that I make is a very informed one, and without understanding my vascularity, my skin integrity, there's just no possible way to determine that over video. A doctor has to be able to assess that and evaluate that firsthand.” (Brown-Johnson et al., 2021)

Triantafillou et al. explored patients' views on using remote consultations beyond the COVID pandemic. Patients preferred in-person visits, stating that remote consultations would be better suited for patients who live far away or for follow-up appointments after establishing a rapport with their healthcare providers. Some also emphasised that the decision to use remote consultations should always be voluntary and not driven by financial reasons, such as pressure from insurance companies (Triantafillou et al., 2021).

In studies involving wearable sensors and continuous monitoring, patients found it comforting to maintain face-to-face contact with nurses to ask questions and discuss their conditions and needs. Some mentioned that knowing there is a person behind the technology improved their trust in it (Areia et al., 2022, Weenk et al., 2020, Downey et al., 2018). Additionally, patients using mobile applications reported slower progress with rehabilitation without direct supervision and encouragement from healthcare professionals (Argent et al., 2019, Timmers et al., 2022, Toft et al., 2024).

While patients appreciated the benefits of incorporating eHealth into their care, they stressed the importance of maintaining in-person contact, which should not be replaced by technology (Abelson et

al., 2017, Brown-Johnson et al., 2021, Downey et al., 2018, Dunphy et al., 2017, Triantafillou et al., 2021)

2.6 Accessibility and Inclusivity

Patients highlighted the potential of integrating digital technology to enhance the accessibility of healthcare resources. For instance, they suggested incorporating voice-over functions and screen magnification in digital devices to assist individuals with visual impairments (Nilsson et al., 2020b, Reid et al., 2021). Moreover, they emphasised the importance of making healthcare resources available in languages other than English and ensuring that the content is comprehensible to patients with varying educational backgrounds (Reid et al., 2021, Van Der Horst et al., 2023). Patients also highlighted the need to promote inclusivity, including catering to individuals with learning difficulties, memory impairment, and mental health issues (Russ et al., 2021). Furthermore, they emphasised the importance of customising digital content for individuals from diverse ethnic backgrounds, such as ensuring that nutritional information is culturally sensitive (Russ et al., 2020).

Theme 3- Technology that works for me

3.1 Information giving

Patients wanted to stay well-informed about their treatment and recovery. They recommended using eHealth technologies to improve the delivery and comprehension of health information.

“Knowledge is power and the more you know the healthier you can be.” (Abelson et al., 2017)

First, patients found accessing health information from a webpage or mobile application more engaging as it allowed for multimedia formats, such as videos explaining pre-op information and demonstrating rehabilitation exercises (Huynh et al., 2021, Dunphy et al., 2017, Abrahamsen et al., 2023, Houwen et al., 2022, Sohl et al., 2024, Van Der Horst et al., 2023). Some patients mentioned feeling more engaged with interactive content than with printed materials. Additionally, it was more convenient for them to access the material on mobile devices (Argent et al., 2019, Trang et al., 2024).

Another benefit was the ability to revisit the information at their own pace. Patients described difficulty retaining information after speaking to healthcare professionals due to time pressure and stress. Some patients preferred to receive information periodically, using a staggered approach to aid retention (Saunders et al., 2022, Robinson et al., 2021, Gustavell et al., 2020, Gill et al., 2024, Timmers et al., 2022, Wright et al., 2023b, Wright et al., 2023a). eHealth technologies allowed them to revisit relevant information efficiently; for example, patients found it helpful to navigate between pages in an electronic resource and quickly locate the relevant sections to reinforce learning (Kettle et al., 2017, Woollen et al., 2016, Kayler et al., 2020, De Regge et al., 2022, Robinson et al., 2022).

"I understand that the staff don't have time to explain everything, or that you are not in the right frame of mind to understand everything they tell you. It was good to have the app directly after being discharged following the surgery and at that time I used that self-care feature a lot."(Gustavell et al., 2020)

"I had a partial knee operation done without any sort of electronic online information delivery. I can compare the information that I was receiving online to what I was receiving in book form. It keeps you more on your toes because information is coming on regular basis whereas on in paper form it is up to you as an individual to look at it and umm...then take it in."(Saunders et al., 2022)

They also found sharing health education information and videos electronically with family and friends empowered them to make more informed choices about their treatment options and facilitates shared decision-making processes. (Kayler et al., 2020, Robinson et al., 2021, Kim et al., 2021, Russ et al., 2020)

Users found the digital content trustworthy, endorsed by clinicians, and containing concise, easy-to-understand medical information (Argent et al., 2019, Dunphy and Gardner, 2020, Dunphy et al., 2017, Gustavell et al., 2020, Russ et al., 2020, Mikkelsen et al., 2022).

"When you Google you can end up on strange sites that don't reflect your situation so this was more straightforward and concise and contains 100% facts."(Gustavell et al., 2020)

3.2 Technical ability

Some patients expressed that accessing eHealth features via computer or smartphone can be challenging. While individuals familiar with technology may take a short time to acclimate to the system, those not tech-savvy, especially the older population, would require additional assistance (Abelson et al., 2017, Nilsson et al., 2020b, Saunders et al., 2022, Triantafillou et al., 2021, Robinson et al., 2022, Toft et al., 2024). It was emphasised that providing necessary support and guiding patients to seek help is crucial (Russ et al., 2021, Saunders et al., 2022).

"It's probably good to present it as a mobile app, but how many over the age of sixty-five do you think can operate this? I'm seventy and I have a cell phone, and I don't have a clue if I can use mobile apps on it."(Nilsson et al., 2020b)

Some patients did not consider utilising technology suitable for their situations or lacked confidence. They proposed that non-digital interaction methods, such as phone calls and in-person appointments,

should continue to be available to patients (van der Meij et al., 2018, Trang et al., 2024, Nilsson et al., 2023).

3.3 User-friendliness

A characteristic of user-friendly technology is its simple and intuitive design. Patients praised the clear and straightforward layout, which made it easier to use the technology, especially for those with less experience (Argent et al., 2019, Dunphy et al., 2017, Nilsson et al., 2020a, Saunders et al., 2022, Kettle et al., 2017, Gill et al., 2024).

Patients also noted that clear instructions accompanying the technology helped them overcome initial difficulties with set-up and navigation (Scott et al., 2017, van der Velde et al., 2021).

“Initially I said to you I wasn’t very computer literate but it’s very simple to use. Once you do it once or twice you can do it with your eyes closed essentially.” (Argent et al., 2019)

On the other hand, some patients find using eHealth difficult, which leads to disuse. This difficulty could be due to too many steps to install an application, slow connections, unclear presentation of information, inability to record data, and system errors (van der Meij et al., 2016, Argent et al., 2019, Drummond et al., 2022).

“We had just the one where it says unusual behaviour, unexpected behaviour, please repeat the exercise. I think I was saying to you that on two occasions I actually repeated the exercise . . . I just said there was a glitch and it didn’t really bother me.”(Argent et al., 2019)

“I have no patience for apps that don’t work well. So if it’s not awesome, it’s not on my phone and I’m not wasting my time using it.” (Dunphy et al., 2017)

Patients recommended that eHealth should be accessible on various devices to enhance usability. For example, it is easier to communicate or share information on a larger computer screen during telehealth consultations (Kim et al., 2021) Also, it would be more convenient to show digital content to friends and family on mobile devices as they are more portable (Kettle et al., 2017, van der Meij et al., 2017).

Patients have also suggested that the design of wearable sensors should prioritise their comfort. Some studies have reported that certain patients found sensors to be cumbersome and limiting to their mobility (Joshi et al., 2021, Areia et al., 2022, Downey et al., 2018, Weenk et al., 2020),

3.4 Customisation and tailoring

Patients noted that eHealth could contribute to offering more personalised care. In the perioperative setting, patients wish to follow rehabilitation plans tailored to their specific needs, allowing them to adjust

the exercise difficulty based on their recovery pace and fitness levels (Dunphy and Gardner, 2020, van der Velde et al., 2021, den Bakker et al., 2019, Willems et al., 2021, Robinson et al., 2022, Toft et al., 2024). Some patients suggested that this approach would enable healthcare professionals to closely monitor their progress using real-time data and customise the rehabilitation plan accordingly (den Bakker et al., 2019, Wright et al., 2023b).

“I would want to have the option to make exercises more difficult: younger bodies recover faster than older ones, and I was often frustrated during my therapy by how basic some exercises were, especially early during the recovery.” (Dunphy and Gardner, 2020)

Patients also expressed their wish to have control over the reading materials they receive during the perioperative period. They believed that the material should accommodate their various learning styles, and they should have the option to customise the amount of information they receive. They wanted options to go into more detail if they choose to, such as specific information about their surgery type, healthcare providers, and institutions. Patients also valued the option to tailor the reading material to their own pace and requirements, allowing them to incorporate it into their schedule (Reid et al., 2021, Martorella et al., 2014, Kim et al., 2021, Russ et al., 2020, Nilsson et al., 2020b, Dunphy et al., 2017, Abrahamsen et al., 2023).

3.5 Reminder

Patients found that using push notifications and reminders on their devices has improved their adherence to perioperative instructions. These digital tools prompted patients to perform rehabilitation exercises and facilitated symptom reporting. Many admitted they may forget these important tasks without such reminders, mainly due to their busy schedules. In addition, digital reminders helped ensure that patients attended hospital appointments and took medications at the prescribed times, especially for those managing multiple medical conditions (Gill et al., 2019, Dunphy et al., 2017, Graetz et al., 2018, Harder et al., 2017, Huynh et al., 2021, Russ et al., 2020, van der Velde et al., 2021, Wright et al., 2023b).

“An app is useful because you read it. Only knowing something, does not mean you will do it, but when you read it in an app you are reminded that you have to do it. Some days I forgot or I was busy, so on those days the notifications came in handy.” (van der Velde et al., 2021)

Patients also appreciated reminders to access relevant information and advice tailored to specific stages of their surgical journey. Delivering information in this staggered manner was found to enhance its relevance and impact (Robinson et al., 2021, Saunders et al., 2022, Timmers et al., 2022).

“I had a partial knee operation done without any sort of electronic online information delivery. I can compare the information that I was receiving online to what I was receiving in book form. It keeps you

more on your toes because information is coming on regular basis whereas on in paper form it is up to you as an individual to look at it.” (Saunders et al., 2022)

Patients also expressed the importance of being able to easily change the frequency or stop reminders and unsubscribe from push notifications (Gill et al., 2019, Harder et al., 2017)

3.6 Trust and Security

Patients expressed concerns about the security of health technology, particularly regarding the access and use of their data. They are concerned about potential impacts on their insurance status if their health behaviours were disclosed (Downey et al., 2018) and about the risk of unauthorised parties or criminals accessing their confidential information (Gill et al., 2019, Sanger et al., 2014). They believed that a secure server infrastructure is essential. Several studies have emphasised that trust in health technology also depends on the reliability of the system, including stable internet connections and bug-free programs (Argent et al., 2019, Nilsson et al., 2020a, Scott et al., 2017, Gill et al., 2024).

“Obviously with mobile technology you want to be really considerate of privacy and have secure servers and—especially if there’s contact information with a whole list of women...as it relates to mobile, that’s definitely something to consider.” (Gill et al., 2019)

Although patients often seek quick information on search engines or platforms like YouTube, they still prefer content approved by official health organisations such as the National Health Service (NHS). This is because they trust that the information is evidence-based, highlighting the importance of reliable and credible sources (Dunphy et al., 2017, Mikkelsen et al., 2022).

“When you Google, you can end up on strange sites that don’t reflect your situation, so this was more straightforward and concise and contains 100% facts.” (Gustavell et al., 2020)

Additionally, people frequently leave negative comments in online interactions, highlighting the need for critical evaluation of online information and consideration of potential biases in user-generated content (Gill et al., 2019)

surgery (Collette et al., 2018) and reducing hospital length of stay in the hospital following arthroplasty surgery (Jones et al., 2011). However, some studies have reported minimal or negative effects of empowerment interventions, which may be attributed to the variability in the design, quality, frequency, and delivery of these interventions (Callaghan and Li, 2002, Gräwe et al., 2010).

eHealth tools offer a novel approach to empowerment by providing tailored information, allowing patients to revisit the material at their own pace, and motivating them to engage in self-care practices. A systematic review by Timmers et al. (2020) demonstrated that mobile health applications with features like push notifications and personalised content can enhance patient engagement, improve treatment adherence, and increase satisfaction (Timmers et al., 2020).

Challenges and barriers to eHealth acceptance

Despite the potential benefits of using eHealth during surgical treatments, there were legitimate concerns that poorly designed technologies, inadequate support and a population incapable of interacting with technology could hinder eHealth adoption. A UK national survey involving 2040 adults estimated that 41% of people felt unprepared to use technology to manage their healthcare needs. Vulnerable groups, including older adults and those with lower educational backgrounds, are particularly at risk of being marginalised by the rapid digital transformation in healthcare (Sounderajah et al., 2021).

However, as highlighted by Martorella (Martorella et al., 2014) and Russ (Russ et al., 2021), assumptions about the lack of motivation among these groups should be avoided. With appropriate guidance and support, even older adults can successfully engage with eHealth if they perceive its benefits. In the post-COVID era, with the acceleration of eHealth adoption, it is imperative to develop user-friendly, customisable, and accessible eHealth solutions that meet diverse patient needs.

A systematic review by O'Connor et al. (2016) suggests that educational background and computer skills influence patient engagement with eHealth (O'Connor et al., 2016). However, limited research exists on how specific factors, such as age, ethnicity, and socioeconomic status, impact eHealth acceptance. The next chapter will assess the specific needs of different patient groups and how the different user factors may affect eHealth acceptance level.

Enhancing communication and support

Another key advantage of eHealth is its potential to enhance communication and provide extended support between patients and clinicians. Patients expressed a strong desire for better access to healthcare providers and closer communication during their treatment. The success of eHealth tools depends heavily on active engagement and encouragement from healthcare providers. The findings of this review align with broader patterns observed during earlier phases of technological change in

healthcare. Historical accounts of the introduction of computers, electronic health records, and email communication describe concerns similar to those identified here, particularly with the increased workload, workflow disruption, data privacy issues, and perceived threats to professional autonomy (Cresswell and Sheikh, 2013, Greenhalgh et al., 2017). As with digital health tools today, initial resistance frequently reflected uncertainty about usability and the potential impact on clinician–patient relationships. Over time, these earlier technologies became embedded in clinical practice as their benefits, such as improved access to information, efficiency, and continuity of care (May et al., 2007). The review also demonstrated that limited clinician support can negatively influence the acceptability and sustainability of digital programmes. For already overstretched clinical teams, digital interventions risk being perceived as an added burden if adequate resources, training, and protected time are not provided. Effective implementation strategies must therefore include organisational recognition of digital care as legitimate clinical work, leadership endorsement, and alignment of digital tasks with existing workflow demands. As previous research emphasises, the successful adoption of healthcare technologies depends not only on technical usability but also on institutional capacity, workload feasibility, and the extent to which clinicians feel supported in integrating these tools into everyday practice (Ahmed et al., 2025). Future research should prioritise the satisfaction of both patients and clinicians to optimise the implementation of eHealth in surgical care.

3.5 Limitations

The review mainly focused on studies conducted in developed countries, which could limit the applicability of the findings to other settings. The benefits and challenges of eHealth technologies can vary significantly depending on the resources and healthcare infrastructure available in different regions.

Although the Unified Theory of Acceptance and Use of Technology (UTAUT) was referenced to understand patients' perceptions and acceptance of eHealth technologies, the limited number of studies and the heterogeneity of the patient groups made it difficult to apply the model using a framework approach fully. While common themes aligned with the UTAUT, such as performance expectancy and effort expectancy, there was limited exploration of social influence and facilitating conditions. As such, I developed three new distinct themes that better describe the needs, expectations and challenges of surgical patients undergoing treatments. Future research should aim to measure patients' digital abilities objectively, explore social factors influencing specific patient groups, and include a comparative analysis of clinicians' perceptions to provide a more comprehensive understanding.

3.6 Conclusion

This systematic review examined surgical patients' perceptions of various eHealth interventions, such as mobile health applications, wearable sensors, telemedicine, web-based tools, digital programs, and electronic health records across 60 studies. The findings identified three primary themes: "Reaching My Full Potential for Recovery," "Getting Help Easily," and "Technology That Works for Me." These themes reflect patients' expectations of eHealth, emphasising the desire for reassurance, motivation, and empowerment while highlighting the importance of efficient, accessible, and personalised healthcare.

While eHealth technologies offer significant potential to improve surgical care and recovery, it's important to address challenges related to inclusivity, accessibility, clinician engagement, and healthcare providers' perspectives. Future research should prioritise exploring specific patient factors, including diverse populations and their perspectives on the relevance of eHealth at different stages of their surgical journey. In the next chapter, I will explore how surgical patients interact with the internet and eHealth technologies and describe how different patient factors and eHealth literacy levels can influence the perceptions and experience of using eHealth.

Table 2 Summary of key findings

Key findings	Barriers / Facilitators	Implications for clinical practice	Implications for policy	How recommendations could be implemented
Reaching my full potential for recovery – reassurance, motivation, mental wellbeing, empowerment.	Barriers: information overload, anxiety, fatigue with data entry, non-tailored goals. Facilitators: multimedia education, visualisation, trusted content, automated alerts.	Embed eHealth into perioperative education; support engagement; monitor psychological impact.	Support digital perioperative pathways; require staged patient-centred information; ensure safe governance.	Use multimedia, staged info; adjustable goals; clear escalation pathways; integrate monitoring into workflow.
Getting help easily – convenience, communication, support, clinician involvement, hybrid care.	Barriers: delayed responses, lack of endorsement, impersonal feel, limits of virtual exam. Facilitators: rapid access, peer support, hybrid options, out-of-hours monitoring.	Use telemedicine selectively; set explicit response times; maintain face-to-face for complex care.	Formalise hybrid models; define digital workflow responsibilities; ensure remote care is optional.	Create triage protocols; integrate messaging; enable photo uploads; retain in-person reviews.

Technology that works for me – usability, customisation, reminders, trust/security.	Barriers: glitches, incompatibility, low digital literacy, privacy concerns. Facilitators: intuitive design, clear instructions, IT support, reminders, NHS-endorsed content.	Ensure accessibility; provide non-digital alternatives; support older adults and low-literacy users.	Mandate accessibility standards; multilingual content; invest in tech support infrastructure.	Simplify interfaces; offer tutorials/helplines; ensure compatibility; transparent privacy messaging.
---	--	--	---	--

Table 3 Summary of included studies

Author	Date	Country	Data Collection	Study Aim	Intervention type
Abelson	2017	USA	Telephone surveys	To determine the public's perception of barriers and benefits to using mHealth to enhance recovery after operation To develop an mHealth solution that addresses patients' information needs after surgical or non-surgical treatment for an ankle fracture	Mobile health application
Abrahamsen	2023	Denmark	Workshops		Mobile health application
Areia	2021	UK	Semi-structured interviews	To understand patients' and clinical staffs' current perceptions of current vital signs monitoring practices To explore the feasibility, usability, perceived impact, and user experience of an exemplar exercise biofeedback system for orthopaedic rehabilitation in the home	Wearable sensor
Argent	2019	Ireland	Semi-structured interviews		Wearable sensor and mobile health application
Brown-Johnson	2021	USA	Semi-structured telephone interviews	To understand the perceptions, potential and limitations of preoperative and postoperative video visits in plastic surgery To explore experiences associated with postoperative recovery after a day surgery in patients using a mobile app to assess the quality of their recovery	Telemedicine
Dahlberg	2018	Sweden	Semi-structured interviews		Mobile health application
Dawes	2015	USA	Open ended questionnaires	To explore feasibility of using a pre-programmed tablet computer to track colorectal surgical patients after discharge	Tablet computer programme eHealth programme containing a website , an app, activity tracker, online portal
den Bakker	2019	Netherlands	Semi-structured interviews	To evaluate whether the eHealth intervention was executed as planned	
DeRegge	2022	Belgium	Semi-structured interviews	To assess usability, applicability and user-friendliness of a patient portal used in a tertiary ambulatory surgical care unit To discover what patients think of monitoring in hospital, with a particular emphasis on intermittent early warning scores versus remote continuous monitoring	Digital patient platform
Downey	2018	UK	Semi-structured interviews	To explore patients' experience of a multimodal teleprehabilitation program for cancer patients undergoing elective thoracic and abdominal cancer resection surgery	Wearable sensor eHealth programme containing an app, smart watch and telemedicine
Drummond	2022	Canada	Questionnaires and notes		

Dunphy, Gardener	2020	USA	Web based surveys	To explore patients' understanding and opinions about the acceptability of telerehabilitation as part of anterior cruciate ligament reconstruction surgery care	Telerehabilitation
Dunphy, Hamilton	2017	UK	Semi-structured interviews	To evaluate the acceptability of a web-based blended intervention in post ACL reconstruction rehabilitation	Web based tool
Gill	2024	Canada	Semi-structured interviews	To understanding how innovative mobile solutions can support integrative health programs	Mobile health intervention
Gill	2019	Canada	Semi-structured interviews	To evaluate the feasibility and acceptability of a mobile technology intervention to support postabortion care	Mobile health intervention
			Telephone interviews and focus groups		
Graetz	2018	USA	Semi-structured interviews	To evaluate a postoperative web-based app intervention to provide real-time symptom monitoring	Web based / mobile health application
Gustavell	2020	Sweden		To describe how patients used a mobile health application following pancreatic cancer surgery and their experience	Mobile health application
				To design and develop a mobile app with target users to support self-management of arm and shoulder exercises following breast cancer treatment	
Harder	2017	UK	Focus groups		Mobile health application
		Netherlands	Semi-structured interviews	To explore drivers of value of an mHealth app in patients with trauma and trauma care professionals	
Houwen	2022				Mobile health application
			Semi-structured interviews	To understand patient and provider attitudes and perceptions about the implementation of mobile health technology	
Huynh	2021	USA			Mobile health application
			Semi-structured interviews	To explore patient experiences with wearable sensor technology and carry out continuous monitoring in an acute hospital setting	
Joshi	2021	UK			Wearable sensor
			Focus groups and semi-structured interviews		
Kayler	2020	USA	Structured telephone and in-person interviews	To understand users' acceptability, usability and feasibility of digital health animation for kidney transplant	Animation based education
				To explore the needs of patients and anaesthesiologists regarding postoperative follow-up, the benefits and caveats for mobile application to facilitate perioperative care	
Ke	2019	Canada			Mobile health application
			Semi-structured interviews	To understand patients' perceptions of an online information resource	Online information resource
Kettle	2017	UK			
			Semi-structured interviews	To explore the perspectives of patients and clinicians regarding the feasibility and acceptability of a web based decision aid	
Kim	2021	Australia			Web based decision aid

Lew	2023	USA	Semi-structured interviews	To evaluate the attitudes and perception of elective surgery patients and health care providers toward telehealth conducted for preanesthesia evaluation.	Telemedicine
Low	2020	USA	Semi-structured interviews	To develop and test a mobile technology-supported intervention to reduce sedentary behaviour before and after cancer surgery, and to evaluate the usability and feasibility	Mobile health application and smart watch
LurbeIPuerto	2023	France	Focus groups	To evaluate a telemedicine intervention program to promote physical activity following bariatric surgery	Telemedicine
Martorella	20214	Canada	Semi-structured interviews	To understand patients' perceptions of the acceptability of a web-based intervention for pain management post cardiac surgery	Web based intervention
Mikkelsen	2022	Denmark	Semi-structured interviews	To explore patients' perspectives on care needs for abdominal aortic aneurysm and development of an eHealth solution	Mobile health application
Nilsson, Hellström	2020	Sweden	Semi-structured interviews and think-aloud technique	To identify design, functionality and usability issues in using an e-Health application to support self-care after prostate cancer surgery	Web based application
Nilsson, Hultgren	2023	Sweden	Individual in-depth interviews	To explore patients' experiences of an eHealth tool and tailored psychosocial support throughout the care of AAA repair	Mobile health application
Nilsson, Hultgren	2020	Sweden	Focus groups	To develop an eHealth tool for patients with abdominal aortic aneurysm using a participatory design process	Mobile health application
O'Leary	2024	USA	Semi-structured telephone interviews	to identify factors that influenced use of ePROs to report their symptoms post-discharge	Web based tool
Reid	2021	Canada	Focus groups and semi-structured interviews	To investigate patients' and family caregivers' perspectives and preferences regarding eHealth tools for total hip and knee replacement surgery	Online information resource
Richards	2021	UK	Semi-structured interviews	To understand participants' experiences and perceptions of using the ePRO system after hospital discharge following upper gastrointestinal cancer surgery	Web based tool
Robinson, Husbund	2022	UK	Semi-structured interviews	To explores patients' perspectives on technology features that would support behaviour changes during the pre- and postoperative periods	Mobile phone apps, web platforms, wearable activity trackers

Robinson	2021	UK	Semi-structured interviews	To explore patient perspectives on technology features that support lifestyle behaviours changes during the pre- and postoperative periods	Digital health technologies
Russ, Latif	2020	UK	Reflective notes	To evaluate surgical patients' perceptions of a perioperative mobile app in terms of its content, usability, and potential impacts on communication and safety	Mobile health application
Russ, Sevdalis	2021	UK	Focus groups	To evaluate service users' perceptions of the mobile application, and ideas about how to facilitate its effective implementation	Mobile health application
			Semi-structured interviews and open-ended surveys	To identify challenges patients experience when managing surgical wound complications after discharge, to understand patients' perceptions about the acceptability of an mHealth wound monitoring application	Mobile health application
Sanger	2014	USA			
Saunders	2022	Australia	Semi-structured interviews	To explore patient experiences, perceived benefits and suggestions of an eHealth program for pre- and post-operative education for total hip arthroplasty	Web based tool
				To gauge interest in smartphone app use among patients after colorectal surgery ,to better understand factors affecting patient app use in a postoperative, at-home setting.	
Scott	2017	USA	Semi-structured interviews	To determine the feasibility and acceptability of eHealth Mindful Movement and Breathing in women planning to undergo surgery for malignancy	Mobile health application
Sohl	2024	USA	Semi-structured interviews		Electronic information resource
Sreedharan	2022	USA	Semi-structured interviews	To evaluated the attitudes of patients and providers towards using a remote wound monitoring application	Mobile health application
				To explored patients' perspectives on the benefits of receiving feedback on PROMs in the context of a web-based personalised decision	
Stern	2022	USA	Semi-structured interviews		Web based tool
Timmers	2022	Netherlands	Semi-structured interviews	To explore the added value of patient involvement in developing the content for an eHealth app	Mobile health application
				To explore the usability, acceptability, and relevance of a mobile health application designed to support remote exercise-based cardiac rehabilitation	
Toft	2024	Denmark	Semi-structured interviews		Mobile health application
			Semi-structured interviews		
Trang	2024	USA		To evaluate the association of eConsent delivery	Web based tool

Triantafillou	2021	USA	Unstructured telephone interviews	To understand head and neck patients' perceptions about telemedicine clinic visits during COVID-19	Telemedicine
VanDerHorst	2023	Netherlands	Semi-structured interviews	To develop a digital intervention based on Acceptance and Commitment Therapy for spinal surgery patients	Mobile health application
vanderMeij	2018	Netherlands	Semi-structured interviews	To describe the process evaluation of a perioperative eHealth intervention and participants' attitudes	eHealth programme containing a website , an app, activity tracker, online portal
vanderVelde	2021	Netherlands	Semi-structured interviews	To evaluate the usability of the mHealth app prototype for people undergoing major surgery	Mobile health application
Wathne	2023	Norway	Semi-structured interviews	To design a nurse-assisted eHealth service to foster patient acceptability, support self-management, and smooth the transition from hospital to home	eHealth programme
Weenk	2020	Netherlands	Semi-structured interviews	To identify positive and negative effects as well as barriers and facilitators for the use of two wearable devices	Wearable sensor
Willems	2021	Netherlands	Open ended questionnaires	To evaluate the usability and the attitudes of users toward the app, to evaluate positive and negative user experiences	Mobile health application
Woollen	2016	USA	Semi-structured interviews	To investigate patients' experience using an inpatient personal health record on a tablet computer to increase engagement in their hospital care	Electronic health record
Wright (pilot)	2023	Australia	Semi-structured interviews	To assess the feasibility, acceptability, cost, and potential effect on weight of a mHealth follow-up program in bariatric surgery	Mobile health application
Wright pre (N&D)	2023	Australia	Semi-structured interviews	To assess the feasibility, acceptability, cost, and potential effect on weight of a mHealth follow-up program in bariatric surgery	Mobile health application
Wu	2023	China	Semi-structured interviews	To design and develop a mobile application, and use Internet technology to manage nutritional health following malignant tumour surgery	Mobile health application

Chapter 4

4 Digital Health Survey

4.1 Rationale

In response to the global COVID-19 pandemic, there has been a significant transformation in the delivery of healthcare services. The pandemic placed unprecedented pressures on surgical pathways, with widespread cancellations of elective procedures, reduced face-to-face contact, and a shift towards remote care to reduce viral transmission and protect vulnerable patients. During this period, both patients and clinicians became increasingly reliant on digital tools for communication, triage, and follow-up, which in turn reshaped expectations regarding the accessibility, safety, and convenience of care in the post-pandemic era (Fisk et al., 2020, Connor et al., 2021). The unprecedented challenges of maintaining access to healthcare and reducing viral transmission have led to the rapid expansion of digital healthcare, and transformed how surgical care is delivered (McMaster et al., 2021).

Traditionally reliant on face-to-face interactions, surgical care has undergone a digital transformation that now includes pre-operative assessments, post-operative care, enhanced recovery, and rehabilitation through a combination of remote and in-person models or being carried out remotely entirely (Sharif et al., 2020, De La Cruz Monroy and Mosahebi, 2019, van Egmond et al., 2018). The rapid adoption of eHealth during COVID-19 did not simply introduce temporary workarounds; it created lasting shifts in patient expectations, with many now accustomed to remote access, quicker communication, and digital self-management options. At the same time, the pandemic highlighted inequalities in digital access, confidence, and literacy, emphasising the need to understand which patient groups remain disadvantaged. It is important to note that the increased use of eHealth was not just a response to pandemic restrictions, but also in line with the government's goals to modernise healthcare systems and address long-standing issues such as extensive waiting lists (Alderwick and Dixon, 2019).

As the delivery of surgical care continues to evolve, it is imperative to consider the impact of this technological change on patient experience and outcomes. The latest eHealth technologies commonly utilised for surgical patients encompass telemedicine for remote consultations, mobile applications for monitoring and managing health, and electronic health records for storing and accessing patient information, as detailed in Chapter 3.

However, the specific patient characteristics, how surgical patients use eHealth technologies and their willingness to use these technologies in the post-COVID age remain unknown. Various barriers have been identified, including lack of device ownership, limited access to the Internet, and issues related to eHealth literacy, age and socioeconomic disparities (O'Connor et al., 2016, Hall et al., 2014). Identifying these challenges is critical to ensure equitable access to digital health interventions, particularly for surgical patients who require comprehensive perioperative care and monitoring.

4.2 Aims

This study explored how patients attending surgical outpatient clinic interact with the internet and eHealth technologies in the post-COVID era and described how different patient factors and eHealth literacy levels influence the perceptions of face-to-face consultations, remote consultations, and mobile health applications.

Ethics

This study (IRAS 303858) has received approval from the research ethics committee of the Health Research Authority.

4.3 Methods

4.3.1 Setting and participants

Participants were approached in the waiting areas of the Breast, Bariatric, Colorectal, Hepatobiliary, and Oesophagogastric surgical outpatient clinics at Imperial College Healthcare NHS Trust. Consecutive patients attending routine appointments during the study period (27 January to 7 April 2022) were screened for eligibility by the researcher. Eligible individuals were provided with a written participant information sheet outlining the purpose of the study, voluntary nature of participation, data confidentiality, and the approximate completion time of the survey.

Patients were given an opportunity to ask questions before deciding whether to participate. Completion of the questionnaire was taken as implied consent, in accordance with Health Research Authority guidance for anonymised, minimal-risk survey research approved under IRAS 303858. No identifiable information was collected, and participants placed their completed surveys into a sealed collection box in the clinic area.

Surveys were self-completed on paper. Participants who experienced difficulties with reading, writing, or physical dexterity were permitted to receive assistance from accompanying family members or friends, but clinic staff were not involved in the completion of questionnaires. No incentives were offered. Completed surveys were transported securely to the study site and manually entered into Qualtrics for data management and analysis.

4.3.2 Data collection

Survey instrument development

This survey (Appendix C) consisted of two components: an adapted digital health attitudes questionnaire and a validated eHealth literacy instrument. The first section was developed in

collaboration with the primary supervisor to explore patients' perceptions and experiences of digital technology and health interventions. Published literature was reviewed to identify comparable studies and compiled a list of questionnaire items to be included in the questionnaire (Symonds R, 2020, Korn et al., 2022). Additional questions were developed by modifying a previously published survey entitled "Survey of patient attitudes towards face-to-face and telemedicine teaching in the COVID-19 era", created by my supervisor (Coady et al., 2023). This earlier survey provided the conceptual foundation for exploring perceptions of digital health. Several adaptations were made to ensure applicability to surgical patients in perioperative care. These adaptations included rewording items to reflect clinical rather than educational interactions, removing questions relevant only to medical student–patient encounters, and adding items pertaining specifically to perioperative digital communication and remote support.

The second component comprised the eHealth Literacy Questionnaire (eHLQ) developed by Kayser et al. (Kayser et al., 2018), included verbatim under licence and with explicit permission from the authors. As the eHLQ is a proprietary instrument, it cannot be reproduced in full; however, an author-approved excerpt has been included in Appendix C in accordance with licensing restrictions. No modifications were made to the eHLQ items, which served as the validated metric for assessing participants' eHealth literacy. Together, these two components provided complementary insight into participants' digital health attitudes and literacy.

The 68-point questionnaire covered the following domains:

- (1) individual characteristics following Office of National Statistics guidance (ONS, 2021), encompassing gender, age, ethnicity, education attainment, socio-economic status, and disability;
- (2) ownership of digital technology and patterns of internet and social media usage, including two quantitative items and one 6-point Likert scale item (ranging from "never" to "almost all the time");
- (3) experiences related to health information retrieval through digital platforms, comprising one quantitative item and eighteen 5-point Likert scale items (ranging from "never" to "daily" and "extremely trustworthy" to "extremely untrustworthy");
- (4) perceptions of face-to-face consultations, remote consultations, and smartphone health applications, involving three quantitative items and twenty-one 7-point Likert scale items. The Likert items are derived from a similar study conducted by our research group on patient attitudes of face-to-face and telemedicine clinical teaching (Coady et al., 2023), including four positive impressions: Convenience, Comfort, Relevance, and Easy understanding; and three negative impressions: Embarrassing, Infringing privacy, and Time-consuming (ranging from "strongly agree" to "strongly disagree"); A composite acceptance score was derived by reverse coding three out of seven items

reflecting negative impressions. A higher acceptance score represents a more positive attitude towards the type of interaction, out of a possible range of 7 to 47.

(5) assessment of the impact of the COVID pandemic on day-to-day behaviour and acceptance of eHealth, including seventeen 5-point Likert scale items (ranging from "significantly decreased" to "significantly increased");

(6) eHealth literacy evaluation using the eHLQ questionnaire, comprising thirty-five 4-point Likert scale items (ranging from "strongly agree" to "strongly disagree"). Average scores were calculated for each dimension. Responses were manually entered into the Qualtrics software application for data processing.

4.3.3 Statistical analysis

The statistical analyses were performed using IBM SPSS (Version 29). Frequency analyses and Chi-square tests were conducted on demographic variables, including gender, age, education attainment, socioeconomic status, internet use, and digital healthcare experience. Medians and interquartile ranges were calculated for continuous variables such as age, level of education, social grade, and scores derived from the eHealth Literacy Questionnaire (eHLQ). The Kolmogorov-Smirnov test found a non-normal distribution of eHLQ scores. To assess differences in scores among various age groups, the Kruskal-Wallis test was used. Age, education level, and social grade were subsequently recoded as dichotomous variables, and group differences were examined using the Mann-Whitney U test. Spearman's rank correlation coefficient was used to investigate the correlation between the dependent variables deemed significant and the corresponding eHealth scores.

For the composite acceptance scores related to patients' perceptions of face-to-face consultations, remote consultations, and mobile health applications, post-hoc data transformation was implemented. Medians and interquartile ranges were estimated for demographic variables and acceptance scores. The Kolmogorov-Smirnov test found a non-normal distribution of perception scores. Friedman test was used to explore differences in perception scores among the three interaction types. Post hoc analysis with Wilcoxon signed-rank tests was conducted with a Bonferroni correction applied.

Kruskal-Wallis test was used to examine differences in acceptance scores among age groups. Mann-Whitney U test was used to assess differences among dichotomised age, education level, and social grade groups. Spearman's rank correlation coefficient was used to investigate the correlation between the dependent variables deemed significant and the corresponding acceptance scores. A comparison of face-to-face and remote consultations was conducted with Wilcoxon signed-rank test. The effect size was calculated by dividing the absolute standardised test statistic z by the square root of the number of pairs. In instances of missing data, pairwise deletion was employed to maximise the retention of available data in the analyses.

4.4 Results

Responses and Demographics

A total of 153 responses were received out of 180 distributed surveys, resulting in an 85% response rate. 152 were included in the analysis, with one survey being excluded due to incomplete sections in the returned questionnaire (Figure 4-1).

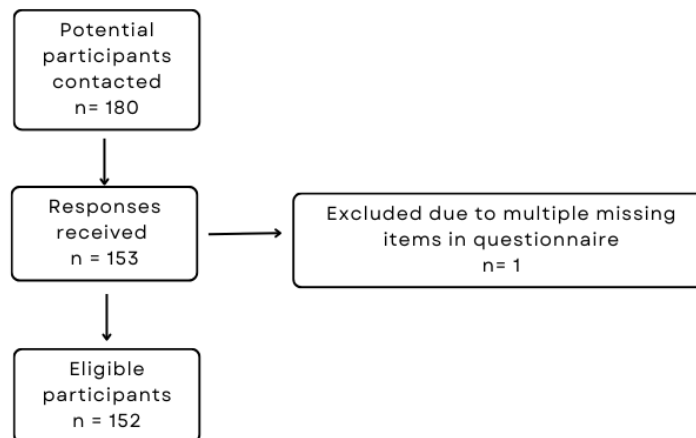


Figure 4-1 Flowchart of the participant recruitment process

(62/152 [40.8%]) of respondents were over 55, the gender distribution was relatively balanced, with (74/152 [48.7%]) male and (78/152 [51.3%]) female participants. Over two-thirds of the participants (128/152 [69.3%]) possessed a university degree. Regarding socioeconomic status, (74/152 [48.7%]) of the participants were classified as being in the higher (ABC1) group according to the NRS classification, while (63/152 [41.4%]) were classified as being in the lower (C2DE) group. Regarding ethnicity, (71/152 [46.7%]) identified as white, and (81/152 [53.3%]) identified as non-white.

Internet access and digital device usage

Participants were highly engaged with the Internet, with (137/152 [90.1%]) accessing it daily, (7/152 [4.6%]) accessing it weekly or monthly, and only (8/152 [5.3%]) reporting infrequent or no Internet usage

Smartphones are the primary device for internet access (143/152 [94.1%]), followed by computers (115/152 [75.7%]) and tablets (94/152 [61.8%]). Approximately one-third of participants used smart home devices (48/152 [31.6%]), with smaller numbers utilising other internet-connected devices such as wearables (29/125 [19.2%]), game consoles (23/152 [15.1%]), and virtual reality headsets (13/152 [8.6%]). Interestingly, (87/152 [57.2%]) of respondents used more than three digital devices, contrasting with (3/152 [2%]) who reported not using any devices.

Use of social media

Most participants engaged with social media, with (128/152 [84%]) using messaging applications like WhatsApp, and (105/152 [69%]) interacting on platforms such as Facebook, Instagram, and Twitter. Additionally, (80/152 [52.6%]) viewed content on media-sharing sites like YouTube and Pinterest. However, participation in review sites, online blogs, and forums was less common, with (50/152 [32.9%]) and (35/152 [23%]) of respondents having prior experience, respectively.

Experience in digital healthcare

Most respondents reported using the internet to find health information, with (133/152 [87.5%]) using search engines. Other sources of health-related information included NHS or health charity websites (113/152 [75.3%]), electronic documents (115/152 [76.7%]), online videos (110/152 [72.8%]), social media (98/152 [67%]). A high percentage of respondents (112/152 [73.8%]) reported prior experience with telemedicine. (81/152 [54%]) of respondents reported contacting healthcare professionals via email, while fewer reported downloading mobile health applications (86/152 [57.3%]), interacting on social media (47/152 [31.3%]) or participating in healthcare-related web forums (29/125 [19.5%])

The proportion of older adults who searched the internet for health information is significantly lower (81% in the 55-74 age group [42/52] and 50% in the over 75 age group [5/10]) compared to young and middle-aged adults (100% in the 18-34 age group [26/26] and 97% in the 35-54 age group [60/62]) ($P < .001$). Similarly, a lower percentage of older adults reported downloading mobile health applications (46% in the 55-74 age group [24/52] and 20% in the over 75 age group [2/10]) compared to younger adults (62% in the 18-34 age group [16/26] and 71% in the 35-54 age group [44/62]) ($p = 0.004$). There is no statistical difference between age groups in telemedicine experience ($p = 0.228$). Health advice preference

The preferred sources of health information for most people are healthcare professionals and official NHS or health charity websites, with (135/152 [88.9%]) and (124/152 [81.5%]) of respondents seeking advice from these sources. The next most common approaches are seeking advice from friends and family, and conducting online searches, both at (85/152 [55.6%]). Less frequently utilised sources include health blogs and forums at (17/152 [11.1%]) and mobile health apps at (29/152 [18.8%]).

Trustworthiness of Health Information Sources

Healthcare professionals were considered the most trustworthy source of health information, with (149/152 [97.9%]) of respondents in agreement. Official NHS and health charity websites followed at (134/152 [88.7%]). Approximately half of the respondents indicated trust in advice from family and friends (89/152 [58.6%]) and information obtained from mobile health applications (77/152 [50.4%]). Trust in health information from traditional news media (66/152 [43.4%]) and news websites (49/152 [32.5%]) was reported by less than half of the participants. Online videos, blogs and forums were regarded as trustworthy by only (33/152 [22%]) and (24/152 [15.7%]) of respondents, respectively.

Future use of digital technology

(67/152 [44.1%]) of the participants indicated that they were willing to work remotely in the future. Additionally, (83/152 [54.6%]) of the respondents were ready to use video conferencing tools for professional interactions, while (48/152 [31.8%]) expressed interest in using video conferencing for social purposes. Moreover, (56/152 [37.1%]) of the participants were interested in health and fitness apps, and (73/152 [48.2%]) were open to engaging in teleconsultations in the post-pandemic era.

eHealth literacy

Participants showed significant variations in eHLQ scores across the seven dimensions (Figure 4-2). Overall, the highest scores were achieved in Dimension 3 (Ability to actively engage with digital services) with a median of 3.00 (IQR 2.81-3.02) and the lowest in Dimension 7 (Digital services that suit individual needs) with a median of 2.50 (IQR 2.41-2.61).

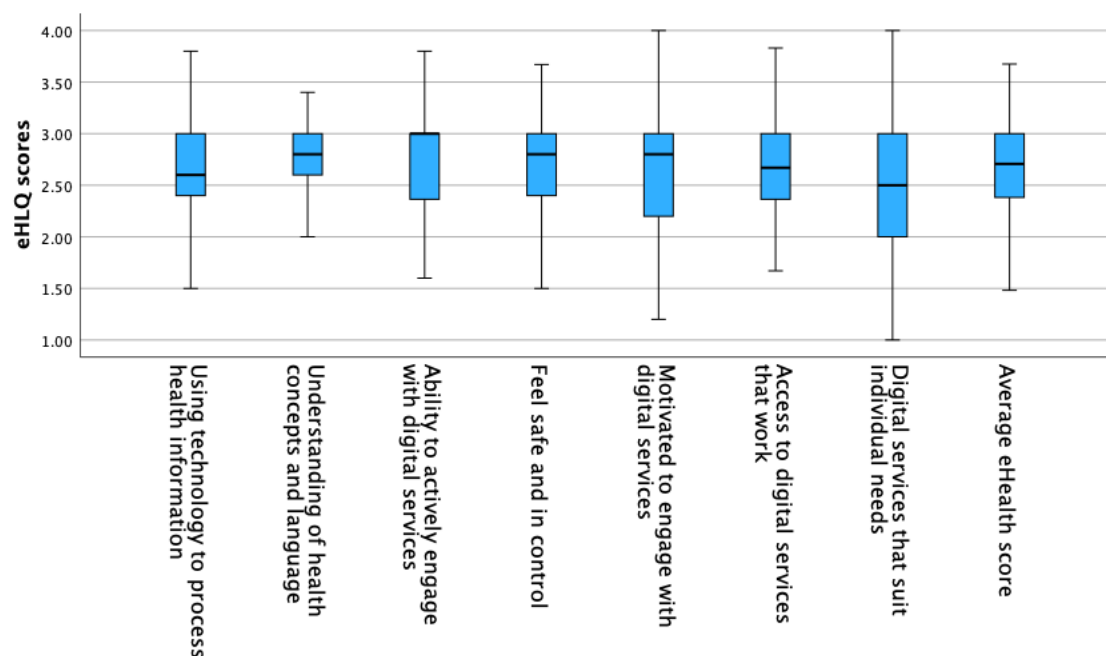


Figure 4-2 Overall eHLQ scores among participants

The eHLQ scores varies with the different patient factors including age, education levels and socioeconomic status, as outlined in Table 4-1. The impact of education levels on eHLQ scores was analysed first, showing significant differences across all dimensions except for one. Specifically, notable disparities were found in Dimensions 1 (Using Technology to Process Health Information), 2 (Understanding of health concepts and language), 3 (Ability to actively engage with digital services), 4 (Feel safe and in control), 5 (Motivated to engage with digital services), 6 (Access to digital services that work), and 7 (Digital services that suit individual needs) Additionally, eHLQ scores were found to be positively correlated with higher levels of education ($r = .359$, $p < 0.001$) (Figure 4-3).

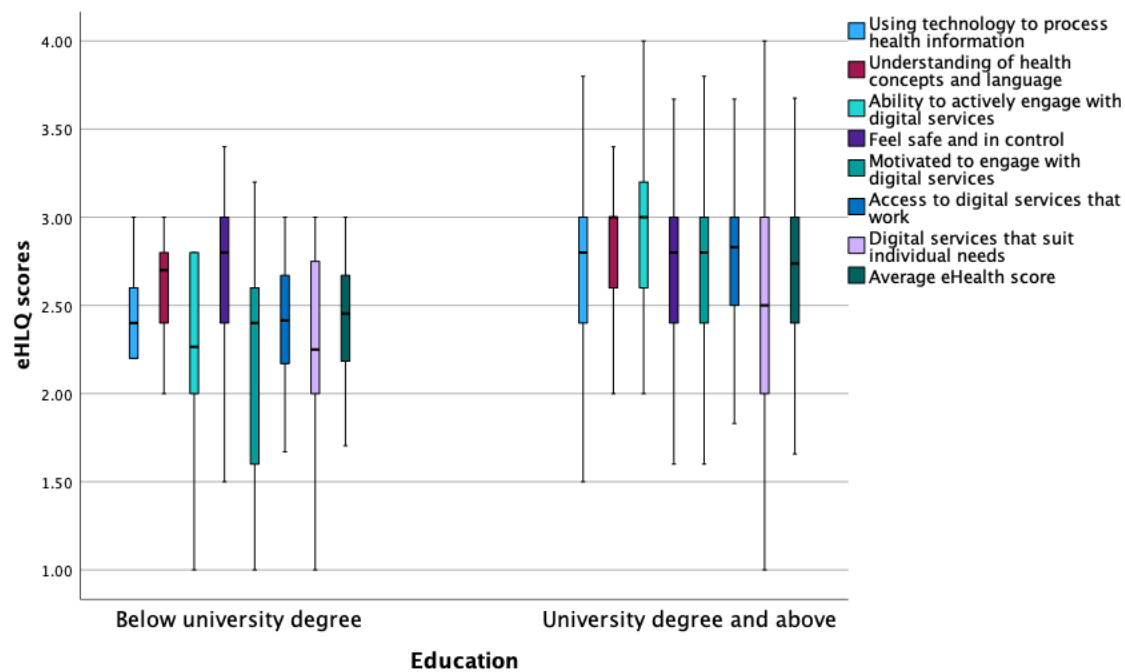


Figure 4-3 eHLQ scores and education levels

Table 4-1 Seven dimensions of eHLQ scores and different participant characteristics

Characteristics	1.Using Technology to Process Health Information	2.Understanding of health concepts and language	3. Ability to actively engage with digital services	4. Feel safe and in control	5. Motivated to engage with digital services	6. Access to digital services that work	7. Digital services that suits individual needs	Average score
Age								
18-34	n = 25							
Median (IQR)	2.80 (2.65-3.06)	3.00 (2.65-3.08)	3.00 (2.87-3.31)	2.80 (2.44-2.98)	2.80 (2.61-3.03)	2.83 (2.57-2.99)	2.75 (2.47-2.92)	2.77 (2.64-3.02)
35-54	n = 57							
Median (IQR)	2.80 (2.57-2.82)	3.00 (2.74-3.00)	3.00 (2.74-3.06)	2.80 (2.49-2.83)	2.80 (2.58-2.89)	2.83 (2.62-2.86)	2.63 (2.44-2.74)	2.74 (2.61-2.86)
55-74	n = 49							
Median (IQR)	2.60 (2.26-2.64)	2.80 (2.57-2.86)	2.80 (2.35-2.74)	2.80 (2.57-2.93)	2.45 (2.69-2.67)	2.67 (2.44-2.73)	2.25 (2.20-2.55)	2.57 (2.44-2.75)
75 and over	n = 9							
Median (IQR)	2.20 (1.68-2.53)	2.80 (2.25-3.21)	2.00 (1.48-2.40)	2.80 (2.33-3.35)	2.50 (1.98-2.93)	2.50 (2.29-2.77)	2.00 (1.60-2.79)	2.39 (2.08-2.72)
Kruskal-Wallis (H; p)	14.27; 0.003*	2.89; 0.409	24.63; <0.001*	0.52; 0.915	7.51; 0.057	6.06; 0.109	7.52; 0.057	7.51; 0.057
Education								
Up to secondary education	n = 18							
Median (IQR)	2.40 (1.96-2.56)	2.70 (2.29-2.79)	2.27 (1.90-2.47)	2.80 (2.42-2.98)	2.40 (1.88-2.51)	2.42 (2.12-2.62)	2.25 (1.90-2.49)	2.45 (2.14-2.72)
University or above	n = 123							
Median (IQR)	2.80 (2.55-2.77)	3.00 (2.76-2.94)	3.00 (2.71-2.95)	2.80 (2.60-2.83)	2.80 (2.60-2.81)	2.83 (2.64-2.80)	2.50 (2.45-2.66)	2.74 (2.63-2.80)
Mann-Whitney U (z; p)	-2.69, 0.007*	-2.46, 0.014*	-4.22, <0.001*	-0.54, 0.589	-3.05, 0.002	-2.74, 0.006*	-2.15, 0.032*	-2.50, 0.012*
Socioeconomic group								
Lower (C2DE)	n = 58							
Median (IQR)	2.60 (2.28-2.64)	2.80 (2.57-2.88)	2.70 (2.35-2.74)	2.80 (2.61-2.94)	2.60 (2.35-2.72)	2.67 (2.54-2.84)	2.50 (2.30-2.66)	2.62 (2.45-2.76)
Higher (ABC1)	n = 71							
Median (IQR)	2.80 (2.62-2.86)	3.00 (2.81-3.02)	3.00 (2.81-3.10)	2.80 (2.53-2.83)	2.90 (2.65-2.88)	2.74 (2.58-2.77)	2.50 (2.44-2.69)	2.74 (2.66-2.85)

Mann-Whitney U (z; p)	-2.54, 0.011*	-1.45, 0.147**	-3.58, <0.001*	-1.05, 0.293	-1.879, 0.60	-0.49, 0.624	-0.52, 0.602	-1.474, 0.141
Gender								
Male n = 68								
Median (IQR)	2.60 (2.44-2.73)	2.90 (2.72-2.97)	3.00 (2.55-2.89)	2.80 (2.57-2.85)	2.80 (2.52-2.80)	2.83 (2.63-2.82)	2.50 (2.41-2.70)	2.74 (2.57-2.80)
Mean (SD)	2.59 (0.60)	2.85 (0.51)	2.72(0.69)	2.71 (0.58)	2.66(0.58)	2.72 (0.39)	2.56 (0.59)	2.69 (0.48)
Female n = 75								
Median (IQR)	2.60 (2.48-2.77)	2.80 (2.65-2.89)	2.80 (2.62-2.93)	2.80 (2.55-2.87)	2.70 (2.48-2.78)	2.63 (2.51-2.76)	2.50 (2.32-2.61)	2.69 (2.55-2.80)
Mann-Whitney U (z; p)	-0.246, 0.805	-.0932, 0.351	-0.161, 0.872	-0.123, 0.902	-0.213, 0.832	-0.962, 0.336	-0.826, 0.409	-0.493, 0.622
Overall n=141								
Median (IQR)	2.60 (2.51-2.71)	2.80 (2.72-2.89)	3.00 (2.68-2.86)	2.80 (2.61-2.82)	2.80 (2.54-2.75)	2.67 (2.60-2.76)	2.50 (2.41-2.61)	2.71 (2.60-2.77)
eHealth Literacy Questionnaire (eHLQ), interquartile range (IQR). standard deviation (SD), Kruskal–Wallis test score (H), Mann-Whitney test score (z). Significant differences are denoted in asterisk (p < 0.05)								

When examining variations among socioeconomic groups, significant differences were observed in only two eHLQ dimensions—Dimension 1 (Using Technology to Process Health Information) and Dimension 3 (Ability to actively engage with digital services). Higher social grades correlated positively with higher eHLQ scores ($r = .354$, $p < 0.001$) (Figure 4-4).

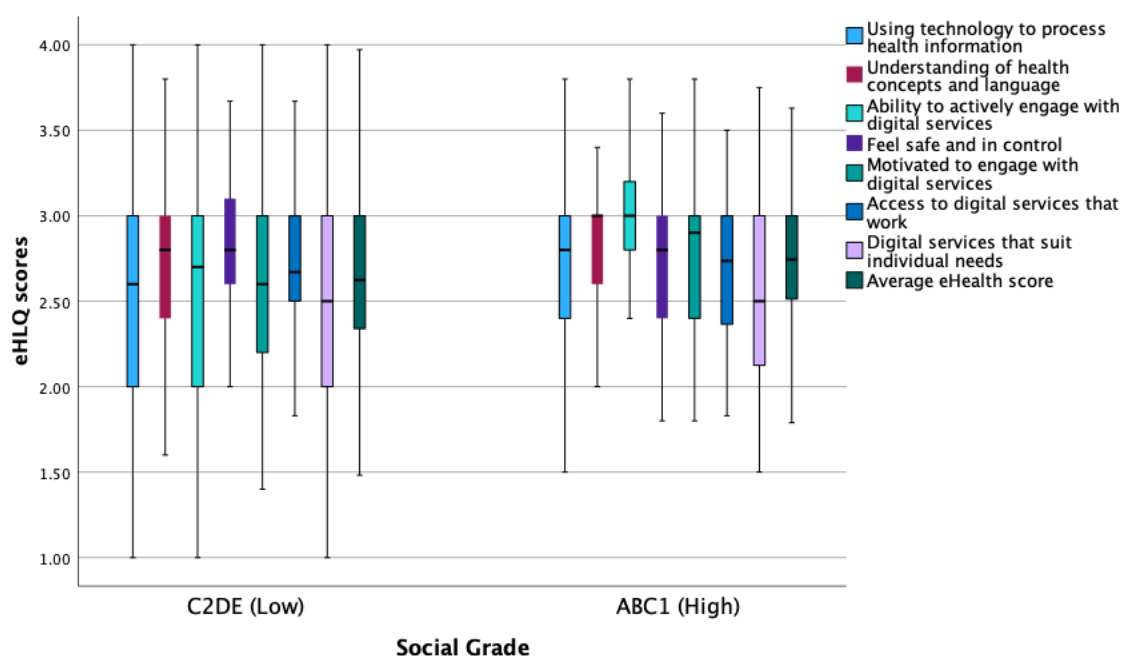


Figure 4-4 eHLQ scores and socioeconomic status

Similarly, significant differences in eHLQ Dimensions 1 and 3 were found among different age groups. Notably, eHLQ scores were negatively correlated with older age groups ($r = -.398$, $p < 0.001$) (Figure 4-5). In contrast, no significant differences in eHLQ scores were observed between genders ($p = 0.87$).

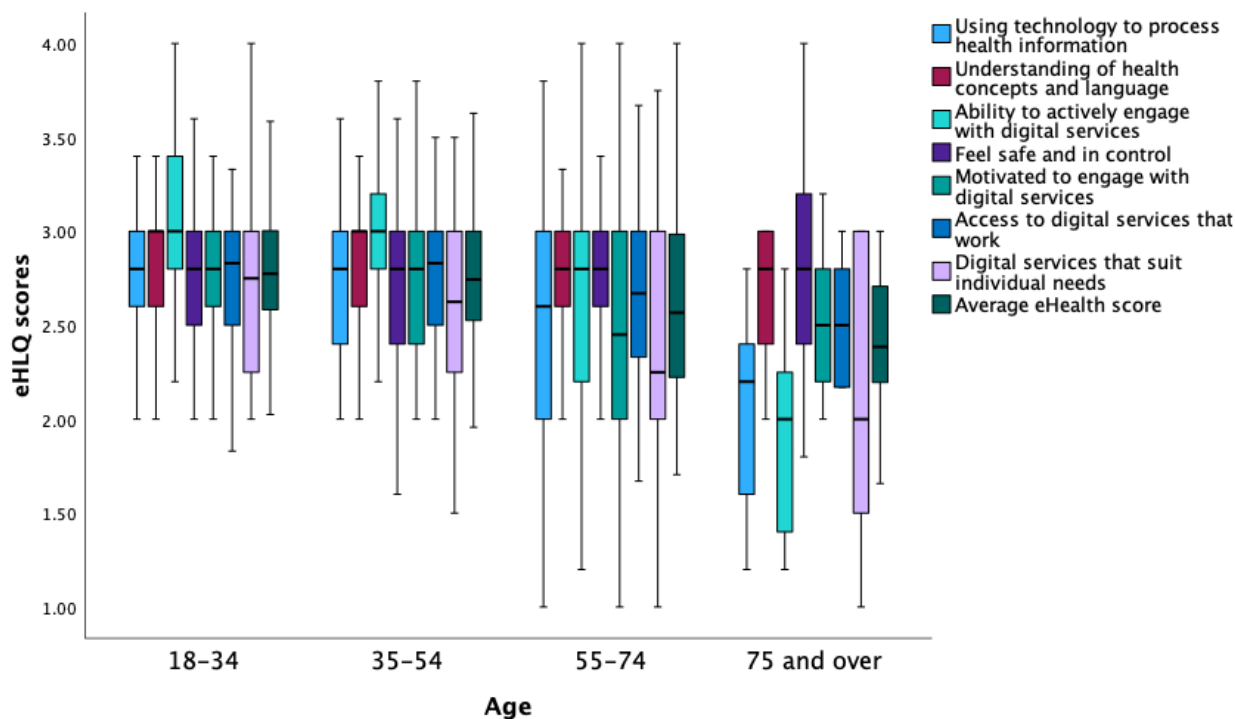


Figure 4-5 eHLQ scores and age

Perceptions of face-to-face consultations, remote consultations, and mobile health applications

There were significant differences in patients' attitude when comparing face-to-face consultations, remote consultations, and the use of mobile health applications ($\chi^2(2) = 74.05$, $p < 0.01$). Post hoc Wilcoxon signed-rank tests with Bonferroni correction (significance level set at $p < 0.017$) revealed that face-to-face consultations received significantly higher acceptance scores than both remote consultations ($Z = 6.37$, $p < 0.001$) and mobile health applications ($Z = 7.90$, $p < 0.001$).

Overall, patients reported a positive attitude toward face-to-face consultations, reporting a median acceptance score of 43.00 (IQR 41.03-43.28) out of a possible range of 7 to 47. In contrast, remote consultations received a median score of 37.00 (IQR 33.47-36.58), and mobile health applications obtained 33.50 (IQR 31.70-34.54).

The relationships between the different patient demographics and acceptance scores of each interaction were examined, as presented in Table 4-2.

Older age was positively correlated with attitude in face-to-face consultations ($r = 0.224$, $p = 0.008$) and negatively with remote consultations ($r = -0.264$, $p = 0.002$) and mobile health applications ($r = -0.276$, $p = 0.001$).

There is a positive relationship between higher social grades and attitude with remote consultations ($r = .351$, $p < 0.001$) as well as mobile health applications ($r = .252$, $p = 0.004$).

Similarly, a positive correlation is found between higher education attainment and attitude with remote consultations ($r = .248$, $p = 0.004$) Figure 4-7. No significant gender-based differences in acceptance scores were observed ($p = 0.73$).

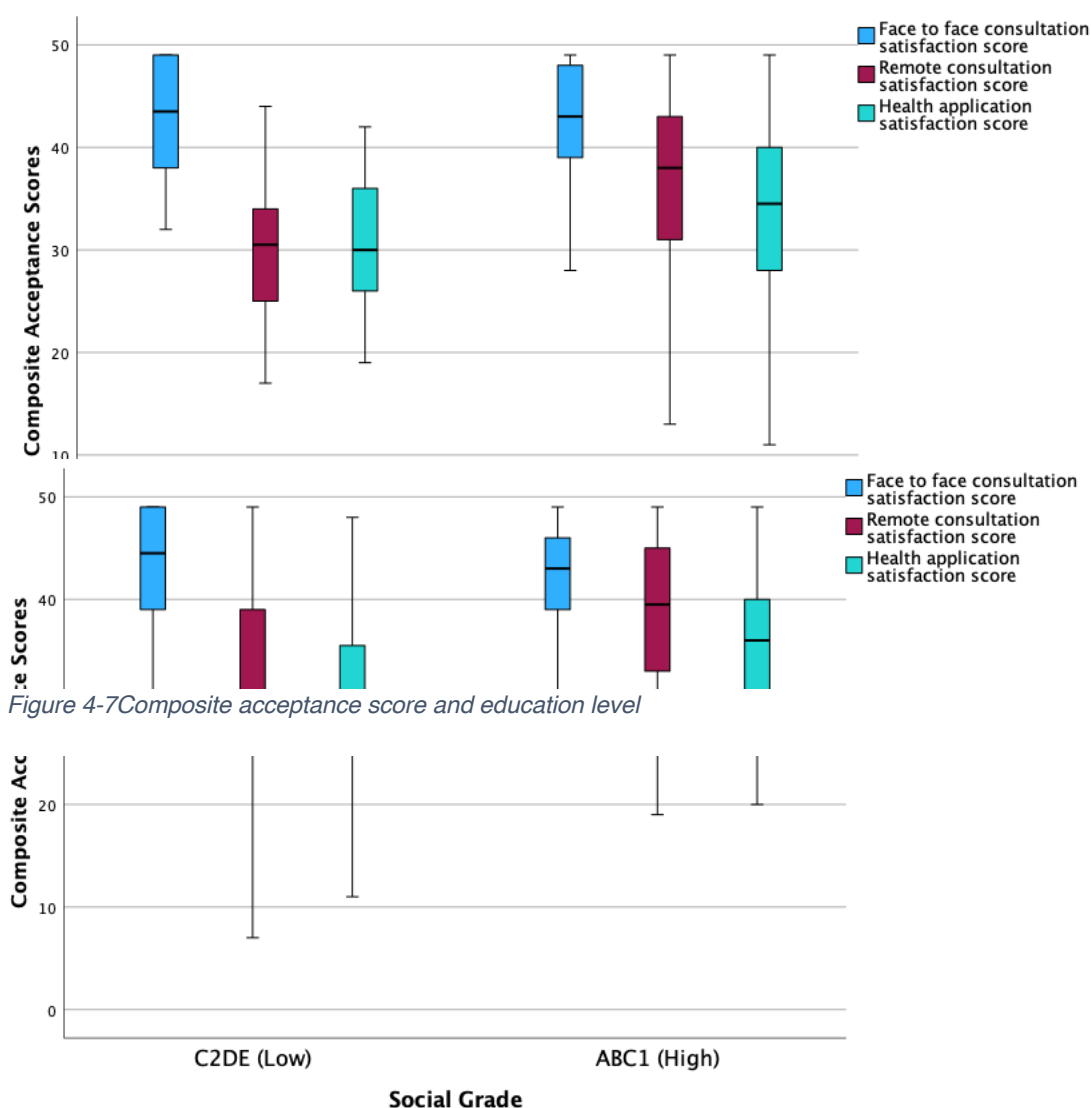


Figure 4-6 Composite acceptance score and socioeconomic status

Table 4-2 Composite acceptance scores and different participant characteristics

	Composite acceptance score (Minimum = 7, Maximum = 49)		
Characteristics	Face-to-face consultation	Remote consultation	Mobile health applications
Age			
18-34	n = 26		
Median (IQR)	40.50 (37.44-41.94)	37.00 (34.37-39.25)	37.00 (32.76-39.32)
Mean (SD)	39.69 (5.57)	37.84 (6.83)	36.04 (7.94)
35-54	n = 56		
Median (IQR)	44.00 (40.77-44.01)	39.00 (34.37-39.25)	35.00 (32.34-36.85)
Mean (SD)	42.39 (6.04)	36.81 (9.19)	34.59 (8.25)
55-74	n = 48		
Median (IQR)	45.00 (40.94-45.44)	32.00 (29.01-34.78)	28.00 (27.62-32.34)
Mean (SD)	43.19 (7.75)	31.90 (10.04)	29.98 (7.94)
75 and over	n = 8		
Median (IQR)	42.00 (36.97-47.53)	32.00 (28.55-36.31)	30.00 (27.70-36.30)
Mean (SD)	42.25 (6.32)	32.43 (4.20)	32.00 (4.66)
<i>Kruskal-Wallis (H; p)</i>	9.26; 0.026*	10.62; 0.014*	12.01; 0.007*
Education			
Up to secondary education	n = 18		
Median (IQR)	43.50 (36.69-46.64)	30.50 (22.99-33.90)	30.00 (24.82-33.89)
Mean (SD)	41.67 (10.01)	28.44 (10.96)	29.35 (8.82)
University or above	n = 120		
Median (IQR)	43.00 (41.13-43.32)	38.00 (34.47-37.57)	34.00 (32.19-35.16)
Mean (SD)	42.23 (6.07)	36.02 (8.58)	33.68 (8.04)
<i>Mann-Whitney U (z; p)</i>	-0.47; 0.642	-2.84; 0.004**	-1.72; 0.080
Socioeconomic group			
Lower (C2DE)	n = 58		
Median (IQR)	44.50 (40.42-44.44)	31.00 (28.24-33.41)	28.50 (27.92-32.47)
Mean (SD)	42.43 (7.64)	30.83 (9.83)	30.20 (8.49)
Higher (ABC1)	n = 69		
Median (IQR)	43.00 (40.71-43.32)	39.50 (36.48-39.92)	36.00 (33.96-37.32)
Mean (SD)	42.01 (5.43)	38.20 (7.22)	35.64 (6.90)
<i>Mann-Whitney U (z; p)</i>	-1.15; 0.252	-4.33; <0.001**	-3.68; <0.001**
Gender			
Male	n = 68		
Median (IQR)	43.00 (39.77-43.36)	37.00 (33.37-37.57)	31.00 (31.22-35.35)
Mean (SD)	41.57 (7.47)	35.47 (8.82)	33.29 (8.20)
Female	n = 75		
Median (IQR)	44.00 (41.35-44.12)	36.50 (32.23-36.92)	34.00 (30.97-34.97)
Mean (SD)	42.74 (5.76)	34.57 (9.70)	32.97 (8.32)
<i>Mann-Whitney U (z; p)</i>	-0.72; 0.474	-0.35; 0.728	-0.41; 0.685

Exploring the impact of eHealth Literacy Questionnaire (eHLQ) scores on different interactions, higher eHLQ scores correlated positively with attitude in remote consultations across all dimensions except

Dimension 4 (Feeling safe and in control). Furthermore, higher eHLQ scores correlated positively with attitude in mobile health applications across all eHLQ dimensions (Table 4-3).

Table 4-3 Correlation between perception score and eHealth scores

	1.Using Technology to Process Health Information	2.Understanding of health concepts and language	3. Ability to actively engage with digital services	4. Feel safe and in control	5. Motivated to engage with digital services	6. Access to digital services that work	7. Digital services that suits individual needs	Average score
Face-to-face consultation perception								
Spearman's rho (r_s , p)	-0.07 (0.380)	0.003 (0.973)	-0.08 (0.347)	0.06 (0.489)	-0.12 (0.155)	-0.02 (0.826)	-0.07 (0.425)	-0.06 (0.484)
Remote consultation perception								
Spearman's rho (r_s , p)	0.43 (<0.001)*	0.29 (<0.001)*	0.43 (<0.001)*	0.13 (0.126)	0.46 (<0.001)*	0.30 (<0.001)*	0.33 (<0.001)*	0.40 (<0.001)*
Mobile health applications perception								
Spearman's rho (r_s , p)	0.42 (<0.001)*	0.33 (<0.001)*	0.46 (<0.001)*	0.30 (<0.001)*	0.46 (<0.001)*	0.43 (<0.001)*	0.39 (<0.001)*	0.48 (<0.001)*

To understand how patients perceive different types of interactions, a comparison of the seven domains constituting the perception score was conducted for face-to-face and remote consultations. Face-to-face consultations were perceived more positively in terms of convenience ($Z = 6.492$, $p < 0.001$, large effect size [$d = 0.76$]), comfort ($Z = 7.818$, $p < 0.001$, large effect size [$d = 0.67$]), relevant information ($Z = 8.24$, $p < 0.001$, large effect size [$d = 0.69$]), easy understanding ($Z = 8.01$, $p < 0.001$, large effect size [$d = 0.68$]), and maintaining privacy ($Z = 2.84$, $p = 0.004$, small effect size [$d = 0.24$]). No significant differences between the two modalities were observed in perceptions of embarrassment ($Z = 1.07$, $p = 0.286$) or time consumption ($Z = 1.04$, $p = 0.298$).

4.5 Discussion

To my knowledge, this is the first survey study exploring the impact of surgical patients' characteristics and eHealth literacy levels on their perceptions of eHealth technologies in the post-COVID era.

This study has shown a high frequency of daily internet usage (137/152 [90.1%]), mainly through smartphones, across all age groups, including participants over 55, demonstrating a technologically connected demographic. There is also widespread adoption of social media for communication and information consumption, particularly through messaging applications. These findings contrast with a previous study investigating surgical patients' use of technology before the COVID outbreak that reported a lower proportion of patients who had experience searching the internet about diseases (67%) or using a health-related mobile application (12.2%) (Korn et al., 2022). This supports the observation that there has been a shift towards a more technologically enabled patient population.

The interest in technology extends to health-related activities, with a significant proportion utilising various digital channels to seek health information, using internet searches with (133/152 [87.5%]), NHS websites (113/152 [75.3%]). However, most participants only engaged in simple digital tasks such as searching the internet or sending messages through smartphones. More complex tasks like downloading and installing health apps (86/152 [57.3%], communicating with healthcare professionals via email (81/152 [54%]), or participating in forums (29/125 [19.5%]) are not common. This study cannot conclusively determine whether this limitation is due to the participants' lack of technical ability, interest, or the unavailability of specific digital health services. To explore this further, the eHealth Literacy Questionnaire (eHLQ) was used. This tool provides an objective assessment of users' knowledge, skills, and confidence to interact with digital services. (Kayser et al., 2018). This study revealed considerable variations in eHLQ scores across dimensions, with participants demonstrating the highest score in Dimension 3- actively engaging with digital services, and the lowest in Dimension 7- finding services that suit individual needs. Of particular interest is the unexpected high score in Dimension 3, contrary to findings in other studies that reported low scores in participants' ability to actively engage with digital services (García-García et al., 2023, Cheng et al., 2021). This anomaly may be due to the increased comfort levels of our participants, who had gained more exposure to eHealth technologies during the pandemic, including the NHS COVID app (Sukriti et al., 2023) and telemedicine (Fisk et al., 2020). This observation supports the hypothesis that eHealth literacy is a dynamic skill, being improved through increased experience and confidence in using technology.

The positive correlation between higher education levels and eHLQ scores is widely known, suggests that education plays a significant role in improving eHealth literacy (Xesfingi and Vozikis, 2016) . However, the overrepresentation of university-educated respondents may have influenced the results. Despite this, age-related differences highlight the necessity for targeted interventions to improve lower eHLQ scores in older age groups. Notably, there are no significant differences in literacy scores between younger and older individuals in terms of understanding health language and concepts (Dimension 2), accessing and being motivated to use digital services (Dimension 5 and 6), and the ability to find digital services that meet individual needs (Dimension 7). This indicates that older patients have a similar interest in using eHealth, provided that it meets their capabilities and health requirements. To address this, initiatives such as the eHealth literacy framework (Kayser et al., 2015) can be utilised to create specialised programs for older adults aimed at improving their grasp of technical terminology, understanding of suitable digital platforms, and building trust in the use of digital technologies. These strategies are in line with the conclusions of a focus group study that explored older patients' attitudes toward eHealth. (Terp et al., 2021).

When evaluating the perceptions of different healthcare interactions, a positive attitude towards traditional face-to-face consultations is consistent with established healthcare norms (Hammersley et al., 2019a, Antonio et al., 2024). However, lower acceptance scores for remote consultations and mobile health applications indicate potential challenges in transitioning to digital healthcare modalities.

Despite having extensive prior experience with remote consultations, participants reported more negative impressions, showing a negative correlation with older age and lower eHealth scores. It is important to note that participants do not find remote consultations more convenient than face-to-face encounters, but they are more likely to compromise privacy and hinder understanding of information, leading to a reduced willingness to engage in teleconsultations in the future. These findings diverge from the results of two systematic reviews, which suggested that surgical patients have an equivalent or higher preference for remote consultations over traditional outpatient clinics (Oates et al., 2021, Blount et al., 2023).

As previously discussed, the relationship between eHealth literacy and the use of technology is complex and is influenced by individuals' abilities, system factors, and the supporting environment. This complex relationship is outlined in the Unified Theory of Acceptance and Use of Technology (UTAUT) framework described in Chapter 2. The framework focuses on participants' perceived effort, perceived benefits, social influence, and facilitating conditions as determinants of technology adoption (Venkatesh et al., 2016). To further understand the factors that affect patients' perceptions, additional research using qualitative techniques and focus groups is necessary to investigate the acceptance and use of eHealth using a robust theoretical model in the next chapter.

4.6 Limitations

This exploratory study has several limitations. First, recruiting participants exclusively from a large, inner-city teaching hospital may have introduced a selection bias, as individuals with higher education levels were disproportionately represented. This limits the generalisability of the findings to broader populations. Second, the recruitment process conducted by a single researcher resulted in limited sample size and may have inadvertently introduced sampling bias. Third, the study was conducted solely in English, which restricted the diversity of participants and further limited the generalisability of the results, particularly to non-English-speaking populations. The questionnaire was made available in paper format to include participants who may not be familiar with electronic formats. However, this approach could introduce bias, as it may preferentially recruit individuals who are less tech-savvy and potentially hold more negative views toward technology.

Furthermore, the scarcity of pre-existing validated instruments to assess perceptions of eHealth technologies required the design of a tailored survey. While validated surveys, such as the Technology Acceptance Model (TAM) Questionnaire (Gagnon et al., 2012) and the Patient Engagement Questionnaire (PEQ) (Steine et al., 2001) are available for examining technology use, a custom survey was developed to accommodate a broader spectrum of technologies and ensure relevance to the surgical healthcare context. Although the survey items were informed by relevant literature, the lack of validation may affect the reliability and psychometric robustness of the findings. Additionally, the length

of the survey and the potential for missing responses may have impacted the completeness and quality of the data collected.

4.7 Conclusion

This study demonstrated the widespread use of technology in a digitally equipped surgical patient population. However, there is much reluctance to adopt technology for healthcare purposes. Age, education level, and eHealth literacy were influencing factors, particularly affecting the ability to process and understand technological terminology, the use of relevant digital platforms, and the confidence to engage with digital services actively. Despite these challenges, targeted education and support could overcome these barriers. Furthermore, it is crucial to better understand patients' awareness of eHealth technologies and their impact on healthcare experience. These findings highlighted the complex relationship between patient factors, digital health literacy, and perceptions of technology, supporting the need for further research into tailored strategies to overcome barriers to health technology adoption.

Chapter 5

5 Factors influencing surgical patients' acceptance and use of eHealth technologies- a focus group study

5.1 Introduction

Much of the existing literature has focused on the general obstacles to adopting eHealth (Schreiweis et al., 2019, Granja et al., 2018). There is a lack of thorough understanding of how these technologies are viewed and used by specific patient groups, especially those undergoing surgical care. This chapter aims to move beyond simply identifying barriers to eHealth adoption and instead provide a detailed qualitative exploration of the specific attitudes and behaviours within the surgical patient demographic. The Theoretical Framework of Acceptability model was used in the analysis to offer a unique understanding of the various factors that influence eHealth acceptance, as described in Chapter 2 (Sekhon et al., 2017).

In addition, studies involving surgical patients often concentrate on a specific type of technology, such as a perioperative mobile application (van der Meij et al., 2016) or a wearable device (Knight et al., 2021). This approach leads to a limited and fragmented comprehension of patients' attitudes towards eHealth. The purpose of this study is to close the gap by gathering firsthand experiences from patients who are currently undergoing surgical treatment. I aim to use this information to guide the development and implementation of eHealth interventions specifically designed to meet the needs of surgical patients throughout the different stages of treatment, such as pre-operative assessments, surgical procedures, post-operative care, and rehabilitation. My goal is to contribute to the current discussion on eHealth and pave the way for developing more inclusive, patient-centric interventions. These interventions are essential for addressing the challenges of the rapidly evolving healthcare landscape, ultimately improving the quality and accessibility of care for surgical patients.

5.2 Methods

5.2.1 Study Design

A focus group methodology was selected to provide a platform where participants could actively engage in discussions, share diverse perspectives, and debate their views. This approach allowed for the exploration of nuanced attitudes and perceptions among participants. A total of three focus groups were conducted, each comprising participants recruited from a General Surgery clinic at a large teaching hospital in London.

5.2.2 Participant Approach, Information Provision, Consent, and Assessment Procedures

Participants were approached through posters, clinic leaflets, and direct invitation via surgical clinics. All individuals who expressed interest were provided with a written participant information sheet outlining the study aims, voluntary nature of participation, data use, and confidentiality procedures.

Participants were recruited using purposive sampling to ensure a diverse representation across various demographic factors, including age, sex, ethnicity, and educational background. To further enhance diversity and capture a broad range of experiences, snowball sampling allowed existing participants to

invite others within their network who met the study criteria. Participants were also encouraged to bring a friend or family member for support. Inclusion criteria for the study required participants to be 18 years or older, proficient in English, and able to provide written informed consent. Additionally, participants needed to have had at least one inpatient or outpatient surgical encounter, including face-to-face, virtual, or telephone consultations. Exclusion criteria included individuals who could not provide written informed consent, those who were not proficient in reading or writing English, and patients who lacked previous surgical encounters. Potential participants were given at least 48 hours to review the information and ask further questions. Written informed consent was obtained individually at the start of each focus group session. Participants completed a brief demographic form prior to participation.

5.2.3 Procedure for Conducting Focus Groups

All focus groups were conducted in person in a private seminar room within the hospital. Sessions were scheduled for three hours with pre-planned comfort breaks. A total of 50 patients were initially approached, from which 18 participants were recruited across three groups. Group size was determined in consultation with a qualitative research supervisor, ensuring feasibility for two facilitators and allowing rich discussion; each group included approximately six participants.

Focus groups took place between September and October 2022. Participants were compensated according to the NIHR public contributor payment policy with hourly reimbursement and travel expenses. The focus groups followed a semi-structured topic guide (included in Appendix 1), covering experiences of digital health, barriers, facilitators, and expectations. The first group was co-facilitated by the primary researcher and a doctoral colleague (YG) under supervision of the qualitative research lead. The remaining two groups were facilitated by the same two researchers.

5.2.4 Ethical Considerations

The study received approval from the Research Ethics Committee (REC Protocol ID 21SM7147). All participants provided written informed consent before their involvement in the study, ensuring they fully understood the nature of the research and their rights as participants.

5.2.5 Confidentiality and Management of Group Dynamics

Confidentiality was explained verbally and in writing. Participants were informed that information shared within the group must not be discussed outside the session. To enhance confidentiality, all participants used pseudonyms during transcription, and identifiable details were removed. Although focus groups were held in a hospital setting and moderated by a clinician-researcher, steps were taken to minimise perceived power imbalances. The facilitator explicitly emphasised that contributions would not affect clinical care, and participants were invited to challenge or disagree with the researcher at any point. A reflexive approach was taken throughout, acknowledging the potential influence of professional identity on participant responses.

5.2.6 Inclusivity and Impact of In-Person Format

Holding focus groups in person may have influenced the diversity of the participant sample. Individuals of working age, those with childcare responsibilities, mobility limitations, or difficulty travelling may have been less able to attend. This limitation is acknowledged and discussed in the chapter's limitations section.

5.2.7 Data Handling and Security

Audio recordings were transferred to an encrypted, password-protected institutional drive. A professional transcription service signed a confidentiality agreement before generating anonymised transcripts. Only the research team had access to the data. NVivo software was used to organise and analyse the transcripts.

5.2.8 Data Analysis

Thematic analysis, as outlined by Braun and Clarke (Braun and Clarke, 2019), was employed to analyse the focus group transcripts. The process began with an in-depth reading of the transcripts to identify recurring themes across participants. The doctoral student (CH) conducted initial coding, applying codes line-by-line to capture the essence of the data. These codes were then systematically reviewed to ensure consistency and relevance to the emerging themes. Another researcher (YG) independently verified the codes to enhance the reliability of the analysis. Any discrepancies identified between the initial codes and the transcripts were thoroughly discussed, and consensus was reached between the researchers on the final coding. The final coding was then re-categorised and interpreted using the Theoretical Framework of Acceptably.

5.3 Results

5.3.1 Overview

Participant Characteristics

Eighteen participants took part in the three focus groups. The group included twelve females and six males, ages ranging from 30 to 72. The group was ethnically diverse, comprising individuals of Asian, White, Black, and other backgrounds. Educational levels among participants varied from secondary school completion to postgraduate degree attainment.

Participant ID	Age	Gender	Educational attainment
1	41	F	Postgraduate degree
2	30	F	Postgraduate degree
3	64	F	Postgraduate degree
4	65	M	Secondary school
5	54	F	Postgraduate degree
6	72	M	Postgraduate degree
7	33	F	Undergraduate degree
8	36	F	Postgraduate degree
9	35	M	Postgraduate degree
10	69	F	Further education
11	58	F	Undergraduate degree
12	51	F	Undergraduate degree
13	44	F	Postgraduate degree
14	45	M	Undergraduate degree
15	68	F	Secondary school
16	69	M	Further education
17	65	M	Further education
18	46	F	Postgraduate degree

Table 1 – Participant demographics

5.3.2 Themes

Theme 1 : Affective attitude

Within this theme, participants discussed their initial impressions of eHealth technology, exploring how these impressions might shape their overall acceptance of such innovations.

Subtheme 1- Perceived benefits

Convenience

The first sub-theme focused on the advantages of embracing eHealth technology. Participants believed that eHealth interventions could improve their healthcare experience. They particularly appreciated the convenience of saving time and eliminating the need for travel through remote consultations. The flexibility of remote consultations was also well-received, as it accommodated the demands of their personal and work schedules, freeing them from the need to visit the doctor's office at a specific time.

“ I found that experience quite convenient because I am not always staying in the same location, I’m moving around, it means that I can make an appointment and see my GP within 24 hours pretty much without having to be in a certain place which gets better around my job.” Participant 2 (30, Female)

The use of mobile apps for virtual consultations helped allow patients to share images of their ailments remotely with healthcare professionals for diagnosis.

“ say if it’s my arm that’s swollen or something, I can take a picture and say, “Well, this is what it is”, which again is a convenience, so I don’t actually physically have to go to the surgery, so that’s great. ...they send in your link so you click on the link and it says add pictures, take a picture with fantastic technology and you send it and they get it straight away and you’re still on the phone, “Oh, yeah, I see that, maybe you need some...” I don’t know, whatever you need so just as an example which is great. So in a way it’s just saved me two hours or one hour of travelling up and down.” - Participant 3 (64, Female)

Patients reported the advantages of using online platforms to access their health information. They found it convenient and reassuring to quickly view their test results and appointment letters without the delays of traditional mail services. Moreover, these platforms are also helpful in handling administrative tasks that would otherwise require an in-person visit to the healthcare providers. For example, electronic requests for medical documents eliminate the need for patients to visit their General Practitioner (GP) surgery.

"I really like the app because I'm able to see all my records, and the fact that the use of this digital technology that all healthcare providers can access your information, for me that's fantastic because you don't have to go every time repeating yourself"– Participant 1 (41, Female)

"I got all my letters through the portal, I got my test results through the portal ... and it's great because if somebody, "Oh what's your whatever result, blood result" just log in and "Oh, this is what it is, do I need to do anything about it?" so that has been a tremendous help and like, you know, other people they say they don't get the letter what you just said, I know at least I've got a text to say I've got an appointment on 8 October or whatever it is and then I can go into the portal and say, "Well, I haven't got the letter but at least the letter is there" which is fantastic. So even if a physical letter doesn't appear, you know, because I think postmen are on strike, you know, all the time we don't get letters so that has helped tremendously." - Participant 3 (64, Female)

Information giving

Patients found it more engaging to access health information from a webpage or mobile application, as it allowed for the presentation of information in multimedia formats, such as videos explaining pre-operative information and demonstrating rehabilitation exercises. Another benefit was the ability to revisit the information at their own pace. Patients described difficulties in retaining information after speaking to healthcare professionals, citing time pressure and stress as contributing factors. Some patients preferred to receive information periodically.

"I think preparing someone mentally and physically for potential a lifesaving operation, a serious operation, having videos of what's likely to happen, what do you need to do it's really good. So having the visual or just printed, because with printed we've talked about how some people can't read properly." Participant 14 (45, Male)

"And also when I finished, well, she gave me a lot of exercises to do, and of course, I couldn't remember the first exercise by the time she got to the last one, and it was really helpful as she sent me this email afterwards where she just summarised what had happened in our meeting and had this wonderful little PDF document with images of what the exercises should be like and just reminding me what to do" Participant 9 (35, Male)

Real-time monitoring and the wider support network

The group explored the potential of eHealth technologies to extend patient support networks by involving family and friends in their healthcare journey. Sharing important health information through digital means could be highly beneficial for patients who are vulnerable or living alone, providing them with a greater sense of safety and security. Participants wanted to use technology to share real-time health data with healthcare providers, family and friends. This can help detect sudden deterioration, enable quick alerts, and facilitate early interventions during post-operative care.

“my boyfriend’s nephew, he’s got diabetes, so he has one of those things that constantly monitor him and he has the app, but also his parents have the app as well, because he’s young, so they can monitor it as well. So, maybe if you had a patient that had come home and they didn’t have family, close family that could constantly be with them, they could maybe have the app as well or whatever the system and they could track someone else as well to be... because you’ve got those old-school things of like the alarms, haven’t you?” - Participant 7 (33, Female)

Staff shortage

Some participants also perceived eHealth technology could be the solution to alleviate staff shortages in health services.

“Yeah, so if technology can help that because I don’t know because it’s like we haven’t got enough people that’s my understanding and I think that’s what the reports say, we have to use technology because we haven’t got enough people.” - Participant 1 (41, Female)

Subtheme 2: Inevitability

Participants shared their experiences of how their relationship with technology has evolved in both healthcare and their daily lives. The group recognised that the acceptance of technology as the "new normal" in healthcare has increased. They reflected on how the COVID-19 pandemic has changed their fundamental connection with technology, even compelling those who are less tech-savvy to acquire essential digital skills. Participants acknowledged that technology is no longer just an accessory but an integral component for executing daily routines, making integration unavoidable.

"I didn't want to have the internet in my house. Even though I had internet like I didn't use it for a long, long time. But now if I didn't have the internet, I wouldn't be able to have food during the COVID. That is simply the fact to survive for you, we have to." - Participant 11 (58, Female)

"I don't think people will allow us to go backwards anyway. I think the government have found ways of communicating to patients now directly, saying, "Come and get your COVID vaccine. I'm texting you now. You've got to... you want your COVID certificate for travelling abroad, it's on your app through your NHS app," and this, that and the other, so they're finding that they can actually direct people for public health and people are finding useful ways of effectively more personal to their local hospitals and so on to engage in this way for all sorts of things, you know, getting appointments, cancelling appointments, all sorts. It is the modern way and it will increase." - Participant 6 (72, Male)

Subtheme 3: Empowerment

This subtheme explored the transformative effect of eHealth on empowering individuals to take control of their health management. It highlights this impact on their interaction with healthcare professionals and their understanding of their health conditions.

"most times the GP sends me to do an analysis but they never call me back to provide me the results so if I go in the portal I can see what my results are and probably the GP didn't see something when I go he says, "Oh okay, oh" so now I go on the research and see what it is, so I can see all the information there" - Participant 3 (64, Female)

Participants reported taking an active role in reviewing their test results, facilitated by easy access to their health records through digital portals. This increased access enables patients to communicate confidently with healthcare providers about their results and the necessary actions.

"And it's the most recent experience this week. So, I had some blood tests done and I've got the app where you, you know the patient, the... what's it called? Care Exchange? So, you can see your results. So, my thyroid levels were a bit all over the place and so I contacted the GP to make an appointment to see if I could get the medication adjusted."- Participant 13 (44 , Female)

Furthermore, the availability of electronic health information improves their understanding of post-operative instructions, increasing awareness of their recovery progress.

"during rehab she gave me a lot of exercises to do and of course I couldn't remember the first exercise by the time she got to the last one, and it was really helpful as she sent me this email afterwards where she just summarised what had happened in our meeting and had this wonderful little PDF document with images of what the exercises should be like and just reminding me what to do and a little list that

you had to tick every day when you were doing it. So, things like that, they can help a lot.” - Participant 9 (35, Male)

Subtheme 4: Perceived Concerns

The group expressed their concern about data security, with participants emphasising a preference for the NHS app over third-party alternatives. They believed their data was safer with the NHS as it holds individuals accountable for data breaches, providing reassurance to their engagement with eHealth technologies.

“I guess it can all be hacked. Other people can access your information or if you’re not... like my mum, for example, is terrified of technology.” - Participant 7 (33, Female)

“This is why we say NHS app ... because then obviously there’s someone held accountable, isn’t there? You know, it’s a body as opposed to an individual small company. And you don’t want your data passed round, your name, your details” - Participant 13 (44 , Female)

A small number of participants have expressed hesitancy in sharing their data and engaging in virtual interactions due to privacy concerns. They are worried that discussing sensitive topics remotely could cause embarrassment or harm if the conversation was leaked. Additionally, they have reservations about inadvertently revealing details of their living environment and circumstances, which could infringe on their personal privacy.

“I have quite a few points about video calls. It’s, to me, it’s like my privacy. I feel like if I was, I mean, I was asked to do the face and then a live... and I didn’t want to show my, you know, where I live, how I live. And so that’s why I refused it. And it was a counselling which was very important at the time. I wasn’t really, I was really down. And so, video, I don’t think so. I mean for some patients it’s off-putting, like myself. And I have missed quite a few appointments because of it. I just said, “No, I’m fine. Goodbye”. I don’t want to do the video calling.” - Participant 11 (58 , Female)

Theme 2: Burden

In this theme, we discussed the perceived effort required to use eHealth technology.

Subtheme 1- Technical challenges

Participants found the major challenges to be technical difficulties, platform complexities, and issues related to connectivity.

One common concern was the lack of interoperability between different digital platforms. Participants reported instances where they received notifications of their latest health results on their digital apps, only to discover that their General Practitioner (GP) did not have access to these up-to-date records. This inconsistency raised doubts about the reliability of the technology. Furthermore, the abundance of apps with similar functions presented an additional challenge, leaving patients unsure about which ones to download and use for their specific healthcare needs. There was a clear desire for a more integrated system.

"I think for me there are so many other, every hospital or every GP has got different app or different site, different place for me to look on. And then I get confused which one, which design logo, which hospital should I look on because every single one of them is saying a new app that you have to log on your phone. And then it's not all... how can I say it? Combined together. And it says that you can find your results this. It's very difficult to navigate."- Participant 11 (58 , Female)

Participants also found booking appointments through hospital IT systems cumbersome. They had to manage multiple passwords for different appointments and family members, which led to frustration and inconvenience. The process was further complicated by connectivity issues, such as dropped WiFi signals, which made it difficult for them to use eHealth tools effectively.

"at our local hospital, you get sent the appointment, you get sent a PIN, and what they do is when they sent an appointment, they won't say whose name it is, who it's for. I've got four children, so I'm the primary contact, so they have my phone number. "You have an appointment. Please log on". So, then it's like playing the lottery. So, first I'll put one child's name and date of birth in. Not them. Then I'll put the other child's. Not them. Then I put my own in. You know? Eventually we'll get there. But what I'm saying is, you know, can you see there's flaws ... Things just need finetuning a little bit." - Participant 13 (44 , Female)

Subtheme 2: Cost

The group agreed that the cost of using eHealth technologies is a crucial factor in their acceptance, especially given the current cost-of-living crisis. The expense of internet access and the necessary equipment are important factors that affect people's ability to engage with these technologies. For some individuals, particularly those not tech-savvy, the financial burden of acquiring the required devices and internet packages may prevent some people from considering using health technology altogether.

“But we’ve got to be able to allow them to be able to access that information in an appropriate way, and it can’t always be at our expense. People who can’t afford, you know, the £40 per month for their phone are not going to be able to access information because, you know, that’s one expense they can’t afford. We’ve got to find solutions that are appropriate for them to engage.”- Participant 6 (72, Male)

Theme 3: Ethicality

This theme concerns how eHealth interventions fit with individuals' value systems.

Subtheme 1: Attitude to technology adoption

Participants displayed various attitudes toward adopting technology. Some showed great enthusiasm for new technologies, taking a proactive stance by staying updated on the latest advancements, reading product reviews, and evaluating product features. They carefully considered a product's compatibility with existing devices and its overall value before adopting it. Furthermore, the support of family members played a significant role, with families investing in tech products such as smartwatches to aid in health monitoring and support.

“I like new technology, but I'm not going to buy the latest and the greatest. But what I do is I'm on the website, I probably look at some publications or reviews of the products. So if someone says, “Look, it's not measuring my steps correctly compared to my Fitbit or something, then I know that there's something, there's a high number of negative reviews, I probably look at that and I probably look at also the tech reviews, not just customer reviews but also tech reviews of what they think of a product. And also I look at how it kind of synchronise is with all my other devices. So, some people are, have bought into the Apple ecosystem, and that's fine for them, and I'm into the Samsung ecosystem, so Android. And others like the Google ecosystem. So, I kind of use that to kind of manage my health as best as I can.”- Participant 14 (45, Male)

On the other hand, some individuals can be categorised as late adopters, demonstrating a more careful stance towards adopting technology. While they may utilise technology for essential daily tasks, they exhibit hesitancy when it comes to embracing eHealth interventions. For these individuals, integrating eHealth technologies presents additional obstacles that impede their involvement.

"I just got a ten-inch tablet, I don't know what you can do with that, you know, I can order things online, I can do that with this 4 gigabyte on this 8-year-old phone I can order things from Amazon and I'm quite satisfied with that... but when I get that text, you know, to do face to face on this Zoom, they sent me a second [hospital] appointment, I rang them up yesterday and I was going to explain it but then when they said you're number four in the queue I thought to myself, I can't be bothered" - Participant 4 (65 , Male)

Subtheme 2: Inclusivity

The group has highlighted the importance of providing inclusive healthcare services that cater to all individuals and consider those with varying abilities and preferences. They believe that it is crucial to acknowledge the requirements of people who opt not to use technology to access healthcare services. Thus, it is vital to maintain traditional methods of healthcare access to prevent any bias based on technology usage and to ensure equitable access to healthcare services for everyone.

"my mum doesn't have a smartphone so there's things like she'll sometimes... and she can be so cut off from things sometimes. Like they'll say, "Oh, we've sent a picture to your phone," and she'll say, "Well, my phone doesn't receive pictures," or a link, and then we're suddenly then almost like pushed aside in society if you don't have a smartphone."- Participant 7 (33, Female)

"I definitely think it's here to stay, but it needs to be accessible and inclusive, especially to a neurodiverse audience." - Participant 8 (36, Female)

"You can't leave people behind... everyone's got to move in the same direction." - Participant 13 (44, Female)

Theme 4: Intervention coherence

This theme explored how the effectiveness of eHealth technology is influenced by the understanding of the intervention by both healthcare professionals and the patients, as well as how it works in relation to the problem it targets. During the discussion, participants shared varying perspectives based on their past experiences with eHealth technology. One participant found remote consultations to be simple and efficient, whereas another participant identified inherent limitations in using eHealth technology.

“GP he asked me to send pictures to see what’s going on. And then I sent him the pictures, he said, “I think it’s an eczema, but to make sure that you need to book you in”. Next day I could able to book in. And he gave me a skin cream and it cured, it’s better than ever, And it feels like it’s so smooth and so easy, and that’s exactly what you want. That’s all, that’s all we all want. That’s all we all want, don’t we?” - Participant 12 (51, Female)

Participants emphasised that there are situations when relying on technology to manage certain medical conditions may not be appropriate. Furthermore, they highlighted that some people may lack the necessary computing skills to effectively use eHealth interventions. Consequently, it is imperative for clinicians to have a comprehensive understanding of the technology's capabilities and limitations before integrating it into clinical practice.

“I’ve seen the neurologist recently he said to me to send videos which I don’t even have videos of when I am in full seizure mode, I mean that’s not what somebody would be looking to do, take videos if you’re having a seizure... When I got home I eventually sent the videos because trying to send videos over email is quite tricky if you do not know how to use technology. So I literally had to go and look for an app to compress all of the videos and then able to send all of them via email”- Participant 1 (41, Female)

Theme 5: Opportunity costs

Subtheme 1 – Face-to-face interactions

Participants discussed the trade-off between the increasing use of eHealth technologies and traditional face-to-face interactions. They highlighted the importance of real human connections and trust in healthcare interactions and pointed out that digital communication platforms have limitations in conveying nuances such as tone and body language.

“I guess it’s finding the balance between speaking to someone face to face and having that real connection with someone and trusting someone and them knowing what they’re talking about because it’s different, isn’t it, speaking to someone face to face and speaking to someone on a computer, WhatsApp, things get missed even on... even if you’re not talking about medical things. Sometimes

tone gets... the tone might not be right or someone doesn't say something. So, I think for me, I guess finding the balance between technology and face to face I think is quite important.” - Participant 2 (30, Female)

They believe that face-to-face interactions are crucial when conducting physical examinations and discussing complex or critical clinical decisions to avoid any misunderstandings. They suggested that some people may process information differently through phone conversations, indicating the need for supplementary materials to enhance comprehension. However, they also acknowledge that there are situations where remote consultations are suitable, such as when managing mild symptoms or communicating routine test results.

“There have been other times when I've had phone calls like say for instance if I need to get results or something like that where they could give me that information over the phone and it wasn't necessary for them to see me but like you, I'm a diabetic as well so you need to come in for those diabetic checks, they need to actually physically see your feet, they need to see if you've got a cut that's not healing or whatever.” - Participant 8 (36, Female)

“But because of my complicated medical issue I'd rather a face to face because probably I might come for one thing but during the discussion with my GP she might ask something and I say yes, it does happen and then probably she might think, “Okay, it's important, so probably we should send you to a specialist for this, we should get this checked out.” - Participant 1 (41, Female)

Subtheme 2- Non-verbal communications

The participants also highlighted the importance of non-verbal cues and human empathy while delivering significant news. They expressed concerns about the inability to convey compassion effectively over the phone. Additionally, they cited long waits for specialist reviews and disappointment with telephone-based consultations as barriers to their acceptance.

“I think it's easier to do that face to face, you can see the facial expressions, you can actually see the compassion and she was so compassionate and for me that meant quite a lot, I wouldn't have been able to do that over the phone because over the phone it's like a rush, rush. But when you're speaking face to face you can see the reactions and she's explaining, you can internalise what is being said you can say, “Okay, so you said that so what about this? What about the other” and you can have that meaningful discussion as opposed to over the phone, you still get time to ask certain questions and get information for you to make informative decisions” - Participant 3 (64, Female)

Theme 6: Perceived Effectiveness

The group felt strongly that the effectiveness of eHealth programs depends on the level of clinicians' engagement with the technology. Some participants have noticed a lack of commitment from healthcare professionals to effectively integrate technology into healthcare delivery. They have noted situations where clinicians appeared to be unfamiliar with digital communication methods, unaware of technological issues, or unable to provide adequate support. This has resulted in a weakening of the doctor-patient relationship and a feeling of inconsistency in care provision. Participants have expressed that they are reluctant to embrace eHealth technology without the endorsement of clinicians, emphasising the necessity for a collaborative learning process between patients and healthcare providers.

" Sometimes you don't understand why things don't work and yet they've provided the platforms, they don't know that all of their patients have got that same technology or ability to be able to utilise it .. I think the answer is we're dealing with humans as well, aren't we? Technology is not the problem here, it's human beings who are trying to deliver the issues... it's all about the investment of time and, you know, in this. But if someone's going to provide it, you know, this technology, they've got to play their part and deliver it in a true and sensible way... I think there's an awful lot of learning on both sides, both patient and the healthcare professionals as to how to engage with technology" - Participant 6 (72, Male)

The COVID-19 pandemic has aggravated feelings of invisibility and detachment from healthcare professionals. As interactions increasingly occurred through phone calls and computers, participants noted difficulties in initiating contact with healthcare providers and navigating virtual queues.

"You know, healthcare people have become invisible. They almost hide behind the phone, the computer, you know, whatever. You can contact them but only if you initiate it rather than they initiating it. So, healthcare people become invisible and the more the technology is thrust upon us in terms of, "Oh, send your urine sample in, send your throat swab, send your blood," you know, whatever, it means that you don't have to go to the clinic. You don't have to see anybody. You don't have to talk to anybody, you can almost do it like remotely and I just feel in a way that healthcare workers are almost hiding behind the façade." - Participant 6 (72, Male)

Some participants have voiced their frustration with the insufficient communication and lack of response from their healthcare providers. Patients feel confused and overwhelmed when reaching out to healthcare professionals because they are frequently directed to different individuals or departments without clear guidance. Navigating through these complexities requires persistent efforts, and some participants have reported feeling neglected or dismissed by healthcare staff. They have emphasised the need for clearer communication channels and support mechanisms while introducing technology.

"I had a problem dislocating my shoulder that happened in France, and when I came back, I wanted to see a doctor just to follow things up. And it was impossible for me to figure out who to call. And I would call someone and they'd say, "No, you need to call this other person," And they're just constantly sending you to different areas, and it requires the patient to be very persistent. It almost feels like they're hoping that if they put you off enough then you'll be like, "Oh, that's fine. It'll heal on its own"... And you do say they offer a lot of options in terms of the way they can contact them, but none of them seem to be efficient enough. So, would it be better just to have one option and say, "This is how you contact them. If this happens, this is what you do and this always works," as opposed to offering like a hundred of them and none of them work." - Participant 9 (35, Male)

Staff shortages and limited time during consultations have weakened the relationship between healthcare staff and patients. Patients often feel rushed or overlooked when communicating through digital means, which contrasts with face-to-face interactions, where patients feel more comfortable requesting immediate attention.

"And even when you get to see someone, I'm sure it's because of shortages, but it feels like no-one really cares. You're in there with the GP and they're kind of like, "Okay, cool, yeah, yeah, yeah, okay," and you're talking and it feels like they want to get you out and see the next person or if they're three appointments behind, whatever, so you're constantly like, "Okay, I need to say this really quickly and really fast," which then things get missed and then things don't get diagnosed. So, yeah, I think that's what it feels like constantly, even with the phone calls, like, "Call someone else. Call someone else". It's just constantly shifting responsibility onto other people, which is made easier by technology... if you storm into surgery and be like, "Someone fix me," they can't ignore it. They can't ignore you and they can't ignore you on a human level, whereas sending emails, yeah, they can ignore it." - Participant 7 (33, Female)

Participants also expressed scepticism towards the reliability of eHealth technologies, particularly when clinicians dismissed patient-provided results obtained through online platforms.

"I had some blood tests done and I've got the app Care Exchange to see the results. ... when I spoke to the GP, she didn't have the same results in front of her which was a bit peculiar because you expect her to have the same results. She was adamant what I was seeing was wrong... I think if it was face to face I could have shown it to her. I needed to have my medication adjusted – it was like I was almost lying. - Participant 13 (44, Female)

Theme 7: Self-efficacy

Subtheme 1: Technical abilities

This theme explores participants' confidence in performing necessary behaviours in the intervention, emphasising the need for inclusive strategies to accommodate diverse technology competencies and preferences. The group acknowledges that many in society may be unable to use technology, citing reasons such as educational backgrounds or old age.

"my mother had schooling in Uganda and she hadn't even reached O Levels, I think it's probably just primary school and how can you teach somebody like, "Oh, here's the iPhone", "Oh, here's another phone" and, yeah, start using it? It's so difficult." Participant 3 (64, Female)

there's probably a lot of people my age that haven't got the technology ...I'd say there are a lot of people that just can't deal with it or do it."- Participant 4 (65, Male)

Subtheme 2: Non-digital alternatives

Participants identified a need for readily available alternative options to complement digital technologies, especially for those who may not be as comfortable or capable of using such platforms. They recommended initiatives such as maintaining face-to-face interactions with healthcare providers, providing alternative support for technology-related issues, and addressing the needs of individuals without access to smart devices. Additionally, it is crucial to allow patients free choice to decide if they would like to participate in eHealth technologies without compromising the quality of their care.

"My mum hates technology, everything she would... she wants to deal with people and I think you also have to take that into consideration. You can't suddenly just be like, "Oh, technology's amazing," and push it on people. Of course, the way we're going, as you said, the four, five-year-olds that are... we're all going to be digitally, but for now you have to take those people into consideration, people that don't want to use technology, people that for whatever their reasons are don't want to use it, that there then has to be... they still have to have accessible medical care. It can't just be, "Right, we're doing everything digitally now. So, there's still the... you're always going to have to have another way, yeah." – Participant 7 (33, Female)

"But also, I think coming back to that think about maybe opting into digital, so maybe when you register with the GP, says, "Are you happy to receive digital services? Yes or no". And that way are you competent? And then you can say, "Yes, I can". "Do you have...?" because some people Don't have access to the Internet at home, they're experiencing digital poverty, they have no devices, they have

no clue. So, I think if you're sending them links to, clickable links and they can't access that "- Participant 14 (45, Male)

Subtheme 3: Training and support

The group highlighted the importance of targeted education and training programs to enhance eHealth literacy for people of all ages and backgrounds. They emphasised that healthcare providers should not assume someone's technical abilities based on characteristics like old age and should not automatically exclude them. The group suggested introducing patients to eHealth tools in a personalised manner, focusing on providing step-by-step instructions for essential tasks such as logging in and navigating digital platforms that they plan to use.

"You know, to tell you the truth, older people are not stupid, they're just either can't see properly, they can't hear properly and they can't touch properly sometimes with whatever, and also they're afraid because they haven't... they'll be seen to be stupid if they can't use such a device, or they're confused, you know, they've understood what it's about but then if a message comes up, re-put in your password again, you know, "What the hell is that?" you know, etc. It confuses them because there are unexpected issues. But if there was, you know, a patient-directed technology so, for instance, if you were in hospital and, again, it comes back to this initial consultation and someone explaining it to you, but if they were given devices, "This is how it works. You press A, you press" you know, digital technology can be specific and focused to individuals."- Participant 6 (72, Male)

"I think that's what's most important, when we are teaching digital skills, we don't show someone how to use the computer completely, you know, every aspect, how to use folders, files, transfer formatting. What's really important is for it to do what you want it to do. So, if your needs are just to check your emails, watch YouTube videos, and you can do that confidently and independently, that is more than enough. So, I think you've got to make sure that that information knowledge it's not encompassing everything, because then it will be almost impossible to get everyone to that stage, to kind of make it really specific." Participant 14 (45, Male)

Participants proposed the establishment of dedicated digital technology departments within healthcare institutions to address patients' aftercare needs. This department could offer equipment loans, such as pre-loaded iPads for remote follow-ups, and conduct training sessions to ensure equal access to digital healthcare. Technology specialists could provide personalised instructions and support to accommodate varying abilities, helping patients build confidence and competence in using eHealth.

"It should have been provided at the point that we were given the letter about the portal and say, "Look, this is the portal, this is what you do to sign up for it" it would have been great just even 20 minutes, it doesn't have to be that long just something set up on a screen this is how you do your password, this is how you navigate it, this is where you find your results, , check it, how frequently you need to check it, do you know what I mean, depending on what your circumstances are, just something just to give people the confidence to actually use it because otherwise you don't, you know, you just rely on... for me if I'm relying on the text I might not get to where I'm supposed to get so you do need to use it" - Participant 5 (54, Female)

Some participants have suggested that technology engagement should start at the community level by establishing a single point of contact to promote digital inclusion. This can be achieved through community-centric initiatives such as digital learning sessions at GP surgeries, libraries, or community centres. These sessions should be designed to cater to the diverse learning preferences and linguistic needs of patients, using a combination of video and in-person guidance such as practical demonstrations and interactive workshops.

"... so that NHS app, we all have access to it because we all managed to get on it somehow during COVID, didn't we? We did it, you know? Slowly but surely. They really should have little surgeries. You know in libraries or community centres, you know we're an hour a week some company gets a bit of funding to sit there and have digital sessions for the elderly, and physically help you, so physically help you download and maybe give you a little worksheet, so maybe have a sheet in different languages. You know, there is ways to do it." - Participant 13 (44, Female)

Others suggested integrating medical technology education into early schooling and offering specialised training programs to bridge the digital divide. A technologically capable generation can act as advocates and support the wider family network.

"I think there's also an element of introducing how to use technology linked to medicine early on in school so that you kind of grow up with it, I think now because it is available it would make sure that the next generation can kind of understand it as a whole and be used to it and it becomes second nature so they can actually help other generations as well because I help my mum, I help my grandad, he's got Parkinson's. He doesn't actually speak English so anything to do with technology it's me and my mum helping him because we know how to use it so it's kind of being able to get like a whole bubble that can help independently as well as maybe training courses for people that might not have that support as well." - Participant 2 (30, Female)

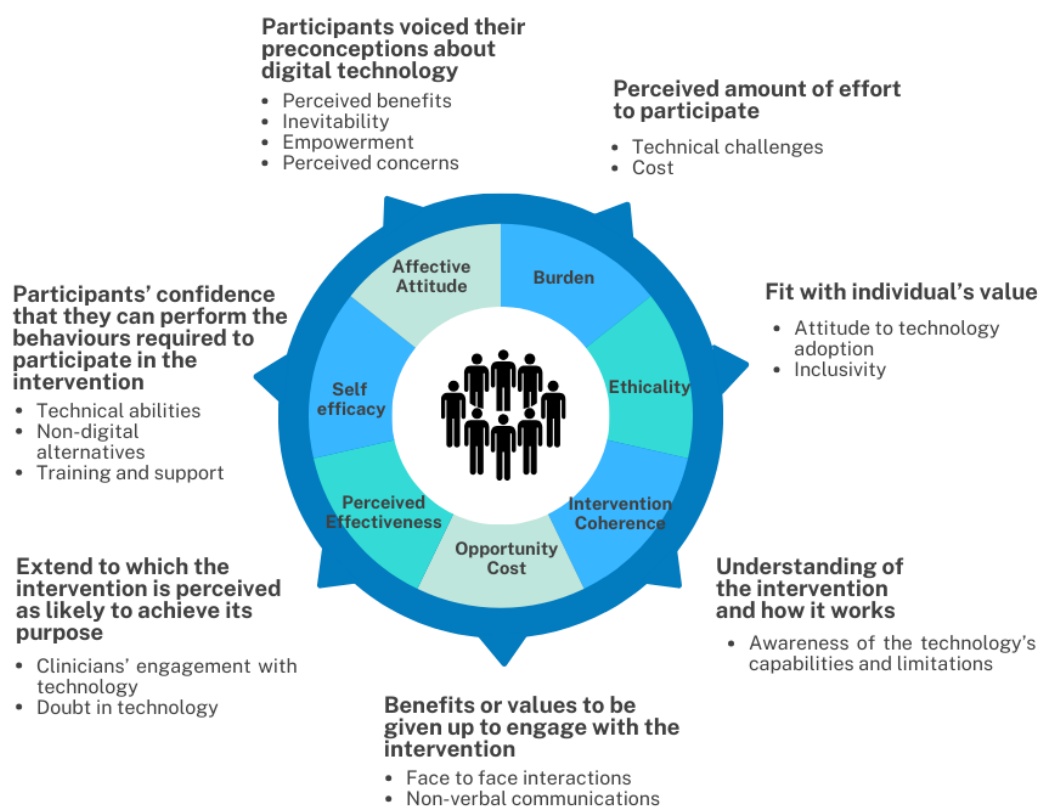


Figure 5-1 Thematic map

5.4 Discussion

The findings of this study demonstrate that participants held mixed and often ambivalent views about eHealth technologies in the context of surgical care. While many recognised potential benefits—such as convenience, access to information, and opportunities for self-management—these positive perceptions were consistently accompanied by substantial concerns. Participants described technical frustrations, connectivity problems, cost barriers, worries about losing face-to-face contact, and challenges in navigating digital systems. For several, these burdens outweighed the perceived advantages.

Participants tended to evaluate eHealth through a lens of conditional acceptance: technology was appreciated when it worked well, was supported by clinicians, and complemented rather than replaced interpersonal care. At the same time, the limitations of digital access, lack of interoperability, insufficient support, and variable clinician engagement shaped a cautious and sometimes sceptical approach.

This nuanced pattern of coexisting enthusiasm and concern aligns with previous literature showing that patient acceptance of digital health is highly context-dependent and influenced by personal capabilities, resources, and clinical relationships.

Empowerment

They recognise its potential to improve their surgical experience, which is consistent with existing literature emphasising the increasing acceptance of eHealth technologies among patients (Hägglund et al., 2022). Our findings that participants appreciate the convenience, accessibility and increased sense of empowerment provided by eHealth are consistent with previous research. For instance, systematic reviews by Taylor et al. (2022) and Jonker et al. (2020) have similarly highlighted that patients value the convenience and accessibility offered by eHealth platforms, particularly in managing chronic conditions (Taylor et al., 2022) and post-operative care (Jonker et al., 2020). A review of general patient perspectives by Madanian et al. found that patients who engage with eHealth tools tend to feel more in control of their health management and exhibit higher satisfaction with their healthcare experiences (Madianian et al., 2023). Similarly, a systematic review by Shaw et al. (2018) concluded that eHealth interventions can enhance patient engagement and improve clinical outcomes, particularly when patients have access to their health data and can actively participate in decision-making (Shaw et al., 2017). Our research expands on these findings by demonstrating that patients undergoing surgery have specific eHealth requirements related to their surgical care. They found it helpful to receive information through videos regarding pre-and post-operative care and rehabilitation exercises, which they could easily access on their smartphones to review and reinforce what they had learned. Furthermore, they expressed a need for features that would enable continuous monitoring and real-time sharing of health data with their healthcare providers and family members. This highlights the growing use of eHealth for improved monitoring in outpatient settings and the push for enhanced recovery and virtual wards, as outlined in the NHS Long Term Plan, which aims to boost out-of-hospital care (Alderwick and Dixon, 2019).

Barriers and Inclusivity

The study also revealed a societal shift towards integrating technology into daily life, accelerated by the COVID-19 pandemic. The participants recognised that the growing use of eHealth technologies is unavoidable. However, they expressed concern for individuals lacking the necessary skills or access to technology, as it could potentially widen healthcare disparities. The burdens associated with eHealth adoption were discussed, including technical difficulties, platform complexities, connectivity issues, and the lack of interoperability between digital systems. The financial burden of obtaining smart devices and internet subscriptions during the current cost of living crises further hindered widespread adoption. The challenges described here were similar to those previously reported in a systematic review on the use of telemedicine (Reinhardt et al., 2021), mobile health apps in general practice (Byambasuren et al., 2020) and eHealth interventions in dermatology (Ariens et al., 2017). All participants, regardless of age,

strongly believe that eHealth should be customised to meet the specific needs of the patient and their stage of treatment. For example, they feel that remote consultations are more suitable for follow-up monitoring, especially when patients already have a good relationship with their healthcare providers. They emphasised that the use of eHealth should always be the patients' choice and should never be imposed on them. These requirements highlight the unique needs of surgical patients, including both acute and chronic care for a wide range of health conditions that require personalised eHealth strategies.

Clinician Availability and Trust

A distinct theme identified from this study revealed that the effectiveness of eHealth as perceived by participants depended on healthcare professionals' familiarity and responsiveness to technology. The COVID-19 pandemic intensified feelings of detachment among participants, as patients found it extremely challenging to access their healthcare professionals. They felt pressured to rely on eHealth and telemedicine without adequate guidance or support. There is a concern that clinicians may be using technology as an excuse to avoid contact with patients even after the pandemic. Participants also discussed how the improper use of eHealth technologies could weaken patient-provider relationships, emphasising the crucial role of healthcare professionals' engagement with digital tools in maintaining trust and ensuring consistent care. Furthermore, the theme of Opportunity Costs highlighted the trade-offs between digital convenience and the nuanced communication possible through face-to-face interactions. Participants stressed the need for a balanced approach, emphasising the importance of both digital and face-to-face healthcare interactions in preserving human connection and empathy. Studies by Norbery (2023) and Hammersley et al. (2019) have highlighted that the shift towards digital consultations can lead to a perceived reduction in the quality of care, particularly when face-to-face interactions are minimised (Norberg et al., 2023, Hammersley et al., 2019b). Unlike previous studies on eHealth barriers (Granja et al., 2018, Houser et al., 2023), the participants did not consider privacy and security concerns to be significant issues, as they had a high level of trust in NHS and clinician-recommended technologies. Maintaining this trust is vital to ensure continuous improvement in eHealth implementation.

Education and Training

The importance of education and training in improving eHealth adoption is well-supported by existing literature. Shaw et al. (2020) emphasised the necessity of targeted training programs to ensure that all patients, regardless of their digital proficiency can take advantage of eHealth technologies (Shaw et al., 2020). Our study focused on community-based initiatives and establishing digital support services

within healthcare institutions, which aligns with these recommendations and offers practical solutions to bridge the digital divide. Participants in our study challenged the common assumption that older individuals lack interest or ability to engage in eHealth (Frishammar et al., 2023, Cimperman et al., 2016). This aligns with the findings of the Digital Health Survey presented in Chapter 4, which advocated for inclusive strategies accommodating varying technical abilities through targeted education programs and dedicated support structures within healthcare institutions. This study was unable to determine the role of formal eHealth literacy assessments due to the lack of familiarity by our participants.

5.5 Limitations

The study's findings are based on a relatively small sample size. Although it included patients from diverse backgrounds and age groups, they are generally highly educated, reflecting the urban city demographic. This could limit the generalizability of the results. While the qualitative approach provided in-depth insights into participants' perceptions, a larger and more diverse sample would be necessary to validate these findings across different demographic groups and healthcare settings. Participation in the focus group is voluntary, with additional recruitment through snowball sampling. This self-selection could introduce bias, as those who chose to participate may have had stronger opinions about eHealth. This could skew the findings towards more favourable perspectives, potentially overlooking the views of more neutral or less engaged individuals. A further limitation of this study is the under-representation of groups who are typically most affected by digital exclusion. In particular, adults over the age of 75 and individuals who do not speak English fluently were largely absent from the sample. These groups are known to face significant barriers to engaging with eHealth, including lower digital literacy, limited access to devices or internet connectivity, and greater reliance on face-to-face communication. Their exclusion means that the findings may not fully capture the needs, concerns, and priorities of those most vulnerable to inequities in digital healthcare adoption. As such, the perspectives presented here likely reflect a more digitally engaged population, and future research should prioritise targeted recruitment strategies to ensure the inclusion of older adults, non-English speakers, and those with low eHealth literacy.

While this study provides a comprehensive view of patient perceptions, it did not include the perspectives of healthcare providers. Understanding how clinicians view the integration of eHealth into their practice is crucial for addressing the identified challenges, particularly those related to clinician availability, trust, and the reliability of eHealth technologies.

Future research could explore these perspectives to provide a more holistic view of eHealth adoption in surgical care. Additionally, a detailed strategy for the design of bespoke eHealth training programs remains under exploration.

5.6 Conclusions

This study contributes to the growing body of literature on eHealth by highlighting both the positive perceptions and the challenges associated with its adoption in surgical care. While patients are generally optimistic about eHealth's potential, the findings highlighted the need for individualised support, inclusive strategies, and a balanced approach that integrates digital and traditional care models. Addressing these challenges through targeted education, training, and support measures will be essential for realising eHealth's full potential in enhancing patient outcomes and experiences.

Table 4 Summary of key findings

Key Findings	Barriers	Facilitators	Implications for Clinical Practice	Implications for Policy	Implementation Recommendations
Convenience and accessibility of eHealth valued	Technical difficulties; interoperability; connectivity	Simple platforms; clinician endorsement	Provide onboarding/support; ensure digital follow-up	Invest in interoperable systems	Standardised onboarding; fund digital navigators
Desire for autonomy via access	Low skills; lack confidence	Training; family support	Digital literacy assessment + tailored support	Expand digital inclusion programmes	Pre-loaded devices; in-person tutorials
Need for face-to-face for complex issues	Loss of non-verbal cues; clinician inaccessibility	Hybrid pathways	Maintain blended models with criteria	Guidance on digital consult standards	Mandate hybrid pathways
Concerns about clinician engagement	Inconsistent use; delayed responses	Clear communication channels	Improve clinician training	Protected digital communication time	Monitor response times; eHealth competency standards
Digital exclusion for older/non-English speakers/poverty	Cost; language; inaccessible interfaces	Community programmes; multilingual resources	Use interpreters; translated materials	Invest in digital poverty initiatives	Subsidised data; tech hubs; multilingual onboarding

Chapter 6

6 Factors influencing healthcare professionals acceptance and use of eHealth technologies- an interview study

6.1 Introduction

The digital transformation within large healthcare organisations is a complex and expensive process, especially in systems as intricate as the UK's National Health Service (NHS)(Maguire, 2018). Previous efforts to promote eHealth and healthcare digitalisation, such as the discontinued National Programme for IT initiated in 2002, revealed significant challenges (House of Commons, 2013). A significant barrier was the inability to effectively integrate technology with clinical workflows and secure adequate buy-in from key stakeholders including clinicians (National Audit Office, 2020). The Wachter Review also recommended the importance of understanding and supporting the needs and perspectives of clinicians, promoting adaptive changes in organisational culture and practices for successful digital transformation (Wachter, 2016).

Recent literature continues to reflect these concerns. A systematic review of clinicians' perceptions of eHealth across all specialities revealed multiple challenges that clinicians face, particularly in the lack of adequate IT infrastructure, technical difficulties, incompatibility with personal and work cultures and fears of increased workload (Borges do Nascimento et al., 2023). In another review involving cardiovascular care practitioners, clinicians similarly cited the lack of robust digital infrastructure and the poor integration of new technologies with existing electronic medical records as significant obstacles to the effective adoption of eHealth (Whitelaw et al., 2021). Moreover, a recent review conducted by our team focusing on surgical care practitioners highlighted that clinicians' perceptions of an intervention's effectiveness are critical to its successful implementation. If clinicians do not perceive these tools as effective or beneficial to patient care, their adoption will likely be limited (Ahmed et al., 2025).

Insights from patient focus groups in the previous chapter of this thesis have highlighted the vital role of clinician attitudes in adopting eHealth technologies. Patients stressed that clinician endorsement and involvement are crucial for their willingness to use digital health tools. This emphasizes the importance of thoroughly exploring clinician perspectives, especially those involved in the surgical care pathways, to uncover potential barriers and facilitators to eHealth adoption.

This chapter addresses the gap by presenting findings from interviews with a diverse range of clinicians involved in the surgical patient journey. Participants include professionals from various surgical care teams, such as endoscopy screening, surgeons, eHealth researchers, pharmacy, and physiotherapy. Through these discussions, I aim to capture a comprehensive understanding of clinicians' perceptions, concerns, and the challenges they face in integrating eHealth into surgical care. I seek to inform strategies that can enhance the clinicians' adoption of eHealth technologies, ensuring that they are both effective and well-integrated into clinical practice.

6.2 Methods

6.2.1 Study Design

A semi-structured interview design was used to enable an in-depth exploration of clinicians' perceptions of digital health and their professional experiences in patient-facing roles. Eighteen potentially eligible clinicians were approached via email, text message or phone; fourteen agreed to take part, and four declined, primarily due to clinical workload constraints. Recruitment occurred between February and April 2023. Purposive sampling ensured a diverse representation across the surgical multidisciplinary team, including nurses, pharmacists, physiotherapists, surgeons, service managers, and eHealth researchers. To enhance diversity and to access clinicians from different services and Trusts, snowball sampling was also employed, allowing existing participants to recommend colleagues who met the criteria.

Participants were recruited through the research team's professional networks within NHS Trusts. The researcher had limited pre-existing professional relationships with some participants from current or previous workplaces, and a small number were reached via the extended networks of supervisory team members. To mitigate any potential power dynamics or researcher influence, the study emphasised voluntary participation, clarified that participation or declining would have no consequences for workplace relationships, and used a consistent topic guide to minimise interviewer bias. Reflexive notes were maintained throughout data collection to acknowledge and bracket the researcher's assumptions. Eligibility criteria required participants to be aged 18 years or older, proficient in English, and able to provide written informed consent. Individuals unable to provide written informed consent or without sufficient English proficiency were excluded.

6.2.2 Data Collection

Interviews were conducted via Microsoft Teams. The doctoral student used a pre-determined topic guide, included in Appendix 2. This guide was developed collaboratively with the supervisory team and mirrored key domains explored in the earlier patient focus groups, but reframed to reflect clinicians' perspectives—for example, focusing on workflow integration, perceived risks and benefits, and professional experiences with digital health tools. Interviews lasted an average of 32 minutes (range

22–57 minutes). Audio recordings were auto-transcribed by Microsoft Teams and subsequently verified and corrected by the researcher. Anonymised transcripts were uploaded into NVivo (Lumivero NVivo 20) to support systematic coding and organisation of the dataset. Recruitment concluded following fourteen clinician interviews when thematic saturation was reached, evidenced by no new concepts emerging in the final interviews. Sample size was therefore guided by information power and is consistent with recommendations for in-depth qualitative interviews in relatively homogenous clinical groups.

6.2.3 Ethical Considerations

The study received approval from the Research Ethics Committee (REC Protocol ID 21SM7147). All participants provided written informed consent prior to their involvement in the study, ensuring that they fully understood the nature of the research and their rights as participants.

6.2.4 Data Analysis

Reflexive thematic analysis, as outlined by Braun and Clarke (Braun and Clarke, 2019), was employed to analyse the interview transcripts. The process began with an in-depth reading of the transcripts to identify recurring themes across participants. The doctoral student (CH) conducted initial coding, applying codes line-by-line to capture the essence of the data. These codes were then systematically reviewed to ensure consistency and relevance to the emerging themes. Another researcher (YG) independently verified the codes to enhance the reliability of the analysis. Any discrepancies identified between the initial codes and the transcripts were thoroughly discussed, and consensus was reached between the researchers on the final coding. Although formal peer debriefing or triangulation was not undertaken, this was due to the constraints of the doctoral research period and the practical difficulties of arranging follow-up analytic meetings with busy clinicians. Rigour was instead supported through reflexive journalling, independent verification of codes, and supervision meetings. The final themes were developed inductively and refined iteratively to form the conceptual framework presented in the results.

6.3 Results

6.3.1 Overview

Participant Characteristics

Fourteen participants took part in the interviews. The group included nine females and five males. The group comprised five advanced nurse practitioners specialised in endoscopy screening, acute surgery and coloproctology, two consultant general surgeons, two general surgery registrars, two eHealth researchers, one pharmacist, one physiotherapist and one service manager.

Participant ID	Gender	Role
1	F	Consultant Surgeon
2	M	Pharmacist
3	M	Researcher
4	F	Researcher
5	M	Registrar
6	M	Registrar
7	F	Service manager
8	M	Advanced nurse practitioner
9	F	Physiotherapist
10	F	Advanced nurse practitioner
11	F	Advanced nurse practitioner
12	F	Consultant Surgeon
13	F	Advanced nurse practitioner
14	F	Advanced nurse practitioner

6.3.2 Themes

Theme 1: Perceived benefits of using technology

This section explores how digital health technologies can transform clinical practice, highlighting their benefits from the perspective of healthcare professionals.

Enhancing multidisciplinary collaboration

Digital technologies have improved the potential for interdisciplinary collaboration, allowing healthcare professionals to engage in joint consultations without being limited by physical distance. This virtual integration can facilitate a more holistic approach to patient care, drawing on diverse expertise that would be difficult to assemble in a traditional setting.

“we were holding a multidisciplinary meeting between a number of different clinical professionals and in that it definitely made what would have been impossible possible. There's no doubt about it for one of the consultations we had. A we have myself. We had a consultant gastroenterologist. We had a General practitioner. We had a dietitian, we had a HIV medicine physician. We had a radiologist. All of these people working within our trust on the on a conference call together with the patient that would never have been possible if it if it wasn't for people's familiarity with zoom and with teams and things like that.” - Participant 1 (Consultant surgeon, Female)

Another participant commented that using teleconferences resulted in significant savings in time and resources previously spent on face-to-face meetings, which enhanced operational efficiency.

“The other thing I've used a lot is for my training sessions. I work cross-site at the moment ...so on a Thursday... it was my team, Mount Vernon team, Ealing team and three teams within the community in Central and Northwest London, so the technology enables you to all come together at 2:00 o'clock you know we don't have to factor in any transport time, so that's extra activity for physiotherapy and you can all be online.” - Participant 9 (Physiotherapist, Female)

Digital technologies are also becoming increasingly important for healthcare professionals adapting to the growing prevalence of remote working arrangements. These technologies help to compensate for the lack of spontaneous, ad hoc interactions that typically occur within physical work environments, enabling healthcare professionals to collaborate effectively and maintain continuity in their clinical and academic activities.

“I think changes in working practices meaning that not everyone is on site at the same time we don't have face to face meetings as well as reduced that ability to bump into colleagues and to have those corridor chats that we used to rely on very efficiently for information transfer we don't have that anymore

so we've started to become much more used to telemedicine.” *Participant 1 (Consultant surgeon, Female)*

Improve accuracy

Participants commented that using electronic medical notes and prescribing has resulted in clearer and more legible documentation. This has significantly reduced the risk of errors caused by misinterpretation, ensuring patient safety and maintaining the accuracy of medical records.

“I mean, reading the doctor's handwriting can be quite a nightmare. It's helpful because they have to type and spell it correctly and legibly, so mistakes are minimised. Me misinterpreting paracetamol to something else.” - Participant 8 (Advanced nurse practitioner, Male)

Some highlighted the benefits of electronic health records in consolidating all medical notes and investigation results into one accessible location, making it easier for healthcare providers to access and review patient histories. This helps ensure clinical decisions are made based on the most complete and up-to-date information available, leading to better patient care.

“So I think in my day-to-day work, all of my ward rounds are done digitally. We have a complete ward and I find it personally very useful to be able to review all of the notes in one place. You're not hampered by trying to find where the notes are from the orthopaedic team. Working as a major trauma consultant I'm involved with lots of other teams and if I had to run around trying to find the notes from each team individually and be really difficult. So I think having everything in the same place, not having to contend with people's handwriting and or their diction is really really good.” - Participant 12 (Consultant surgeon, Female)

In addition, digital record-keeping can enhance medical legal protection. Documentation of clinical discussions around diagnosis, treatment, and decision-making can be stored and easily retrieved, thus safeguarding both healthcare professionals and patients.

“It is a place for the records to get stored in a safe place essentially... which theatres can use and stays with the patient throughout their journey. And you know, for historical, for medical-legal reasons as well, are you? It's most things are documented on the consent forms, but you know it doesn't replace the clinical practice in terms of the discussions we have answering questions, risks, benefits, alternative treatments, etc.” Participant 6 (Registrar, Male)

Enhanced information giving

Participants suggested that digital communications provide a more dynamic and interactive exchange of information. With screen sharing, concepts can be explained as clearly and effectively as in face-to-

face conversations. Others suggested electronic messaging and mobile health applications offered a fast and reliable channel for information dissemination, reducing the risk of undelivered mail or postal delays, and allowing patients more time to absorb and understand the information presented.

“They can show it, they can share the screen, show the storybook wherein we show the picture of the bowel and, you know, explain to them about polyps. So we show it through the screen. It's not different to what you would see face to face. So you know that option of sharing the screen, all that is quite useful for the for the practitioners as well... We also post the bowel prep instructions and you know the bowel cleansing agents. I can send the instruction leaflet via e-mail. You can have a good read of that one whilst waiting for the post considering how it is with the postal services now.” Participant 7 (Service manager, Female)

“especially with clinic letters, we've got dictated letters, most of them are dictated. It goes down to like how fast the medical secretaries type them in. So you probably have clinic now and then you probably get the letter two weeks after because the secretary able to catch up. I think patients tend to wait longer. They end up calling multiple times because they haven't heard anything or haven't received anything ... One thing that would improve is, you know, patients being able to have, you know better access to clinical letters. I think it's just, I find it primitive for patients to still receive, like GP letters and clinic letters by post. And why can't it be done through e-mail or through NHS app? You know, if people get any, they can probably get an update.” - Participant 8 (Advanced nurse practitioner, Male)

Some clinicians had experience with a hybrid model that combined remote consultations with in-person meetings. They commented that this approach helped patients better prepare for their in-person visits by providing the necessary information in advance, maximising the benefits of both digital and traditional forms of communication.

“And then we would always say on the next one [following an initial remote consultation], this is gonna be your objective assessment. Then you're gonna come in. We're going to do an examination. So actually one of the positives about not having a face to face on the first one was they could prepare for it. They knew what was coming. For the second one because the physio would have told them all about that. So actually what it happened and everyone had an initial which was remote. And then the second one was face to face. Some people didn't even want face to face.” - Participant 9 (Physiotherapist, Female)

Participants also highlighted that the abundance of information provided through digital channels may not always translate to a more personalised patient experience. The generic nature of some digital content may detract from the tailored advice and guidance that a patient might receive in a one-on-one consultation.

“And we use digital technology a little bit more now for some of our normal day-to-day stuff like for example where using a online consenting application for consenting our patients for operations and colonoscopies... It gives them a lot of information actually and probably more information that I would normally give them during my paper filled one. I think that there are benefits and they do get more information in that than I would probably give them myself, but that information isn't nuanced to their particular condition, whereas my consultation and my style would be and then if I wanted to add that level of nuance into the consent process, it's extremely time-consuming.” - Participant 1 (Consultant surgeon, Female)

Additionally, as medical knowledge is constantly evolving, and digital content needs to be frequently updated, they face a significant challenge regarding the time and resources required to keep up with these changes.

“I think some of the difficulty or the barriers is doing information leaflets goes through a lot of process and a long process. So it's not very encouraging, I must say, to try and update your leaflets maybe more than every three years. At the moment I think is like every three years, which is probably not that good. So definitely there is room for improvement, but that takes time.” - Participant 10 (Advanced nurse practitioner, Female)

Benefits to patients

Clinicians commented digital health technologies enabled patients in remote areas to get access to tertiary services. The move to digital platforms offered cost savings to patients by removing travel and parking expenses. These solutions provide flexibility for patients with different needs, for example those with childcare responsibilities, experiencing illness, or travel difficulties. Some participants suggested by providing alternative options for accessing care, digital health can reduce missed appointments and make healthcare resources more efficient.

“Most certainly there has been quite an uptake in telemedicine clinics and it's been used in pre-assessment. This is the regional centre that does things like orthopaedic surgeries and cardiac surgeries and serves everywhere from Dumfries right up to the Western Isles. You know you've only got two options. You either try and go to a clinic that's near they are, which is happened much less since COVID we used to do more of that, or you try and get the patient down to you and still provide that traditional transport service, etc, just logistically difficult and costly, but it still has to be there. That's really helped patients access it and reduce their travelling time and things like that as well. They can have their assessment closer to their home or within their own home effectively, which helps to reduce their initial admission time.” - Participant 2 (Pharmacist, Male)

"I use it a lot, so I've used both zoom and NHS anywhere platform I think is called. So we use that for patient new patient appointments and follow up appointments. I find that really good to have the option for a digital appointment because it makes patients don't have to travel, it might be good with childcare, they might not feel well that day. I think it reduces DNAs I think." - Participant 9 (Physiotherapist, Female)

In addition, electronic prescribing and dispensing of medications removed the need for patients to travel and physically wait for paper prescriptions. Some also commented on the added environmental benefit of reducing carbon footprints.

"after the procedure our consultant has to prescribe medication. Now we'll just do it online and they can pick it in any pharmacy that's nearest to their area. So that saves them time of waiting in the hospital, considering how long it will take to stay in the pharmacy outside to collect the medicine. So that sort of like we have that one in place...And apart from that, of course it reduces the carbon footprints and also think greener and everything." - Participant 13 (Advanced nurse practitioner, Female)

Remote access to results and records

The participants suggested that having remote access to patients' records and results can improve patient care and clinical efficiency. Remote monitoring and diagnostics, such as ECG and vital signs observations, can transform the care of patients recuperating at home by providing clinicians with immediate access to clinical data through mobile technologies.

"The people that have a pacemaker in and send off their arrhythmia data to your central point periodically and I think like making that more standard and across a wider variety of settings. So you can take decisions about their treatments and their drugs and this and that. You know, I think that remote monitoring could, really that's what investment needs to be. So we can get it closer to in person care." - Participant 2 (Pharmacist, Male)

Clinicians in specialist fields such as trauma surgery valued the ability to remotely access diagnostic images and real-time patient data, which facilitates swift decision-making and expedites patient management.

"I think other aspects of digital care is the ability to be able to review CT from wherever you are in the hospital and is also invaluable, particularly when you are moving around as much as I do, you know. Uh in trauma, particularly, things are time sensitive as they are in general surgery. Sometimes when I am on call, I don't have to wait till I come back into the hospital to have a look at this CT. I have remote access and I can access it there and then and I can do it whilst I'm on the phone to the registrar. I can start getting the ball rolling and whatever management the patient needs. So I feel like it creates a much

more speedy service and a better service to the patient because your diagnosis and your management is expedited by the fact that you're able to review things and at the time that the happening and from home. So without the delay in attending the hospital and having to go through it all again.” - Participant 12 (Consultant surgeon, Female)

Timely feedback

Healthcare professionals were asked to share how they used technology to provide feedback to their patients in a timely manner. Some established a single point of contact for patient queries through email to centralise communication. They set aside a specific time each day to address these communications to ensure a systematic response mechanism. Additionally, they incorporated telephone contact and committed to reviewing voice messages by the next working day, accommodating calls that occurred outside usual business hours. This multi-channel approach was adopted to maintain continuity and responsiveness. Some participants were concerned about the impact of digital communications on people's sense of urgency and anxiety. They reported a rise in complaints about delayed response times, which reflects the difficulties in meeting the expectations of patients who want an immediate response.

“We have a generic email for the bowel cancer screening, which our admin team have daily allocations on checking it. Every day, we check it in the morning and afternoon and follow up on what's on the generic e-mail. And apart from that, we also have phone line for our screening centre if they need to call us for questions. We have one to the specialist screening practitioners office, and one to the admin team. And we check voice messages first thing in the morning to cover the messages from the night before or the day late in the evening before or even on the weekends... to attend to their queries.” - Participant 13 (Advanced nurse practitioner, Female)

“Everything was urgent, I think anxieties were heightened...If we did not respond within the 24 to 48 hours we were being reported to PALS. They went via PALS to communicate with us and trying to reduce that anxiety is something that we couldn't provide because everybody's level of anxiety is different. You are at home.” - Participant 11 (Advanced nurse practitioner, Female)

Safety netting

The participants discussed the safety measures they have in place to ensure patient safety during remote consultations. They developed protocols to triage patients with concerning symptoms to be reviewed urgently and in person. Additionally, the participants emphasised the importance of providing patients with clear and easily accessible information to guide them towards emergency care in case of acute issues.

“if somebody had like raging leg pain or somebody had symptoms of cauda equina, we were like you need to come in tomorrow so that we can do the next examinations in order to rule in or rule out these red flags. So we always had standard operating procedures that we wrote to enable like the younger staff to be like, OK, this is when you need to bring someone in and this is when you're not, you don't bring someone in so they will refer to decision trees.” - Participant 9 (Physiotherapist, Female)

“ we ensure that the patient is aware of our number... we do emphasise that in the call, we give them the post-procedure instruction leaflet with the number to call in case of emergencies. The same is true that we follow it up after the procedure. - Participant 7 (Service manager, Female)

Theme 2: System-level and infrastructure challenges in using technology

This theme brings together organisational and infrastructural factors that shaped clinicians' experiences of digital health tools, including governance and data security, IT infrastructure, training and technical support, and the extent to which clinicians were involved in planning, implementation and evaluation.

Data security

Healthcare professionals have expressed concerns about data security in the context of digital health. They are particularly worried about the accurate and secure transmission of electronic information to the intended recipient, as many lack awareness about the security measures used for data transfer, data storage and the mechanisms in place to protect this information. Others have pointed out that healthcare providers must comply with the General Data Protection Regulation (GDPR) when it comes to remote monitoring and collection of patients' information.

“I do question a little bit whether when we send the information to them, if it's going to the right place in the right person. But I'm assuming that someone else handles that element of the data protection. I checked with them often, but you never 100% sure.” - Participant 1 (Consultant surgeon, Female)

“We needed to really ensure that we were compliant with GDPR security. I don't want to have any kind of surveillance at home because that can be quite obtrusive for people. And so it's making sure that things are kept within a secure network.” - Participant 4 (Researcher, Female)

The participants also expressed concern about maintaining privacy and confidentiality during video consultations and direct messaging. This issue becomes particularly challenging when patients prefer to communicate through generic messaging applications, which often do not have the necessary security features that meet the standards required by healthcare institutions. This may discourage patients from digitally engaging with healthcare providers as they may need to download and navigate unfamiliar software.

“A lot of the patients do say, oh, can we do it on WhatsApp? We can't do WhatsApp, we have to use Attend Anywhere and you explain to them why. You know, confidentiality, we can't use WhatsApp, and a lot of the patients get disappointed when you say no; so if you had something like WhatsApp but had it as secure because it's NHS, it would be better for the patient. Yeah, you get more videos that way.”- Participant 14 (Advanced nurse practitioner, Female)

IT infrastructure and interoperability

The participants highlighted the impact of IT infrastructure deficiencies on their workflow efficiency. The limited availability of computers and the slow performance of existing systems made it difficult for healthcare providers to access electronic records and utilise digital health resources effectively.

“So I think for a start, we need to make sure that our computers, I mean the computer itself is to, to scratch and up to date because some of the computers are very slow. And very old. The functional ability is not as good and sometimes it can be a bit of wasting time trying to connect onto things and get things done.”- Participant 10 (Advanced nurse practitioner, Female)

Healthcare professionals have reported difficulties in dealing with different IT systems used by various healthcare trusts. This has resulted in extra workload as they need to familiarise themselves with a new system or use outdated software that does not integrate with modern operating systems.

“And the other thing is that you can have two systems implemented they are meant to be the same. For example, here two major health boards, and those two systems don't talk to each other, so that means that all that information needs to be transcribed from one system to the other manually. I think what they need to do is have a national coordinated approach to implement these systems.”- Participant 2 (Pharmacist, Male)

Another participant commented that the lack of intuitive design in digital health software, characterised by clunky interfaces and complex functionalities, hindered user engagement and efficiency. Efforts should be made to develop software that is intuitive and user-friendly, minimising the need for extensive training.

“With digital programmes that are supposed to be high fidelity. The fact that they're not fundamentally usable and you need to have 8 hours of training or whatever it is to use them means they're not usable, right? And so the future of this space is to enhance that usability, more intuitive and more behaviourally. Accommodating systems that so people can just literally plug and play and just get on with it, and that hasn't always happened.”- Participant 3 (Researcher, Male)

IT training, support and peer technical champions

Participants have reported a shortage of adequate IT training. One issue they face is being given short notice to attend training sessions, which are limited in availability and often feel rushed. As a result, they feel unprepared to handle complex IT systems. Many healthcare providers prefer ongoing training in the workplace and value shadowing experienced users to gain practical experience.

“whilst I can use all of the programs we have, I always feel like I'm using them at a very basic level and that there is so much more that Cerner can do and that I could be using Cerner so much more effectively...And there's little time for formal training too...in my experience of it and induction generally, as we all know, hands out lots of laptops and in my experience of two inductions, by the time the laptops are handed out, the person's already moved so much through their presentation that you don't catch up.”- Participant 12 (Consultant surgeon, Female)

Despite these challenges, healthcare providers were satisfied with the availability of IT support for addressing technical issues and troubleshooting digital platforms. They commented that technical support teams were accessible during regular working hours. However, the lack of out-of-hours IT support created a gap that failed to align with clinical hours, potentially delaying the timely resolution of technical issues and impacting patient care.

“I can't speak for other organisations, but certainly in our own organisation, the eHealth department is very accessible, and they do sort of appoint people who are... in terms of ongoing support, they do try to respond to specific issues, but it tends not to fix it on a scale; this tends to be individual hiccups as they go along.” - Participant 2 (Pharmacist, Male)

“But the NHS runs 24 hours a day, seven days a week, so the meant the problem I had with the the new electronic delete system happened on a Friday afternoon and over the weekend there was very little support to know where, where to go or how to fix it.”- Participant 5 (Registrar, Male)

In addition to formal training and IT support, participants acknowledged that different individuals in healthcare settings require varying levels of support, and that informal peer support often fills this gap. Clinicians with a deeper knowledge of digital health technologies usually emerge as digital champions within their respective departments, offering guidance and assistance to their colleagues. This support network may include specialised roles, such as nurse informatics specialists, who provide targeted training and assistance in specific clinical areas.

“We all learn Cerner. That was to sit down with the house officer and they taught us what they knew and then the SHO added on a bit that they knew about accessing theatre lists. And now I handle my little tips and tricks for using the IT system. And so it's all really dependent on who came before. And I

probably do feel like if the junior had really good initial training, it would filter through the other ranks quite easily. Maybe there isn't a need for everyone's senior to have in-depth training ... You can ask and someone will show you quickly and that's what the most practical way.”- Participant 12 (Consultant surgeon, Female)

“I think it's helpful in the trust that we have Nurse informatics and so we have a designated members of nursing team where every time a technology or an application is being rolled out, they are there to introduce training or ad hoc training to members of staff.”- Participant 8 (Advanced nurse practitioner, Male)

Clinician involvement in planning, implementation and evaluation

Clinicians felt there was a lack of meaningful engagement and response to clinician feedback regarding the decision-making process regarding technology adoption, given their direct engagement with patient care and their understanding of clinical needs. They voiced frustrations when the decision-making process regarding adopting new technologies frequently falls under the purview of management or leadership teams, leading to a disconnect between the intended and actual utility of these tools in clinical settings. They also felt that resources are sometimes allocated to technologies prioritising cost savings over clinical needs.

“I've never been consulted or asked, it's just something that's been thrown in and say, here, you're using this new system now. I don't think I've ever been asked or surveyed as to what the most efficient use of the time would be, or the most appropriate technology, or even feedback regarding the implementation of a new technology. But we are one of the primary stakeholders using the technology. You need to have the stakeholders on board if you are introducing a new type of technology.”- Participant 6 (Registrar, Male)

“I went to speak to some colleagues who've been involved in the introduction of digital technology, the trust. We've had really bad experience of introducing apps. There's a lot of resistance there, like, where's the benefit? And if there is a benefit in terms of money-making, in terms of cost savings, in terms of efficiency savings, then the app would come. But when it comes to something that's purely for patient benefit, nobody really cares because it's not going to save money for the NHS.”- Participant 1 (Consultant surgeon, Female)

Healthcare professionals have emphasised the importance of collaboration during the planning and development stages of digital health initiatives. They felt that involving clinicians who possess relevant skills and knowledge in this area can ensure that technological solutions are practical and aligned with the overall healthcare system's objectives and patient care requirements.

"I think even in planning stages and innovation stages needs to be a collaborative approach and that might be a clinician who's doing an innovations, secondment ... and when I say clinician I maybe don't mean the shop floor clinician, but I mean someone with an interest and an expertise that can advise in that area. , so I know you're able to speak to other clinicians in the same language... I think when you build these things, it would be nice to think there's a common ground that we all understand the language being spoken. We all understand the direction of the project and we all understand what the start and the end points are and how we're going to get from A to B."- Participant 12 (Consultant surgeon, Female)

Linked to this, clinicians also reflected on how often digital systems felt static once implemented, with limited opportunities to revisit, refine or improve them based on user feedback. They suggested that ongoing evaluation processes should be implemented to assess whether the implemented technology truly enhances clinical workflows and patient care. Suggestions for evaluation methods include conducting sample user surveys to gather feedback from frontline staff and organising follow-up sessions approximately 6–8 weeks post-implementation to help identify any emerging issues or areas of improvement. Clinicians stressed the importance of providing a transition period to adapt to new technology, ensuring a comprehensive understanding of the benefits and challenges associated with its use, and conducting further evaluation.

"Having a period of transition to get used to it, then following up and then asking again, you know what, what issues have you been having? Cause you know there certainly have been a lot of new technologies introduced. How can we improve the system? Once it's implemented, it tends to be fairly static or feels that way. I guess it's the re-evaluation... having a process of looking at whether the technology is actually truly improving the situation... the ongoing process which is often lost in the process cause you make a big change and then it's about you know following that up and iteratively improving the situation rather than making lots of big changes kind of you know you identify a problem, you find a solution and then you introduce it in iteratively improve it rather than just implement something."- Participant 5 (Registrar, Male)

Theme 3: Clinician-related factors

This theme focuses on individual-level factors, including clinicians' technical confidence, perceptions of time and workload, and their motivation and perceived value of digital health tools.

Technical competency of healthcare professionals

Clinicians have generally reported very few technical difficulties when adopting digital health practices. Many found the transition smooth, with a small learning curve that they could adjust to easily. Even those who consider themselves average technology users found it quite quick to adapt, considering

their existing level of computer literacy to be second nature. Furthermore, clinicians who described themselves as basic tech users were strongly willing to engage more with digital health tools.

“A week to get adjusted to that. After that, no barriers with regards to training, the only barriers would be technology itself, in case there's no Internet, if the system doesn't work for some reason.” - Participant 7 (Service manager, Female)

“It's coming up more and more and I think personally for myself, I would need to. Even engage a bit more than I'm doing at the moment, because I'm really really basic tech user I call myself.” - Participant 10 (Advanced nurse practitioner, Female)

Time and workload pressures

Alongside technical competence, clinicians described how digital technologies can add to their workload and create time pressures, which in turn influenced their willingness and capacity to engage with new systems. Healthcare professionals have reported that the use of digital technology has added to their workload, leading to additional tasks that can interfere with their already demanding clinical schedules. Some examples included processing large amount of electronic communication, digital dictations and supporting patients connecting to video consultations. To manage these tasks more efficiently, they have requested dedicated time allocation, so that healthcare providers can address their digital responsibilities without compromising patient care.

“like digital dictation, we are being asked to do more and more; editing in real time, the notes are transcribed, and we then have to edit the text and forward them to the Secretary. So the amount of tasks for us to do in a clinical session is increasing without decreasing the amount of patients in the clinic. So, the number of bookings in the clinic will either decrease or you will become more burdened by having to do additional tasks.”- Participant 5 (Registrar, Male)

“[During video consultation appointments], I am talking them through the phone whilst I'm waiting to see them pop up on my screen. That was painful because you need patience. You need 10, sometimes 15 minutes with the patient prior to the time so that you guide them through, and then you're in the room. Then you go like, do you mind giving me 2 minutes? I just need to go to the loo. Do you mind giving me 5 minutes? I need to make a cup of tea after this. But do not click any other button. That was the struggle. I think it was the multiple things they needed to click to start the appointment.”- Participant 11 (Advanced nurse practitioner, Female)

Motivation and perceived value

Healthcare professionals have expressed frustration and scepticism towards introducing new technologies, as they often come with additional administrative burdens and may not align with their clinical priorities and workflows. They feel compelled to conform to someone else's agenda, which can negatively affect patient care. Moreover, clinicians have raised concerns about the time-consuming nature of digital processes compared to paper-based methods, leading to uncertainty about the efficiency gains for patient care.

“And they were using it as an opportunity to get us to do, you know, to do extra work, which, although I see the clinical value of that, it's certainly not part of my primary role, nor am I able to be efficient at what I'm best at. And that's patient care. So I think that that I'm kind of sceptical often about the introduction of this technology because of the creep of other ideas that is not.”- Participant 1 (Consultant surgeon, Female)

Despite these concerns, some healthcare professionals acknowledge the potential for technology to streamline workflows and enhance efficiency. They emphasise the importance of introducing technology through a bottom-up approach that involves multiple disciplines rather than a top-down approach. Healthcare professionals highlight the need for a clear understanding of the rationale behind technology adoption and careful consideration of the balance between its benefits and the efforts required for its integration into clinical practice.

“I'm a very firm advocate for using health tech to make our lives easier. And we can do this every day, from electronic health records to new technologies and surgeries, to clinic management, to Dictaphone. Everything really appears to be going that way, and we're all trying to make things as efficient as possible.”- Participant 4 (Researcher, Female)

“I think it needs to be a more multi-disciplinary approach to it. Because you need to know why are we doing it. You know what's the benefit? Is it financial? Is it patient care?...Inform you as to how much I need to take this on board and how much effort I need to give to this. Show me the benefits in terms of healthcare for my patient. How is my patient going to get better care... because it is always a time investment and a cognitive investment.”- Participant 12 (Consultant surgeon, Female)

Theme 4: Patient-related factors

Digital exclusion

The clinicians interviewed were critically aware of the digital exclusion among patients. Patients with low literacy levels or language barriers may face challenges in fully engaging with digital health technologies, potentially leading to disparities in healthcare access and outcomes. Issues related to access and affordability of digital devices further exacerbate these disparities, particularly for individuals

from older generations or those experiencing social and economic deprivation. To address these challenges, participants highlighted the need to enhance the usability and accessibility of digital platforms, as well as ensure equitable access to technology regardless of socioeconomic status. Moreover, efforts to improve digital inclusion should involve collaboration with stakeholders from various sectors, including healthcare providers, technology developers, and community organisations, starting from the design phase of digital health initiatives.

“It is a major issue of who is digitally literate and who isn't in 2023. And it is associated with socioeconomic status and age. But the issue is that because there is such a wide stream of platforms and there's complexity, I think when faced with that, many people tend to kind of regress and not want to engage. I think that is the responsibility of A health policy makers and B conditions to facilitate that process because that is the language of communication of medicine and everything else as we move forward... Usability, accessibility, equity, equality. There are the things you need to make sure you get you around your head.” - Participant 3 (Researcher, Male)

“I can see the benefits of it, but it's not for every patient though. That one thing we have to do as much as we want to move into that digital phase and era, which is good, we also don't have to lose sight of the fact that there will be some people who are not able to engage with it. And they shouldn't be penalised or have a less service or anything like that” - Participant 10 (Advanced nurse practitioner, Female)

Clinicians are adopting different strategies to ensure inclusivity in digital health. One of these strategies includes translating digital health materials and platforms into the top languages spoken in their catchment areas. This helps patients from diverse backgrounds to understand and engage better with digital health technology. In some cases, the use of digital health technologies has been reported to promote inclusivity. Patients who face language barriers or have limited mobility can benefit from remote consultations involving family members, who can assist in interpreting medical information.

“For our patient population a lot of them are non-English speaking, so the information needs to be available in lots of different languages... we made animated format, they are all accessible on a website which people can go on and they're about one or two minutes each and then they've been translated into the top 6 languages in London.” - Participant 9 (Physiotherapist, Female)

“there was once we also connected to a patient's daughter from Australia on a four-way call. Like the interpreter, you know? So it was it was wonderful. These kind of systems really help patients, especially the ones who are really helpless and they don't have anybody to, you know, rely on technology has helped in such.” - Participant 7 (Service manager, Female)

Patient support

Participants agreed that training and support are pivotal in ensuring successful patient adoption of digital health technologies. They suggested involving patients in the training process by encouraging them to try the technology and providing demonstrations, often leveraging support from allied colleagues such as healthcare assistants and the administration team.

"I think introducing technology is fairly similar to traditional consent process. Do you mind if we try this, this is how it works... you know, you're busy doctor, pharmacist wherever you are and you might not be the person to sit and show them how all that technology works. But actually if it's about it's about the sort of the nuts and bolts of what buttons do you press and things you could get healthcare assistant to do that." - Participant 2 (Pharmacist, Male)

Importantly, clinicians emphasise the importance of assessing patients' abilities and preferences regarding technology empathetically and tailoring their approach accordingly. They acknowledged that one should not make assumptions about patients' technological capabilities based solely on age, as increasing numbers of older patients have also expressed interest in accessing digital information. Additionally, specialised teams for patient training and the creation of user-friendly guides are suggested to facilitate patient involvement in remote consultations.

"I think for me because probably I use myself as an example. I always thought it through myself to say if I was a patient for example, and because I'm not that tech savvy, if I have the option, what would I really want? And for me, if it was possible, it would be a face to face one seeing you there with the hard copy, talking through and getting some drawings or anything that would make it more understandable for me. And so based from that experience, I then also think, OK, I should also be. Where I don't take it for granted though, that maybe because somebody is much older or more mature, they are not tech savvy. I don't make that assumption, but I just do check and I think it's important. But so it wasn't difficult at all because I kind of use myself as an example and then I do say to them as well, it doesn't matter if you're not tech savvy, they're still that information available in different ways." - Participant 10 (Advanced nurse practitioner, Female)

"I was also made a guide for the test calls for the calls. You know how to how to log in every screen shot. This is the start button. This is, you know, this is the next step. This is the agree to terms and conditions. You know, every little like literally spoon feeding the patient. So that I think really helps them when they look at the guide and they go through it because some of them they really are not that tech savvy, so when they read that they feel better and that's how they get through. So I think we've provided a lot of guidance and support. You know, sometimes with the video test calls and if they have difficulty on the link is our admin team will still call them and then go through step by step with the instruction to support them" - Participant 7 (Service manager, Female)

Patient autonomy, alternatives to technology and hybrid approach

Healthcare professionals have expressed concerns about the limited options available to patients, especially those most vulnerable. They emphasise the importance of providing a variety of healthcare delivery formats, enabling patients to choose the most suitable one based on their needs and preferences. This includes offering different consultation modalities and information presentation formats. Additionally, clinicians emphasise the significance of giving patients sufficient time and support to make informed decisions about opting in or out of digital healthcare services.

“I think we need to be cautious that when you're creating things, we create things in a variety of formats. So people can have choice. And I think that's really what patients are looking for choices that suit their needs and it's difficult. So I don't think digital will completely replace. You know, sort of face-to-face and pieces of paper and everything like that. I think they've got to. They've got through this balance of access and to, you know, the right sort of the right medium for the right time” - *Participant 2 (Pharmacist, Female)*

“We offer them a telemedicine appointment or a face to face appointment. We don't say what type of appointment would you like. ...my argument is we don't allow them to choose, we just introduced it. So it's offering us choice, it's not offering them choice.” - *Participant 1 (Consultant surgeon, Female)*

“it might be a about looking at whether what is the elements of that of that technology which are useful. Or would they actually benefit from a customized healthcare incentives. And so what are you trying to do? You trying to provide them with information? Can that information be provided in alternative means? ... If you have people who are tech savvy, it is likely that they will benefit more from a technological device than someone who's not tech savvy, because the barrier to that individual are probably more numerous and therefore the advantages versus the barrier ratio is different. You know it's delivering that healthcare or to the individual to provide the maximum benefit then whether it's a digital technology is secondary to that. The digital element is meant to assist us and if it isn't, if it's providing a barrier then we should be looking at how to overcome that barrier? It might be that we lose the digital element altogether. We just provide them with the information and then a traditional analogue way or in a face to face consultation.” - Participant 5 (Registrar, Male)

Participants also acknowledged the limitations of digital health technologies. While digital tools offer convenience and efficiency, they cannot entirely replace face-to-face interactions, particularly in performing clinical examinations and investigations. They suggested the adoption of hybrid approaches that blend digital and non-digital modalities. These include embedding digital links onto paper documents to provide patients with access to additional information, emailing supplementary materials to patients, and implementing mixed consultation formats that combine both digital and in-person interactions.

“And the way I've done it is first appointment. It needs to be a face-to-face appointment because I need to do a direct examination and pelvic floor assessment. So that I get I can put a plan in place for the patient. And then the second appointment can be remote. Where I now use remote consultation is follow up of patients because if they are fine, they do not need to come in to my clinic to tell me I'm actually fine. If they're not doing well I bring their other appointment forward so that I can see them earlier.” -

Participant 11 (Advanced nurse practitioner, Female)

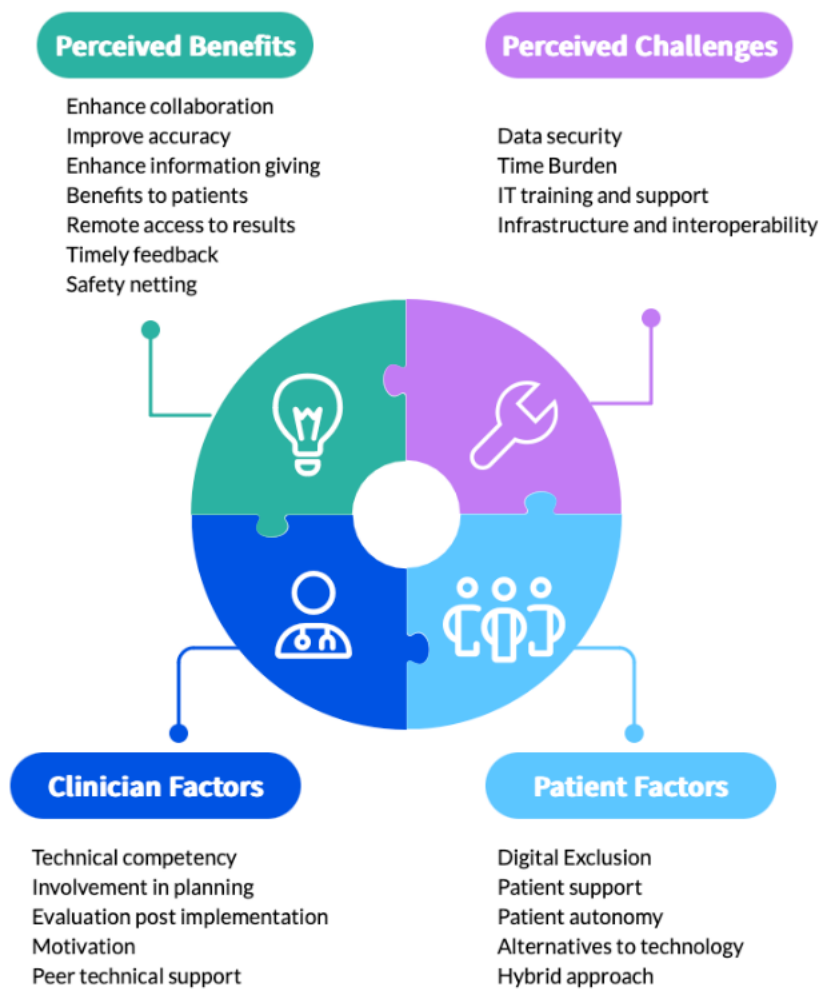


Figure 6-1 Thematic map

6.4 Discussion

The results of this study illustrated the different perceptions of healthcare professionals regarding incorporating digital health technologies in surgical care. The key themes highlighted the significant potential of digital tools to improve clinical practice while emphasising the importance of addressing various challenges to ensure successful implementation.

Clinician Involvement in Technology Development and Implementation

One key point discussed was the importance of involving clinicians in every stage of technology development and implementation. Clinicians, as end-users, provide valuable insights into patient care practicalities and should guide the design and deployment of eHealth tools. Their direct involvement ensures that the technology aligns with clinical workflows and addresses real-world challenges in clinical settings (Wachter, 2016). This recommended approach helps healthcare professionals feel ownership and motivates them to adopt and use new technologies effectively. In a report by Ballaster et al., the development of an electronic health record mobile application for inpatient care in a US quaternary medical centre was achieved through a co-design approach involving clinicians from multidisciplinary teams working with design engineers throughout the design, development, and implementation phases. This collaboration resulted in a user-focused technology that maximised utility, usability, and satisfaction (Soegaard Ballester et al., 2021). Papoutsi et al. also demonstrated co-designing the technology implementation process by engaging clinicians, support staff, and patient clinics to improve remote consultations in Scotland. The collaboration focused on making the technology more accessible to patients, improving workflow for healthcare staff, and aligning with clinic organisations, ultimately increasing user adoption and satisfaction (Papoutsi et al., 2021, Papoutsi et al., 2022).

Clear Indication of the Purpose of Technology

Participants emphasised the necessity of clearly demonstrating the purpose of any new technology introduced into clinical practice. When healthcare professionals understand the specific goals of a technology—whether it is to improve patient outcomes, increase efficiency, or enhance the accuracy of medical records—they are more likely to engage with and support its implementation. This transparency helps align the expectations of all stakeholders, ensuring that the technology delivers its intended benefits without causing unnecessary disruptions to existing workflows. A relevant example is the need for hybrid working and virtual attendance in cancer multidisciplinary team (MDT) discussions during the COVID-19 pandemic. A national survey of UK MDT members highlighted that, despite initial challenges with IT-related issues and slower meetings, clinicians continued to support the technology. This ongoing endorsement was driven by the clearly defined purpose of facilitating remote working and the demonstrated efficiency gains from electronic referrals and paperless documentation. These factors

contributed to significant improvements in IT infrastructure, increased teleconferencing, and expanded remote MDT access, ultimately allowing more time for focused discussions on complex cases (Soukup et al., 2023).

Benefits to Patients as a Primary Goal

The primary motivation for adopting eHealth technology should be to benefit patients. Clinicians highlighted the importance of ensuring that new tools are designed and implemented to enhance patient care. This includes improving patient safety, increasing access to care, and providing more personalised treatment options. When technologies are perceived as directly improving patient outcomes, they are more likely to be embraced by healthcare professionals dedicated to providing high-quality care. This is supported by the review findings of Li et al., who highlighted that the perceived benefit to patient care as a major determinant of healthcare professionals' acceptance of new digital tools (Li et al., 2013). Similarly, a review by Gagnon et al. emphasised that technologies which align closely with clinical workflows and enhance patient care are more readily adopted (Gagnon et al., 2016).

Importance of IT Support and Fit-for-Purpose Infrastructure

This study highlighted challenges caused by inadequate IT resources such as outdated systems, insufficient hardware, and poor interoperability between platforms. These issues can hinder the effective use of digital tools and cause frustration among clinicians. To maximise the potential of digital health technologies, healthcare organisations need to invest in modern IT infrastructure and ensure comprehensive support is available to address technical issues promptly. From a financial standpoint, the UK government has pledged £3.4 billion in funding to support NHS digital transformation, including updating "fragmented and outdated" IT systems (HM Treasury, 2024). The important role of nurse informatics and Clinician peer IT support has been highlighted. Nurse informatics contributes by ensuring that digital systems are designed and implemented to align with clinical practices, promoting usability and efficiency (ANA, 2024). Additionally, clinician peer support can help cascade their knowledge about existing and new IT systems, as they understand the clinical context and practical needs of their colleagues, can provide timely assistance, reduce workflow disruptions, and enhance the adoption of eHealth tools (NHS England, 2023).

Developing an equitable and secure eHealth environment

A recurring theme in the discussion was the need to provide thoughtful alternatives for patients unable or unwilling to engage with digital health technologies. Digital exclusion, whether due to age, socioeconomic status, or personal preference, can exacerbate disparities in healthcare access and outcomes (Latulippe et al., 2017, Davies et al., 2021, Hider et al., 2023). Clinicians emphasised that alternatives should not merely be an "off-the-shelf" leaflet or a basic telephone call but a well-considered

improvement to current practices that function parallel to digital solutions. These alternatives include personalised in-person consultations, comprehensive paper-based information, and hybrid models combining digital and traditional methods. By giving patients meaningful choices, healthcare providers can ensure that all individuals receive the care they need, regardless of technological capabilities or preferences.

In the future, we expect that older populations will become more comfortable with technology due to its widespread availability and lower costs (Zhang, 2023). This will make smartphones and wearable technology more accessible to them. At the same time, younger, tech-savvy individuals will have different preferences for healthcare delivery, such as preferring digital communication channels like video consultations. The COVID-19 pandemic has encouraged some healthcare workers who were initially hesitant to embrace technology to overcome their resistance with support from their families and colleagues. Nevertheless, challenges remain, especially for the older generation, who may still encounter barriers to adopting technology and have concerns about data security and privacy (Houser et al., 2023). In our group, clinicians are very conscious of the potential risks to data security and confidentiality posed by eHealth technologies. In contrast, the patient focus group expressed high trust in NHS and clinician-endorsed eHealth technologies. This emphasises the crucial role of clinicians as gatekeepers, responsible for maintaining the integrity and security of eHealth systems to uphold the trust that patients have in digital health solutions.

6.5 Limitations

The study provided insights into clinicians' perceptions of digital health technologies. However, there are a few limitations that should be considered. The sample size and the scope of participants might limit the generalizability of the findings, especially considering that the study may have overrepresented individuals who are already engaged with or supportive of digital tools. Furthermore, the study did not fully explore broader systemic factors that influence technology adoption, such as organisational culture, policy, and funding, which are crucial in determining the success of digital health initiatives.

Additionally, the study emphasizes the importance of clinician involvement in technology development but does not offer detailed strategies for achieving this effectively. Future research could explore models of clinician engagement that ensure their input is integral to the development process and that their needs are prioritised in the design of digital tools.

6.6 Conclusion

While digital health technologies have the potential to enhance surgical care, their successful implementation depends on a comprehensive approach. This approach should include clinician involvement, clear communication of purpose, robust IT support, patient-centred design, and the provision of alternatives for those unable or unwilling to use digital tools. By addressing these factors, healthcare systems can better utilise eHealth to improve patient outcomes and enhance the efficiency of clinical practice.

Table 5 Summary of key findings

Key findings	Barriers / Facilitators	Implications for clinical practice	Implications for policy	How recommendations could be implemented
Improved collaboration, accuracy & workflow efficiency	Barriers: slow systems, poor interoperability, limited hardware. Facilitators: remote access, screen-sharing, hybrid MDTs.	Normalise hybrid MDTs; integrate remote access; use screen-sharing during consultations.	Invest in modern IT infrastructure; national interoperability standards.	Procurement frameworks requiring user-centered design; funding for integrated EHR.
Patient benefits: access, flexibility, reduced DNAs	Barriers: digital exclusion, language barriers, device affordability. Facilitators: translated materials, family involvement.	Use hybrid models; provide translated resources; assess digital literacy.	National digital inclusion programmes; funding for patient support teams.	Enhanced NHS App functionality; targeted investment in deprived groups.
Data security and confidentiality	Barriers: lack of secure messaging, unclear IG processes. Facilitators: NHS-encrypted platforms, IG guidance.	Ensure clinicians understand governance; offer secure alternatives to WhatsApp.	National secure messaging platform; mandatory IG training.	Trust-level protocols for video/messaging; NHS-approved communication tools.
System-level barriers: poor infrastructure & training	Barriers: outdated hardware, no out-of-hours support, rushed training. Facilitators: peer champions, nurse informatics.	Protected time for training; embed peer support; allocate time for digital tasks.	National training standards; 24/7 IT support funding; mandated interoperability.	Hardware minimum standards; centralised IT procurement.
Clinician involvement & evaluation	Barriers: top-down rollout, no feedback loops. Facilitators: co-design, iterative evaluation.	Engage clinicians early; test iteratively; use feedback cycles.	Require co-design; mandate evaluation checkpoints.	Tie funding to iterative user testing and evaluation.

Clinician factors: confidence, workload, motivation	Barriers: increased admin time, unclear benefits. Facilitators: motivation to improve care.	Reduce duplicative admin; clarify purpose of tools.	Workflow mapping before procurement; invest in automation.	Develop national guidance on fit-for-purpose tools.
---	---	--	--	--

Chapter 7

7 Discussion and conclusion

In this final chapter, I will revisit the aims of the thesis and bring together the findings of the systematic review (Chapter 3) and the empirical results from the Digital Health Survey (Chapter 4), patient focus groups, and clinical interviews on perceptions and implementation of eHealth in Surgery (Chapters 4 and 5). I will propose a refined set of strategies used to improve the acceptance and utilisation of eHealth and the implications of this work for future research. I will then discuss the overall strengths and limitations of this doctoral study. The relative strengths and limitations of each study were discussed in the previous chapters. Lastly, I will present the closing remarks for this thesis.

7.1 Thesis aims

eHealth has an important role in modern healthcare, providing patients with convenient access to health information and new ways of obtaining healthcare services, as well as connecting with healthcare providers through the internet and mobile devices. The COVID-19 pandemic has accelerated eHealth adoption, with many healthcare services transitioning to digital platforms. Patients have generally responded positively to these technologies, and there is potential for continued growth beyond the pandemic. However, there are multiple barriers to eHealth adoption, including individual, organisational, and technical challenges that impede the widespread use of eHealth technologies. Individual patient factors and eHealth literacy are crucial factors in ensuring the effective use of these technologies. The thesis explores patients' perceptions and experiences with eHealth, particularly in surgical contexts.

This thesis used a mix of quantitative and qualitative methods to achieve its aims, with the following specific research questions:

1. What are the current internet usage patterns, eHealth experiences, and preferences of surgical patients?
2. How do eHealth literacy, individual patient factors, and experience with digital technology influence the acceptability and utility of eHealth?
3. What are patients' and clinicians' perceptions of eHealth technology?
4. What are the enablers and barriers to eHealth technology implementation?

7.2 Summary of findings

The key findings are discussed as they relate to each research question.

What are the current internet usage patterns, eHealth experiences, and preferences of surgical patients?

Chapter 3 presents a systematic review of 38 qualitative studies on eHealth interventions for surgical patients. The review revealed that eHealth qualitative research was most active in gastrointestinal and orthopaedic surgeries, while also encompassing a diverse range of surgical specialties such as gynaecological, urological, transplant, and cardiac surgeries addressed by eHealth interventions. Among the types of interventions, mobile health applications were the most studied, followed by wearable sensors, telemedicine, web-based tools, and integrated digital programs. This indicated a significant focus on mobile technology and its role in surgical care.

Chapter 4 provided empirical data on surgical patients' current internet usage patterns and eHealth experiences. The research showed that most participants, including those over 55, have high levels of daily internet usage, primarily on smartphones. This widespread use of technology across diverse age demographics signifies a highly connected patient population, with social media and messaging applications being commonly used for communication and information consumption.

The findings from Chapter 4 represent a noticeable shift from previous research, such as Korn and colleagues' survey study on surgical patients in Germany before the COVID-19 pandemic (Korn et al., 2022), which reported lower levels of engagement with online health information and health-related mobile applications. The current study indicates a trend towards more technologically engaged surgical patients, reflecting an overall increase in eHealth interaction.

Despite the high frequency of internet use, the study found that most patients engaged only in basic digital activities, such as searching the internet or sending messages. More complex tasks, like downloading and using health apps, communicating with healthcare professionals via email, or participating in online health forums are less common. This limitation raises questions about whether technical skills, interest, or the availability of relevant services constrain patients' engagement with eHealth tools.

Chapters 3 and 4 address the research question concerning the current internet usage patterns, eHealth experiences, and preferences of surgical patients. Chapter 3 outlines a broad, international perspective on eHealth interventions, while Chapter 4 provides specific insights into patient behaviour and technological engagement. The combined findings suggest a shift towards a more technologically adept patient population with varied levels of interaction with digital health resources. This evolution reflects both increased digital engagement and the rising need for eHealth technologies.

How do eHealth literacy, individual patient factors, and experience with digital technology influence the acceptability and utility of eHealth?

eHealth Literacy: Variations and Implications

Chapter 4 further explored the complexities of eHealth literacy among surgical patients. The eHealth Literacy Questionnaire (eHLQ) revealed significant disparities in digital health literacy among patients. While participants showed proficiency in using digital services, they encountered difficulties in identifying and accessing services that cater to their specific needs. This suggests that while patients are becoming more familiar with digital technologies, they may lack the technical skills, confidence, or interest required for more advanced eHealth activities. The higher engagement observed in the study could be linked to the increased comfort levels with eHealth technologies acquired during the COVID-19 pandemic, which led to broader exposure to digital health tools. The study also found that higher educational attainment is correlated with higher eHLQ scores, suggesting that education enhances ehealth literacy. However, the overrepresentation of university-educated participants in the sample may skew this correlation, emphasising the need for a more representative demographic analysis. Interestingly, while older patients tend to have lower overall eHLQ scores, age-related differences do not significantly affect their ability to understand health language or access digital services. This suggests that older patients are equally interested in eHealth solutions, provided these technologies align with their capabilities and needs.

Individual Patient Factors: Preferences and Trust

In Chapter 4, the patient survey showed that people of all age groups are generally familiar with basic digital technologies. However, the utilisation of more advanced eHealth tools such as health apps and remote communications was limited during their surgical treatments. This indicated that even though people are comfortable with basic digital technologies and are willing to engage in remote work and video consultations, they may not necessarily be open to using technology for healthcare.

The positive correlation between higher eHealth literacy and favourable perceptions of remote consultations and mobile health applications further underscores the role of digital competency in enhancing the acceptability and utility of eHealth solutions. This relationship highlighted the need for interventions that improve eHealth literacy and align eHealth tools with patients' specific needs and preferences.

In addition, the survey revealed a clear preference for information from healthcare professionals and authoritative health websites rather than informal sources like health blogs and apps. This preference underscores the importance of trust and credibility in adopting eHealth resources. Moreover, the study highlights a mixed reception to digital health modalities. While traditional face-to-face consultations remain the preferred choice, there is noticeable reluctance towards remote consultations and mobile

health applications. This reluctance is particularly pronounced among older patients and those with lower eHealth literacy. Despite the increased exposure to remote consultations during the pandemic, participants reported lower satisfaction and expressed concerns about privacy and comprehension compared to face-to-face interactions.

The integration of these findings reveals a complex interplay between eHealth literacy, individual patient factors, and experience with digital technology in shaping the acceptability and utility of eHealth solutions. Higher eHealth literacy is generally associated with more positive perceptions of digital health tools, while individual factors such as age, education, and socioeconomic status significantly influence patient preferences and trust. The mixed usage patterns observed suggest that while there is a general readiness for eHealth, actual engagement is contingent on the complexity of the tools and their alignment with personal needs and expectations. By addressing the importance of targeted education and support to enhance eHealth literacy, and tailoring digital health tools to diverse patient needs, it is possible to improve patient engagement and the overall effectiveness of eHealth interventions.

What are patients' perceptions of eHealth technology and their perceived barriers?

The systematic review in Chapter 3 demonstrated that patient empowerment is central to their expectations of using eHealth. eHealth technologies significantly contributed to an increased sense of motivation and reassurance, enabling individuals to actively participate in their recovery process. eHealth tools facilitated the delivery of tailored perioperative information, encouraged patient engagement, and supported self-care practices, which are particularly beneficial in surgical contexts. Examples of these technologies include mobile health applications with personalised content and push notifications, which have been shown to improve treatment adherence and patient satisfaction.

Empowerment was also a prominent theme in the patient focus group discussions (Chapter 5). Participants recognised the potential of eHealth to enhance their surgical experience by providing added convenience, accessibility, and a better understanding of clinic advice throughout their surgical journeys. Specific features such as pre- and post-operative care videos and continuous health monitoring were particularly useful. These findings align with existing literature highlighting patients' growing acceptance of eHealth, particularly for managing chronic conditions and post-operative care.

In the Chapter 3 review, it was noted that patients expressed a strong desire for improved access to clinicians and better communication through eHealth. They found eHealth technologies beneficial for early detection of clinical deterioration and accurate symptom reporting, which helped prevent sudden discontinuation of care after hospital discharge. The focus groups in Chapter 4 also emphasised the potential benefits of sharing important health information digitally, especially for vulnerable individuals or those living alone. Participants expressed interest in using technology to share real-time health data with healthcare providers, family, and friends. This could aid in detecting sudden deterioration, sending quick alerts, and enabling early interventions during post-operative care.

In Chapter 5, surgical patients had detailed discussions about their challenges when using eHealth. These challenges included technical difficulties, complex platforms, and financial burdens. They expressed concerns about eHealth potentially widening healthcare disparities, particularly for those lacking digital skills or technology access. The study emphasised the importance of customising eHealth to meet patients' specific needs at different treatment stages. For example, remote consultations are more suitable for follow-up monitoring than initial consultations.

In addition, the focus group study revealed that the effectiveness of eHealth is heavily influenced by healthcare professionals' familiarity with and responsiveness to technology. During the pandemic, participants felt disconnected as they had to rely on eHealth without adequate support. There is concern that digital tools might harm patient-provider relationships if not used appropriately. Participants emphasised balancing digital and face-to-face interactions to maintain trust and ensure quality care.

The study also identified the need for targeted education and training to improve eHealth adoption. Participants supported community-based initiatives and digital support services within healthcare institutions to bridge the digital divide. In particular, older participants felt that they also took an interest in eHealth but sometimes lacked the ability to engage with it, highlighting the need for inclusive strategies catering to varying technical abilities.

Chapters 3 and 5 explored the attitudes and behaviours of surgical patients towards eHealth technologies, using the Theoretical Framework of Acceptability to analyse factors influencing eHealth acceptance. The findings highlight the need for individualised support, inclusive strategies, and a balanced integration of digital and traditional care models. Addressing these challenges through targeted education, training, and support will be essential for realising eHealth's full potential in enhancing patient outcomes and experiences. The studies also emphasised the need to increase clinician involvement to ensure the successful implementation of eHealth care in the current backdrop of understaffing and limited resources within the public healthcare system.

What are clinicians' perceptions of eHealth technology and their perceived barriers?

In Chapter 6, the in-depth interviews with clinicians revealed the complexities and challenges of integrating eHealth technologies into clinical practice, particularly within surgical care pathways. It highlighted the importance of involving clinicians at every stage of technology development and implementation to ensure alignment with clinical workflows and enhance the utility and acceptance of these tools. Recognising the perspectives and insights of healthcare professionals can guide the design and deployment of eHealth solutions, ensuring they are practical and effective in real-world clinical settings.

Clinicians highlighted the importance of effectively communicating the intended use of new technologies to them. When the objectives such as improving patient outcomes or increasing efficiency are clearly

defined, clinicians are more likely to support and engage with the technology. The chapter highlighted the importance of patient benefits as a primary motivator for adopting eHealth. Clinicians are more inclined to embrace technologies that directly contribute to better patient care, such as improving safety, access, or personalised care.

However, the chapter also identified significant challenges, particularly regarding IT infrastructure. Inadequate resources, such as outdated systems and poor platform interoperability, can hinder the effective use of digital tools and lead to clinician frustration. Healthcare professionals called for substantial investment in modern IT infrastructure and comprehensive support to address these technical challenges promptly.

The discussion also emphasised the need for an equitable eHealth environment that considers patients who may be unable or unwilling to engage with digital technologies. Patients lacking contact with clinicians had lower confidence in technology. These findings also resonated with clinician perspectives reported in Chapter 6, where clinicians reflected that delayed responses, limited capacity to monitor patient messages, and inadequate digital infrastructure contributed to patient frustration and reduced trust in eHealth tools. Clinicians acknowledged that when digital pathways fail to provide timely contact, patients may perceive the technology as a barrier rather than a facilitator of care. This alignment between patient and clinician perspectives reinforces the importance of ensuring responsiveness and continuity within digitally enabled pathways.

Alternatives to digital tools should be thoughtfully developed to ensure that all patients receive the care they need, regardless of their technological capabilities or preferences. This approach would help prevent digital exclusion and maintain equitable healthcare access. Finally, the chapter highlighted the crucial role of clinicians in maintaining data security and privacy, which is essential to maintaining patient trust in eHealth technologies.

7.3 Implications for research, clinical practice and health policy

With over 300,000 mobile health applications and many other digital health products on the market, patients and clinicians, as end users, require a rapid and robust method of screening the appropriate technology that meets their needs. Silberman et al identified seventy-eight assessment frameworks for digital health interventions designed to provide the evidence base for health organisations in technology procurement (Silberman et al., 2023). In the UK, NHS England and the National Institute for Clinical Excellence developed the Digital Technology Assessment Criteria (DTAC) and Evidence Standards Framework (ESF) for Digital Health, respectively. These frameworks aim to guide technology developers and healthcare organisations in designing and evaluating new technology in line with the current legislation and best practices.

The findings culminating from this doctoral study can be translated into an actionable interventional tool, specifically an eHealth User Acceptability Checklist. Current digital health assessment tools, such as the DTAC (NHS Transformation Directorate, 2021) and the ESF (NICE, 2022), are primarily focused on guiding technology developers and procurement teams in designing and selecting appropriate digital tools for health organisations. However, these frameworks do not adequately address the evaluation and promotion of usability and acceptability of eHealth technologies from the perspectives of patients and clinicians.

This study offers qualitative evidence that can be incorporated into existing standard frameworks, providing an essential perspective on user acceptability. By doing so, it addresses a gap in the current assessment processes, ensuring that eHealth technologies not only comply with regulatory standards but also genuinely meet the needs and expectations of their end users in clinical practice.

Table 7.1 summarises the proposed eHealth User Acceptability Checklist and maps emergent patient and clinician themes from this thesis onto existing national digital assessment frameworks, including the NHS Digital Technology Assessment Criteria (DTAC) and the NICE Evidence Standards Framework (ESF) for Digital Health. Codes such as ESF8 refer to specific criteria within the ESF (e.g., ESF8 = “Show credibility with UK professionals”), while codes beginning with D refer to domains within the DTAC. Presenting the findings in this mapped format illustrates how user-centred insights from this doctoral work align with or extend current national expectations for safe, usable, and acceptable digital technologies.

Importantly, this table is not intended as a technical procurement tool but as a practical guide illustrating how patients' and clinicians' lived experiences can inform service design, training needs, and policy decisions. The mapping highlights areas where implementation barriers—such as digital exclusion, IT infrastructure gaps, or lack of clinician involvement—must be addressed to ensure successful adoption of eHealth within surgical pathways.

Table 7.1 eHealth Technology Assessment Checklist- Mapping to patients' and clinicians' acceptability

Mapping Code	Domain	Patient perspectives	Clinician perspectives
D1.1, ESF 10	Understanding the needs of users in context of health and social care	- Understand the physical and emotional needs during the perioperative period e.g. information giving and close monitoring to detect deterioration - Technology to aid patients in post-op	- Enhance collaborations with other health care professionals e.g. timing saving and reduce travel - Improve record-keeping and accuracy of clinical communications

		recovery e.g. provide motivation and reassurance. Enhanced communication with clinicians	- Enhanced information sharing with patients - Remote access to results and records - Remote consultations
D1.2, ESF 11, ESF 12,	Work towards solving a whole problem for users Describe the current pathway and system process and re-map using digital health technology	- Explanation of benefits to users and demonstration how claimed benefits is achieved e.g. convenience, reminder, customisation and tailoring - Getting help easily – complement to face to face interactions, extension of standard support	- Enhanced patient care with real-time data - Timely communication with patients and primary care - Convenience and efficiency - Benefits of additional information input by patients - Reducing clinical error - Uncertainty about clinical benefits vs benefits to administration or cost saving
D1.3	Making service simple to use	- Consideration to different level of technical abilities - Design with patients and usability testing - Work with a range of devices	- Design should be intuitive - Minimal disruption to workflow - Interoperability among different systems
D1.12, ESF 19, ESF 20	Technical support and training Transparency about requirements for deployment Describe strategies for communications, consent and training process to allow DHT to be understood	- Combination of in person and online demonstration and training sessions - Dedicated channel to help with aftercare and troubleshooting	- Inadequate IT infrastructure - Learning from colleagues- digital champions - IT support- appropriate induction and ongoing support

D1.4, ESF 4	Making sure everyone can use the service Health and care inequalities and bias mitigation	• Mitigate digital exclusion for at risk groups e.g. elderly patients • Dedicated and enhanced support channels • Loan devices • Non digital alternatives • Patient choice to opt in or out	• Health inequalities impacting patient care
D1.5	Create a team that includes multi-disciplinary skills and perspectives	• Involve patient in design and development of DHT	• Lack of clinician involvement in planning DHT
D1.7, ESF 16	Iterate and improve frequently Plan for measuring usage and evaluation and changes in performance over time	• Service evaluation and assessment with end users	• Lack of evaluation and non-responsive to feedback post implementation
D1.11	Operate a reliable service	• Clear signposting to support and alternatives when technology fails	• Out of hours IT support
D1.12	Report to customers on your performance with respect to support, system performance (response times) and availability (uptime) at a frequency required by your customers?	• Lack of timely response • Lack of support and directions	• Timetabled sessions and additional time allocated for responding to messages and related administration tasks
ESF 1	Demonstrate safety and quality standards	• Refer to NHS standards	
ESF 5	Embed good data practice	• Refer to NHS standards	

ESF 6	Define level of professional oversight	• Transparent about named clinician overseeing care • Provide contact details of clinicians • Indication of response timeframe • Signposting emergency support	• Involve clinicians in development and implementation
ESF 7	Show process for creating reliable health information	• Reference to latest evidence	
ESF 8	Show credibility with UK professionals	• Provide evidence from other users or examples from other hospitals	• Involve clinicians in development and implementation
ESF 9	Safeguarding assurances	• Refer to NHS standards	

Overall, Table 7.1 demonstrates how the findings from this thesis can provide actionable guidance for clinical practice, inform organisational policy around digital health deployment, and highlight priority areas for future research. By explicitly linking user experiences to national digital standards, the table clarifies how addressing key barriers such as digital literacy, workflow integration, and equitable access can strengthen the implementation of eHealth tools across the surgical care continuum.

To enhance the usability of checklists in clinical settings, they should be designed as quick-reference tools in the form of concise, easy-to-use documents that can fit into standard consultations (Winters et al., 2009). Research has shown that infographics are highly effective in raising awareness and promoting engagement in healthcare initiatives, including lifestyle interventions (Arcia et al., 2016) and eHealth interventions (Comello et al., 2016). Visual tools such as diagrams and graphs are particularly valuable for conveying complex information, especially for individuals with low health literacy, as they help to simplify and clarify key concepts (Houts et al., 2006). The proposed eHealth User Acceptability Checklist could be tailored to specific eHealth technologies and presented in an infographic format, making it both accessible and practical for clinical use.

The infographic presented below Figure 7-1 was created specifically for this thesis to illustrate how the proposed eHealth User Acceptability Checklist could be translated into a practical tool for real-world clinical settings. The purpose of the infographic is to demonstrate how complex acceptability criteria

can be distilled into a concise, visually intuitive format suitable for routine consultations, clinician training, or patient discussions, which is not currently available as an NHS resource.

GETTING STARTED WITH

Sensium sensor/Fitbit and Mobile App

NEW STARTER CHECKLIST

1) DEVICE



- ☐ A Fitbit watch will be given to you at your first appointment
- ☐ You will need a smartphone or tablet that runs Apple iOS or Andriod
- ☐ You may borrow a smartphone from our clinic, contact 123-456-789
- ☐ Alternative paper-based programme, see section 8

2) INTERNET ACCESS

- ☐ This app uses minimal data to transfer your heart rate information, we recommend you have at least 500MB on your data plan
- ☐ To watch the videos on the phone, we recommend connecting to your home or public Wi-Fi. A 10 minute video uses around 100MB of data
- ☐ You may want to borrow our loan smartphone that comes with internet connection



3) TECHNICAL SUPPORT



- ☐ Step by step guide on how to install and use the app can be found in the booklet provided
- ☐ You can watch demonstration videos on this website: www.-----.com
- ☐ Book an in person training session, call 123-546-789
- ☐ If you have further questions, call 123-546-789 during office hours, or leave a message. Our technical support team will call you back within 48 hours

4) CLINICAL SUPPORT

- ☐ If you have questions about the exercises, contact Joe Jones, physiotherapist and his team on :
Tel : Email:
- ☐ For medical queries, contact Dr Anna Smith and her team on :
Tel : Email:



5) IN CASE OF EMERGENCY



- ☐ If you feel unwell, contact our nurse specialist on 234-567-890 between 8am -5pm Mon to Fri
Or email:
We aim to get back to you within 24 hours
- ☐ If you need medical help fast, or outside office hours, call 111
- ☐ If you have a life-threatening emergency, call 999

6) ACCESSIBILITY



- ☐ Language, Font size, voice over



7) ALTERNATIVE FORMAT

- ☐ Paper programme

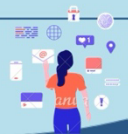


Figure 7-1 Acceptability checklist infographic

Future research into improving eHealth acceptance should focus on evaluating and piloting usability checklists that assist patients and clinicians in selecting eHealth tools suited to their health goals, while also identifying specific training and support needs. Furthermore, health policy research addresses the need for targeted education and training to improve eHealth adoption. Several strategies identified in the focus group study include developing community-based initiatives and digital support services within healthcare institutions to mitigate health inequality arising from the digital divide.

7.4 Thesis limitations

I will discuss this thesis's broad limitations. The specific limitations of each study were discussed previously in the relevant chapters.

Sample size and population

In qualitative research, sample sizes are determined by the concept of information power, which differs significantly from the power calculations used in quantitative studies. According to Malterud et al. (Malterud et al., 2015), information power suggests that the more relevant and rich the data provided by the sample, the fewer participants are needed to achieve meaningful results. In this study, three rounds of patient focus groups and fourteen individual clinician interviews were conducted. The participants were highly specific: patients who had experienced surgical care during and after the COVID-19 digital transformation, and clinicians with direct patient-facing roles who had incorporated eHealth into their practice. The discussions yielded high-quality, in-depth dialogues, enabling robust data analysis using established theoretical frameworks. The information power derived from these qualitative studies was deemed sufficient to address the research questions.

However, the study population was limited to patients from a single large London teaching NHS trust. While this population is diverse, encompassing a range of age groups and backgrounds, it was skewed towards participants who were highly educated and more likely to have access to digital technology, reflecting the affluent inner-city context. To achieve a more comprehensive understanding of patient perceptions in the eHealth arena, future research should include focus groups with patients from rural areas, lower educational backgrounds, and those with limited internet access and digital literacy.

Existing research on telemedicine in rural communities highlights contrasting challenges and enablers when compared with urban settings. Studies have shown that rural populations often report greater appreciation of remote technologies due to travel distances, limited specialist availability, and reduced service access; however, they also face significant barriers including poorer broadband connectivity, fewer digital support services, and lower baseline digital literacy. These contextual differences suggest that the experiences of this London-based sample, with comparatively high digital infrastructure and technology penetration, may not reflect the full spectrum of eHealth challenges encountered in rural

regions. Future research should therefore incorporate rural populations to explore how geographical context shapes acceptability, access, and the implementation of digital surgical care.

Moreover, the patient participants primarily had experiences in general surgery. Although general surgery covers a broad spectrum, including both acute and chronic care, the study would benefit from incorporating a wider range of surgical specialties to provide a more complete picture of patient experiences across different types of surgical care.

Similarly, while the clinicians interviewed represented multidisciplinary teams involved in surgical patient care, their perspectives were predominantly from those working in secondary and tertiary care settings. As the focus of surgical care increasingly shifts towards day-case surgeries and hospital-at-home models, incorporating the views of community care teams would enhance the overall understanding of clinicians' perceptions.

For the quantitative component of the thesis, expanding the sample size to include participants from smaller district general hospitals and rural care settings would be crucial. Special emphasis should be placed on recruiting older age groups to better capture the full spectrum of patient experiences and preferences across different healthcare settings.

eHealth literacy and assessments

Throughout this thesis, I have highlighted the significant role that eHealth literacy plays in the acceptance and utilisation of eHealth technologies. This concept was also explored empirically using the validated eHealth Literacy Questionnaire (eHLQ) in the digital health survey presented in Chapter 4. Despite the insights gained, the studies were inconclusive regarding whether the eHLQ should be employed as a screening tool to identify individuals who may need help with eHealth and require additional training and support, or if alternative assessment methods might be more appropriate.

The eHLQ assesses seven domains of digital competencies, ranging from the ability to use technology to process health information to identifying digital services that meet individual needs. Notably, the authors of the eHLQ caution against using a single cut-off score to categorise individuals as having either high or low eHealth literacy. Instead, the eHLQ is most effective as a research tool for pinpointing specific areas where individuals may lack competency, thus guiding targeted interventions.

This finding aligns with the qualitative data, which suggests that an individual's ability to engage with and effectively use eHealth technologies highly depends on the specific technology in question and their unique circumstances. Participants in the patient focus groups and clinician interviews were

generally unfamiliar with existing eHealth literacy assessment tools, which led to uncertainty about their applicability and generalizability.

Both patients and clinicians preferred a more practical approach by introducing users to the technology, assessing their ability to use it directly, and providing targeted training to help them accomplish the specific tasks required by the eHealth system. However, the qualitative data did not provide sufficient evidence to either support or refute the effectiveness of eHealth literacy assessments as a standalone measure. This suggests that while the eHLQ and similar tools may offer valuable insights, a more individualised and task-specific approach may be necessary to fully support users in their adoption of eHealth technologies.

Qualitative methods

As a researcher new to qualitative techniques, I employed thematic analysis (TA) as the primary method in the design and analysis of the study. TA is a flexible method suited to a wide range of research questions and can be adapted to different theoretical frameworks. However, it is limited to identifying, analysing and reporting patterns (Braun and Clarke, 2006). In this thesis, multiple theoretical frameworks were utilised to guide the analysis. For example, the Unified Theory of Acceptance and Use of Technology (UTAUT) was applied in the systematic review, while the Theoretical Framework of Acceptability (TFA) was used in the focus group study. Despite these frameworks providing valuable structure, there were challenges in aligning the data strictly with established theories. The complex and context-specific nature of the data often required flexibility beyond what these frameworks could offer.

In the clinician interview study, the dataset was coded and analysed inductively to capture the specialised perspectives of healthcare professionals engaged in surgical eHealth. This inductive approach is more closely aligned with Grounded Theory, where data are analysed without preconceived theoretical constraints and allows for the emergence of new insights. The research questions and data collection processes were refined iteratively, informed by the data itself, to develop a deeper understanding or potentially construct new theoretical insights (Chun Tie et al., 2019).

As a practising clinician working within surgical services, I recognised that my professional background and personal experiences could shape the interpretation of qualitative data. To ensure reflexivity, I adopted several strategies throughout the study. First, I maintained a reflexive log documenting assumptions, analytic decisions, and potential biases during data collection and analysis. Second, codes and themes were discussed with supervisors who had no clinical involvement in the study context, providing external challenge and preventing over-interpretation through a clinical lens. Third, data were repeatedly revisited to ensure that interpretations remained grounded in participants' own accounts rather than my preconceptions. These steps helped ensure that the analysis reflected participants' perspectives authentically while acknowledging and mitigating the influence of my clinical background.

However, the constraints of time and my relative inexperience with advanced qualitative research limited the extent to which theory-generating techniques could be fully utilised in this doctoral thesis. Consequently, while the study provides valuable insights, there is potential for further exploration using more sophisticated qualitative methods to generate new theories from the data.

8 Reference

- ABELSON, J. S., KAUFMAN, E., SYMER, M., PETERS, A., CHARLSON, M. & YEO, H. 2017. Barriers and benefits to using mobile health technology after operation: A qualitative study. *Surgery*, 162, 605-611.
- ABRAHAMSEN, C., SERRITSLEV, R. & MYHRE JENSEN, C. 2023. Information needs and preferences of patients with an ankle fracture: User involvement study creating an mHealth solution. *Patient Education and Counseling*, 116, 107891.
- ABROMS, L. C., AHUJA, M., KODL, Y., THAWEETHAI, L., SIMS, J., WINICKOFF, J. P. & WINDSOR, R. A. 2012. Text2Quit: results from a pilot test of a personalized, interactive mobile health smoking cessation program. *J Health Commun*, 17 Suppl 1, 44-53.
- ADJEKUM, A., BLASIMME, A. & VAYENA, E. 2018. Elements of Trust in Digital Health Systems: Scoping Review. *J Med Internet Res*, 20, e11254.
- AHMED, A., HO, C. W., GRANT, Y., ARCHER, S. & CARRINGTON, E. V. 2025. Acceptability of digital health interventions in perioperative care: a systematic review and narrative synthesis of clinician perspectives. *BMJ Open*, 15, e086412.
- AJZEN, I. 1991. The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50, 179-211.
- ALDERWICK, H. & DIXON, J. 2019. The NHS long term plan. *BMJ*, 364, l84.
- ALQAHTANI, F. & ORJI, R. 2020. Insights from user reviews to improve mental health apps. *Health Informatics Journal*, 26, 2042-2066.
- ANA 2024. What Is Nursing Informatics and Why Is It So Important? | ANA. *American Nurses Association*.
- ANTHONY JNR, B. 2021. Implications of telehealth and digital care solutions during COVID-19 pandemic: a qualitative literature review. *Informatics for Health and Social Care*, 46, 68-83.
- ANTONIO, S., JOSEPH, D., PARSONS, J. & ATHERTON, H. 2024. Experiences of remote consultation in UK primary care for patients with mental health conditions: A systematic review. *DIGITAL HEALTH*, 10, 20552076241233969.
- ARCIA, A., SUERO-TEJEDA, N., BALES, M. E., MERRILL, J. A., YOON, S., WOOLLEN, J. & BAKKEN, S. 2016. Sometimes more is more: iterative participatory design of infographics for engagement of community members with varying levels of health literacy. *Journal of the American Medical Informatics Association*, 23, 174-183.
- AREIA, C., KING, E., EDE, J., YOUNG, L., TARASSENKO, L., WATKINSON, P. & VOLLAM, S. 2022. Experiences of current vital signs monitoring practices and views of wearable monitoring: A qualitative study in patients and nurses. *J Adv Nurs*, 78, 810-822.
- ARGENT, R., SLEVIN, P., BEVILACQUA, A., NELIGAN, M., DALY, A. & CAULFIELD, B. 2019. Wearable Sensor-Based Exercise Biofeedback for Orthopaedic Rehabilitation: A Mixed Methods User Evaluation of a Prototype System. *Sensors (Basel)*, 19.
- ARIENS, L. F. M., SCHUSSLER-RAYMAKERS, F. M. L., FRIMA, C., FLINTERMAN, A., HAMMINGA, E., ARENTS, B. W. M., BRUIJNZEEL-KOOMEN, C. A. F. M., DE BRUIJN-WELLER, M. S. & VAN OS-

- MEDENDORP, H. 2017. Barriers and Facilitators to eHealth Use in Daily Practice: Perspectives of Patients and Professionals in Dermatology. *J Med Internet Res*, 19, e300.
- BAKKER, M. M., PUTRIK, P., AABY, A., DEBUSSCHE, X., MORRISSEY, J., BERGE, C. R 2019. Acting together - WHO National Health Literacy Demonstration Projects (NHJDPs) address health literacy needs in the European Region. *Public Health Panorama*, 5(2-3), 123–329.
- BALESTRA, M. 2018. Telehealth and Legal Implications for Nurse Practitioners. *The Journal for Nurse Practitioners*, 14, 33-39.
- BANDURA, A. 1986. *Social foundations of thought and action: A social cognitive theory*, Englewood Cliffs, NJ, US, Prentice-Hall, Inc.
- BARNETT-PAGE, E. & THOMAS, J. 2009. Methods for the synthesis of qualitative research: a critical review. *BMC Med Res Methodol*, 9, 59.
- BASHSHUR, R., DOARN, C. R., FRENK, J. M., KVEDAR, J. C. & WOOLLISCROFT, J. O. 2020. Telemedicine and the COVID-19 Pandemic, Lessons for the Future. *Telemedicine and e-Health*, 26, 571-573.
- BERLIN, A., LOVAS, M., TRUONG, T., MELWANI, S., LIU, J., LIU, Z. A., BADZYNSKI, A., CARPENTER, M. B., VIRTANEN, C., MORLEY, L., BHATTACHARYYA, O., ESCAF, M., MOODY, L., GOLDFARB, A., BRZOZOWSKI, L., CAFAZZO, J., CHUA, M. L. K., STEWART, A. K. & KRZYZANOWSKA, M. K. 2021. Implementation and Outcomes of Virtual Care Across a Tertiary Cancer Center During COVID-19. *JAMA Oncology*, 7, 597-602.
- BLOUNT, E., DAVEY, M. G. & JOYCE, W. P. 2023. Patient reported satisfaction levels with the use of telemedicine for general surgery—A systematic review of randomized control trials. *Surgery in Practice and Science*, 12, 100152.
- BLYTHIN, A. M., ELKES, J., VAN LINDHOLM, T., BHOGAL, A., WILKINSON, T. M. A., SAVILLE, C. & KIRK, A. 2023. Can digital health apps provide patients with support to promote structured diabetes education and ongoing self-management? A real-world evaluation of myDiabetes usage. *Digit Health*, 9, 20552076221147109.
- BOKOLO, A. J. 2021. Application of telemedicine and eHealth technology for clinical services in response to COVID-19 pandemic. *Health and Technology*, 11, 359-366.
- BOMMAKANTI, K. K., SMITH, L. L., LIU, L., DO, D., CUEVAS-MOTA, J., COLLINS, K., MUNOZ, F., RODWELL, T. C. & GARFEIN, R. S. 2020. Requiring smartphone ownership for mHealth interventions: who could be left out? *BMC Public Health*, 20, 81.
- BONOTO, B. C., DE ARAÚJO, V. E., GODÓI, I. P., DE LEMOS, L. L., GODMAN, B., BENNIE, M., DINIZ, L. M. & JUNIOR, A. A. 2017. Efficacy of Mobile Apps to Support the Care of Patients With Diabetes Mellitus: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. *JMIR Mhealth Uhealth*, 5, e4.
- BORGES DO NASCIMENTO, I. J., ABDULAZEEM, H., VASANTHAN, L. T., MARTINEZ, E. Z., ZUCOLOTO, M. L., ØSTENGAARD, L., AZZOPARDI-MUSCAT, N., ZAPATA, T. & NOVILLO-ORTIZ, D. 2023. Barriers and facilitators to utilizing digital health technologies by healthcare professionals. *npj Digital Medicine*, 6, 161.
- BOYATZIS, R. E. 1998. *Transforming qualitative information: Thematic analysis and code development*, Thousand Oaks, CA, US, Sage Publications, Inc.

- BRAUN, V. & CLARKE, V. 2006. Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3, 77-101.
- BRAUN, V. & CLARKE, V. 2013. *Successful Qualitative Research: A Practical Guide for Beginners*.
- BRAUN, V. & CLARKE, V. 2019. Reflecting on reflexive thematic analysis. *Qualitative research in sport, exercise and health*, 11, 589-597.
- BRONSOLER, A., DOYLE, J. J., JR. & VAN REENEN, J. 2021. The Impact of Healthcare IT on Clinical Quality, Productivity and Workers. *National Bureau of Economic Research Working Paper Series*, No. 29218.
- BRØRS, G., NORMAN, C. D. & NOREKVÅL, T. M. 2020. Accelerated importance of eHealth literacy in the COVID-19 outbreak and beyond. *European Journal of Cardiovascular Nursing*, 19, 458-461.
- BROWN-JOHNSON, C. G., SPARGO, T., KLING, S. M. R., SALIBA-GUSTAFSSON, E. A., LESTOQUOY, A. S., GARVERT, D. W., VILENDRER, S., WINGET, M., ASCH, S. M., MAGGIO, P. & NAZERALI, R. S. 2021. Patient and surgeon experiences with video visits in plastic surgery-toward a data-informed scheduling triage tool. *Surgery*, 170, 587-595.
- BYAMBASUREN, O., BELLER, E., HOFFMANN, T. & GLASZIOU, P. 2020. Barriers to and Facilitators of the Prescription of mHealth Apps in Australian General Practice: Qualitative Study. *JMIR Mhealth Uhealth*, 8, e17447.
- BYAMBASUREN, O., SANDERS, S., BELLER, E. & GLASZIOU, P. 2018. Prescribable mHealth apps identified from an overview of systematic reviews. *npj Digital Medicine*, 1, 12.
- BYRNE, D. 2022. A worked example of Braun and Clarke's approach to reflexive thematic analysis. *Quality & Quantity*, 56, 1391-1412.
- CAJITA, M. I., HODGSON, N. A., LAM, K. W., YOO, S. & HAN, H.-R. 2018. Facilitators of and barriers to mHealth adoption in older adults with heart failure. *CIN: Computers, Informatics, Nursing*, 36, 376-382.
- CALLAGHAN, P. & LI, H. C. 2002. The effect of pre-operative psychological interventions on post-operative outcomes in Chinese women having an elective hysterectomy. *British journal of health psychology*, 7, 247-252.
- CAMPAGNA, M., NAKA, F. & LU, J. 2017. Tele dermatology: An updated overview of clinical applications and reimbursement policies. *International Journal of Women's Dermatology*, 3, 176-179.
- CARLQVIST, C., HAGERMAN, H., FELLESSON, M., EKSTEDT, M. & HELLSTRÖM, A. 2021. Health care professionals' experiences of how an eHealth application can function as a value-creating resource - a qualitative interview study. *BMC Health Services Research*, 21, 1203.
- CASTRO, E. M., VAN REGENMORTEL, T., VANHAECHT, K., SERMEUS, W. & VAN HECKE, A. 2016. Patient empowerment, patient participation and patient-centeredness in hospital care: A concept analysis based on a literature review. *Patient education and counseling*, 99, 1923-1939.
- CHENG, C., ELSWORTH, G. & OSBORNE, R. H. 2021. Validity Evidence Based on Relations to Other Variables of the eHealth Literacy Questionnaire (eHLQ): Bayesian Approach to Test for Known-Groups Validity. *J Med Internet Res*, 23, e30243.
- CHERRYHOLMES, C. H. 1992. Notes on Pragmatism and Scientific Realism. *Educational Researcher*, 21, 13-17.

CHUN TIE, Y., BIRKS, M. & FRANCIS, K. 2019. Grounded theory research: A design framework for novice researchers. *SAGE Open Med*, 7, 2050312118822927.

CHUNG, S.-Y. & NAHM, E.-S. 2015. Testing reliability and validity of the eHealth Literacy Scale (eHEALS) for older adults recruited online. *Computers, informatics, nursing : CIN*, 33, 150-156.

CIMPERMAN, M., BRENČIČ, M. M. & TRKMAN, P. 2016. Analyzing older users' home telehealth services acceptance behavior—applying an Extended UTAUT model. *International journal of medical informatics*, 90, 22-31.

CLARKE, V. & BRAUN, V. 2013. Successful qualitative research: A practical guide for beginners.

COADY, L. C., CHATURVEDI, A., GRANT, Y., FEARON, N. M., THORPE, C., HENEGHAN, H. M. & CARRINGTON, E. V. 2023. Survey of patient attitudes of face-to-face and telemedicine teaching in COVID-19. *Ir Med J*, 116, 848.

COLLETTE, A.-M., SPIES, C., ECKARDT, R., WERNECKE, K.-D. & SCHMIDT, M. 2018. Patient Empowerment Reduces Pain in Geriatric Patients After Gynecologic Onco-Surgery: Subgroup Analysis of a Prospective Randomized Controlled Clinical Trial. *Journal of PeriAnesthesia Nursing*, 33, 281-289.

COMELLO, M. L. G., QIAN, X., DEAL, A. M., RIBISL, K. M., LINNAN, L. A. & TATE, D. F. 2016. Impact of Game-Inspired Infographics on User Engagement and Information Processing in an eHealth Program. *J Med Internet Res*, 18, e237.

CONNOR, O., RIELLY, JOSHUA, N.-K., ANIA, K.-R., JOSEPH, D., JONATHAN, W., JILL, R., MARY, B. & KHARA, S. 2021. Surgery and COVID-19: a rapid scoping review of the impact of the first wave of COVID-19 on surgical services. *BMJ Open*, 11, e043966.

CONTRERAS, C. M., METZGER, G. A., BEANE, J. D., DEDHIA, P. H., EJAZ, A. & PAWLIK, T. M. 2020. Telemedicine: Patient-Provider Clinical Engagement During the COVID-19 Pandemic and Beyond. *Journal of gastrointestinal surgery : official journal of the Society for Surgery of the Alimentary Tract*, 24, 1692-1697.

COTTRELL, M. A., GALEA, O. A., O'LEARY, S. P., HILL, A. J. & RUSSELL, T. G. 2017. Real-time telerehabilitation for the treatment of musculoskeletal conditions is effective and comparable to standard practice: a systematic review and meta-analysis. *Clin Rehabil*, 31, 625-638.

CRESSWELL, K. & SHEIKH, A. 2013. Organizational issues in the implementation and adoption of health information technology innovations: an interpretative review. *Int J Med Inform*, 82, e73-86.

CRESWELL, J. W. 2015. *A Concise Introduction to Mixed Methods Research*. SAGE Publications.

CRESWELL, J. W. & CRESWELL, J. D. 2018. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, SAGE Publications.

CRESWELL, J. W. & PLANO CLARK, V. L. 2011. *Designing and Conducting Mixed Methods Research*, SAGE Publications.

CRESWELL, J. W. & POTH, C. N. 2017. *Qualitative Inquiry and Research Design: Choosing Among Five Approaches*, SAGE Publications.

CROTTY, M. 1998. *The Foundations of Social Research: Meaning and Perspective in the Research Process*, SAGE Publications.

- DA FONSECA, M. H., KOVALESKI, F., PICININ, C. T., PEDROSO, B. & RUBBO, P. 2021. E-Health Practices and Technologies: A Systematic Review from 2014 to 2019. *Healthcare (Basel)*, 9.
- DAHLBERG, K., JAENSSON, M., NILSSON, U., ERIKSSON, M. & ODENCRANTS, S. 2018. Holding It Together-Patients' Perspectives on Postoperative Recovery When Using an e-Assessed Follow-Up: Qualitative Study. *JMIR Mhealth Uhealth*, 6, e10387.
- DAVIDSON & TOLICH 2003. *Collecting the data. Social science research in New Zealand*, 2nd ed. (pp. 121-153). Pearson Education.
- DAVIES, A. R., HONEYMAN, M. & GANN, B. 2021. Addressing the Digital Inverse Care Law in the Time of COVID-19: Potential for Digital Technology to Exacerbate or Mitigate Health Inequalities. *J Med Internet Res*, 23, e21726.
- DAVIES, H., CHAPPELL, M., WANG, Y., PHALGUNI, A., WAKE, S., ARBER, M. & SHORE, J. 2023. myCOPD App for Managing Chronic Obstructive Pulmonary Disease: A NICE Medical Technology Guidance for a Digital Health Technology. *Appl Health Econ Health Policy*, 21, 689-700.
- DAVIS, F. & DAVIS, F. 1989. Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*, 13, 319.
- DAVIS, F. D. 1989. Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*, 13, 319-340.
- DAWES, A. J., REARDON, S., CHEN, V. L., KAISER, W., RUSSELL, M. M., KO, C. Y. & LIN, A. Y. 2015. Wireless Technology to Track Surgical Patients after Discharge: A Pilot Study. *Am Surg*, 81, 1061-6.
- DE LA CRUZ MONROY, M. F. I. & MOSAHEBI, A. 2019. The Use of Smartphone Applications (Apps) for Enhancing Communication With Surgical Patients: A Systematic Review of the Literature. *Surg Innov*, 26, 244-259.
- DE REGGE, M., VAN CAELENBERG, E., VAN BELLE, N., EECKLOO, K. & COPPENS, M. 2022. Encouraging Digital Patient Portal Use in Ambulatory Surgery: A Mixed Method Research of Patients and Health Care Professionals Experiences and Perceptions. *Journal of PeriAnesthesia Nursing*, 37, 691-698.
- DECI, E. L. & RYAN, R. M. 1985. *Intrinsic Motivation and Self-Determination in Human Behavior*. SpringerLink.
- DEKKERS, T., MELLES, M., GROENEVELD, B. S. & DE RIDDER, H. 2018. Web-Based Patient Education in Orthopedics: Systematic Review. *J Med Internet Res*, 20, e143.
- DELOITTE 2019. *Mobile Consumer Survey 2019 The state of the smartphone*.
- DEN BAKKER, C. M., HUIRNE, J. A., SCHAAFSMA, F. G., DE GEUS, C., BONJER, H. J. & ANEMA, J. R. 2019. Electronic Health Program to Empower Patients in Returning to Normal Activities After Colorectal Surgical Procedures: Mixed-Methods Process Evaluation Alongside a Randomized Controlled Trial. *J Med Internet Res*, 21, e10674.
- DENZIN, N. K. & LINCOLN, Y. S. 2008. *Strategies of qualitative inquiry*, Sage.
- DESVEAUX, L., SOOBIAH, C., BHATIA, R. S. & SHAW, J. 2019. Identifying and Overcoming Policy-Level Barriers to the Implementation of Digital Health Innovation: Qualitative Study. *J Med Internet Res*, 21, e14994.

DEVELOPMENT, G. M. F. 2021. Health Systems, Digital Health and COVID-19: Insights from Bangladesh, Myanmar, Pakistan, Benin, Nigeria and Rwanda.

DODSON, P., HAASE, A. M., JEFFREYS, M. & HALES, C. 2024. Capturing patient experiences of care with digital technology to improve service delivery and quality of care: A scoping review. *DIGITAL HEALTH*, 10, 20552076241282900.

DOSHI, A., PLATT, Y., DRESSEN, J. R., MATHEWS, B. K. & SIY, J. C. 2020. Keep calm and log on: telemedicine for COVID-19 pandemic response. *Journal of hospital medicine*, 15, 302-304.

DOWNEY, C. L., BROWN, J. M., JAYNE, D. G. & RANDELL, R. 2018. Patient attitudes towards remote continuous vital signs monitoring on general surgery wards: An interview study. *Int J Med Inform*, 114, 52-56.

DRUMMOND, K., LAMBERT, G., TAHASILDAR, B. & CARLI, F. 2022. Successes and challenges of implementing teleprehabilitation for onco-surgical candidates and patients' experience: a retrospective pilot-cohort study. *Scientific Reports*, 12, 6775.

DUNPHY, E. & GARDNER, E. C. 2020. Telerehabilitation to Address the Rehabilitation Gap in Anterior Cruciate Ligament Care: Survey of Patients. *JMIR Form Res*, 4, e19296.

DUNPHY, E., HAMILTON, F. L., SPASIC, I. & BUTTON, K. 2017. Acceptability of a digital health intervention alongside physiotherapy to support patients following anterior cruciate ligament reconstruction. *BMC Musculoskelet Disord*, 18, 471.

ECONOMICS, H. O. 2017. Digital Spillover. Measuring the true impact of the Digital Economy.

ELBERT, N. J., VAN OS-MEDENDORP, H., VAN RENSELAAR, W., EKELAND, A. G., HAKKAART-VAN ROIJEN, L., RAAT, H., NIJSTEN, T. E. & PASMANS, S. G. 2014. Effectiveness and cost-effectiveness of ehealth interventions in somatic diseases: a systematic review of systematic reviews and meta-analyses. *J Med Internet Res*, 16, e110.

FAGHERAZZI, G., GOETZINGER, C., RASHID, M. A., AGUAYO, G. A. & HUIART, L. 2020. Digital Health Strategies to Fight COVID-19 Worldwide: Challenges, Recommendations, and a Call for Papers. *J Med Internet Res*, 22, e19284.

FAZAKARLEY, C. A., BREEN, M., LEESON, P., THOMPSON, B. & WILLIAMSON, V. 2023. Experiences of using artificial intelligence in healthcare: a qualitative study of UK clinician and key stakeholder perspectives. *BMJ Open*, 13, e076950.

FERNANDES, J. 2023. Which mHealth apps are Britons using? *Yougov.com*.

FISHBEIN, M. & AJZEN, I. 1975. *Belief, attitude, intention and behaviour: An introduction to theory and research*.

FISK, M., LIVINGSTONE, A. & PIT, S. W. 2020. Telehealth in the Context of COVID-19: Changing Perspectives in Australia, the United Kingdom, and the United States. *J Med Internet Res*, 22, e19264.

FORUM, W. E. 2016. Global agenda The Fourth Industrial Revolution: what it means, how to respond.

FOUNDATION, T. H. 2019. NHS long term plan launch: pragmatic and ambitious, but making it a reality will be tough.

- FRISHAMMAR, J., ESSÉN, A., BERGSTRÖM, F. & EKMAN, T. 2023. Digital health platforms for the elderly? Key adoption and usage barriers and ways to address them. *Technological Forecasting and Social Change*, 189, 122319.
- GAGNON, M. P., NGANGUE, P., PAYNE-GAGNON, J. & DESMARTIS, M. 2016. m-Health adoption by healthcare professionals: a systematic review. *J Am Med Inform Assoc*, 23, 212-20.
- GAGNON, M. P., ORRUÑO, E., ASUA, J., ABDELJELIL, A. B. & EMPARANZA, J. 2012. Using a modified technology acceptance model to evaluate healthcare professionals' adoption of a new telemonitoring system. *Telemed J E Health*, 18, 54-9.
- GAJARAWALA, S. N. & PELKOWSKI, J. N. 2021. Telehealth Benefits and Barriers. *J Nurse Pract*, 17, 218-221.
- GARCÍA-GARCÍA, D., BAZÁN, M. J. A. & PÉREZ-RIVAS, F. J. 2023. Correlation between Health and eHealth Literacy and a Healthy Lifestyle: A Cross-Sectional Study of Spanish Primary Healthcare Patients. *Healthcare (Basel)*, 11.
- GILL, R., OGILVIE, G., NORMAN, W. V., FITZSIMMONS, B., MAHER, C. & RENNER, R. 2019. Feasibility and Acceptability of a Mobile Technology Intervention to Support Postabortion Care in British Columbia: Phase I. *J Med Internet Res*, 21, e13387.
- GILL, R., OGILVIE, G., NORMAN, W. V., FITZSIMMONS, B., MAHER, C. & RENNER, R. 2024. Feasibility and Acceptability of a Mobile Technology Intervention to Support Postabortion Care After Surgical Abortion (the FACTS Study Phase 3): Mixed Methods Prospective Pilot Study. *JMIR Form Res*, 8, e46284.
- GRAETZ, I., ANDERSON, J. N., MCKILLOP, C. N., STEPANSKI, E. J., PALADINO, A. J. & TILLMANNS, T. D. 2018. Use of a web-based app to improve postoperative outcomes for patients receiving gynecological oncology care: A randomized controlled feasibility trial. *Gynecol Oncol*, 150, 311-317.
- GRANJA, C., JANSSEN, W. & JOHANSEN, M. A. 2018. Factors Determining the Success and Failure of eHealth Interventions: Systematic Review of the Literature. *J Med Internet Res*, 20, e10235.
- GRANT, C. & OSANLOO, A. 2015. Understanding, selecting, and integrating a theoretical framework in dissertation research: Developing a 'blueprint' for your "house". *Administrative Issues Journal*, 4.
- GRÄWE, J., MIROW, L., BOUCHARD, R., LINDIG, M. & HÜPPE, M. 2010. Impact of preoperative patient education on postoperative pain in consideration of the individual coping style. *Der Schmerz*, 24, 575-586.
- GREEN, J. & THOROGOOD, N. 2013. *Qualitative Methods for Health Research*, SAGE Publications.
- GREENHALGH, T., WHERTON, J., PAPOUTSI, C., LYNCH, J., HUGHES, G., A'COURT, C., HINDER, S., FAHY, N., PROCTER, R. & SHAW, S. 2017. Beyond Adoption: A New Framework for Theorizing and Evaluating Nonadoption, Abandonment, and Challenges to the Scale-Up, Spread, and Sustainability of Health and Care Technologies. *J Med Internet Res*, 19, e367.
- GUBA, E. G. 1990. *The paradigm dialog.*: Sage Publications, Inc.
- GUBA, E. G. & LINCOLN, Y. S. Paradigmatic Controversies, Contradictions, and Emerging Confluences. 2005.

GUSTAVELL, T., SUNDBERG, K. & LANGIUS-EKLOF, A. 2020. Using an Interactive App for Symptom Reporting and Management Following Pancreatic Cancer Surgery to Facilitate Person-Centered Care: Descriptive Study. *JMIR Mhealth Uhealth*, 8, e17855.

GUTIERREZ, J., KUPERMAN, E. & KABOLI, P. J. 2021. Using telehealth as a tool for rural hospitals in the COVID-19 pandemic response. *The Journal of rural health*, 37, 161.

HÄGGLUND, M., MCMILLAN, B., WHITTAKER, R. & BLEASE, C. 2022. Patient empowerment through online access to health records. *BMJ*, 378, e071531.

HAIMI, M. 2023. The tragic paradoxical effect of telemedicine on healthcare disparities- a time for redemption: a narrative review. *BMC Med Inform Decis Mak*, 23, 95.

HALL, A. K., BERNHARDT, J. M., DODD, V. & VOLLRATH, M. W. 2014. The Digital Health Divide: Evaluating Online Health Information Access and Use Among Older Adults. *Health Education & Behavior*, 42, 202-209.

HAMMERSLEY, V., DONAGHY, E., PARKER, R., MCNEILLY, H., ATHERTON, H., BIKKER, A., CAMPBELL, J. & MCKINSTRY, B. 2019a. Comparing the content and quality of video, telephone, and face-to-face consultations: a non-randomised, quasi-experimental, exploratory study in UK primary care. *British Journal of General Practice*, 69, e595.

HAMMERSLEY, V., DONAGHY, E., PARKER, R., MCNEILLY, H., ATHERTON, H., BIKKER, A., CAMPBELL, J. & MCKINSTRY, B. 2019b. Comparing the content and quality of video, telephone, and face-to-face consultations: a non-randomised, quasi-experimental, exploratory study in UK primary care. *Br J Gen Pract*, 69, e595-e604.

HANSEN, A. H., BRADWAY, M., BROZ, J., CLAUDI, T., HENRIKSEN, Ø., WANGBERG, S. C. & ÅRSAND, E. 2019. Inequalities in the Use of eHealth Between Socioeconomic Groups Among Patients With Type 1 and Type 2 Diabetes: Cross-Sectional Study. *J Med Internet Res*, 21, e13615.

HARDER, H., HOLROYD, P., BURKINSHAW, L., WATTEN, P., ZAMMIT, C., HARRIS, P. R., GOOD, A. & JENKINS, V. 2017. A user-centred approach to developing bWell, a mobile app for arm and shoulder exercises after breast cancer treatment. *J Cancer Surviv*, 11, 732-742.

HARMON STILL, C., JONES, L. M., MOSS, K. O., VARIATH, M. & WRIGHT, K. D. 2018. African American older adults' perceived use of technology for hypertension self-management. *Research in gerontological nursing*, 11, 249-256.

HENDY, J., REEVES, B. C., FULOP, N., HUTCHINGS, A. & MASSERIA, C. 2005. Challenges to implementing the national programme for information technology (NPfIT): a qualitative study. *BMJ*, 331, 331.

HENNEMANN, S., BEUTEL, M. E. & ZWERENZ, R. 2017. Ready for eHealth? Health Professionals' Acceptance and Adoption of eHealth Interventions in Inpatient Routine Care. *Journal of Health Communication*, 22, 274-284.

HICKMANN, E., RICHTER, P. & SCHLIETER, H. 2022. All together now - patient engagement, patient empowerment, and associated terms in personal healthcare. *BMC Health Serv Res*, 22, 1116.

HIDER, S., MULLER, S., GRAY, L., MANNING, F., BROOKS, M., HEINING, D., MENON, A., PACKHAM, J., RAGHUVANSHI, S., RODDY, E., RYAN, S., SCOTT, I. & PASKINS, Z. 2023. Digital exclusion as a potential cause of inequalities in access to care: a survey in people with inflammatory rheumatic diseases. *Rheumatology Advances in Practice*, 7, rkac109.

HIRST, S. P., LANE, A. & STARES, R. 2013. Health promotion with older adults experiencing mental health challenges: a literature review of strength-based approaches. *Clinical gerontologist*, 36, 329-355.

HM TREASURY 2024. Spring Budget 2024. assets.publishing.service.gov.uk.

HOUSE OF COMMONS 2013. The dismantled National Programme for IT in the NHS Nineteenth Report of Session 2013-14 Report, together with formal minutes, oral and written evidence.

HOUSER, S. H., FLITE, C. A. & FOSTER, S. L. 2023. Privacy and Security Risk Factors Related to Telehealth Services - A Systematic Review. *Perspect Health Inf Manag*, 20, 1f.

HOUTS, P. S., DOAK, C. C., DOAK, L. G. & LOSCALZO, M. J. 2006. The role of pictures in improving health communication: a review of research on attention, comprehension, recall, and adherence. *Patient Educ Couns*, 61, 173-90.

HOUWEN, T., VUGTS, M. A. P., LANSINK, K. W. W., THEEUWES, H. P., NEEQUAYE, N., BEEREKAMP, M. S. H., JOOSEN, M. C. W. & DE JONGH, M. A. C. 2022. Developing mHealth to the Context and Valuation of Injured Patients and Professionals in Hospital Trauma Care: Qualitative and Quantitative Formative Evaluations. *JMIR Hum Factors*, 9, e35342.

HUANG, Y., BENFORD, S., LI, B., PRICE, D. & BLAKE, H. 2023. Feasibility and Acceptability of an Internet of Things-Enabled Sedentary Behavior Intervention: Mixed Methods Study. *J Med Internet Res*, 25, e43502.

HUNTER, B., HINDOCHA, S. & LEE, R. W. 2022. The Role of Artificial Intelligence in Early Cancer Diagnosis. *Cancers*, 14, 1524.

HUXLEY, C. J., ATHERTON, H., WATKINS, J. A. & GRIFFITHS, F. 2015. Digital communication between clinician and patient and the impact on marginalised groups: a realist review in general practice. *British Journal of General Practice*, 65, e813.

HUYNH, B., BARRETT, J., JOACHIM, A., SMITH, D., STAFFORD, L. C., ABBOTT, D. E. & ALAGOZ, E. 2021. Patient and provider perceptions on utilizing a mobile technology platform to improve surgical outcomes in the perioperative setting. *J Surg Oncol*, 123, 1353-1360.

INSIGHTS, G. M. 2021. mHealth Market Size- Industry Analysis Report, Regional Outlook, Application Potential, Competitive Market Share & Forecast, 2021 – 2030.

ISLAM, M. M., POLY, T. N. & LI, Y.-C. J. 2018. Recent Advancement of Clinical Information Systems: Opportunities and Challenges. *Yearb Med Inform*, 27, 083-090.

ISLAM, S. M. R., KWAK, D., KABIR, M. H., HOSSAIN, M. & KWAK, K. S. 2015. The Internet of Things for Health Care: A Comprehensive Survey. *IEEE Access*, 3, 678-708.

JABOUR, A. M. 2024. A comparative study of patient–physician empathy in telehealth and traditional in-person visits. *DIGITAL HEALTH*, 10, 20552076241305284.

JACOBS, R. J., LOU, J. Q., OWNBY, R. L. & CABALLERO, J. 2014. A systematic review of eHealth interventions to improve health literacy. *Health Informatics Journal*, 22, 81-98.

JONES, S., ALNAIB, M., KOKKINAKIS, M., WILKINSON, M., ST CLAIR GIBSON, A. & KADER, D. 2011. Pre-operative patient education reduces length of stay after knee joint arthroplasty. *The Annals of The Royal College of Surgeons of England*, 93, 71-75.

JONKER, L. T., HAVEMAN, M. E., DE BOCK, G. H., VAN LEEUWEN, B. L. & LAHR, M. M. 2020. Feasibility of perioperative ehealth interventions for older surgical patients: a systematic review. *Journal of the American Medical Directors Association*, 21, 1844-1851. e2.

JOSHI, M., ARCHER, S., MORBI, A., ARORA, S., KWASNICKI, R., ASHRAFIAN, H., KHAN, S., COOKE, G. & DARZI, A. 2021. Short-Term Wearable Sensors for In-Hospital Medical and Surgical Patients: Mixed Methods Analysis of Patient Perspectives. *JMIR Perioper Med*, 4, e18836.

JR., B. 2015. From solving a health problem to achieving quality of life: redefining eHealth literacy. *J Lit Technol*, 2015;16(2):33-54.

JUNG, M.-L. & BERTHON, P. 2009. Fulfilling the Promise: A Model for Delivering Successful Online Health Care. *Journal of Medical Marketing*, 9, 243-254.

KASOJU, N., REMYA, N., SASI, R., SUJESH, S., SOMAN, B., KESAVADAS, C., MURALEEDHARAN, C., VARMA, P. H. & BEHARI, S. 2023. Digital health: trends, opportunities and challenges in medical devices, pharma and bio-technology. *CSI Transactions on ICT*, 11, 11-30.

KAYLER, L. K., DOLPH, B., SEIBERT, R., KELLER, M., CADZOW, R. & FEELEY, T. H. 2020. Development of the living donation and kidney transplantation information made easy (KidneyTIME) educational animations. *Clin Transplant*, 34, e13830.

KAYSER, L., KARNOE, A., FURSTRAND, D., BATTERHAM, R., CHRISTENSEN, K. B., ELSWORTH, G. & OSBORNE, R. H. 2018. A Multidimensional Tool Based on the eHealth Literacy Framework: Development and Initial Validity Testing of the eHealth Literacy Questionnaire (eHLQ). *J Med Internet Res*, 20, e36.

KAYSER, L., KUSHNIRUK, A., OSBORNE, R. H., NORGAARD, O. & TURNER, P. 2015. Enhancing the Effectiveness of Consumer-Focused Health Information Technology Systems Through eHealth Literacy: A Framework for Understanding Users' Needs. *JMIR Hum Factors*, 2, e9.

KE, J. X. C., GEORGE, R. B., WOZNEY, L. & CHORNEY, J. L. 2019. Patient-centred perioperative mobile application in Cesarean delivery: needs assessment and development. *Can J Anaesth*, 66, 1194-1201.

KELLY, A., BELCHOS, J., WHEATCROFT, M., BURKE, P. E., ABDELDAIM, Y., KAVANAGH, E. G., ARCHER, N., MCKIBBON, A. & MOLONEY, M. A. 2021. An international experience of electronic communication and implementation of eHealth solutions in a vascular surgery clinic. *Irish Journal of Medical Science (1971 -)*, 190, 291-296.

KETTLE, J., MARSHMAN, Z., BENSON, P. E., MCCARTHY, C., PYE, G., SANDLER, J., WINCHESTER, L. & FLETT, A. 2017. How do patients perceive the British orthodontic society online information resource about orthognathic treatment? A qualitative study. *J Orthod*, 44, 174-182.

KHAIRAT, S., HAITHCOAT, T., LIU, S., ZAMAN, T., EDSON, B., GIANFORCARO, R. & SHYU, C.-R. 2019a. Advancing health equity and access using telemedicine: a geospatial assessment. *Journal of the American Medical Informatics Association*, 26, 796-805.

KHAIRAT, S., LIU, S., ZAMAN, T., EDSON, B. & GIANFORCARO, R. 2019b. Factors Determining Patients' Choice Between Mobile Health and Telemedicine: Predictive Analytics Assessment. *JMIR Mhealth Uhealth*, 7, e13772.

KIM, A. H., GIRGIS, A., DE CRUZ, P., SIEGEL, C. A., KARIMI, N., RUBAN, S. O., SECHI, A. J., NG, W. S. W., ANDREWS, J. M. & CONNOR, S. J. 2021. Development and Feasibility of a Web-Based Decision Aid for Patients With Ulcerative Colitis: Qualitative Pilot Study. *J Med Internet Res*, 23, e15946.

- KIM, H. & XIE, B. 2017. Health literacy in the eHealth era: A systematic review of the literature. *Patient Education and Counseling*, 100, 1073-1082.
- KIM, J., CAI, Z. R., CHEN, M. L., SIMARD, J. F. & LINOS, E. 2023. Assessing Biases in Medical Decisions via Clinician and AI Chatbot Responses to Patient Vignettes. *JAMA Netw Open*, 6, e2338050.
- KIM, S., LEE, K.-H., HWANG, H. & YOO, S. 2016. Analysis of the factors influencing healthcare professionals' adoption of mobile electronic medical record (EMR) using the unified theory of acceptance and use of technology (UTAUT) in a tertiary hospital. *BMC Medical Informatics and Decision Making*, 16, 12.
- KIM, S. S., PATEL, M. & HINMAN, A. 2017. Use of m-Health in polio eradication and other immunization activities in developing countries. *Vaccine*, 35, 1373-1379.
- KNAPP, C., MADDEN, V., WANG, H., SLOYER, P. & SHENKMAN, E. 2011. Internet use and eHealth literacy of low-income parents whose children have special health care needs. *J Med Internet Res*, 13, e75.
- KNIGHT, S. R., NG, N., TSANAS, A., MCLEAN, K., PAGLIARI, C. & HARRISON, E. M. 2021. Mobile devices and wearable technology for measuring patient outcomes after surgery: a systematic review. *npj Digital Medicine*, 4, 157.
- KOO, M., NORMAN, C., & CHANG, H. M. 2012. Psychometric evaluation of a Chinese version of the eHealth Literacy Scale (eHEALS) in school age children. *International Electronic Journal of Health Education*, 15, 29-36.
- KORN, S., BÖTTCHER, M. D., BUSSE, T. S., KERNEBECK, S., BREUCHA, M., EHLERS, J., KAHLERT, C., WEITZ, J. & BORK, U. 2022. Use and Perception of Digital Health Technologies by Surgical Patients in Germany in the Pre-COVID-19 Era: Survey Study. *JMIR Form Res*, 6, e33985.
- KORSTJENS, I. & MOSER, A. 2018. Series: Practical guidance to qualitative research. Part 4: Trustworthiness and publishing. *Eur J Gen Pract*, 24, 120-124.
- KRIST, A. H., TONG, S. T., AYCOCK, R. A. & LONGO, D. R. 2017. Engaging Patients in Decision-Making and Behavior Change to Promote Prevention. *Stud Health Technol Inform*, 240, 284-302.
- KRUSE, C. S., KROWSKI, N., RODRIGUEZ, B., TRAN, L., VELA, J. & BROOKS, M. 2017. Telehealth and patient satisfaction: a systematic review and narrative analysis. *BMJ Open*, 7, e016242.
- LABRIQUE, A. B., VASUDEVAN, L., KOCHI, E., FABRICANT, R. & MEHL, G. 2013. mHealth innovations as health system strengthening tools: 12 common applications and a visual framework. *Glob Health Sci Pract*, 1, 160-71.
- LAGAN, S., AQUINO, P., EMERSON, M. R., FORTUNA, K., WALKER, R. & TOROUS, J. 2020. Actionable health app evaluation: translating expert frameworks into objective metrics. *npj Digital Medicine*, 3, 100.
- LARSEN, M. E., NICHOLAS, J. & CHRISTENSEN, H. 2016. A Systematic Assessment of Smartphone Tools for Suicide Prevention. *PLOS ONE*, 11, e0152285.
- LATULIPPE, K., HAMEL, C. & GIROUX, D. 2017. Social Health Inequalities and eHealth: A Literature Review With Qualitative Synthesis of Theoretical and Empirical Studies. *J Med Internet Res*, 19, e136.
- LEITE, H., GRUBER, T. & HODGKINSON, I. R. 2020. Flattening the infection curve—understanding the role of telehealth in managing COVID-19. *Leadership in Health Services*, 33, 221-226.

LESLIE, D., MAZUMDER, A., PEPPIN, A., WOLTERS, M. K. & HAGERTY, A. 2021. Does “AI” stand for augmenting inequality in the era of covid-19 healthcare? *BMJ*, 372, n304.

LEW, E., TAN, S. F. J., TEO, A., SNG, B. L. & LUM, E. P. M. 2023. Perceptions and Attitudes of Patients and Health Care Stakeholders on Implementing a Telehealth Service for Preoperative Evaluation: A Qualitative Analysis. *Telemedicine Reports*, 4, 156-165.

LI, E., LOUNSBURY, O., HASNAIN, M., ASHRAFIAN, H., DARZI, A., NEVES, A. L. & CLARKE, J. 2025. Physician experiences of electronic health record interoperability and its practical impact on care delivery in the English NHS: a cross-sectional survey study. *BMJ Open*, 15, e096669.

LI, J., TALAEI-KHOEI, A., SEALE, H., RAY, P. & MACINTYRE, C. R. 2013. Health Care Provider Adoption of eHealth: Systematic Literature Review. *Interact J Med Res*, 2, e7.

LINCOLN, Y. S. & GUBA, E. G. 1985. *Naturalistic Inquiry*, SAGE Publications.

LINDBERG, J. & LUNDGREN, A. S. 2022. The affective atmosphere of rural life and digital healthcare: Understanding older persons' engagement in eHealth services. *Journal of Rural Studies*, 95, 77-85.

LITCHFIELD, I., SHUKLA, D. & GREENFIELD, S. 2021. Impact of COVID-19 on the digital divide: a rapid review. *BMJ Open*, 11, e053440.

LITERACY, I. O. M. R. O. H. 2013. Health Literacy: Improving Health, Health Systems, and Health Policy Around the World: Workshop Summary. *National Academies Press*.

LIU, S., LI, J., WAN, D.-Y., LI, R., QU, Z., HU, Y. & LIU, J. 2022. Effectiveness of eHealth Self-management Interventions in Patients With Heart Failure: Systematic Review and Meta-analysis. *J Med Internet Res*, 24, e38697.

LOW, C. A., DANKO, M., DURICA, K. C., KUNTA, A. R., MULUKUTLA, R., REN, Y., BARTLETT, D. L., BOVBJERG, D. H., DEY, A. K. & JAKICIC, J. M. 2020. A Real-Time Mobile Intervention to Reduce Sedentary Behavior Before and After Cancer Surgery: Usability and Feasibility Study. *JMIR Perioper Med*, 3, e17292.

LURBE I PUERTO, K., BRUZZI, M., RIVES-LANGE, C., POGHOSYAN, T., BRETAULT, M., CHATELLIER, G., VILFAILLLOT, A., CHEVALLIER, J.-M., CZERNICHOW, S. & CARETTE, C. 2023. MyGood Trip, a Telemedicine Intervention for Physical Activity Recovery After Bariatric Surgery: Randomized Controlled Trial. *JMIR Form Res*, 7, e26077.

LUTTRELL, C., QUIROZ, S., SCRUTTON, C. & BIRD, K. 2009. Understanding and Operationalising Empowerment.

LYLES, C. R., NELSON, E. C., FRAMPTON, S., DYKES, P. C., CEMBALLI, A. G. & SARKAR, U. 2020. Using electronic health record portals to improve patient engagement: research priorities and best practices. *Annals of internal medicine*, 172, S123-S129.

MADANIAN, S., NAKARADA-KORDIC, I., REAY, S. & CHETTY, T. 2023. Patients' perspectives on digital health tools. *PEC Innov*, 2, 100171.

MAGUIRE, D., EVANS, H., HONEYMAN, M. AND OMOJOMOLO, D. 2018. Digital Change In Health And Social Care | The King's Fund. *The King's Fund*.

MALASINGHE, L. P., RAMZAN, N. & DAHAL, K. 2019. Remote patient monitoring: a comprehensive study. *Journal of Ambient Intelligence and Humanized Computing*, 10, 57-76.

- MALTERUD, K., SIERSMA, V. D. & GUASSORA, A. D. 2015. Sample Size in Qualitative Interview Studies: Guided by Information Power. *Qualitative Health Research*, 26, 1753-1760.
- MARKETSANDMARKETS 2020. eHealth Market by Solutions (EMR, PACS & VNA, RIS, LIS, CVIS, Telehealth, eRx, HIE, Patient Portal, Medical Apps), Services (Remote Patient Monitoring, Diagnostic Services) End User - Global Forecast to 2025.
- MARSHALL, J. M., DUNSTAN, D. A. & BARTIK, W. 2020. Apps With Maps-Anxiety and Depression Mobile Apps With Evidence-Based Frameworks: Systematic Search of Major App Stores. *JMIR Ment Health*, 7, e16525.
- MARTORELLA, G., GELINAS, C. & PURDEN, M. 2014. Acceptability of a web-based and tailored intervention for the self-management of pain after cardiac surgery: the perception of women and men. *JMIR Res Protoc*, 3, e63.
- MARZBAN, S., NAJAFI, M., AGOLLI, A. & ASHRAFI, E. 2022. Impact of Patient Engagement on Healthcare Quality: A Scoping Review. *J Patient Exp*, 9, 23743735221125439.
- MAY, C., FINCH, T., MAIR, F., BALLINI, L., DOWRICK, C., ECCLES, M., GASK, L., MACFARLANE, A., MURRAY, E., RAPLEY, T., ROGERS, A., TREWEEK, S., WALLACE, P., ANDERSON, G., BURNS, J. & HEAVEN, B. 2007. Understanding the implementation of complex interventions in health care: the normalization process model. *BMC Health Services Research*, 7, 148.
- MCINTYRE, D., KOVOOR, J. G., CHOW, C. K., QUINTANS, D., MARSCHNER, S., THOMAS, S., KOVOOR, P. & THIAGALINGAM, A. 2023. Clinician-Created Video Education for Patients With AF: A Randomized Clinical Trial. *JAMA Netw Open*, 6, e2345308.
- MCMASTER, T., WRIGHT, T., MORI, K., STELMACH, W. & TO, H. 2021. Current and future use of telemedicine in surgical clinics during and beyond COVID-19: A narrative review. *Annals of Medicine and Surgery*, 66, 102378.
- MEHRTAK, M., SEYEDALINAGHI, S., MOHSSENIPOUR, M., NOORI, T., KARIMI, A., SHAMSABADI, A., HEYDARI, M., BARZEGARY, A., MIRZAPOUR, P., SOLEYMANZADEH, M., VAHEDI, F., MEHRAEEN, E. & DADRAS, O. 2021. Security challenges and solutions using healthcare cloud computing. *J Med Life*, 14, 448-461.
- MENDIOLA, M. F., KALNICKI, M. & LINDENAUER, S. 2015. Valuable Features in Mobile Health Apps for Patients and Consumers: Content Analysis of Apps and User Ratings. *JMIR mHealth uHealth*, 3, e40.
- MERRIAM, S. B. & TISDELL, E. J. 2015. *Qualitative Research: A Guide to Design and Implementation*, Wiley.
- MERTENS, D. 2004. *Research and Evaluation in Education and Psychology: Integrating Diversity With Quantitative, Qualitative, and Mixed Methods*.
- MERTENS, D. M. 2010. *Research and Evaluation in Education and Psychology: Integrating Diversity With Quantitative, Qualitative, and Mixed Methods*, SAGE Publications.
- MESSIAH, S. E., SACHER, P. M., YUDKIN, J., OFORI, A., QURESHI, F. G., SCHNEIDER, B., HOELSCHER, D. M., DE LA CRUZ-MUÑOZ, N. & BARLOW, S. E. 2020. Application and effectiveness of eHealth strategies for metabolic and bariatric surgery patients: A systematic review. *DIGITAL HEALTH*, 6, 2055207619898987.

MIKKELSEN, R. B. L., DAMSGAARD, B. & DAHL, M. 2022. Patients' perspectives show us how to care for their needs when living with an abdominal aortic aneurysm: Development of an eHealth solution. *Journal of Vascular Nursing*, 40, 92-99.

MILES, M. B., HUBERMAN, A. M. & SALDANA, J. 2013. *Qualitative Data Analysis: A Methods Sourcebook*, SAGE Publications.

MITSUTAKE, S., SHIBATA, A., ISHII, K. & OKA, K. 2012. Association of eHealth literacy with colorectal cancer knowledge and screening practice among internet users in Japan. *Journal of medical Internet research*, 14, e153-e153.

MOHER, D., LIBERATI, A., TETZLAFF, J. & ALTMAN, D. G. 2009. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *J Clin Epidemiol*, 62, 1006-12.

MORGAN, D. 2007. Paradigms Lost and Pragmatism Regained: Methodological Implications of Combining Qualitative and Quantitative Methods. *Journal of Mixed Methods Research*, 1, 48-76.

MORTON, K., DENNISON, L., MAY, C., MURRAY, E., LITTLE, P., MCMANUS, R. J. & YARDLEY, L. 2017. Using digital interventions for self-management of chronic physical health conditions: A meta-ethnography review of published studies. *Patient Educ Couns*, 100, 616-635.

NATIONAL AUDIT OFFICE 2020. Digital transformation in the NHS.

NATIONS, T. U. 2020. UN tackles 'infodemic' of misinformation and cybercrime in COVID-19 crisis.

NEGRO-CALDUCH, E., AZZOPARDI-MUSCAT, N., KRISHNAMURTHY, R. S. & NOVILLO-ORTIZ, D. 2021. Technological progress in electronic health record system optimization: Systematic review of systematic literature reviews. *Int J Med Inform*, 152, 104507.

NEHA, F., BHATI, D., SHUKLA, D. K. & AMIRUZZAMAN, M. 2024. ChatGPT: Transforming Healthcare with AI. *AI [Online]*, 5.

NEJM CATALYST 2018. What Is Telehealth? *Catalyst Carryover*, 4.

NETER, E. & BRAININ, E. 2012. eHealth Literacy: Extending the Digital Divide to the Realm of Health Information. *J Med Internet Res*, 14, e19.

NETER, E. & BRAININ, E. 2017. Perceived and Performed eHealth Literacy: Survey and Simulated Performance Test. *JMIR human factors*, 4, e2-e2.

NEWMAN, I. & BENZ, C. R. 1998. *Qualitative-Quantitative Research Methodology: Exploring the Interactive Continuum*. Southern Illinois University Press.

NHS ENGLAND 2019. NHS Long Term Plan.

NHS ENGLAND 2023. Digital transformation and the application of technology. *England.nhs.uk*.

NHS TRANSFORMATION DIRECTORATE 2021. Digital Technology Assessment Criteria (DTAC). *NHS Transformation Directorate*.

NICE 2022. Evidence standards framework for digital health technologies. *Nice.org.uk*.

NILSSON, L., HELLSTROM, A., WENNERBERG, C., EKSTEDT, M. & SCHILDMEIJER, K. 2020a. Patients' experiences of using an e-Health tool for self-management support after prostate cancer surgery: a deductive interview study explained through the FITT framework. *BMJ Open*, 10, e035024.

NILSSON, O., HULTGREN, R. & LETTERSTAL, A. 2020b. eHealth tool for patients with abdominal aortic aneurysm: development and initial evaluation. *Scand J Caring Sci*, 34, 348-356.

NILSSON, O., HULTGREN, R. & LETTERSTÅL, A. 2023. Experiences of participating in an eHealth intervention for patients with abdominal aortic aneurysm: A qualitative study. *Journal of Vascular Nursing*, 41, 114-120.

NILSSON, O., STENMAN, M., LETTERSTÅL, A. & HULTGREN, R. 2021. A randomized clinical trial of an eHealth intervention on anxiety in patients undergoing abdominal aortic aneurysm surgery. *British Journal of Surgery*, 108, 917-924.

NORBERG, B. L., GETZ, L. O., JOHNSEN, T. M., AUSTAD, B. & ZANABONI, P. 2023. General Practitioners' Experiences With Potentials and Pitfalls of Video Consultations in Norway During the COVID-19 Lockdown: Qualitative Analysis of Free-Text Survey Answers. *J Med Internet Res*, 25, e45812.

NORMAN, C. D. & SKINNER, H. A. 2006. eHEALS: The eHealth Literacy Scale. *J Med Internet Res*, 8, e27.

NOURI, S., KHOONG ELAINE, C., LYLES COURTNEY, R. & KARLINER, L. 2020a. Addressing Equity in Telemedicine for Chronic Disease Management During the Covid-19 Pandemic. *Catalyst non-issue content*, 1.

NOURI, S. S., ADLER-MILSTEIN, J., THAO, C., ACHARYA, P., BARR-WALKER, J., SARKAR, U. & LYLES, C. 2020b. Patient characteristics associated with objective measures of digital health tool use in the United States: A literature review. *Journal of the American Medical Informatics Association*, 27, 834-841.

NURTSCH, A., TEUFEL, M., JAHRE, L. M., ESBER, A., RAUSCH, R., TEWES, M., SCHÖBEL, C., PALM, S., SCHULER, M., SCHADENDORF, D., SKODA, E.-M. & BÄUERLE, A. 2024. Drivers and barriers of patients' acceptance of video consultation in cancer care. *DIGITAL HEALTH*, 10, 20552076231222108.

O'CONNOR, S., HANLON, P., O'DONNELL, C. A., GARCIA, S., GLANVILLE, J. & MAIR, F. S. 2016. Understanding factors affecting patient and public engagement and recruitment to digital health interventions: a systematic review of qualitative studies. *BMC Medical Informatics and Decision Making*, 16, 120.

O'LEARY, M. C., KWONG, E., COX, C., GENTRY, A. L., STOVER, A. M., VU, M. B., CARDA-AUTEN, J., LEEMAN, J. & MODY, G. N. 2024. Patient motivators of postoperative electronic patient-reported outcome symptom monitoring use in thoracic surgery patients: a qualitative study. *Journal of Patient-Reported Outcomes*, 8, 81.

OATES, E. V., LIM, G. H. C., NEVINS, E. J. & KANAKALA, V. 2021. Are Surgical Patients Satisfied With Remote Consultations? A Comparison of Remote Versus Conventional Outpatient Clinic Follow-Up for Surgical Patients: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. *Journal of Patient Experience*, 8, 23743735211035916.

OFCOM 2020. Online Nation 2020 Report.

OFFICE FOR NATIONAL STATISTICS 2020. Internet access – households and individuals, Great Britain.

OLIVIA, M., ALLISTER, S., JEONGYOON, M., MARIE, D., RICHARD, G., CAROL-ANN, V., FATEME, R. & MARYLISE, B. 2023. An online educational and supportive care application for rectal cancer

survivors with low anterior resection syndrome: A mixed methods pilot study. *Colorectal Dis*, 25, 1812-1820.

ONS 2021. People, population and community - Office for National Statistics. *Ons.gov.uk*.

OSSEBAARD, H. C. & VAN GEMERT-PIJNEN, L. 2016. eHealth and quality in health care: implementation time. *International Journal for Quality in Health Care*, 28, 415-419.

PAPOUTSI, C., SHAW, S. & GREENHALGH, T. 2022. Implementing video group consultations in general practice during COVID-19: a qualitative study. *British Journal of General Practice*, 72, e483-e491.

PAPOUTSI, C., WHERTON, J., SHAW, S., MORRISON, C. & GREENHALGH, T. 2021. Putting the social back into sociotechnical: Case studies of co-design in digital health. *J Am Med Inform Assoc*, 28, 284-293.

PAPPOT, N., TAARNHØJ, G. A. & PAPPOT, H. 2020. Telemedicine and e-Health Solutions for COVID-19: Patients' Perspective. *Telemedicine and e-Health*, 26, 847-849.

PAYNE, H. E., LISTER, C., WEST, J. H. & BERNHARDT, J. M. 2015. Behavioral functionality of mobile apps in health interventions: a systematic review of the literature. *JMIR Mhealth Uhealth*, 3, e20.

PAYNTER, C., MCDONALD, C., STORY, D. & FRANCIS, J. J. 2023. Application of the theoretical framework of acceptability in a surgical setting: Theoretical and methodological insights. *British Journal of Health Psychology*, 28, 1153-1168.

PEETERS, J. M., KRIJGSMAN, J. W., BRABERS, A. E., JONG, J. D. D. & FRIELE, R. D. 2016. Use and Uptake of eHealth in General Practice: A Cross-Sectional Survey and Focus Group Study Among Health Care Users and General Practitioners. *JMIR Med Inform*, 4, e11.

PENEDO, F. J., OSWALD, L. B., KRONENFELD, J. P., GARCIA, S. F., CELLA, D. & YANEZ, B. 2020. The increasing value of eHealth in the delivery of patient-centred cancer care. *The Lancet Oncology*, 21, e240-e251.

PHILLIPS, D. C. & BURBULES, N. C. 2000. *Postpositivism and Educational Research*, Rowman & Littlefield Publishers.

POPE, C. & MAYS, N. 2020. The Role of Theory in Qualitative Research. *Qualitative Research in Health Care*. Wiley.

PRICE, C., GREEN, W. & SUHOMLINOVA, O. 2019. Twenty-five years of national health IT: exploring strategy, structure, and systems in the English NHS. *Journal of the American Medical Informatics Association*, 26, 188-197.

RAMASWAMY, A., YU, M., DRANGSHOLT, S., NG, E., CULLIGAN, P. J., SCHLEGEL, P. N. & HU, J. C. 2020. Patient Satisfaction With Telemedicine During the COVID-19 Pandemic: Retrospective Cohort Study. *J Med Internet Res*, 22, e20786.

REGMI, K., KASSIM, N., AHMAD, N. & TUAH, N. A. 2017. Effectiveness of Mobile Apps for Smoking Cessation: A Review. *Tob Prev Cessat*, 3, 12.

REID, H., MOHAMMADI, S., WATSON, W., ROBILLARD, J. M., CROCKER, M., WESTBY, M. D. & MILLER, W. C. 2021. Patient and Caregiver Perspectives on an eHealth Tool: A Qualitative Investigation of Preferred Formats, Features and Characteristics of a Presurgical eHealth Education Module. *Rehabil Process Outcome*, 10, 11795727211010501.

REINHARDT, G., SCHWARZ, P. E. H. & HARST, L. 2021. Non-use of telemedicine: A scoping review. *Health Informatics Journal*, 27, 14604582211043147.

RENZI, E., BACCOLINI, V., MIGLIARA, G., DE VITO, C., GASPERINI, G., CIANCIULLI, A., MARZUILLO, C., VILLARI, P. & MASSIMI, A. 2022. The Impact of eHealth Interventions on the Improvement of Self-Care in Chronic Patients: An Overview of Systematic Reviews. *Life (Basel)*, 12.

RESEARCH, G. V. 2021. Telemedicine Market Size, Share & Trends Analysis Report and Segment Forecasts, 2021 - 2028.

RICHARDS, H. S., PORTAL, A., ABSOLOM, K., BLAZEY, J. M., VELIKOVA, G. & AVERY, K. N. L. 2021. Patient experiences of an electronic PRO tailored feedback system for symptom management following upper gastrointestinal cancer surgery. *Qual Life Res*, 30, 3229-3239.

RICHTERING, S. S., MORRIS, R., SOH, S. E., BARKER, A., BAMPI, F., NEUBECK, L., COOREY, G., MULLEY, J., CHALMERS, J., USHERWOOD, T., PEIRIS, D., CHOW, C. K. & REDFERN, J. 2017. Examination of an eHealth literacy scale and a health literacy scale in a population with moderate to high cardiovascular risk: Rasch analyses. *PLoS One*, 12, e0175372.

RISLING, T., MARTINEZ, J., YOUNG, J. & THORP-FROSLIE, N. 2017. Evaluating Patient Empowerment in Association With eHealth Technology: Scoping Review. *J Med Internet Res*, 19, e329.

RISTEVSKI, B. & CHEN, M. 2018. Big Data Analytics in Medicine and Healthcare. *J Integr Bioinform*, 15.

ROBINSON, A., HUSBAND, A., SLIGHT, R. & SLIGHT, S. P. 2022. Designing Digital Health Technology to Support Patients Before and After Bariatric Surgery: Qualitative Study Exploring Patient Desires, Suggestions, and Reflections to Support Lifestyle Behavior Change. *JMIR Hum Factors*, 9, e29782.

ROBINSON, A., SLIGHT, R. D., HUSBAND, A. K. & SLIGHT, S. P. 2021. Designing the Optimal Digital Health Intervention for Patients' Use Before and After Elective Orthopedic Surgery: Qualitative Study. *J Med Internet Res*, 23, e25885.

ROGERS, E. M. 2003. *Diffusion of Innovations*, 5th Edition, Free Press.

ROH, C.-Y. 2008. Telemedicine: What it is, where it came from, and where it will go. *Comparative Technology Transfer and Society*, 6, 35-55.

ROHDE, J. A., BARKER, J. O. & NOAR, S. M. 2021. Impact of eHealth technologies on patient outcomes: a meta-analysis of chronic gastrointestinal illness interventions. *Transl Behav Med*, 11, 1-10.

ROSS, J., STEVENSON, F., LAU, R. & MURRAY, E. 2016. Factors that influence the implementation of e-health: a systematic review of systematic reviews (an update). *Implementation Science*, 11, 146.

RUSS, S., LATIF, Z., HAZELL, A. L., OGUNMUYIWA, H., TAPPER, J., WACHUKU-KING, S., SEVDALIS, N. & OCLOO, J. 2020. A Smartphone App Designed to Empower Patients to Contribute Toward Safer Surgical Care: Community-Based Evaluation Using a Participatory Approach. *JMIR mHealth and uHealth*, 8, e12859-e12859.

RUSS, S., SEVDALIS, N. & OCLOO, J. 2021. A Smartphone App Designed to Empower Patients to Contribute Toward Safer Surgical Care: Qualitative Evaluation of Diverse Public and Patient Perceptions Using Focus Groups. *JMIR Mhealth Uhealth*, 9, e24065.

SAEED, S. A. & MASTERS, R. M. 2021. Disparities in Health Care and the Digital Divide. *Current Psychiatry Reports*, 23, 61.

SALISBURY, C., O'CATHAIN, A., THOMAS, C., EDWARDS, L., GAUNT, D., DIXON, P., HOLLINGHURST, S., NICHOLL, J., LARGE, S., YARDLEY, L., FAHEY, T., FOSTER, A., GARNER, K., HORSPOOL, K., MAN, M.-S., ROGERS, A., POPE, C. & MONTGOMERY, A. A. 2016. Telehealth for patients at high risk of cardiovascular disease: pragmatic randomised controlled trial. *BMJ*, 353, i2647.

SANGER, P. C., HARTZLER, A., HAN, S. M., ARMSTRONG, C. A., STEWART, M. R., LORDON, R. J., LOBER, W. B. & EVANS, H. L. 2014. Patient perspectives on post-discharge surgical site infections: towards a patient-centered mobile health solution. *PLoS One*, 9, e114016.

SAUNDERS, R., SEAMAN, K., EMERY, L., CROMPTON, D., LYNCH, C., PENJOR, D. & SAGAR, S. 2022. My hip journey: A qualitative study of patients' experiences of an eHealth program for patient preparation and recovery from hip replacement surgery. *J Clin Nurs*, 31, 1580-1587.

SCHMIDT, M., ECKARDT, R., SCHOLTZ, K., NEUNER, B., VON DOSSOW-HANFSTINGL, V., SEHOULI, J., STIEF, C. G., WERNECKE, K.-D., SPIES, C. D. & GROUP, P. 2015. Patient Empowerment Improved Perioperative Quality of Care in Cancer Patients Aged ≥ 65 Years – A Randomized Controlled Trial. *PLOS ONE*, 10, e0137824.

SCHOEPPE, S., ALLEY, S., VAN LIPPEVELDE, W., BRAY, N. A., WILLIAMS, S. L., DUNCAN, M. J. & VANDELANOTTE, C. 2016. Efficacy of interventions that use apps to improve diet, physical activity and sedentary behaviour: a systematic review. *Int J Behav Nutr Phys Act*, 13, 127.

SCHREIWEIS, B., POBIRUCHIN, M., STROTBAUM, V., SULEDER, J., WIESNER, M. & BERGH, B. 2019. Barriers and Facilitators to the Implementation of eHealth Services: Systematic Literature Analysis. *J Med Internet Res*, 21, e14197.

SCHULTE, M. H. J., AARDOOM, J. J., LOHEIDE-NIESMANN, L., VERSTRAETE, L. L. L., OSSEBAARD, H. C. & RIPER, H. 2021. Effectiveness of eHealth Interventions in Improving Medication Adherence for Patients With Chronic Obstructive Pulmonary Disease or Asthma: Systematic Review. *J Med Internet Res*, 23, e29475.

SCOTT, A. R., ALORE, E. A., NAIK, A. D., BERGER, D. H. & SULIBURK, J. W. 2017. Mixed-Methods Analysis of Factors Impacting Use of a Postoperative mHealth App. *JMIR Mhealth Uhealth*, 5, e11.

SCOTT, B. K., MILLER, G. T., FONDA, S. J., YEAW, R. E., GAUDAEN, J. C., PAVLISCSAK, H. H., QUINN, M. T. & PAMPLIN, J. C. 2020. Advanced Digital Health Technologies for COVID-19 and Future Emergencies. *Telemed J E Health*, 26, 1226-1233.

SEKHON, M., CARTWRIGHT, M. & FRANCIS, J. J. 2017. Acceptability of healthcare interventions: an overview of reviews and development of a theoretical framework. *BMC Health Services Research*, 17, 88.

SHARIF, F., RAHMAN, A., TONNER, E., AHMED, H., HAQ, I., ABBASS, R., ASINGER, S. & SBAI, M. 2020. Can technology optimise the pre-operative pathway for elective hip and knee replacement surgery: a qualitative study. *Perioperative Medicine*, 9, 33.

SHARMA, G. & DEVAN, K. 2023. The effectiveness of telepsychiatry: thematic review. *BJPsych Bull*, 47, 82-89.

SHARRAD, K., MARTINI, C., TAI, A., SPURRIER, N., SMITH, R., ESTERMAN, A., GWILT, I., SANDFORD, D. & CARSON-CHAHHOUD, K. 2023. Mixed Reality Technology to Deliver Psychological

Interventions to Adolescents With Asthma: Qualitative Study Using the Theoretical Framework of Acceptability. *JMIR Hum Factors*, 10, e34629.

SHAW, J., BREWER, L. C. & VEINOT, T. 2021a. Recommendations for Health Equity and Virtual Care Arising From the COVID-19 Pandemic: Narrative Review. *JMIR Form Res*, 5, e23233.

SHAW, S. E., HUGHES, G., WHERTON, J., MOORE, L., ROSEN, R., PAPOUTSI, C., RUSHFORTH, A., MORRIS, J., WOOD, G. W., FAULKNER, S. & GREENHALGH, T. 2021b. Achieving Spread, Scale Up and Sustainability of Video Consulting Services During the COVID-19 Pandemic? Findings From a Comparative Case Study of Policy Implementation in England, Wales, Scotland and Northern Ireland. *Front Digit Health*, 3, 754319.

SHAW, S. E., SEUREN, L. M., WHERTON, J., CAMERON, D., A'COURT, C., VIJAYARAGHAVAN, S., MORRIS, J., BHATTACHARYA, S. & GREENHALGH, T. 2020. Video Consultations Between Patients and Clinicians in Diabetes, Cancer, and Heart Failure Services: Linguistic Ethnographic Study of Video-Mediated Interaction. *J Med Internet Res*, 22, e18378.

SHAW, T., MCGREGOR, D., BRUNNER, M., KEEP, M., JANSSEN, A. & BARNET, S. 2017. What is eHealth (6)? Development of a Conceptual Model for eHealth: Qualitative Study with Key Informants. *J Med Internet Res*, 19, e324.

SHENTON, A. K. 2004. Strategies for ensuring trustworthiness in qualitative research projects. *Education for Information*, 22, 63-75.

SHIFERAW, K. B., MENGISTE, S. A., GULLSLETT, M. K., ZELEKE, A. A., TILAHUN, B., TEBEJE, T., WONDIMU, R., DESALEGN, S. & MEHARI, E. A. 2021. Healthcare providers' acceptance of telemedicine and preference of modalities during COVID-19 pandemics in a low-resource setting: An extended UTAUT model. *PLOS ONE*, 16, e0250220.

SHIFERAW, K. B., TILAHUN, B. C., ENDEHABTU, B. F., GULLSLETT, M. K. & MENGISTE, S. A. 2020. E-health literacy and associated factors among chronic patients in a low-income country: a cross-sectional survey. *BMC Medical Informatics and Decision Making*, 20, 181.

SHORTLIFFE, E. H. 2005. Strategic Action In Health Information Technology: Why The Obvious Has Taken So Long. *Health Affairs*, 24, 1222-1233.

SILBERMAN, J., WICKS, P., PATEL, S., SARLATI, S., PARK, S., KOROLEV, I. O., CARL, J. R., OWUSU, J. T., MISHRA, V., KAUR, M., WILLEY, V. J., SUCALA, M. L., CAMPELLONE, T. R., GEOGHEGAN, C., RODRIGUEZ-CHAVEZ, I. R., VANDENDRIESSCHE, B., PARK, S., MISHRA, V., RODRIGUEZ-CHAVEZ, I. R., GOLDSACK, J. C. & THE EVIDENCE, D. W. 2023. Rigorous and rapid evidence assessment in digital health with the evidence DEFINED framework. *npj Digital Medicine*, 6, 101.

SILVA, B. M. C., RODRIGUES, J. J. P. C., DE LA TORRE DíEZ, I., LÓPEZ-CORONADO, M. & SALEEM, K. 2015. Mobile-health: A review of current state in 2015. *Journal of Biomedical Informatics*, 56, 265-272.

SKIVINGTON, K., MATTHEWS, L., SIMPSON, S. A., CRAIG, P., BAIRD, J., BLAZEYBY, J. M., BOYD, K. A., CRAIG, N., FRENCH, D. P., MCINTOSH, E., PETTICREW, M., RYCROFT-MALONE, J., WHITE, M. & MOORE, L. 2021. A new framework for developing and evaluating complex interventions: update of Medical Research Council guidance. *BMJ*, 374, n2061.

SLIFE, B. & WILLIAMS, R. 1995. What's Behind the Research? Discovering Hidden Assumptions in the Behavioral Sciences. Thousand Oaks, California.

SOEGAARD BALLESTER, J. M., BASS, G. D., URBANI, R., FALA, G., PATEL, R., LERI, D., STEINKAMP, J. M., DENSON, J. L., ROSIN, R., ADUSUMALLI, S., HANSON, C. W., KOPPEL, R. & AIRAN-JAVIA, S. 2021. A Mobile, Electronic Health Record-Connected Application for Managing Team Workflows in Inpatient Care. *Appl Clin Inform*, 12, 1120-1134.

SOHL, S. J., STRAHLEY, A. E., TOOZE, J. A., LEVINE, B. J., KELLY, M. G., WHEELER, A., EVANS, S. & DANHAUER, S. C. 2024. Qualitative results from a randomized pilot study of eHealth Mindful Movement and Breathing to improve gynecologic cancer surgery outcomes. *Journal of Psychosocial Oncology*, 42, 223-241.

SOUKUP, T., WINTERS, D., CHUA, K.-C., ROWLAND, P., MONEKE, J., SKOLARUS, T. A., BHARATHAN, R., HARLING, L., BALI, A., ASHER, V., GANDAMIHARDJA, T., SEVDALIS, N., GREEN, J. S. A. & LAMB, B. W. 2023. Evaluation of changes to work patterns in multidisciplinary cancer team meetings due to the COVID-19 pandemic: A national mixed-method survey study. *Cancer Medicine*, 12, 8729-8741.

SOUNDERAJAH, V., CLARKE, J., YALAMANCHILI, S., ACHARYA, A., MARKAR, S. R., ASHRAFIAN, H. & DARZI, A. 2021. A national survey assessing public readiness for digital health strategies against COVID-19 within the United Kingdom. *Scientific Reports*, 11, 5958.

SREEDHARAN, S., NEMETH, L. S., HIRSCH, J. & EVANS, H. L. 2022. Patient and Provider Preferences for Monitoring Surgical Wounds Using an mHealth App: A Formative Qualitative Analysis. *Surgical Infections*, 23, 168-173.

STEINE, S., FINSET, A. & LAERUM, E. 2001. A new, brief questionnaire (PEQ) developed in primary health care for measuring patients' experience of interaction, emotion and consultation outcome. *Fam Pract*, 18, 410-8.

STERN, B. Z., PILA, S., JOSEPH, L. I., ROTHROCK, N. E. & FRANKLIN, P. D. 2022. Patients' perspectives on the benefits of feedback on patient-reported outcome measures in a web-based personalized decision report for hip and knee osteoarthritis. *BMC Musculoskeletal Disorders*, 23, 806.

STEVENS, S., GALLAGHER, S., ANDREWS, T., ASHALL-PAYNE, L., HUMPHREYS, L. & LEIGH, S. 2022. The effectiveness of digital health technologies for patients with diabetes mellitus: A systematic review. *Front Clin Diabetes Healthc*, 3, 936752.

SUKRITI, K. C., SALINA, T., ANTHONY, A. L., CÉIRE, C., CHRYSANTHI, P., CLAIRE, R., BERNARD, G., CRAIG, S., AZEEM, M., JOHN, P. & FELIX, G. 2023. Uptake and adoption of the NHS App in England: an observational study. *British Journal of General Practice*, 73, e932.

SYMONDS R, T.-R. J., STEVENS S, SLEEMAN O 2020. Patient Perception of remote, digital NHS healthcare during the COVID-19 pandemic: a UK-wide survey. *JMIR Preprints*.

TALBOOM-KAMP, E. P. W. A., VERDIJK, N. A., HARMANS, L. M., NUMANS, M. E. & CHAVANNES, N. H. 2016. An eHealth Platform to Manage Chronic Disease in Primary Care: An Innovative Approach. *Interact J Med Res*, 5, e5.

TAN, J., CHENG, W. & ROGERS, W. J. 2002. From Telemedicine to E-Health: Uncovering New Frontiers of Biomedical Research, Clinical Applications & Public Health Services Delivery. *Journal of Computer Information Systems*, 42, 7-18.

TAYLOR, M. L., THOMAS, E. E., VITANGCOL, K., MARX, W., CAMPBELL, K. L., CAFFERY, L. J., HAYDON, H. M., SMITH, A. C. & KELLY, J. T. 2022. Digital health experiences reported in chronic disease management: An umbrella review of qualitative studies. *Journal of Telemedicine and Telecare*, 28, 705-717.

- TEBEJE, T. H. & KLEIN, J. 2020. Applications of e-Health to Support Person-Centered Health Care at the Time of COVID-19 Pandemic. *Telemedicine and e-Health*, 27, 150-158.
- TERP, R., KAYSER, L. & LINDHARDT, T. 2021. Older Patients' Competence, Preferences, and Attitudes Toward Digital Technology Use: Explorative Study. *JMIR Hum Factors*, 8, e27005.
- THIRUNAVUKARASU, A. J., TING, D. S. J., ELANGOVAN, K., GUTIERREZ, L., TAN, T. F. & TING, D. S. W. 2023. Large language models in medicine. *Nat Med*, 29, 1930-1940.
- THOMAS, J. & HARDEN, A. 2008. Methods for the thematic synthesis of qualitative research in systematic reviews. *BMC Med Res Methodol*, 8, 45.
- THOMPSON, R. L., HIGGINS, C. A. & HOWELL, J. M. 1991. Personal Computing: Toward a Conceptual Model of Utilization. *MIS Quarterly*, 15, 125-143.
- TIMMERS, T., JANSSEN, L., KOOL, R. B. & KREMER, J. A. M. 2020. Educating Patients by Providing Timely Information Using Smartphone and Tablet Apps: Systematic Review. *J Med Internet Res*, 22, e17342.
- TIMMERS, T., VAN DER WEEGEN, W., JANSSEN, L., KREMER, J. & KOOL, R. B. 2022. Importance of Patient Involvement in Creating Content for eHealth Interventions: Qualitative Case Report in Orthopedics. *JMIR Form Res*, 6, e39637.
- TOFT, B. S., RODKJÆR, L. Ø., SØRENSEN, L., SAUGBJERG, M. R., BEKKER, H. L. & MODRAU, I. S. 2024. Feasibility of early digital health rehabilitation after cardiac surgery in the elderly: a qualitative study. *BMC Health Services Research*, 24, 113.
- TOROUS, J., LEVIN, M. E., AHERN, D. K. & OSER, M. L. 2017. Cognitive Behavioral Mobile Applications: Clinical Studies, Marketplace Overview, and Research Agenda. *Cognitive and Behavioral Practice*, 24, 215-225.
- TRANG, K., DECKER, H. C., GONZALEZ, A., PIERCE, L., SHUI, A. M., MELTON-MEAUX, G. B. & WICK, E. C. 2024. Electronic Surgical Consent Delivery Via Patient Portal to Improve Perioperative Efficiency. *JAMA Surgery*.
- TRIANA, A. J., GUSDORF, R. E., SHAH, K. P. & HORST, S. N. 2020. Technology Literacy as a Barrier to Telehealth During COVID-19. *Telemedicine and e-Health*, 26, 1118-1119.
- TRIANTAFILLOU, V., LAYFIELD, E., PRASAD, A., DENG, J., SHANTI, R. M., NEWMAN, J. G. & RAJASEKARAN, K. 2021. Patient Perceptions of Head and Neck Ambulatory Telemedicine Visits: A Qualitative Study. *Otolaryngol Head Neck Surg*, 164, 923-931.
- UNSWORTH, H., DILLON, B., COLLINSON, L., POWELL, H., SALMON, M., OLADAPO, T., AYIKU, L., SHIELD, G., HOLDEN, J., PATEL, N., CAMPBELL, M., GREAVES, F., JOSHI, I., POWELL, J. & TONNEL, A. 2021. The NICE Evidence Standards Framework for digital health and care technologies - Developing and maintaining an innovative evidence framework with global impact. *Digit Health*, 7, 20552076211018617.
- UPPAL, A., KOTHARI, A. N., SCALLY, C. P., ROLAND, C. L., BEDNARSKI, B. K., KATZ, M. H. G., VAUTHEY, J.-N., CHANG, G. J. & NULL, N. 2022. Adoption of Telemedicine for Postoperative Follow-Up After Inpatient Cancer-Related Surgery. *JCO Oncology Practice*, 18, e1091-e1099.
- VAN DER HORST, A. Y., BOHLMMEIJER, E. T., SCHREURS, K. M. G. & KELDERS, S. M. 2023. Strength Back – A qualitative study on the co-creation of a positive psychology digital health intervention for spinal surgery patients. *Frontiers in Psychology*, 14.

VAN DER MEIJ, E., ANEMA, J. R., OTTEN, R. H., HUIRNE, J. A. & SCHAAFSMA, F. G. 2016. The Effect of Perioperative E-Health Interventions on the Postoperative Course: A Systematic Review of Randomised and Non-Randomised Controlled Trials. *PLoS One*, 11, e0158612.

VAN DER MEIJ, E., BOUWSMA, E. V. A., VAN DEN HEUVEL, B., BONJER, H. J., ANEMA, J. R. & HUIRNE, J. A. F. 2017. Using e-health in perioperative care: a survey study investigating shortcomings in current perioperative care and possible future solutions. *BMC Surgery*, 17, 61.

VAN DER MEIJ, E., HUIRNE, J. A., TEN CATE, A. D., STOCKMANN, H. B., SCHOLTEN, P. C., DAVIDS, P. H., BONJER, H. J. & ANEMA, J. R. 2018. A Perioperative eHealth Program to Enhance Postoperative Recovery After Abdominal Surgery: Process Evaluation of a Randomized Controlled Trial. *J Med Internet Res*, 20, e1.

VAN DER VAART, R. & DROSSAERT, C. 2017. Development of the Digital Health Literacy Instrument: Measuring a Broad Spectrum of Health 1.0 and Health 2.0 Skills. *J Med Internet Res*, 19, e27.

VAN DER VAART, R., VAN DEURSEN, A. J., DROSSAERT, C. H., TAAL, E., VAN DIJK, J. A. & VAN DE LAAR, M. A. 2011. Does the eHealth Literacy Scale (eHEALS) measure what it intends to measure? Validation of a Dutch version of the eHEALS in two adult populations. *Journal of medical Internet research*, 13, e86-e86.

VAN DER VELDE, M., VALKENET, K., GELEIJN, E., KRUISSELBRINK, M., MARSMAN, M., JANSSEN, L. M., RUURDA, J. P., VAN DER PEET, D. L., AARDEN, J. J., VEENHOF, C. & VAN DER LEEDEN, M. 2021. Usability and Preliminary Effectiveness of a Preoperative mHealth App for People Undergoing Major Surgery: Pilot Randomized Controlled Trial. *JMIR mHealth and uHealth*, 9, e23402-e23402.

VAN EGMOND, M. A., VAN DER SCHAAF, M., VREDEVELD, T., VOLLENBROEK-HUTTEN, M. M. R., VAN BERGE HENEGOUWEN, M. I., KLINKENBIJL, J. H. G. & ENGELBERT, R. H. H. 2018. Effectiveness of physiotherapy with telerehabilitation in surgical patients: a systematic review and meta-analysis. *Physiotherapy*, 104, 277-298.

VAN MIDDELAAR, T., BEISHUIZEN, C. R., GUILLEMONT, J., BARBERA, M., RICHARD, E. & VAN CHARANTE, E. P. M. 2018. Engaging older people in an internet platform for cardiovascular risk self-management: a qualitative study among Dutch HATICE participants. *BMJ open*, 8, e019683.

VAN STEENBERGEN, G., VAN VEGHEL, D., VAN LIESHOUT, D., SPERWER, M., TER WOORST, J. & DEKKER, L. 2022. Effects of Video-Based Patient Education and Consultation on Unplanned Health Care Utilization and Early Recovery After Coronary Artery Bypass Surgery (IMPROV-ED): Randomized Controlled Trial. *J Med Internet Res*, 24, e37728.

VENKATESH, V., THONG, J. Y. & XU, X. 2016. Unified theory of acceptance and use of technology: A synthesis and the road ahead. *Journal of the association for Information Systems*, 17, 328-376.

VENKATESH, V., THONG, J. Y. L. & XU, X. 2012. Consumer Acceptance and Use of Information Technology: Extending the Unified Theory of Acceptance and Use of Technology. *MIS Quarterly*, 36, 157-178.

WACHTER, R. 2016. Making IT Work: Harnessing the Power of Health Information Technology to Improve Care in England.

WATHNE, H., MORKEN, I. M., STORM, M. & HUSEBØ, A. M. L. 2023. Designing a Future eHealth Service for Posthospitalization Self-management Support in Long-term Illness: Qualitative Interview Study. *JMIR Hum Factors*, 10, e39391.

WEBSTER, P. 2019. Digital health technologies and health-care privatisation. *The Lancet Digital Health*, 1, e161-e162.

WEBSTER, P. 2020. Virtual health care in the era of COVID-19. *The Lancet*, 395, 1180-1181.

WEENK, M., BREDIE, S. J., KOENEMAN, M., HESSELINK, G., VAN GOOR, H. & VAN DE BELT, T. H. 2020. Continuous Monitoring of Vital Signs in the General Ward Using Wearable Devices: Randomized Controlled Trial. *J Med Internet Res*, 22, e15471.

WHALEY, C. M., PERA, M. F., CANTOR, J., CHANG, J., VELASCO, J., HAGG, H. K., SOOD, N. & BRAVATA, D. M. 2020. Changes in Health Services Use Among Commercially Insured US Populations During the COVID-19 Pandemic. *JAMA Network Open*, 3, e2024984-e2024984.

WHITELAW, S., PELLEGRINI, D. M., MAMAS, M. A., COWIE, M. & VAN SPALL, H. G. C. 2021. Barriers and facilitators of the uptake of digital health technology in cardiovascular care: a systematic scoping review. *European Heart Journal - Digital Health*, 2, 62-74.

WHO 2018a. mHealth Use of appropriate digital technologies for public health Report by the Director-General.

WHO 2018b. mHealth: New horizons for health through mobile technologie. *WHO*

WHO 2018c. SEVENTY-FIRST WORLD HEALTH ASSEMBLY WHA71.7 Agenda item 12.4 26 Digital health.

WHO 2019a. Global Observatory for eHealth. *Who.int*.

WHO 2019b. Global strategy on digital health 2020–2025.

WILLEMS, S. J., COPPIETERS, M. W., PRONK, Y., DIKS, M. J. F., VAN DER HEIJDEN, K., ROOKER, S. & SCHOLTEN-PEETERS, G. G. M. 2021. A Clinical Journey Mobile Health App for Perioperative Patients: Cross-sectional Study. *JMIR Hum Factors*, 8, e20694.

WILSON, J., HEINSCH, M., BETTS, D., BOOTH, D. & KAY-LAMBKIN, F. 2021. Barriers and facilitators to the use of e-health by older adults: a scoping review. *BMC Public Health*, 21, 1556.

WINTERS, B. D., GURSES, A. P., LEHMANN, H., SEXTON, J. B., RAMPERSAD, C. J. & PRONOVOST, P. J. 2009. Clinical review: checklists - translating evidence into practice. *Crit Care*, 13, 210.

WITKOWSKI, K., DOUGHERTY, R. B. & NEELY, S. R. 2024. Public perceptions of artificial intelligence in healthcare: ethical concerns and opportunities for patient-centered care. *BMC Medical Ethics*, 25, 74.

WOOLLEN, J., PREY, J., WILCOX, L., SACKEIM, A., RESTAINO, S., RAZA, S. T., BAKKEN, S., FEINER, S., HRIPCSAK, G. & VAWDREY, D. 2016. Patient Experiences Using an Inpatient Personal Health Record. *Appl Clin Inform*, 7, 446-60.

WOOLLEY, A. K., HADJICONSTANTINO, M., DAVIES, M., KHUNTI, K. & SEIDU, S. 2019. Online patient education interventions in type 2 diabetes or cardiovascular disease: A systematic review of systematic reviews. *Prim Care Diabetes*, 13, 16-27.

WORLD HEALTH ORGANIZATION 2011. *Atlas EHealth Country Profiles: Based on the Findings of the Second Global Survey on E-Health*, World Health Organization.

- WRIGHT, C., KELLY, J. T., BYRNES, J., CAMPBELL, K. L., HEALY, R., MUSIAL, J. & HAMILTON, K. 2023a. A non-randomised feasibility study of a mHealth follow-up program in bariatric surgery. *Pilot and Feasibility Studies*, 9, 176.
- WRIGHT, C., KELLY, J. T., CAMPBELL, K. L., HEALY, R., MUSIAL, J. & HAMILTON, K. 2023b. A mixed-method study to inform the development and implementation of eHealth in a bariatric surgery service in an Australian public hospital. *Nutrition & Dietetics*, 80, 425-434.
- WU, Y., WANG, X., GAO, F., LIAO, J., ZENG, J. & FAN, L. 2023. Mobile nutrition and health management platform for perioperative recovery: an interdisciplinary research achievement using WeChat Applet. *Frontiers in Medicine*, 10.
- XESFINGI, S. & VOZIKIS, A. 2016. eHealth Literacy: In the Quest of the Contributing Factors. *Interact J Med Res*, 5, e16.
- YAO, R., ZHANG, W., EVANS, R., CAO, G., RUI, T. & SHEN, L. 2022. Inequities in Health Care Services Caused by the Adoption of Digital Health Technologies: Scoping Review. *J Med Internet Res*, 24, e34144.
- ZHANG, J., GALLIFANT, J., PIERCE, R. L., FORDHAM, A., TEO, J., CELI, L. & ASHRAFIAN, H. 2023. Quantifying digital health inequality across a national healthcare system. *BMJ Health Care Inform*, 30.
- ZHANG, M. 2023. Older people's attitudes towards emerging technologies: A systematic literature review. *Public Underst Sci*, 32, 948-968.
- ZIBRIK, L., KHAN, S., BANGAR, N., STACY, E., NOVAK LAUSCHER, H. & HO, K. 2015. Patient and community centered eHealth: Exploring eHealth barriers and facilitators for chronic disease self-management within British Columbia's immigrant Chinese and Punjabi seniors. *Health Policy and Technology*, 4, 348-356.
- ZIMMERMANN, G., VENKATESAN, A., RAWLINGS, K. & SCAHILL, M. 2021. Improved Glycemic Control With a Digital Health Intervention in Adults With Type 2 Diabetes: Retrospective Study. *JMIR Diabetes*, 6.

Appendix A- Medline OVID search terms- narrative synthesis

1.	Telemedicine/
2.	Telecommunications/
3.	exp telehealth/
4.	(mhealth* or m-health* or mobile health).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]
5.	(ehealth or ehealth* or mobile health).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]
6.	(digital health or digital technology or digital device or digital healthcare).mp.
7.	(mobile health app* or mobile app* or mobile phone app* or smartphone app* or health app).mp.
8.	exp activity tracker/ or fitbit.mp. or wearable technology.mp. or pedometer.mp. or pedometer.mp. or smartwatch*.mp. or (wearable adj device*).mp. or wearables.mp. or "real-time monitoring device*".mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]
9.	(social media* or facebook or twitter or tweetOR tweets).mp.
10.	(webcast* or webinar* or podcast* or wiki* or youtube).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]
11.	(iphone* or ipad* or andrioid* or tablet PC or tablet computer).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]
12.	Videoconferencing/
13.	(videoconferenc* or "video conferenc*" or videoconsultation* or "video consultation*" or Skype* or facetime or zoom).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]

14.	(online or on-line or internet or www or web or website* or webpage* or broadband or broad-band).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]
15.	("interactive multimedia" or "interactive software" or "digital media" or "software program*").mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]
16.	(chat room* or chatroom* or blog* or blogging or blogger* or weblog*).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]
17.	specialties, surgical/ or colorectal surgery/ or general surgery/ or gynecology/ or neurosurgery/ or obstetrics/ or ophthalmology/ or orthognathic surgery/ or orthopedics/ or otolaryngology/ or surgery, plastic/ or surgical oncology/ or thoracic surgery/ or traumatology/ or urology/
18.	surg*.tw.
19.	Surgical Procedures, Operative/
20.	("abdominal surgeryOR breast surgery" or "cardiovascular surgery" or "cardiac surgery" or "heart surgery" or "ear nose and throat surgery" or "endocrine surgery" or "eye surgery" or "general surgery" or "geriatric surgery" or "head and neck surgery" or "maxillofacial surgery" or "neurosurgery" or "orthopedic surgery" or "pelvis surgery" or "reconstructive surgery" or "thorax surgery" or "Thoracic Surgery" or "transplant surgery" or "urolog* surgery" or "oral surgery" or "aesthetic surgery" or "bariatric surgery" or "orthognathic surgery" or "knee surgery" or "hip surgery" or "plastic surgery" or "vascular surgery" or "trauma surgery" or "hepatobiliary surgery" or " liver surgery").mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]
21.	Preoperative Care/ or Preoperative Period/
22.	Perioperative Care/ or Perioperative Period/
23.	Postoperative Period/ or Postoperative Care/
24.	Qualitative Research/
25.	Interview/

26.	Focus Groups/
27.	exp "Surveys and Questionnaires"/
28.	((("semi-structured" or semistructured or unstructured or informal or "in-depth" or indepth or "face-to-face" or structured or guide or guides or follow up or self report) adj3 (interview* or discussion* or questionnaire*)).tw.
29.	(focus group* or advisory group* or qualitative or ethnograph* or fieldwork or field work or key informant or thematic analy* or grounded theor* or phenomenolog* or discourse analy* or content analy* or narrative* or observational method* or open ended evaluation* or action research or inductive analy* or emic or etic or hermeneutic* or constant compar* or grounded theor* or lived experience* or life experience* or theoretical sampl* or purposive sampl* or quasi-experiment* or (case adj2 stud*)).tw.
30.	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16
31.	17 or 18 or 19 or 20 or 21 or 22 or 23
32.	24 or 25 or 26 or 27 or 28 or 29
33.	30 and 31 and 32
34.	limit 33 to english

Appendix B

Critical Appraisal Skills Checklist (CASP) for systematic review of qualitative studies

	1. Was there a clear statement of the aims of the review?	2. Is a qualitative methodology appropriate to the aims of the review?	3. Was the research design appropriate to address the aims of the review?	4. Was the recruitment strategy appropriate to the aims of the review?	5. Was the data collected in a way that addressed the aims of the review?	6. Has the relationship between researcher and participants been addressed?	7. Have ethical issues been taken into consideration?	8. Was the data analysis sufficiently rigorous?	9. Is there a clear statement of findings?	10. How valuable is the research?
1	Abelson	Yes	Yes	Yes	Yes	No	Can't tell	Yes	Yes	Yes
2	Abrahamsen	Yes	Yes	Yes	Yes	Can't tell	Yes	Yes	Yes	Yes
3	Areia	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4	Argent	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
5	Brown-Johnson	Yes	Yes	Yes	Yes	No	Can't tell	Yes	Yes	Yes
6	Dahlberg	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
7	Dawes	Yes	Yes	Yes	Yes	Can't tell	Yes	Can't tell	Yes	Yes
8	den Bakker	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
9	Deleage	Yes	Yes	Yes	Yes	Can't tell	Yes	Yes	Yes	Yes
10	Downey	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
11	Drummond	Yes	Yes	Yes	Yes	Can't tell	Yes	Yes	Yes	Yes
12	Dunphy, Gardener	Yes	Yes	Yes	Yes	Can't tell	Yes	Yes	Yes	Yes
13	Dunphy, Hamilton	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
14	Gill	Yes	Yes	Yes	Yes	Can't tell	Yes	Yes	Yes	Yes
15	Gill	Yes	Yes	Yes	Yes	Can't tell	Yes	Yes	Yes	Yes
16	Graetz	Yes	Yes	Yes	Yes	Can't tell	Yes	Can't tell	Yes	Yes
17	Gustavell	Yes	Yes	Yes	Yes	Can't tell	Yes	Yes	Yes	Yes
18	Harder	Yes	Yes	Yes	Yes	Can't tell	Yes	Yes	Yes	Yes
19	Houwen	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
20	Huynh	Yes	Yes	Yes	Yes	Can't tell	Yes	Yes	Yes	Yes
21	Joshi	Yes	Yes	Yes	Yes	Can't tell	Yes	Yes	Yes	Yes
22	Kayler	Yes	Yes	Yes	Yes	Can't tell	Yes	Can't tell	Yes	Yes
23	Ke	Yes	Yes	Yes	Yes	Can't tell	Yes	Can't tell	Yes	Yes
24	Kettle	Yes	Yes	Yes	Yes	Can't tell	Yes	Can't tell	Yes	Yes
25	Kim	Yes	Yes	Yes	Yes	Can't tell	Yes	Yes	Yes	Yes
26	Lew	Yes	Yes	Yes	Yes	Can't tell	Yes	Yes	Yes	Yes
27	Low	Yes	Yes	Yes	Yes	Can't tell	Yes	Can't tell	Yes	Yes
28	LuribellPuerto	Yes	Yes	Yes	Yes	Yes	Yes	Can't tell	Yes	Yes
29	Martorella	Yes	Yes	Yes	Yes	Can't tell	Yes	Yes	Yes	Yes
30	Mikkelsen	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
31	Nilsson, Hellström	Yes	Yes	Yes	Yes	Can't tell	Yes	Yes	Yes	Yes
32	Nilsson, Hultgren 23	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
33	Nilsson, Hultgren	Yes	Yes	Yes	Yes	Can't tell	Yes	Yes	Yes	Yes
34	O'Leary	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
35	Reid	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
36	Richards	Yes	Yes	Yes	Yes	Can't tell	Yes	Yes	Yes	Yes
37	Robinson, Husbund	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
38	Robinson	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
39	Russ Lativ	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
40	Russ Sevdalis	Yes	Yes	Yes	Yes	Can't tell	Yes	Yes	Yes	Yes
41	Sanger	Yes	Yes	Yes	Yes	Can't tell	Yes	Yes	Yes	Yes
42	Saunders	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
43	Scott	Yes	Yes	Yes	Yes	Can't tell	Yes	Can't tell	Yes	Yes
44	Sohl	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
45	Sreedharan	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
46	Stern	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
47	Timmers	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
48	Toft	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Can't tell	Yes
49	Trang	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
50	Triantafillou	Yes	Yes	Yes	Yes	Can't tell	Yes	Yes	Yes	Yes
51	VanDerHorst	Yes	Yes	Yes	Yes	Can't tell	Yes	Yes	Yes	Yes
52	Van der meiji	Yes	Yes	Yes	Yes	Can't tell	Yes	No	Can't tell	Yes
53	Van der velde	Yes	Yes	Yes	Yes	Can't tell	Yes	Yes	Yes	Yes
54	Weenk	Yes	Yes	Yes	Yes	Can't tell	Yes	Yes	Yes	Yes
55	Willems	Yes	Yes	Yes	Yes	Can't tell	Yes	Yes	Yes	Yes
56	Wolien	Yes	Yes	Yes	Yes	Can't tell	Yes	Yes	Yes	Yes
57	Wright en	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
58	Wright aus	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
59	Wu	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Digital Health and eHealth Literacy Survey

Thank you for taking part in our survey.

This survey contains **two parts**.

Part one has 7 sections. We ask about your experience using digital technology and your views on digital health information delivery.

Part two is the internationally validated eHealth literacy survey which contains 35 items. We ask about your confidence level in using digital health technology.

If you have any questions, please ask the researchers, Chik Wai or Yasmin, in the clinic waiting area.

Part One

Section 1: About you

We want to make sure we are hearing from a wide range of people.

This section includes 6 questions about yourself.

Are you...

- ☐ Male
- ☐ Female
- ☐ Other

What is your age?

☐ Under 18

☐ 18 - 24

☐ 25 - 34

☐ 35 - 44

☐ 45 - 54

☐ 55 - 64

☐ 65 - 74

☐ 75 - 84

☐ 85 or older

How would you describe yourself? Please select all that apply.

Asian/Asian British

- ☐ Indian
- ☐ Pakistani
- ☐ Bangladeshi
- ☐ Chinese
- ☐ Any other Asian background _____

Black/African/Caribbean/Black British

- ☐ African
- ☐ Caribbean
- ☐ Any other Black/African/Caribbean background

Mixed/Multiple ethnic groups

- ☐ White and Black Caribbean
- ☐ White and Black African
- ☐ White and Asian
- ☐ Any other Mixed/Multiple ethnic background

White

- ☐ English, Welsh, Scottish, Northern Irish or British
- ☐ Irish
- ☐ Gypsy or Irish Traveller
- ☐ Any other White background _____

Other ethnic group

- ☐ Arab
- ☐ Any other ethnic group

What is the highest level of education you have completed? [choose one only]

- ☐ No formal education completed
 - ☐ Primary school
 - ☐ Secondary school up to 16 years
 - ☐ Higher or secondary or further education (A-levels, BTEC, etc.)
 - ☐ College or university
 - ☐ Post-graduate degree
-

Please indicate to which occupational group you belong, or which group fits best.

- ☐ Semi or unskilled manual worker (e.g. Manual workers, Apprentices in skilled trades, Caretaker, Park keeper, non-HGV driver, Shop assistant)
- ☐ Skilled manual worker (e.g. Skilled Bricklayer, Carpenter, Plumber, Painter, Bus/ Ambulance, Driver, HGV driver, AA patrolman, Pub/bar worker, etc.)
- ☐ Supervisory or clerical/ junior managerial/ professional/ administrative (e.g. Office worker, Student Doctor, Nurse, Foreman with 25+ employees, Salesperson, etc.)
- ☐ Intermediate managerial/ professional/ administrative (e.g. Newly qualified (under 3 years) Doctor, Solicitor, Board Director in a small organisation, Middle Manager in a large organisation, Principal Officer in civil service/local government, Teacher)
- ☐ Higher managerial/ professional/ administrative (e.g. Doctor, Solicitor, Board Director in a large organisation (200+ employees), Top-level civil servant/public service employee)
- ☐ Student
- ☐ Casual worker – not in permanent employment
- ☐ Homemaker
- ☐ Retired and living on state pension
- ☐ Unemployed or not working due to long-term sickness
- ☐ Carer of other household member
- ☐ Other

Do you consider yourself to be a disabled person?

- ☐ Yes
- ☐ No
- ☐ Prefer not to say

Section 2:

This section includes 3 questions about your experience of using the **internet** and **social media**

During the survey, when we refer to...

- 'Internet' we mean going online, to access websites, use social media (like Facebook, Instagram etc.), be entertained, buy things, look for information etc.
 - 'Devices' we mean mobile phones, computers, laptops, tablets, games consoles, smart TVs etc. - any electronic gadgets
-

Have you used any of these devices to go online? [choose all that apply]

- ☐ Computer (desktop/laptop)
 - ☐ Mobile phone or smartphone
 - ☐ Tablet (e.g. iPad, Kindle Fire, Samsung Galaxy Tab)
 - ☐ Games console (e.g. PlayStation, Xbox, Wii, Nintendo DS)
 - ☐ Wearable device (e.g. Apple Watch, FitBit)
 - ☐ Smart home devices (e.g. Amazon Echo, Google Home)
 - ☐ Virtual Reality headset
 - ☐ Not applicable – I do not have access to any digital devices
 - ☐ Other, please give more detail :
-

How often do you use the internet (on any device / in any place)? [choose one only]

- ☐ Never or Hardly ever
 - ☐ Monthly
 - ☐ Weekly
 - ☐ Daily
 - ☐ Several times a day
 - ☐ Almost all the time
-

Which, if any, of the following social media or messaging accounts do you have? [choose all that apply]

- ☐ Social Networks. Examples: Facebook, Twitter, Instagram, LinkedIn
 - ☐ Messaging app. Examples: WhatsApp, Telegram, Signal
 - ☐ Media Sharing. Examples: YouTube, Vimeo, Pinterest
 - ☐ Review Sites. Examples: TripAdvisor, Trustpilot
 - ☐ Blogs and forums. Examples: Money Saving Expert, Mumsnet, Digital Spy
-

Section 3: Digital Health Information

This section includes 3 questions about your experience of **receiving or gathering information** about **health, fitness or wellbeing** on the **internet**.

How often do you perform these tasks? [choose one only]

1a. Use social media (e.g. Facebook, LinkedIn, Instagram) to look for information about health, fitness and wellbeing

- ☐ Daily
- ☐ Weekly
- ☐ Monthly
- ☐ Few times a year
- ☐ Never

b. Use a search engine (e.g. google, yahoo, bing) to look for information about health, fitness and wellbeing

- ☐ Daily
 - ☐ Weekly
 - ☐ Monthly
 - ☐ Few times a year
 - ☐ Never
-

c. Use NHS websites or health charity websites (e.g. Diabetes UK, British Heart Foundation) to look for information about health, fitness and wellbeing

- ☐ Daily
 - ☐ Weekly
 - ☐ Monthly
 - ☐ Few times a year
 - ☐ Never
-

d. Connect with other patients or carers through social media or online forum

- ☐ Daily
 - ☐ Weekly
 - ☐ Monthly
 - ☐ Few times a year
 - ☐ Never
-

e .Connect with doctors or nurses through social media or online forum

- ☐ Daily
 - ☐ Weekly
 - ☐ Monthly
 - ☐ Few times a year
 - ☐ Never
-

f. Read an electronic document, e.g. PDF of a patient information leaflet, a health newsletter

- ☐ Daily
 - ☐ Weekly
 - ☐ Monthly
 - ☐ Few times a year
 - ☐ Never
-

g. Watched an online video (e.g. on YouTube) to learn about health, fitness and wellbeing

- ☐ Daily
 - ☐ Weekly
 - ☐ Monthly
 - ☐ Few times a year
 - ☐ Never
-

h. Email your doctors and nurses

- ☐ Daily
 - ☐ Weekly
 - ☐ Monthly
 - ☐ Few times a year
 - ☐ Never
-

i. Downloaded a mobile phone application to support or learn about about health, fitness and well being

- ☐ Daily
 - ☐ Weekly
 - ☐ Monthly
 - ☐ Few times a year
 - ☐ Never
-

2. To what extent do you trust the information you receive from the following sources?

	Extremely trustworthy	Somewhat trustworthy	Neither trustworthy nor untrustworthy	Somewhat untrustworthy	Extremely untrustworthy
NHS or Health Charity websites	☐	☐	☐	☐	☐
Other websites directed from search engine	☐	☐	☐	☐	☐
Mobile Health app	☐	☐	☐	☐	☐
News websites	☐	☐	☐	☐	☐
Online blog or forum	☐	☐	☐	☐	☐
Online video	☐	☐	☐	☐	☐
Television, radio, newspaper	☐	☐	☐	☐	☐
Family and friends	☐	☐	☐	☐	☐
Doctors and nurses	☐	☐	☐	☐	☐

3. In general, when you have a question about health, fitness, or wellbeing,

where do you go for advice? [choose all that apply]

- ☐ Family and friends
 - ☐ Health professional e.g. GP, health visitor etc
 - ☐ NHS or health charity websites
 - ☐ I search online for the advice I need
 - ☐ News media (e.g. newspaper, magazines)
 - ☐ I post a question to my social networks (e.g. on Facebook)
 - ☐ Religious/community leaders
 - ☐ Companies selling devices and products
 - ☐ Smartphone health and fitness app
 - ☐ Health blog or forum
-

Section 4

This section includes 2 questions about how you feel about **face to face consultation** for medical purposes

Have you ever used a **face to face consultation** service for medical purposes?

- ☐ No
 - ☐ Yes, to a small degree
 - ☐ Yes, to a large degree
-

Please rate how much you **agree or disagree** with each of these statements about **face to face consultation**

	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree
I would find a face to face consultation convenient	☐	☐	☐	☐	☐	☐	☐
I would feel comfortable using a face to face consultation	☐	☐	☐	☐	☐	☐	☐
I think face to face consultation gives me information that is relevant to me	☐	☐	☐	☐	☐	☐	☐
I think face to face consultation gives me information that is easy to understand	☐	☐	☐	☐	☐	☐	☐
I would find face to face consultation embarrassing	☐	☐	☐	☐	☐	☐	☐

I think face to
face
consultation
would infringe
on my privacy

☐☐☐☐☐☐☐

I would find
face to face
consultation
time-
consuming

☐☐☐☐☐☐☐

Section 5

This section includes 2 questions about how you feel about **remote consultation** for medical purposes

Example of remote consultation:

received a medical assessment via your mobile phone, laptop, webcam etc

Have you ever used a **remote consultation** service for medical purposes?

- ☐ No
- ☐ Yes, to a small degree
- ☐ Yes, to a large degree

Please rate how much you **agree or disagree** with each of these statements about **remote consultation**

	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree
I would find a remote consultation convenient	☐	☐	☐	☐	☐	☐	☐
I would feel comfortable using remote consultation	☐	☐	☐	☐	☐	☐	☐
I think remote consultation gives me information that is relevant to me	☐	☐	☐	☐	☐	☐	☐
I think remote consultation gives me information that is easy to understand	☐	☐	☐	☐	☐	☐	☐
I would find remote consultation embarrassing	☐	☐	☐	☐	☐	☐	☐
I think remote consultation would infringe on my privacy	☐	☐	☐	☐	☐	☐	☐

I would find
remote
consultation
time-
consuming



Section 6

This section includes 6 questions about how you feel about **smartphone health applications** for medical purposes

Examples of mobile health apps:

NHS app, NHS COVID-19 contact tracing, myGP, mySugery etc.

Have you ever used a **smartphone health application** for medical purposes?

- ☐ No
- ☐ Yes, to a small degree
- ☐ Yes, to a large degree

Please rate how much you **agree or disagree** with each of these statements about **smartphone health applications**

	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree
I would find using smartphone health apps convenient	☐	☐	☐	☐	☐	☐	☐
I would feel comfortable using smartphone health apps	☐	☐	☐	☐	☐	☐	☐
I think smartphone health apps gives me information that is relevant to me	☐	☐	☐	☐	☐	☐	☐
I think smartphone health apps gives me information that is easy to understand	☐	☐	☐	☐	☐	☐	☐
I would find using smartphone health apps embarrassing	☐	☐	☐	☐	☐	☐	☐
I think using mobile health apps would infringe on my privacy	☐	☐	☐	☐	☐	☐	☐
I would find using smartphone health apps time-consuming	☐	☐	☐	☐	☐	☐	☐

Section 7

This section contains 2 questions about the **impact of the COVID pandemic** on your daily life and on your use of technology

Please rate each of the following statements about **changes** to your day-to-day life **since the beginning of COVID**

	Significantly decreased	Slightly decreased	Grossly similar	Slightly increased	Significantly increased
Using public transport	☐	☐	☐	☐	☐
Being in public places	☐	☐	☐	☐	☐
Purchase groceries or order food online	☐	☐	☐	☐	☐
Take a shower/bath after coming from outside	☐	☐	☐	☐	☐
Work from home	☐	☐	☐	☐	☐
Use videoconference for work	☐	☐	☐	☐	☐
Use videoconference to socialise	☐	☐	☐	☐	☐
Do exercise	☐	☐	☐	☐	☐
Use a health or fitness smartphone app	☐	☐	☐	☐	☐
Visit GP surgery	☐	☐	☐	☐	☐

Attend hospital
appointment



Looking at life after COVID, would you be more or less likely to...

	Definitely will	Probably will	Might or might not	Probably will not	Definitely will not
Purchase groceries or order food online	☐	☐	☐	☐	☐
Work from home	☐	☐	☐	☐	☐
Use videoconference for work	☐	☐	☐	☐	☐
Use videoconference to socialise	☐	☐	☐	☐	☐
Use a health or fitness smartphone app	☐	☐	☐	☐	☐
Speak to doctor via teleconference	☐	☐	☐	☐	☐

Part 2- eHealth Literacy Questionnaire

This section contains 35 items about your experience in using digital technologies to:

- Find, understand and use health information
- Manage your health
- Communicate with your doctors or healthcare providers

Redacted eHLQ questionnaire due to licensing agreement

Multimedia Appendix 2: The 7 constructs of the eHealth Literacy Framework and derived scales of the eHealth Literacy Questionnaire.

eHealth Literacy Framework constructs		eHealth Literacy Questionnaire scale names and items ^a	
1. Ability to process information		1. Using technology to process health information	
Able to read, write and remember, apply basic numerical concepts, and understand context-specific language (eg, health, IT or English) as well as critically appraise information. Know when, how and what information to use			<i>I use technology to find...</i>
			<i>I often use technology to understand...</i>
			<i>Technology helps me decide...</i>
			<i>I use technology to share...</i>
			<i>I use technology to organize...</i>
2. Engagement in own health		2. Understanding of health concepts and language	
Know about basic physiological functions and own current health status. Aware of risk factors and how to avoid them or reduce their influence on own health as well as navigating the health care system			<i>The information I have helps me...</i>
			<i>I have enough information to take part in...</i>
			<i>I understand medical results...</i>
			<i>Overall, I understand how my body...</i>
			<i>I use measurements about my body to...</i>
3. Ability to actively engage with digital services		3. Ability to actively engage with digital services	
Being comfortable using digital services for handling information			<i>I know how to get...</i>
			<i>I know how to make health technology...</i>
			<i>I can enter data...</i>
			<i>I quickly learn how to...</i>
			<i>I easily learn to use...</i>
4. Feel safe and in control		4. Feel safe and in control	
Feel that you have the ownership of personal data stored in the systems and that the data are safe and can be accessed only			<i>I am sure that my health data...</i>
			<i>My electronic health care data are being stored...</i>

(Kayser et al., 2018)

End of survey

We thank you for your time spent taking this survey.

Appendix D- Focus group topic guide

Focus Group Schedule

Greetings: We work at Imperial College London – in the Patient Safety Translational Research Centre. [Introduce names]. We are interested to learn about your views on using digital technology to communicate and receive health information during surgical care and the extent to which you are engaged with it. There are no right or wrong answers, just ideas.

Ground rules: For the focus group, we'll try to have one person talking at one time, but everyone is free to speak up and ask questions or offer their opinion at any time. This can be a group conversation, so if someone says anything in the group, feel free to talk directly to them, you don't have to talk to us. Don't feel you have to agree with the group. We are looking at the range of opinions people have.

Ethics: As explained on your information sheet and consent form we are planning to audio record the focus group because we won't be able to remember or note all of your suggestions or opinions. We will transcribe the data and then destroy the audio recording. Anything mentioned during the focus group will be treated confidentially by us. Nobody will be identifiable. We are going to sum up the ideas raised here and write these down and take them into consideration for future interventions to improve the quality of health information giving and communication at this trust and more generally.

You can ask questions at any time if you would like clarification of anything.

Now, what's going to happen: If everybody is happy then we will turn the dictaphone on, and ask you some questions about your thoughts on incident reporting both locally and in general.

Prompts/questions for discussion and exploration

What is your experience of surgical consultations and communications in the peri and postoperative period ?

What is your opinion on using digital technologies in surgical care?

What is your view on the quality of the information received through traditional methods and using ehealth technologies?

What practical changes could be made to support you in receiving information during the perioperative period?

What are the barriers to the adoption of ehealth? e.g. trust, security, cultural factors, motivation, and perceived benefit

What is the impact of the COVID pandemic on your perception and utility of technology and ehealth?

Appendix E- Clinician interview topic guide

Clinicians' experience of digital health in surgery- interview topic guide

Have you had any experience using digital health technology* with your patients? ^

Prompt- Telemedicine, apps

How did you feel about using it? Like/dislike? Benefits?

How much effort did it take you to use it? (Technical/cognitive/time requirements)

Are there other barriers to using this technology?

Do you think these technologies can help patients improve their health?

What are the features that are important to patients/ and clinicians?

Are there any difficulties introducing the technology to your patients and helping them engage with it?

How can we make it easier to use and more acceptable?

Prompt: Training, responsiveness, transparency, organisation and infrastructure, technical issues

*The use of digital, mobile and wireless technologies to support the achievement of health objectives. Digital health describes the general use of information and communications technologies (ICT) for health and is inclusive of both mHealth and eHealth.

Some examples are telemedicine, patient portal, wearable sensors, mobile health apps

^For tech researchers and designers- put more focus on issues they encounter in designing and implementing digital health technology.

How did they overcome these issues?