Mid and South Essex Integrated Care System

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Innovation and Information Sharing Project Report

Final Report

Project Team:

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Contents

Tables

Figures

Executive summary

One in five patients experiences adverse events during the transition from hospital to home, leading to an increase in avoidable emergency readmission. The clarity and adequacy of the information shared during this transition verbally and via discharge summaries are key challenges (Le Berre et al, 2017; Kapoor et al, 2019; Markiewicz et al, 2020; Hoek et al, 2021; Baxter et al, 2022). Exploring the experiences of those involved, including patients/relatives, hospital and community staff, will help address the issues above and enhance the quality of care. Leveraging information and communication technologies, such as mobile applications, presents an opportunity to enhance the transition of care and information sharing.

The purpose of the project is to explore the use of technology to enhance information sharing and hospital discharge across Mid & South Essex Foundation NHS Trust (MSE): a collaborative project with Anglia Ruskin University (ARU) and MSE Integrated Care System (ICS). ARU & MSE ICS have engaged with a wide range of key stakeholders and departments to support the development of the project, including but not limited to, MSE NHS Foundation Trust, Community Collaborative [Essex Partnership University Trust (EPUT), Provide Community, Northeast London NHS Foundation Trust (NELFT)] and Digital Teams. This innovative concept would not have been possible without collaboration and positive engagement from our contributors and their commitment to deliver the project to benefit our patients.

Overall aims at the beginning of the project

- Better health management at home through improved communication between patients, relatives, and staff across primary and secondary care during discharge and post-discharge.

- To empower patients to engage more confidently in their own care by increasing their understanding of their next care steps on discharge.
- Reducing the chance of unplanned re-attendance and admittance to Hospital due to unclear discharge information
- Using a collaborative innovation to improve working practices and person-centred outcomes across the ICS using quality improvement methodologies

Projects objectives:

1. To identify patterns and gaps on patient discharge from hospital to community settings.
2. To synthesize the best available evidence from published work on the role of technology in improving patient discharge from hospital.
3. To establish how digital technology is currently utilised to enhance patient discharge.
4. To investigate patients' and staff digital readiness of employing digital technology for patient discharge.
5. To explore the feasibility and acceptability of video-discharge from hospital hosted in a digital application in improving patients' experience.

Stages of the project (Figure 1)

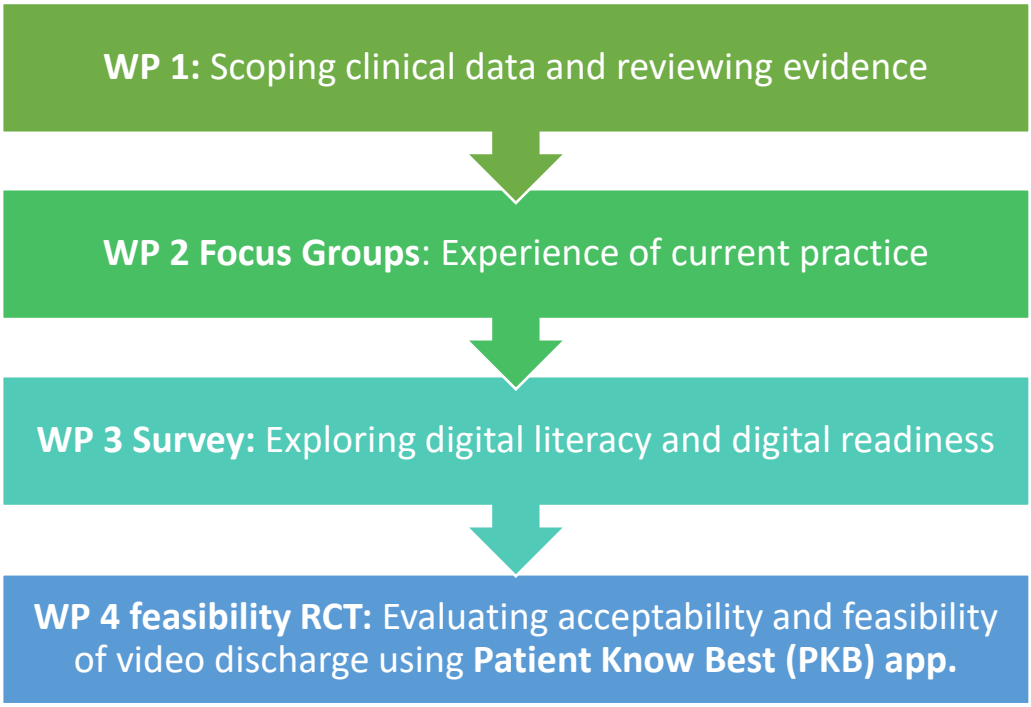


Figure 1 Stages of the project

Work Package (WP) 1a: Developing insight using clinical data analysis

Aim: To identify patterns and gaps on patient discharge from hospital.

Research question 1: How does routinely collected MSE ICS data influence a good-quality discharge?

Outcome measures: Data on

- Fit-to-discharge or readiness
- Information sharing on discharge with healthcare providers across settings.
- Patients and caregivers on the quality of discharge and how it is communicated.
- Patient and carer's experience of the discharge?

Methodology: Secondary, quantitative data analysis, +/- content analysis of free-text comments on feedback forms.

WP 1b: Scoping literature review of evidence

Aim: To synthesize the best available evidence from published work on the role of technology in improving patient discharge from hospital.

Research question 2: Does technology enhanced information sharing improve patient discharge from hospital?

Methodology: Scope review of evidence

WP2-Focus Groups: Scoping the utilisation of digital technology for discharge.

Aim: To establish how digital technology is currently utilised to enhance patient discharge.

Research question 3: What are the innovative approaches in using technology for patient discharge from the perspectives of service users and healthcare workers?

Methodology: Groups interview with staff/ patient and relatives.

Participants: Patients and their carers/family with experience of discharge from acute to community settings, staff (acute, community, GP).

WP3 Survey: Assessing acceptability, digital literacy and readiness

Aim: To investigate patients' and staff readiness, digital literacy and acceptability of employing digital technology for patient discharge.

Research question 5: What is the perceived value of technology-based discharge from the perspectives of patients, caregivers, and healthcare staff?

Participants: Patients and their carers/family with experience of discharge from acute to community settings, staff (acute, community, GP).

Methodology: cross sectional survey

WP4: feasibility study: Evaluating acceptability and effectiveness of video discharge using PKB.

Aim: To explore the feasibility and acceptability of video-discharge from hospital hosted in a digital application in improving patients' experience.

In particular, the study will explore:

1. The acceptability, usefulness and feasibility of video-discharge from hospital to community settings embedded in Patient Knows Best application to patients, carers and staff;
2. The feasibility of the methods to identify, recruit and retain patients and staff and to determine the best way to follow up participants.

Research question 7: What is the feasibility and acceptability of video-discharge from hospital hosted in a digital application in improving patients' experience?

Primary outcomes measure:

Acceptability and feasibility of video discharge

Secondary outcomes measure:

- Patient satisfaction and confidence
- Staff satisfaction
- Quality of care/life

Methodology: A randomised controlled feasibility trial of two wards within two acute NHS Trusts.

Summary

This report evaluates the use of digital health technologies to enhance patient discharge from hospital, focusing on ways to enhance information sharing and participants experience and perspective on the use of technology and barriers to adoption. The findings provide a comprehensive literature review of existing literature and current practices, gaps, and opportunities for leveraging technology in discharge to better meet patient needs and improve clinical practice based on patients and staff experience and abilities.

Key Findings

Scoping clinical data on discharge

- Routinely collected MSEFT data offers a strong foundation for improving discharge quality. A gap still exists on how to integrate and utilised technology effectively across the system.
- By addressing gaps in communication, system integration, and feedback collection, the organisation can ensure safer, more efficient discharges aligned with patient needs and policy objectives.

Scope review of studies

- A total of 52 studies were reviewed, representing diverse geographical regions and clinical areas. The majority (42%) were conducted in the Americas, predominantly in the USA (73%), followed by Asia (35%), Europe (15%), and Australia (4%). Surgical and cardiology-related discharges were the most studied clinical areas. Most studies were randomised controlled trials (79%).

- Eight distinct types of technologies were identified, including apps, telephone follow up, telemonitoring, video, and wearable devices. These

were often used in combination to support patient transitions from hospital to home. Digital application was the most frequently used alone or in combination with other types of technologies.

- Technologies demonstrated potential in improving patient self-care, medication adherence, quality of life, and patient satisfaction. Gaps remain in establishing their impact on readmission rates and healthcare utilisation.

Challenges in adoption and use of technology

- Patients identified several challenges with communication technology, particularly with existing telephone systems, which lacked flexibility and made rescheduling appointments difficult. They also highlighted the limitations of one-way communication, which hindered clear follow-up.

- While patients saw potential benefits in using video for discharge information, especially for younger individuals more familiar with technology, concerns were raised about its accessibility for older adults, as the effectiveness of video largely depends on the patient's ability to access and navigate the technology.

Patient digital literacy

- The patient survey showed moderate engagement with webpages and text messages for information but lower use of the NHS app, video calls, and remote monitoring.

- Participants reported high confidence in using computers and smartphones, particularly for touchscreen navigation and app usage, though confidence was lower for recording, uploading, and downloading videos. Typing on touchscreens and using certain digital applications, such

as uploading and downloading media, were more challenging, while taking and watching videos were easier. These findings highlight both familiarity with digital tools and areas for improving usability.

- Participants found searching for health information online relatively easy but faced challenges in assessing its quality, reliability, and relevance. While they were generally confident in using search terms and understanding information, difficulties arose in pinpointing specific details, identifying commercial bias, and applying the information to health decisions.
- Patient Digital health literacy survey indicated a moderate overall level based on the WHO HLS19 measure.
- Addressing challenges and making targeted efforts are needed to increase the adoption of specific digital health services. The study findings highlight the need for further research on patient digital literacy to improve the adoption and integration of digital technology into daily health routines.

Digital literacy and staff perceptions:

- Participants were generally confident using technology but reported lower confidence with specific technologies and concerns on the practicality of video recordings for patient discharge were noted. Younger staff, medical staff and those in secondary care settings exhibited greater comfort and perceived usefulness of digital health tools available to them.

- Technology and Information systems were generally perceived as useful and user-friendly but concerns about the practicality of video recordings for patient discharge were noted. Participants reported moderate support from peers and organisational culture, but leadership support was

inconsistent, with concerns about system compatibility and anxiety over mistakes.

Recruitment challenges and limitation:

- The study findings were based on 52 studies from the literature review, six patients and 13 staff who completed the survey and one patient interview. The team encountered challenges with patient and staff recruitment and therefore the sample is reasonably small to reflect the opinion of the wider patient and staff population at the recruitment sites.

- Active clinician involvement was critical to overcoming difficulties in patient and staff recruitment for the study and area that need further development at early stages of any future projects.

- In the final three months of the project, the team identified a challenge: the Patient Knows Best application lacked the functionality to share information between secondary and primary care settings, limiting digital information sharing across the system. Moreover, Patient Knows Best was not ready for testing at the time of ethical approval. As a result, the team identified an alternative application in the last three months of the project (Ortus-iHealth). However, Ortus-iHealth was restricted to cardiology departments at MSEFT and was not accessible to other departments or primary care services. The team modified the documentation and sought a research ethics amendment to use Ortus-iHealth. The delayed readiness of Patient Knows Best for practical implementation required a clinical plan by the digital team to develop the necessary functionality. Additionally, multiple iterations in the ethics process and reduced clinical capacity further impacted the feasibility study, making it ethically challenging to begin recruitment within such a limited timeframe.

Key recommendations

- Focus future service improvement on partnership with patient and clinical staff and develop more patient-centred and flexible communication systems to enhance information sharing with service users and their relatives.
- Address digital literacy challenges through targeted training and resources for both patients and staff. Target the use of technology-based information sharing with service user based on the digital abilities.
- Provide tailored training for older staff and those in primary care settings to boost confidence in using technology.
- Strengthen managerial and leadership support to promote technology adoption.
- Ensure compatibility of digital tools with existing systems to improve usability and integration between the different system.
- Increase research on patient and staff experiences with discharge technologies to guide future developments.

Broader implementation and evaluation:

- Seek additional qualitative insights into staff perceptions to refine technology-based discharge interventions.
- Conduct further studies to evaluate the impact of digital tools on readmission rates and overall healthcare utilisation.

This report highlights the growing importance of digital health technologies in discharge processes and highlights the need for patient-centred designs, improved staff engagement, and robust organisational support to realise their full potential.

WP1a: Scoping clinical data

Introduction

Hospital discharge is a critical phase in patient care that requires careful coordination to ensure continuity, safety, and efficiency. **Section 91** of the Health and Care Act 2022 mandates localised approaches to discharge processes, emphasising a "discharge to assess, home first" methodology.

Multi-disciplinary hospital discharge teams and transfer of care hubs should work together so that everyone has the opportunity to recover and rehabilitate at home (wherever possible) before their long-term health and care needs and options are assessed and agreed.
https://www.gov.uk/government/publications/hospital-discharge-and-community-support-guidance/hospital-discharge-and-community-support-guidance

In 2016 MSEFT began dealing with the issue of delayed discharges (bed blocking) via a “Bridging Service” where it started to provide short term domiciliary care services directly to patients leaving hospital while waiting for the local authority to commission a longer, more sustainable care package. Between April and December 2022 this service alone resulted in 11,500 saved bed days.

Building on the Bridging concept, the Trust pioneered a more holistic service in June 2022 called the Southend Enhanced Discharge Service (SEDS). SEDS is a Discharge To Assess Service that provides a full and complete therapy-led hospital discharge assessment at home for Southend residents rather than an assessment being provided by the hospital before discharge. It enables patients to leave hospital sooner with appropriate provision of care at home where they then tend to recover more quickly.

In Southend NHS Hospital every hospital discharge for patients requiring a new package of care is via SEDS. This includes patients who may be at risk of falling at home, people with chest infections or those with mobility issues.
Innovative hospital discharge model leads to daily release of 60 additional beds (carelinelive.com)

At MSE ICS, initiatives such as the Bridging Service and the Southend Enhanced Discharge Service (SEDS) have improved discharge outcomes. However, gaps remain in how data informs and enhances discharge quality.

This phase of the project explored how routinely collected MSE ICS data can inform a high-quality discharge process. Specifically, it addresses the data collected on readiness for discharge, information sharing, and patient and caregiver experiences, aiming to identify actionable insights for improving discharge processes.

Primary Research Question:

How does routinely collected MSE ICS data inform a good-quality discharge?

Sub-questions:

- What data does MSE ICS collect on fit-to-discharge or readiness to discharge?
- What data does MSE ICS collect on information sharing/communication of discharge with other healthcare settings?
- What data does MSE ICS collect from patients and caregivers on the quality of discharge?
- What data does MSE ICS collect on how discharge information is communicated to patients and caregivers?

- What data does MSE ICS collect on the patient and caregiver experiences of the discharge process?

Method

This study employs secondary quantitative data analysis, supplemented by content analysis of free-text comments in patient feedback forms where available. The research leverages multiple data sources.

Routine data on fit-to-discharge or readiness to discharge

MSEFT routinely collects the above data for inpatients/ readmissions and ED patients. Other data, as shown is collected by GPs and Healthcare Service Provider (SPs). Details are shown in Figure 2 including sources.

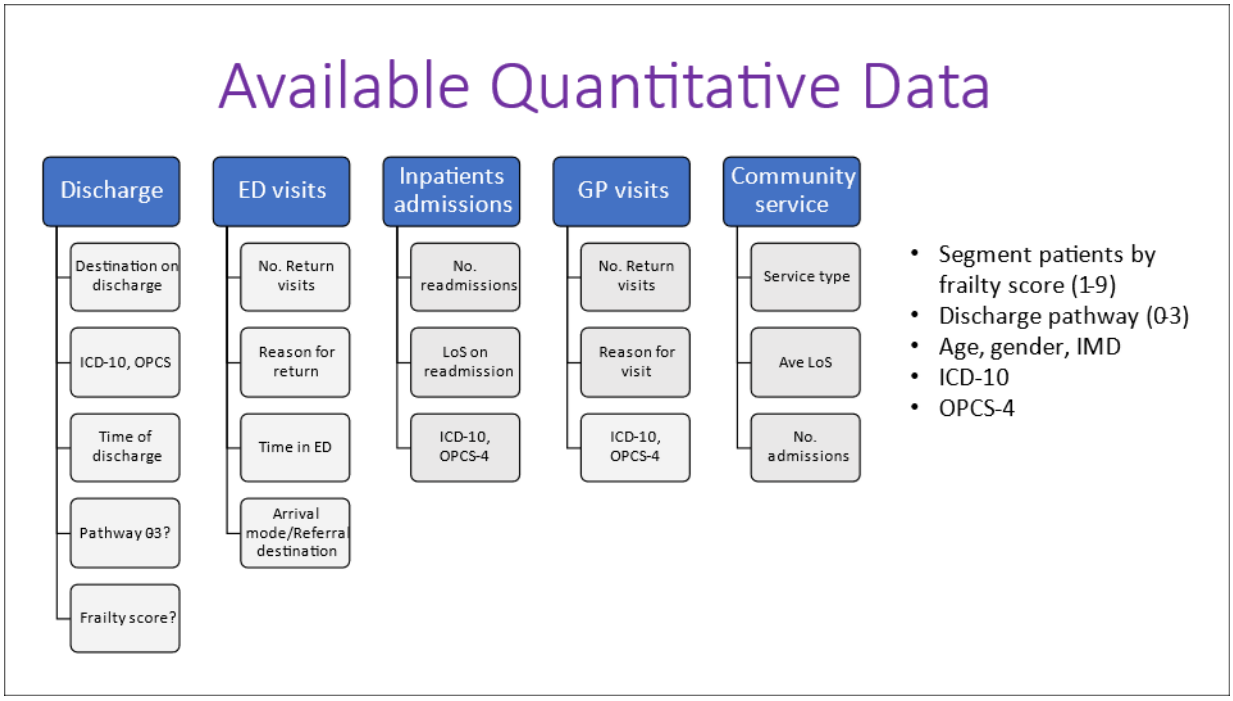


Figure 2 Available data on patient discharge

MSE ICS collects data on patient readiness to discharge, delays, and associated causes such as:

- Care package delays
- Care home placement delays

- Social care delays
- Home reablement package delays
- Homeless/housing situation
- Intermediate care bed not available
- Out of area care package delays
- Private care package delays

This data is routinely documented in discharge records and provides actionable insights for reducing delayed transfers of care.

Information sharing with healthcare settings

The main tool for discharge communication in MSE ICS is SystmOne (S1). This platform supports data sharing across GPs, community services, and other healthcare providers. However, hospital staff adoption of S1 remains low, leading to paper-based discharge summaries for GPs. This gap hinders seamless communication and necessitates ongoing training and support to integrate S1 more effectively.

Current technology used

SystemOne (S1)/Primary Care TPP

SystemOne (S1) is the main software platform used for the communication of discharge information across various healthcare settings. It is a centrally hosted clinical computer system developed by The Phoenix Partnership (TPP) and is used by healthcare professionals predominantly in primary care. It is being deployed as one of the accredited systems in the government's programme of modernising IT in the NHS.

S1 is used in all GP surgeries bar one across MSE, enabling good visibility of primary care records. A wide range of patient data is collected but the main data

that are aggregated centrally, available and relevant to this project are listed in Table 1 above. Patients can access their own health record 'S1 account' via the free MyGP app.

Across MSE, S1 is also accessible by community teams (such as District Nursing, Community Long Term Condition Teams, Urgent Community Response Team (UCRT), Virtual Wards, Adults Speech & Language Therapy (SALT), Tissue Viability Nurses (TVN), Continence Care, Therapist teams, Dementia teams, Out Of Hours 111 teams, Hospices , Community Hospitals etc)

Various teams involved in a patient's care can access live patient information in one place. Community services and GPs can track what has happened with patients, enabling joined up two way communications across the hospital and community services. Direct messages in the form of assigned 'tasks' can be sent to teams or specific individuals involved in a patient's care, e.g. informing a community service of patient discharge from hospital, contacting community nurse with a query, requesting prescription from GP.

However, only a minority of hospital staff in MSEFT currently use S1 even though it is technically possible using the current free version of S1 EPR core. The main challenge has been in providing dedicated inhouse S1 IT support, training and security rights configuration.

For this reason discharge notes are typically input at the GP surgery from the patient's paper-based discharge notes rather than by hospital inpatient staff. Some work is on-going to enable the use of S1 across MSEFT Oncology, End of Life & Frailty Wards and ED.

- *Accessible by community teams, GPs and patients.*
- *Not used by MSEFT hospital staff*
- *Not fully integrated with the secondary care systems*

Patient knows Best App (PKB)

This free online patient portal is being piloted across the MSE region; the project started in April 2023. At the time of writing the system is being rolled out across MSEFT and EPUT with plans for other SPs to be included soon. Patients have to register with the app to gain access to their records.

The Patient knows Best App (PKB) web portal stores personal digital health information and is designed to improve the patient experience. By enabling a patient's information to be held in a single place, it permits information to be shared with the patient, family, carers, and healthcare professionals. This allows for joined-up care that is safer, efficient, and focused for people that may be more dependent on others. It is the patient's own Personal Health Record (PHR) and they can share it with whoever they wish.

This includes messages, consultations, care plans, medicines and appointments. Other features including test results (hospitals), symptom tracking and the journal are scheduled to be released soon.

Importantly, PKB is the first PHR to integrate with the NHS App making it accessible to more people. The main value of the PKB app to this project is that it will allow videos of the final discharge instructions to be stored and shared via the app.

- *Sharing information with patients to enhance patient experience*
- *Two-way communication functionality with hospital staff and patients.*
- *Limited functionality of sharing information between secondary and primary care healthcare professionals.*
- *In its early days of deployment*

- *Not fully integrated across the system*

Patient and caregiver feedback on discharge quality

MSEFT does not specifically collect data on how discharge information is communicated to patients and caregivers, Feedback might be collected via the Care Quality Commission (CQC) inpatient surveys and the Friends and Family Test (FFT). Both mechanisms capture patient perspectives, with some comments on discharge quality. These responses are stored in systems like Envoy and provide qualitative insights into patient satisfaction and challenges.

Launched in 2013, the NHS FFT was created to help service providers and commissioners understand whether patients are happy with the service provided, or where improvements are needed. It's an anonymous way for patients to give their views after receiving NHS care or treatment.

The FFT can be completed either online, mobile phone, by telephone or on paper. The survey is based around a single question: *"Overall how was your experience of our service?"* Answers can be rated from "**very good**" to **"very poor**". Patients have the opportunity to explain their score by adding verbatim comments and may also be asked some follow-up questions.

Questions are not specifically asked about the discharge process.

- https://healthcare-communications.com
- https://www.england.nhs.uk/fft/friends-and-family-test-data/

Communication of discharge information to patients and caregivers

Currently, MSE ICS does not systematically collect data specifically on how discharge information is communicated based on the provided information. However, the use of apps like the Patients Know Best (PKB) app aim to bridge this gap by allowing patients to access personalised health information digitally.

Patient and caregiver experience of discharge

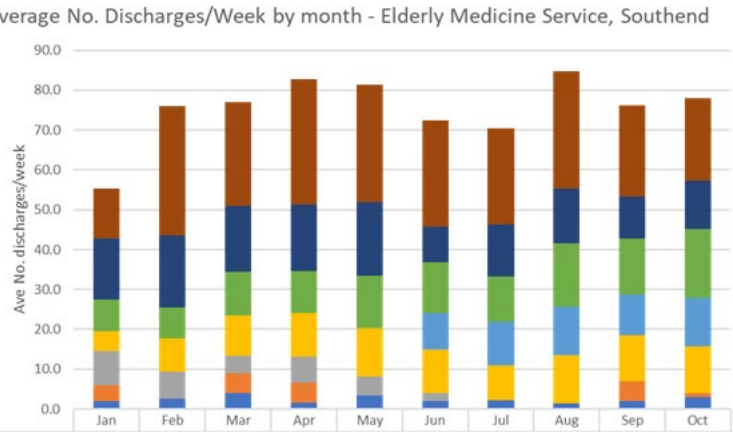
The FFT and CQC surveys occasionally capture aspects of discharge experience, though not as a dedicated focus. The emerging use of tools like PKB offers potential for structured feedback directly linked to discharge quality.

Clinical areas and pattern of discharge

Two wards in acute Trusts were identified as research areas to examine discharge and readmissions: Elderly wards in Southend Hospital and Cardiology wards at Basildon Hospital. The following provides discharge data that support the selection.

Southend wards Care of the Elderly discharges – Jan 23-Oct 23

Data in figure 3 shows patients discharged under the specialty, 'Elderly Medicine Service' Some wards have been filtered out due to low numbers of discharges. Significant numbers of discharge from the Ambulatory Emergency Care (13-32) and Hockley Active Home Suite (9-19) – frailty reablement. Chalkwell (8-17), Hockley (9-12) & Balmoral (5-12) wards are dedicated to medicine for the elderly.

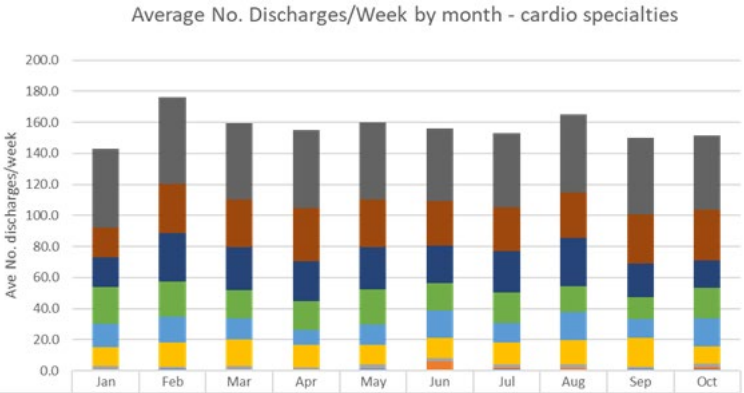


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Ambulatory Emergency Care OPAS (on DAU)	12.5	32.3	26.0	31.5	29.5	26.8	24.0	29.5	23.0	20.8
Active Home Suite on Hockley Ward	15.3	18.3	16.5	16.6	18.5	9.0	13.2	13.8	10.5	12.0
Chalkwell Ward (DME)	8.0	7.8	11.0	10.6	13.0	12.8	11.4	16.0	14.0	17.4
Hockley Ward DME						9.0	10.8	12.0	10.3	12.0
Balmoral Ward (DME)	5.0	8.3	10.3	11.0	12.3	11.0	8.8	12.3	11.5	11.8
Windsor Ward	8.5	6.8	4.3	6.6	4.8	2.0				
Cardiac and Medical Day Stay	4.0		5.0	5.0					5.0	1.0
Benfleet Ward, Ground Floor, Cardigan Building	2.0	2.7	4.0	1.5	3.3	2.0	2.2	1.3	2.0	3.0

Figure 3 Discharge data Southend

Basildon wards Cardiac discharges – Jan 23-Oct 23

Data figure 4 shows discharges for patients under the Cardiac Specialties: Cardiac physiology service, Cardiac rehabilitation service, Cardiac surgery service, Cariology service, Cardiothoracic surgery service. Cardiothoracic transplantation service. Some wards have been filtered out due to low numbers of discharges. Largest average weekly discharges from Thames day unit (47-56), Roding (19-33), Chelmer (19-31) and Brook (14-24).



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Thames Ward Day Unit	50.8	55.8	49.5	50.2	50.3	46.8	47.4	50.5	49.5	47.6
Roding Ward	19.2	31.5	30.3	34.2	30.3	28.8	28.4	29.3	31.8	32.6
Chelmer Ward	19.4	31.3	28.0	25.6	27.3	24.3	26.6	31.0	21.8	18.0
Brook Suite	23.5	22.8	18.3	18.8	23.0	17.8	19.8	16.8	14.0	19.6
Cardiac Day Unit Basildon	15.0	16.5	13.3	9.8	13.0	17.3	12.4	18.3	11.8	18.0
James Mackenzie Ward	12.2	15.8	17.0	14.4	12.5	13.0	14.0	15.5	19.0	11.2
Critical Care, Colne Ward, Ctc	3.0	1.5	3.3	2.0	3.0	2.3	2.0	2.3	1.3	2.0
Medical Short Stay						6.0	1.3	1.7		1.3
Elizabeth Fry		1.0			1.0		1.0		1.0	1.0

Figure 4 Discharge data based on speciality

Key Findings:

MSE ICS collects extensive data on discharge readiness, but the challenge lies in integrating hospital and community data systems. Tools like SystmOne and PKB hold promise for improving data sharing but require wider adoption and user training.

Feedback mechanisms such as FFT and CQC surveys provide valuable insights but lack specificity in capturing discharge-related issues.

Recommendations:

- Expand the scope of routinely collected data to include communication practices and patient/caregiver experiences.
- Enhance IT Integration: Promote S1 and PKB adoption among hospital staff with dedicated training and support.
- Develop tailored surveys or modules focusing specifically on discharge processes to gather more granular insights.
- Pilot communication interventions: Use digital tools like PKB to standardise and personalise discharge instructions, ensuring clear communication with patients and caregivers.

Conclusion

Routinely collected MSE ICS data offers a strong foundation for improving discharge quality. *By addressing gaps in communication, system integration, and feedback collection, the organisation can ensure safer, more efficient discharges aligned with patient needs and policy objectives.*

WP1b: Systematic scoping review

Technologies to enhance patient discharge from hospital: A scoping review of the literature

Background

Patients are discharged from hospitals to the community on a daily basis worldwide. Part of the discharge process involves providing information to patients to support their recovery after leaving the hospital. The discharge process can vary between hospitals and clinical areas (e.g., different practices across specialties). In this scoping review, we aim to identify the types of technologies used to enhance patient discharge from hospitals. Using the Joanna Briggs Institute (JBI) guidance for conducting scoping reviews as a framework (Peters, 2021), we identified gaps in research related to technology-enhanced discharge and examine how such research is conducted.

Review questions

The overarching review question was:

Which technologies are used to enhance patient discharge from hospital after an overnight stay? Other questions to be answered by the review were:

In what way (How) do technologies to enhance discharge from hospital improve discharge for patients, families, and healthcare staff?

- Does technology enhanced discharge reduce hospital readmissions?
- Does technology enhanced discharge improve satisfaction for patients, relatives and staff? e.g. reduce patients' anxiety, improve confidence.

- Does technology enhanced discharge improve patient's discharge journeys? (e.g. enhance communication between services, effective use of services, and related factors)

Methods

We conducted this review following the Joanna Briggs Institute (JBI) guidance for scoping reviews (Peters, 2021). This framework employs the Participants, Concept, and Context (PCC) approach to structure the title and inclusion criteria of the review (Peters, 2021). The findings are intended to inform decision-makers, guiding the development of programmes and service improvement interventions (Table 1).

Participants

The review included studies that focused on patients aged 18 years or older who were recently discharged or preparing for discharge from a hospital. Eligible studies examined the use of technologies designed to enhance the hospital-to-home transition. Studies involving healthcare professionals, patients, carers, and relatives using these technologies were included.

Concept

The review explored technologies aimed at improving patient discharge experiences. Examples include:

- Digital/mobile applications
- Electronic discharge forms and letters
- Podcasts
- Social media group forums
- Websites, webpages, and webinars providing discharge information
- Videos

Technologies could have been used in any secondary care clinical setting following an overnight hospital stay (e.g., surgical, medical, mental health, or maternity care). The definition of "enhance" was based on the Oxford English Dictionary definition: "to raise the quality of." In this review, enhancement referred to improvements in patient outcomes, such as:

- Quality of life
- Medication adherence
- Reduction in hospital readmissions
- Prevention of adverse events

Context

The review focused on the application of these technologies to enhance patient discharge from hospital settings, considering all geographical locations.

Eligibility Criteria

Studies published in English between 2019 and 2024 were included. This timeframe ensures relevance to contemporary technological advances and healthcare practices. We included quantitative studies that determined the effectiveness and/or use of technologies to enhance patient discharge from hospital and results of relevant qualitative and mixed methods studies.

Refer to Table 1 for a detailed overview of the criteria used to determine eligibility.

Table 1 Inclusion and Exclusion Criteria

	Inclusions	**Exclusions**
Participants	Patients over 18 years discharged from hospital	Patients under 18 years of age

Concept	Technology to enhance patient discharge from hospital after overnight stay	Technologies to enhance patient discharge from A+E, or outpatient clinics, or day surgery/care without an overnight stay
Context	Any hospital clinical setting or geographical area	Discharge from primary care, community or rehabilitation settings

Types of sources of evidence

We searched the following electronic databases from 2019-2024 for English language studies:

- Medline
- Embase
- CINAHL
- Cochrane library.
- In addition to the reference lists of all eligible studies for additional relevant studies not picked up by our database search.

Search strategy

Database Searches were restricted to the last 5years as we anticipated technologies to enhance patient discharge from hospital

have been developed and introduced to secondary care to enhance patient discharge within the past 10 years and they will have been reported on in the past 5 years. The date of each search was recorded, and the number of titles and abstracts produced

(technolog* OR enhance OR information) AND (patient hospital discharge)

Evidence screening and selection

All titles and abstracts from the initial search were screened by one reviewer (VB) using text analysis to identify potentially eligible studies. Index terms and keywords were

recorded from the included studies and were subsequently used to refine and build a more focused search strategy across all databases. A proportion of abstracts from each database search was randomly selected by one reviewer (VB)and screened by a second reviewer (NA) for eligibility against the inclusion criteria. Full-text papers for potentially eligible studies were identified by VB and reviewed collaboratively with NA. Additionally, 20% of all included studies were independently reviewed by NA to further validate the selection process.

Data extraction

Data were extracted from each eligible paper, on the author, year of publication, source database, source of data (e.g., clinical area), country, study aim, study population (e.g., patients), sample size, research method, description of the technology and any comparator, concept, duration of the intervention, outcomes, methods of outcome measurement, and key findings related to the review question (Peters, 2015). To ensure comprehensive data extraction, one author conducted a trial extraction (VB), which was independently reviewed and discussed with a second author (NA). This process ensured that all relevant data were captured to address the research question: Which technologies are used to -enhance patient discharge from hospital?

Synthesis of results

All included studies were read and reread to identify the types of technologies used, healthcare providers involved (e.g., public and private hospitals), study locations, and users of the technologies. Characteristics of included studies were described, including outcomes measured and experiences of using technologies from the perspectives of staff and patients. Key aspects examined included satisfaction, acceptability, continuity of care, usefulness, impact on readmission and barriers to technology use. Methods used for each study were also recorded.

Presentation of results

The results of the search strategy and screening process were described and presented in a PRISMA-ScR diagram (Tricco, 2018). Data relating to the population, concept, and context in which the technologies were used were summarised in tables. Gaps in research and areas for further development of technologies to enhance patient discharge from hospital were identified.

Selection of sources of evidence

Evidence screening and selection

The screening of titles and abstracts was conducted by one reviewer (VB), using text analysis to identify studies potentially meeting the inclusion criteria. Screening was carried out based on pre-specified inclusion criteria, as detailed in Table 1. To ensure rigour, a second reviewer (NA) independently screened a random 10% of all full-text papers and 20% of the included studies against the inclusion criteria. Additionally, a third reviewer (ME) independently assessed eight full-text papers focused on complex technologies. Any disagreements regarding the inclusion of these papers were resolved through consensus among all reviewers (VB, NA, ME).

Data charting process

Charting

Data charting was performed by one author (VB), who extracted relevant information from the eligible studies. Extracted data were entered into a master Excel spreadsheet with clearly defined column headings for each data item. Summarised data were reviewed by a second author (NA), focusing on interventions, key findings, and categorisation of the technologies. Any discrepancies or queries were resolved by

cross-referencing with the full text included study report, and consensus was achieved between the two authors (VB and NA).

Data extraction and management

Data were extracted by one author (VB), who copied verbatim quotes for each data item from the full-text PDFs of eligible studies into the master spreadsheet. This spreadsheet was used to summarise the data, which were then transferred into a secondary sheet for analysis. The summarised data were subsequently reviewed by NA, who verified the categorisation of technologies and the reported findings. Both authors (VB and NA) reached agreement on all extracted data and their interpretations.

Results

Fifty-two studies were included in the review (Prisma chart figure 5)

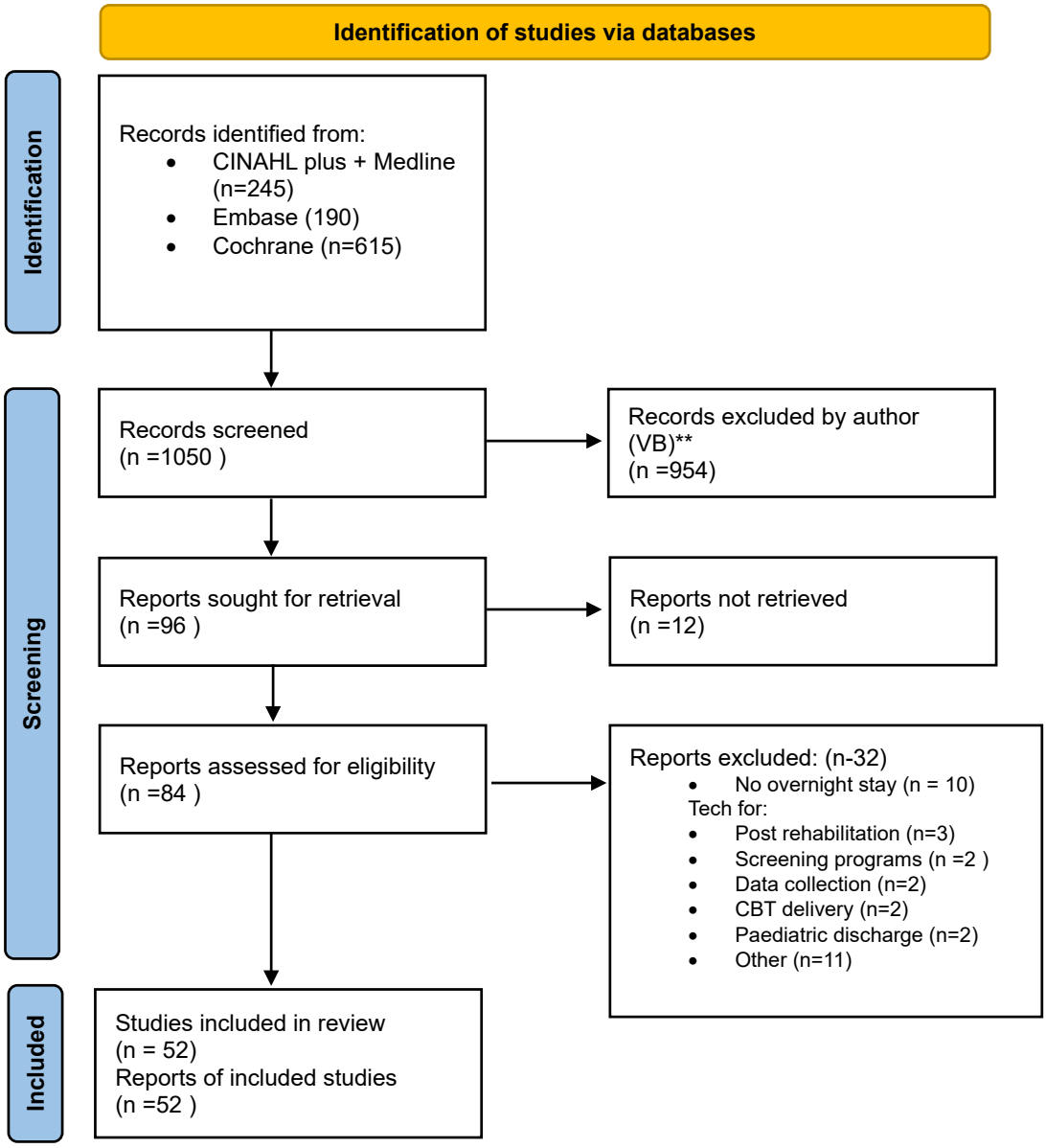


Figure 5 Prisma chart

Description of Included Studies:

Table 2 presents the key characteristics of the 52 studies included in the scoping review. It includes information about the regions and countries where the studies were conducted, the clinical areas addressed, and the types of studies. This data highlights the global distribution of studies, with the majority coming from the Americas and Asia, and focuses on a variety of clinical areas such as cardiology, surgery, and stroke.

Additionally, it outlines the types of research conducted, with the majority being Randomised Controlled Trials (RCTs).

The 52 studies included in this review span a diverse range of clinical areas and geographical regions (Appendix 1). As shown in Figure 6 and table 2, 42% of the studies were conducted in the Americas, with most from the USA (73%). Asia accounted for 35% of studies, with China contributing the largest share (9 studies). Europe and Australia were represented by a smaller proportion of studies (15% and 4%, respectively). The clinical areas covered were varied, with the largest proportion focused on surgery (28%), followed by cardiology (23%). Other clinical areas, including respiratory, stroke, and chronic conditions, were also well-represented. Regarding study types, 79% of the studies were randomised controlled trials (RCTs), reflecting a strong emphasis on rigorous evaluation of technologies. Observational studies (10%) and mixed methods studies (4%) also contributed to the body of evidence. A small number of studies focused on quality improvement (5%) and qualitative research (2%) (Table 2).

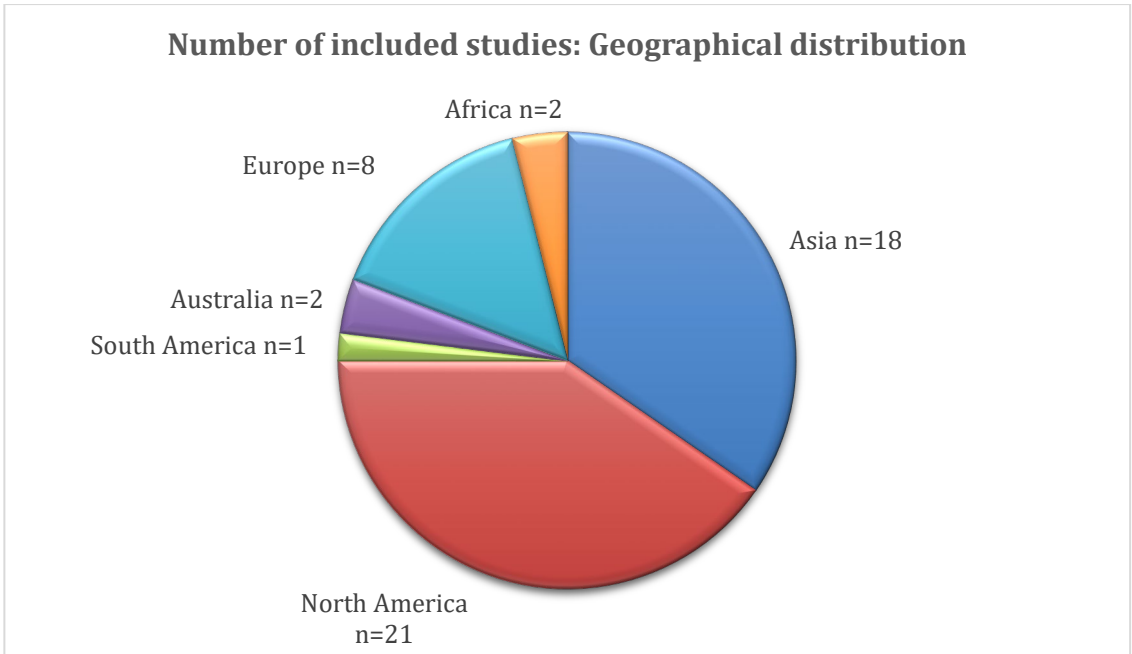


Figure 6 Number of included studies: Geographical distribution

Table 2 Characteristics

Characteristics		Included studies (n=52)
Regions and Countries		
Africa (n=2, 4%)	Egypt	1
	Tanzania	1
America (n=22, 42%)	Brazil	1
	Canada	5
	USA	16
Asia (n=18, 35%)	China	9
	Hongkong	1
	Iran	4
	Malaysia	1
	Singapore	1
	Taiwan	1
	Thailand	1
Oceania (n=2, 4%)	Australia	2
Europe (n=8, 15%)	Germany	1
	Netherlands	1
	Spain	1
	Sweden	1
	Turkey	3
	UK	1
Clinical area	Cardiology	12
	Chronic Conditions	2
	Mental Health*	2

	Respiratory	5
	Stroke	6
	Surgery	15
	Other	10
Study type	Qualitative	1
	Quality improvement	3
	RCT	41
	Mixed methods	2
	Observational	5

Types of technologies to enhance patient discharge

Eight different types of technologies to enhance patient discharge from hospital were identified in, each aimed to improve patient outcomes following hospital discharge after an overnight stay. These technologies were used either independently or in combination e.g., app + video to support patients transitioning to home-based care. This synthesis categorises interventions by technology type; wearables, video-based education, telephone follow-ups, mobile applications, and combined approaches. Eight different types of technologies were identified in the included studies, each aimed at improving patient outcomes following hospital discharge. These technologies were used either independently or in combination to support patients transitioning to home-based care.

Apps

Eleven studies evaluated mobile applications designed to enhance patient discharge. These studies were conducted in China (Gou, Qiao-Ping Li), the USA (Pickens, Riegel), Canada (Habib), Germany (Neumayr), Egypt (Kamel), Malaysia (Hanita), Iran (Rouzfarakh), and Thailand (Jehloh). The methodologies used included pilot RCTs (Gou, Habib, Hanita, Li Y, Neumayr, Riegel), quasi-randomised trials (Kamel, Qiao-Ping), observational studies (Pickens, Jehloh), and one full RCT (Rouzfarakh). The sample sizes ranged from 36 to 300 participants, with a mean age of 21–61 years. Apps were designed for diverse patient groups, including post-surgery, cardiology, respiratory illnesses, and chronic conditions. Outcomes included improved medication adherence, exercise compliance, pain management, and anxiety reduction. Apps were also combined with other technologies like video or wearable devices, enhancing communication, education, and monitoring.

Apps for surgical patients' post-discharge

Four studies focused on surgical patients. WeChat-based apps were used to support recovery after spinal surgery. Gou evaluated a WeChat rehabilitation programme, which included an electronic education manual and fortnightly group discussions post-discharge. Qiao assessed a WeChat-based platform offering health information and interactive Q&A with healthcare professionals. Hanita evaluated *MyEducation*, an app providing pre- and post-operative education for patients undergoing coronary artery bypass graft surgery, addressing emotional and physical recovery. Pickens assessed a customised app linked to the Enhanced Recovery After Surgery (ERAS) programme, which included daily symptom tracking and self-care guidance. Apps in this category showed benefits such as improved exercise compliance, reduced anxiety, better pain management, and fewer hospital phone calls.

Apps for cardiology patients

Two studies targeted cardiology patients. Kamel used a Zoom-based telemedicine programme with monthly virtual follow-ups, which was well-received by patients. Li Y assessed a self-management app featuring medication adherence tracking, lifestyle interventions, and Bluetooth-enabled monitoring. The app significantly improved medication adherence and blood pressure control over 12 months.

Apps for medication adherence

Two studies focused on medication adherence. Riegel evaluated a 90-day programme with daily reminders to take aspirin, requiring participants to upload photos of their medication. Habib assessed the *Smart About Meds* app, which helps manage prescriptions and alerts users about side effects and drug interactions. Both studies reported high adherence rates.

Apps for other conditions

Three studies explored apps for diverse conditions. A WhatsApp channel was used for burns patients, offering daily rehabilitation guidance and peer support, resulting in improved quality of life. An app for COPD patients provided daily health records, alerts for symptoms, and emergency guidance, significantly reducing emergency visits. Neumayr's app for eating disorders offered goal setting, reminders, and clinician linkage, with high user adherence reported.

Telephone calls

Nine studies examined telephone-based interventions for post-discharge support. Conducted in the USA, Turkey, China, Iran, and Sweden, these studies included RCTs, pilot RCTs, and observational designs. Sample sizes ranged from 40 to 1,067 participants, targeting conditions such as cardiac recovery, stroke, pneumonia, COPD, schizophrenia, and COVID-19 caregiver support.

Interventions included structured education, problem-solving, and psychoeducational counselling. Frequency varied from weekly calls to tapered schedules. Telephone calls improved self-care, quality of life, and patient satisfaction, though impacts on readmission rates were inconsistent.

Telephone combined with other technologies

Six studies combined telephone calls with websites, videos, or text messages to provide comprehensive post-discharge support. Outcomes included improved self-care, physical health, reduced emergency room visits, and enhanced knowledge about recovery. Results for hospital readmissions were mixed, with some studies reporting no significant differences.

Videos

Three studies evaluated videos for education, targeting conditions like postpartum recovery and COPD. Outcomes included improved knowledge, satisfaction, and inhaler use accuracy. One study noted limited impact on pulmonary rehabilitation uptake. Videos combined with websites or SMS messages were also explored, with participants expressing satisfaction with the content.

Wearable technologies

Two studies examined wearable devices for monitoring post-discharge health. A wristband encouraged stroke patients to increase limb use, while a device for surgical patients monitored oxygen saturation. Both showed feasibility, but effects on clinical outcomes varied.

Text messages

Two studies, from Brazil and Canada, evaluated SMS interventions for patients after acute coronary syndrome. Messages provided tailored health advice, medication reminders, and lifestyle guidance. Both studies highlighted potential benefits for patient

engagement. Although the interventions were well-received, they showed no significant improvements in cardiovascular risk factors or hospital readmission rates.

Telemonitoring

Seven studies assessed telemonitoring via devices like Bluetooth-enabled systems and smartphones for post-surgery and chronic condition management. Benefits included enhanced satisfaction, self-management, and quality of life. Hospital readmission reductions were limited.

Compact disc

One Iranian study evaluated an interactive multimedia CD for post-kidney transplant care. Compared to a booklet, the CD significantly improved patients' quality of life in various domains, though both interventions were effective.

Effect on Readmission

Twenty-two studies examined the impact of digital technologies on hospital readmission, yielding mixed findings. Thirteen studies identified readmission as a primary outcome, with eight measuring within 30 days post-discharge. Significant reductions were observed with telemonitoring in transplant and renal patients, app-based interventions, and SMS or video support in cardiology. However, several studies reported no significant effects across different technologies or populations. Others showed trends toward reduced readmission without statistical significance. Overall, while telemonitoring and combined use of technology appears promising, the evidence remains inconsistent, highlighting the need for further robust, long-term studies to clarify digital interventions' effectiveness on reducing readmissions.

Effect on Satisfaction

Twenty-one studies explored patient satisfaction with digital health interventions. Satisfaction was often a secondary outcome, linked to usability, acceptability, or perceived helpfulness. High satisfaction was reported with app-based and combined

technologies, which improved discharge preparedness, reduced anxiety, and enhanced recovery experiences. Some studies, like Pickens et al. (2019) and Xiao et al. (2020), measured satisfaction as a primary outcome. Others focused on related attitudes such as confidence and enthusiasm. Li et al. (2023) found no significant difference between groups. Overall, satisfaction was highest when interventions combined multiple formats (e.g., app, video, text), suggesting greater patient engagement with well-designed, user-centred tools.

Conclusion

These technologies demonstrated varying degrees of benefits in improving post hospital discharge, including improve confidence in self-care, quality of life, medication adherence, and patient satisfaction. Further research is needed to establish their impact on readmission rates and healthcare utilisation. Technologies to enhance patient discharge from hospital are used and evaluated across clinical areas worldwide but mostly in rich countries. App users were mostly younger (aged 21–60), while telemonitoring was more common among those over 60. This raises concerns about whether older adults, people with less experience using technology, lower education levels, or sensory difficulties can easily access and use these digital tools. Addressing this gap is important to maximise the potential benefits of the use of technologies for patients and staff.

Technologies to Enhance Patient Discharge from Hospital: A Systematic Scoping Review

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Background

- Patients are discharged from hospital every day
- One in five are readmitted within 30 days[1]
- Key challenges are poor communication, inadequate discharge summaries, medication confusion, poor arrangements for homecare[2]
- Technologies could be used to enhance patient discharge[3]
- We conducted a systematic scoping review of the literature to inform the development of a new technology to enhance patient discharge from two wards in the Mid and South Essex NHS Foundation Trust

Review question

Which technologies are used to enhance patient discharge from hospital?

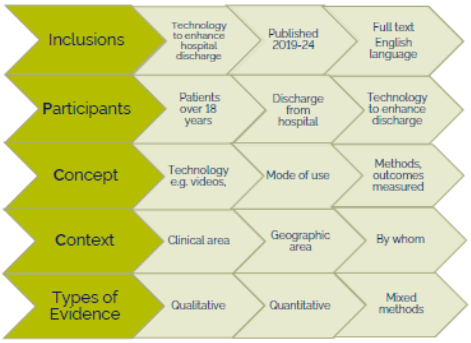
Sub questions:

- Where are they used?
- How are they used and evaluated?

Methods

We used Joanna Briggs Institute (JBI) guidance for conducting scoping reviews[4]

Figure 1. Applied JBI guidance



Identification of studies

We searched Embase, CINAHL, Medline & Cochrane library using:

(Podcast*, mobile app*, phone app*, video*, hyperlink*, website*, webpage*, electronic form*, eDischarge letter*, social media for*, webinar*, telehealth, telemedicine, text message*, WeChat, WhatsApp, mobile health app* technolog*, eHealth, mHealth, wearable device*, remote sensing, sms text message*, voice record*, mobile tablet*, webcast*) **AND** (Patient discharge **OR** discharge planning) **AND** (Hospital **OR** secondary care **OR** acute care) **AND** (Enhanc* **OR** improve*)

Selection of studies

One author (VB) screened all abstracts, and the full text of all papers accessed. 20% of included studies were independently screened by (NA)

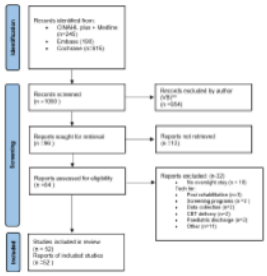
Figure 2 Data extraction

Data Analysis

Counts and descriptions of technologies, evaluation methods, clinical and geographical settings and study findings were processed in Excel

Results

Figure 3 PRISMA diagram[5]



- 4 databases searched
- 1050 abstracts identified
- 52 papers included

Figure 4 Where technologies are used

Geographically

Clinically

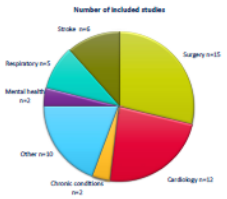


Table 1 Types of technologies identified

Type of technology	No of papers	Example of technology
Apps	19	APP "Recovery Record" with: self-monitoring, positive reinforcement, meal planner, reminders, coping strategies, motivational slogans, link to clinician. Neumayr (2019) Germany
Videos	3	Education video delivered via tablet and secure password protected internet link. Provided with a COPD discharge bundle from specialist respiratory AHP. Barker (2020) UK
Telephone calls	9	Telephone follow-up for person centered care (PCC) plan. First call 1–4 weeks after discharge. RN listens, asks questions identifies pt potential for self-care. Wallstrom (2020) Sweden
Websites	4	Web-based education: (1) post general surgery warning signs; (2) everyday care instructions; (3) a video on surgical wound care and signs of wound complications (Kang 2022) Australia
SMS Texts	3	Automated 1-way SMS text messages about follow-up care, self-management, healthy living and readmission. Delivered at a time specified by patient. Ross (2020) Canada
Wearable technologies	2	Wearable device to detect & alert patients to hypoxia post operatively. Monitoring continued in hospital for select number of days post op and after discharge. Li (2023) USA
Compact Discs	1	Interactive multimedia content for renal transplant patients: education on renal function and problems with guided multiple-choice questions. Mansouri (2020) Iran
Combined technologies	11	Smartphone, BP monitor, medication dispenser, and necklace emergency call button linked to a nurse-led 24/hr call center. Reminders to check signs and take meds. Laing (2020) Taiwan

How technologies were evaluated

Technologies were evaluated in RCTs (n-41), QI projects (n-3), Qualitative studies (n-1), Mixed methods (n-2) & Observational studies (n-5)

Conclusion

Technologies to enhance patient discharge from hospital are used and evaluated across clinical areas worldwide. Few studies have examined user experience. Addressing this gap is important to maximise the potential benefits of the use of technologies for patients and staff.

References

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Acknowledgements

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Mid and South Essex Integrated Care System

Figure 7 Poster of initial findings presented at the RCN International Nursing Research Conference in 2024

WP2: Patients' interviews

Aim

- To explore the current practice of hospital discharge from MSEFT and patient experiences of digital technology currently utilised for patient discharge at MSENFT.

Design

This study adopted a qualitative methodology, using a semi-structure interview for data collection.

Sampling and recruitment

A convenience sampling technique was used to recruit study participants. The study population was patients and staff who had experience with hospital discharge at primary or secondary care settings. After obtaining ethical approval from ARU and relevant Research and Development (R&D) approval from the participating clinical sites (MSENFT, EPUT, PROVIDE, NELFT NHS Foundation Trust), the recruitment process for both patients and staff commenced.

Patient recruitment

Patients were invited to participate in this study through posters placed in patient areas and directly through clinical staff (cascaded via heads of departments to frontline staff). The posters included the researchers' contact details, a QR code, and a link to the Survey System for participants to register their interest.

Participants received a link to the Survey Online system, which included a Participant Information Sheet, a consent form, and the researchers' contact details. This link, provided by the Joint Information Systems Committee (JISC), required participants to review the invitation and information sheet before signing the consent form to

participate in one of the scheduled interviews. Invitations to attend online focus groups were sent to participants via Microsoft Teams.

Staff recruitment

Staff recruitment was facilitated through various channels to ensure maximum reach. Invitations were sent via the intranet by the head of communications at MSEFT and the heads of R&D for all participating sites. During face-to-face visits to Basildon, Broomfield, and Southend hospitals, physical posters were distributed, and the project was introduced during morning staff handovers.

Further recruitment efforts included distributing physical copies of the invites to clinicians and heads of departments. Approximately four to six reminder emails were sent to staff by the head of communications. Similar recruitment strategies were used in primary care settings, with team leads and R&D heads coordinating the dissemination of invitations and posters to both staff and patients. The project was also presented in meetings with Healthwatch, community leadership groups, patient groups, and Thurrock TOCH.

Staff focus group

Data collection was initially planned through focus groups. One focus group was designed for primary care/community healthcare staff, using the questions in Table 3, and another for secondary healthcare staff, using the questions in Table 4. However, despite frequent recruitment attempts (12 attempts) between May and August 2024, no staff registered.

Table 3 Focus group questions primary care staff

1. Could you tell us about the different types of technology you used for receiving discharged patients from the hospital (e.g., messaging, using mobile apps)?
2. Could you share your experiences of using these different types of technology? (Technical issues, ease of use)
3. Can you describe your experience of receiving discharge information from the hospital? How did this impact the quality or clarity of the received information?

4. Any thoughts on how this could impact patient journey/continuity of care or their access to different health services?
5. What barriers/challenges prevented you from using these types of technologies for discharging patients from the hospital?
6. Can you share any positive experiences you've had using these technologies?
7. What are your thoughts on using personalised video-recorded discharge information for patients?

……

Prompts: You mentioned that…could you tell me what that was like for you? Can you give me an example of…? You said…. Can you describe that in more detail for me? How was…. different to you? You said…. Walk me through what that was like for you?

Table 4 Focus group questions hospital/ secondary care staff

1. Could you tell us about the different types of technology you used for discharging patients from the hospital (e.g., messaging, using mobile apps)?
2. Could you share your experiences of using these different types of technology? (Technical issues, ease of use)
3. Can you describe your experience of providing discharge information to patients from the hospital? How did this impact the quality or clarity of the provided information?
4. Any thoughts on how this could impact patient journey/continuity of care or their access to different health services?
5. What barriers/challenges prevented you from using these types of technologies for discharging patients from the hospital?
6. Can you share any positive experiences you've had using these technologies?
7. What are your thoughts on using personalised video-recorded discharge information for patients?

……

Prompts: You mentioned that…could you tell me what that was like for you? Can you give me an example of…? You said…. Can you describe that in more detail for me? How was…. different to you? You said…. Walk me through what that was like for you?

Patients interview/ focus group

Data was planned to be collected through focus groups, which were offered either online or face-to-face. Three patients initially registered their interest, and two confirmed

their attendance. However, only one patient participated, so semi-structured interviews were considered as an alternative, with amendments made to the ethics application. A set of questions (Table 5) was developed and reviewed by the project steering group. The interviews were conducted online through Microsoft Teams and lasted approximately 40 minutes. Audio files were extracted from each video and transcribed. ICS staff booked rooms in case patients preferred face-to-face meetings, but the participating patient opted for an online meeting.

Table 5 Patient interview questions

1. Could you tell us about the different types of technology you encountered as a patient when seeking information about your health needs from health services (e.g., messaging, using mobile apps), particularly upon discharge from the hospital? 2. Could you share your experiences of using these different types of technology? 3. Can you describe your experience of seeking information about your health condition after hospital discharge? How did this impact your journey in accessing different healthcare services? 4. What barriers prevented you from using/accessing these types of technologies after discharge from the hospital? What were the major challenges you faced in using these technologies? 5. Can you share any positive experiences you've had using these technologies to seek information and support after hospital discharge? 6. What are your thoughts of using a personalised video recorded discharge? 7. How do you suggest enhancing your experience/journey post-hospital discharge through the use of technology? …… Prompts: You mentioned that…could you tell me what that was like for you? Can you give me an example of…? You said…. Can you describe that in more detail for me? How was…. different to you? You said…. Walk me through what that was like for you?

Ethical considerations

The study received ethical approval from the Faculty of Health, Medicine, and Social Care Research Ethics Panel at Anglia Ruskin University, approval number ETH2324-3660. The study is considered a quality improvement project by the NHS organisations'

Research and Development departments, as it focuses on patient and staff experiences in MSEFT and partner community services.

Data analysis

The transcripts were imported into NVivo software version 14 software to facilitate qualitative analysis. Guided by the steps outlined by Braun and Clarke (2021), a thematic analysis was conducted. It is important to note that the analysis primarily focused on exploring staff and patients' experiences with the use of technology for hospital discharge.

Qualitative results from patients' interviews

One patient attended the interview that lasted 40 minutes and the analysis of the transcript produce the following themes. The same person (NA) conducted the interview and data analysis.

Challenges with communication technology

Telephone communication issues

The use of telephone calls for managing appointments and consultations after discharge often leads to inconvenience and frustration. The lack of flexibility and the unpredictability of call timings create difficulties for patients, especially those with busy or structured schedules.

"The appointments they make on the phone are absolute. And it's actually quite difficult to reschedule them… you get in severe trouble if you miss a call."

One-way communication barriers

The communication from healthcare providers often feels one-sided, leaving patients without a clear path for follow-up or addressing missed calls. This can exacerbate feelings of vulnerability and frustration.

"There is no information… about who to contact if you've got a problem. It's all one-sided."

Ineffectiveness of digital communication channels

The inability to communicate effectively via digital channels, such as email or messaging apps, can hinder the patient's ability to get timely and effective support.

"The NHS app has a messaging facility… which is disabled for my GP surgery."

Barriers and facilitators in accessing health information

Reliance on alternative information sources

Participants mentioned that they often turn to alternative resources, such as websites or pharmacists, to get accurate information about their health and medications.

"If there's anything I'm unsure about with the medication, I'll just go to the BNF website."

Access barriers to digital health information

While digital platforms like the NHS app offer some conveniences, there are inconsistencies in what information is accessible, such as specific medical results not being available. They were not aware of the Patient Know Best (PKB) application.

"I can access my gastroenterology results… I can't check my all results. There is no result for some of the bloods on the NHS app."

Digital literacy and access

Participants described that patients with a better understanding of the system or insider knowledge can navigate it more effectively, while others may struggle.

"I have knowledge which the general public do not have… I'm not sure I would know how to re-access the service."

Enhancing patient experience with information sharing

Effective use of online resources

Online resources such as NHS websites can be beneficial for patients when they are well-designed and provide accurate, accessible information.

"The NHS site is superb. Most of the NHS app is really useful… It's really, really good. Information resource."

Conditional value of video communication

Participants perceived the usefulness of video for discharge as potentially beneficial but conditional. They highlighted its value, particularly for younger patients who are more likely to be familiar with technology. However, they expressed concerns about accessibility for older adults, suggesting that they believed its ease of use is limited. For them, the video's effectiveness depends on the patient's ability to access and navigate the technology.

"I think the problem with that [video-recorded discharge] is that if you're 23, you probably know how to access it and look at it. If you are 75 and you've got either a brick phone or a very old phone, you may not be able to access it, or even if you can, know how to do it."

Importance of personal support

Personalised support, such as having a dedicated point of contact or a support worker, can significantly enhance the patient experience and provide reassurance.

"One of the greatest experiences I've had… was with a healthcare support worker who was a fantastic resource."

Need for improved communication strategies

Improving how information and communication are managed, including reducing the reliance on telephone calls and providing better digital access, could enhance the patient journey.

"The service needs more aiders… who can commit time and show that they care."

Summary

The findings highlighted a need for more flexible and patient-centred communication methods. Patients identified significant barriers with existing telephone systems, such as lack of flexibility and difficulty rescheduling appointments. They also pointed out the limitations of one-way communication, which left them without a clear path for follow-up. To enhance the patient journey, there is a need to improve digital communication channels, ensure all relevant health information is accessible, and develop educational resources to guide patients on how to use these technologies effectively.

Patients perceived the use of video for discharge information as potentially beneficial, particularly for younger individuals who are more familiar with technology. However, they expressed concerns about its accessibility for older adults, emphasising that the effectiveness of video depends heavily on the patient's ability to access and navigate the technology. This limitation suggests that while video can be a useful tool, it must be accompanied by considerations for varying levels of digital literacy among patients.

The study encountered challenges in both patient and staff recruitment, emphasising the need for more active clinician involvement in participant recruitment. Clinician engagement proved to be a critical factor in enhancing these efforts, as their support not only motivated staff but also played a crucial role in recruiting and encouraging patient participation. Building strong partnerships with healthcare providers and securing their commitment is essential for the successful execution of research projects that rely heavily on the involvement of patients and frontline staff.

WP 3b: Patient Survey level of digital health literacy, effort and confidence of technology

Summary of patient survey

This study explored how a small group of six adults, mostly women aged between 35 and 68 years, use and engage with digital health tools. The participants all lived with a chronic health condition and represented a range of educational backgrounds. The group also had diverse ethnic backgrounds.

Access to digital devices and Internet

All participants owned a smartphone or tablet, and most also had a computer or laptop. While many had access to health-related apps or portals, not all actively used them. Internet access was common among participants, suggesting they were generally well-equipped with digital tools.

Confidence and ease in using technology

Participants reported high confidence in using smartphones and computers, feeling particularly capable with tasks like sending photos and recording videos. However, some found typing on a touchscreen and using certain digital health apps more challenging, suggesting that not all tasks are equally easy to navigate.

Use of digital health services

Most participants showed moderate engagement with digital health services. They accessed webpages and received text messages from services relatively often. However, features like booking appointments or ordering prescriptions via the NHS app were used infrequently, and remote video appointments were rarely utilized. This indicates room for improving familiarity and promoting the use of these services.

Digital health literacy

Participants generally felt comfortable finding and understanding health information online. However, judging the reliability or relevance of information, especially in identifying commercial biases, proved more difficult. Additionally, using information to address health concerns or clearly communicating with health providers via digital platforms posed some challenges.

While participants have access to technology and are generally confident in using it, there is a need to boost engagement with specific digital health services like NHS apps and video consultations and use of videos. Addressing usability issues in recording and sharing digital health information could help improve the use of it everyday healthcare routines. The findings highlight the importance of ongoing support and education to enhance digital health literacy and encourage more consistent use of digital health resources.

Methods

Aim: To investigate patients' digital readiness and acceptability of employing digital technology for patient discharge

Design: This study employed a self-report and cross-sectional survey design.

Sample and recruitment

Patient recruitment was facilitated through various channels to ensure maximum reach. Invitations were sent by the heads of R&D at all participating sites, who then distributed them to all clinical areas. During face-to-face visits to Basildon, Broomfield, and Southend hospitals, physical posters were distributed, and the project was introduced during morning staff handovers. Additional recruitment efforts involved providing physical copies of the invitations to clinicians and heads of departments. Similar recruitment strategies were employed in primary care settings, with team leads and R&D heads coordinating the dissemination of invitations and posters to both staff and patients. The project was also presented at meetings with Healthwatch, community leadership groups, patient groups, Thurrock TOCH and Discharge Lounge Team. Following ethical approval from ARU and the necessary R&D approvals from the participating clinical sites (MSENFT, EPUT, PROVIDE, NELFT NHS Foundation Trust), the recruitment process for patients commenced.

Data collection

The survey's first two sections included a Participant Information Sheet (PIS), a consent form, and the researcher's contact details. Prior to answering survey questions, participants were required to read these sections and sign the consent form. Data was gathered using an anonymised self-report questionnaire administered through a secure online survey (the Joint Information Systems Committee (JISC) (https://www.onlinesurveys.ac.uk/)) between May to August 2024.

The HLS19 Consortium defines digital health literacy (DHL) as "the ability to search for, access, understand, appraise, validate, and apply online health information, and to formulate and express questions, opinions, thoughts, or feelings when using digital devices." This concept is closely related to the frequency with which people use various digital health resources, such as online video consultations, digital personal health records, social media, health-related apps, and more. A review of the literature found that digital literacy is most commonly assessed by measuring (1) users' frequency of use and (2) users' confidence levels, often using a Likert-type scale.

The survey included five sections:

Section One focused on patient access to and ownership of digital devices, such as smartphones, computers, and the internet. This section consisted of four yes/no questions. Additionally, it included six questions measuring the frequency of using different methods to access health services, rated on a five-point Likert-type scale: 'never' (1), 'rarely' (2), 'sometimes' (3), 'often' (4), and 'always' (5).
Section Two assessed patients' confidence in using technology, with five questions rated on a Likert type scale from 1 to 5, ranging from 1 ='not at all confident' to 5= 'completely confident.'
Section Three measured participants' effort in using technology, using nine questions. rated on a Likert type scale from 1 to 4, ranging from 1= 'Very difficult to 4 = 'Very easy'.
Section Four utilised the World Health Organization Digital Literacy Measure (HLS 19), which included three parts: Part One asked six questions about the frequency and methods of accessing health information, with options ranging from 'less than once a week' (1) to 'more than once a day' (5). Part Two focused on the effort required in seeking, identifying, and evaluating health information, with responses ranging from 'very easy' (4) to 'very difficult' (1). This part also included two questions on the effort involved in communicating health inquiries using technology. Part Three (incorrectly numbered as 'Part Two' in the draft) used the same scale ('very easy' to 'very difficult') to measure the effort required to communicate health-related questions via technology. Reliability was excellent (Cronbach's alpha = 0.91).

Section Five included six demographic questions.

This structured survey design provided a comprehensive understanding of patients' digital literacy, access to technology, confidence in using it, and the challenges they may face in finding and communicating health information.

Ethical considerations

The study received ethical approval from the Faculty of Health, Medicine, and Social Care Research Ethics Panel at Anglia Ruskin University, approval number ETH2324-3660 on 13th March 2024. The study is considered a quality improvement project by the NHS organisations' Research and Development departments, as it focuses on patient and staff experiences in MSEFT and partner community services.

Data analysis

Data analysis was performed using Version 28 of the Statistical Package for Social Sciences (SPSS). Categorical data are reported as frequencies and percentages, while continuous data were analysed using the mean, range, and standard deviations (SDs). Spearman's correlation coefficients were utilised to assess the correlations between demographical variables and key study variables (refer to the Results section). To investigate the impact of demographical factors on organisational readiness for SBE, Kruska-Wallis's test was conducted. The statistical significance was set at an alpha level of $p < 0.05$.

Demographic

The study involved six participants, of whom the majority were female (66.7%). Participants were evenly distributed across educational levels, with equal representation from college, university degree, and postgraduate degree holders. All participants reported living with a chronic condition. The average age of participants was 52.67 years (SD = 11.75), ranging from 35 to 68 years (Table 6).

Table 6 Sample Characteristics

		Number (%)	
Agre group	<50 ≥ 50	3 (50%) 3 (50%)	
Sex	Male	2 (33.3%)	
	Female	4 (66.7%)	
	Prefer not say	0 (0%)	
Highest level of education	College	2 (33.3%)	
	University Degree	2 (33.3%)	
	Post-graduate degree	2 (33.3%)	
Chronic condition	Yes	6 (100%)	
	No	0 (0%)	
Ethnic group	English/Welsh/Scottish/ Northern Irish/ British	3 (50%)	
	Mixed/Multiple ethnic groups	1 (16.7%)	
	African	1 (16.7%)	
	Any other ethnic group	1 (16.7%)	
Characteristics	**Mean (SD)**	**Range**	
		Minimum	Maximum
Age (years)	52.67 (11.75)	35	68

Access and ownership of digital devices

All participants reported using a smartphone or tablet, and most (83.3%) also used a computer or laptop (Figure 8). Half of the participants utilised health apps, portals, or systems, and the majority had internet access (Figure 8).

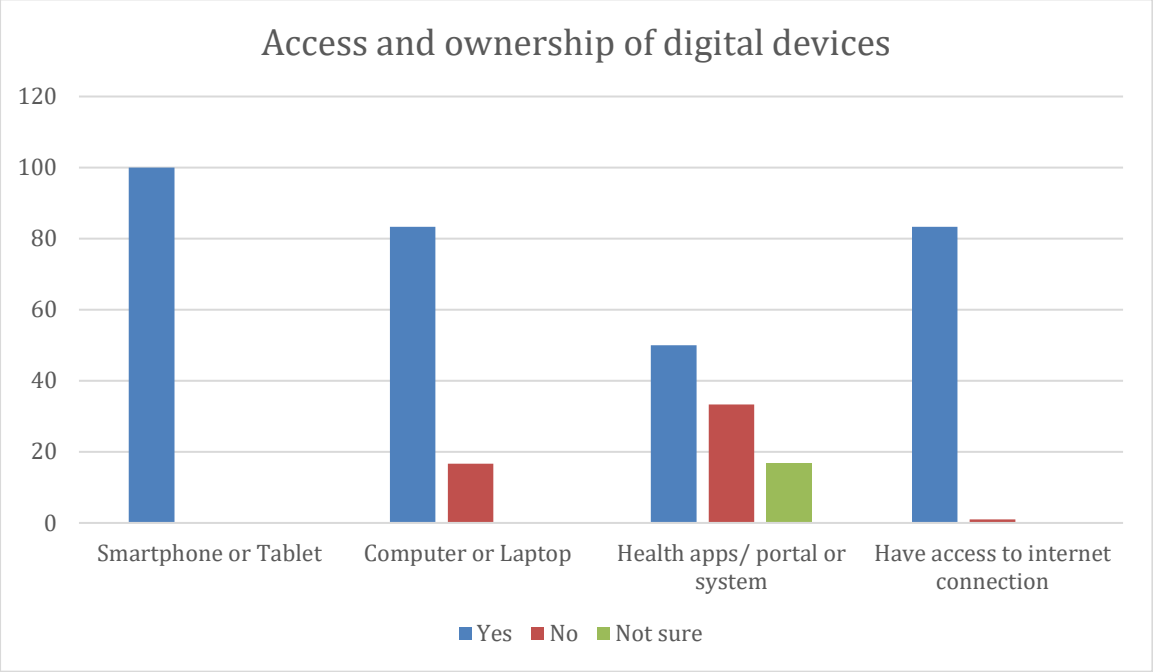

Figure 8 Access and ownership of digital devices

Participants showed a moderate level of engagement with webpages for information, with half using them sometimes and the other half often, resulting in a mean of 3.50 (SD = 0.55) (Table 7, Figure 9). Text messages from services were used with similar frequency, yielding a mean of 3.50 (SD = 1.05). The use of the NHS app to book appointments was less common, with the majority rarely using it (66.7%), resulting in a mean of 2.17 (SD = 0.98). Similarly, the NHS app to order prescriptions was used infrequently, with 50% of participants never using it and a mean of 2.17 (SD = 1.60). Video calls for appointments were used even less, with 66.7% of participants never using this method, leading to a mean of 1.83 (SD = 1.33). Remote monitoring equipment had the lowest usage, with half of the participants never using it and a mean score of 1.67 (SD = 0.82) (Figure 9).

Table 7 Methods of accessing the health services

	Mean (SD)
Webpages for information	3.50 (.55)
Text message from services	3.50 (1.05)
NHS app to book appointment	2.17 (0.98)
NHS app to order prescription	2.17 (1.60)
Video call for appointment	1.83 (1.33)
Remote monitoring equipment	1.67 (.82)

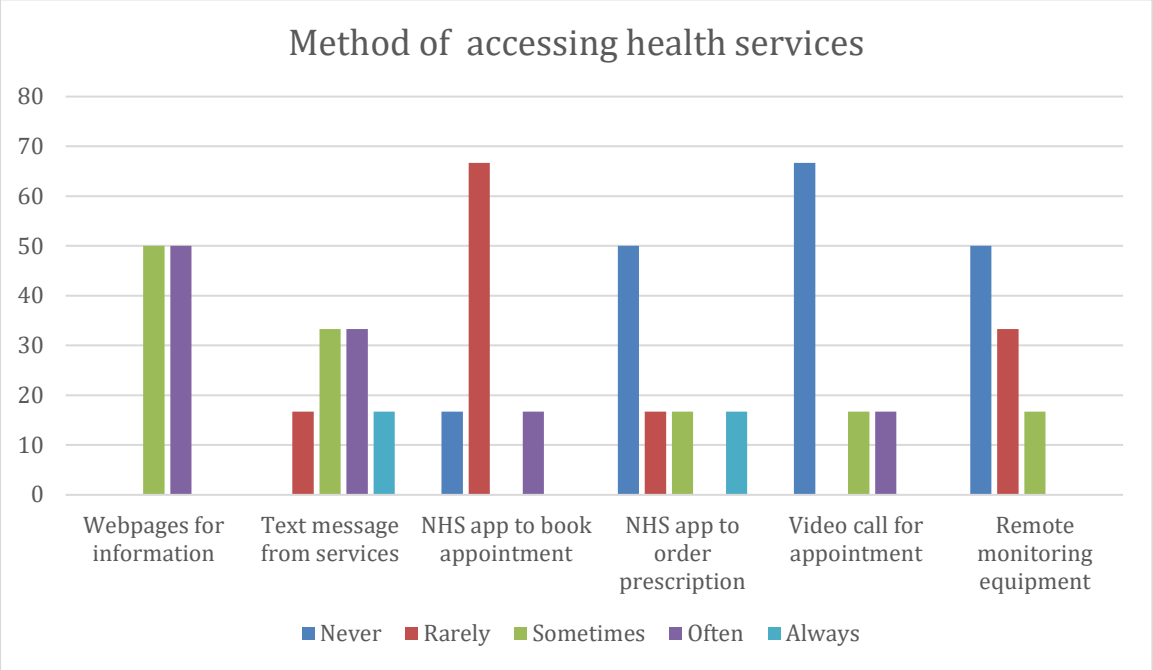

Figure 9 Method of accessing health services

Confidence in using technology

Participants reported a high level of confidence in using computers or laptops, with 50% being completely confident and a mean score of 4.17 (SD = 0.98). Confidence in using smartphones or tablets was even higher, with a mean score of 4.50 (SD = 0.55) (Figure 10 and Table 8). For recording a video using a smartphone or tablet, confidence levels were more varied, with a mean score of 3.50 (SD = 0.05). Participants showed slightly less confidence in uploading or downloading videos to different applications, with a mean of 3.33 (SD = 1.03). Sending a picture or video via a smartphone or tablet had a high confidence level among participants, with most feeling moderately or completely confident, resulting in a mean score of 4.0 (SD = 0.63).

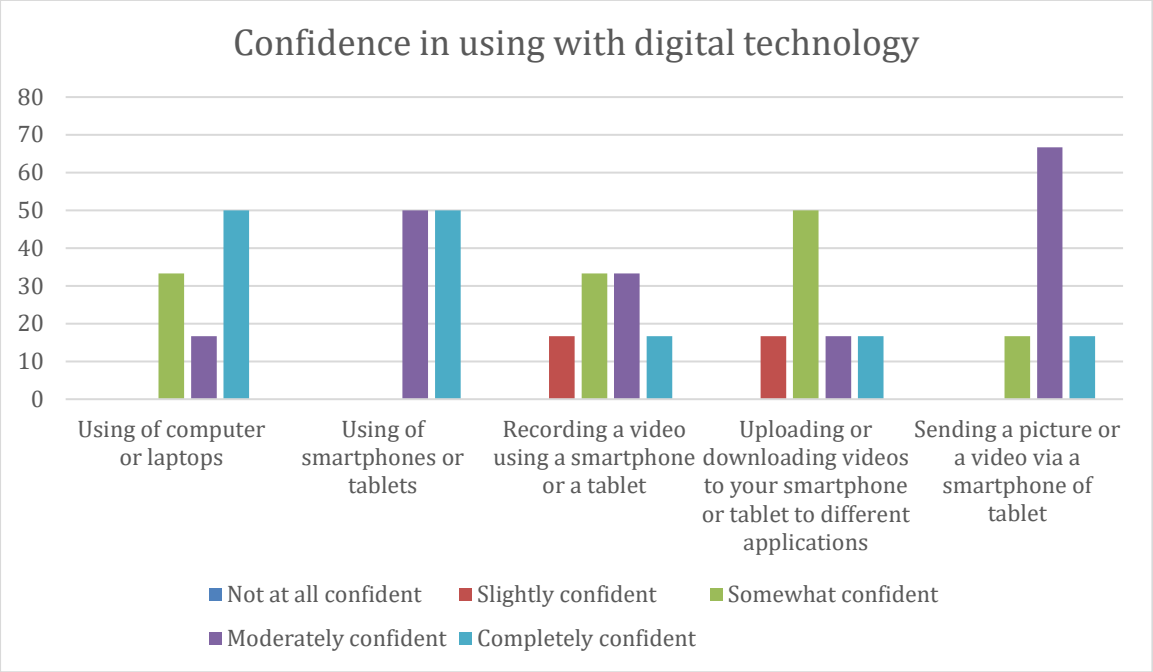

Figure 10 Confidence in using with digital technology

Table 8 Overall level of use of digital devices and technology

	Mean (SD)
Using of computer or laptops	4.17 (.98)
Using of smartphones or tablets	4.50 (.55)

Recording a video using a smartphone or a tablet	3.50 (.05)
Uploading or downloading videos to your smartphone or tablet to different applications	3.33(1.03)
Sending a picture or a video via a smartphone of tablet	4.0 (.63)

Effort in using a digital technologies and videos

The findings provide insight into participants' experiences with various tasks on smartphones and tablets, indicating a generally positive perception of usability across most activities (Table 9). Participants reported little effort is needed in using touchscreen technology, with 83.4% rating it as "easy" and a mean score of 4.0. Similarly, navigating applications received favourable ratings, with a mean score of 3.83, suggesting a familiarity and comfort with touchscreen-based interactions. In contrast, typing on a touchscreen keyboard posed challenges, reflected in a mean score of 2.17. While half of the participants rated this task as "easy," a significant proportion (33.3%) found it "difficult," indicating that text input remains a barrier for some users. The use of digital applications yielded mixed responses, with a mean score of 2.33. While 50% of participants rated this task as "fairly easy," others found it "very difficult," suggesting that certain applications may present usability challenges, particularly for less digitally skilled individuals.

Recording short videos and taking pictures were generally perceived as manageable, with mean scores of 2.17 and 3.50, respectively. Notably, watching recorded videos was rated as the easiest task, with a mean score of 4.0, highlighting participants' confidence in passive media consumption. Uploading and downloading pictures or videos generated more varied responses. In particular, downloading content posed greater difficulties, with one-third of participants finding it "fairly difficult." This suggests potential areas for improvement in user interface design and functionality to enhance accessibility and ease of use.

Table 9 Effort in using a digital technologies and videos

	Easy [very or fairly]	**Difficult (fairly or very]**	**Mean (SD)**
...use of the touchscreen on smart device?	5 (83.4%)	1(16.7%)	1.50(.84)
...use of touchscreen keyboard to type?	4 (66.7%)	2 (33.3)	2.17 (.75)
...navigate through different applications in the smartphone or tablet	6 (100%)	0	1.83 (.41)
...use the digital applications (*e.g., messaging app, internet explorer app, NHS app, Ortus, Patient Knows Best PKB app*)	4 (66.7%)	2(33.4%)	2.33 (1.0)
…record short videos using a smartphone or a tablet	5 (83.4%)	1(16.7%)	2.17 (.98)
…take pictures using a smartphone or a tablet	6 (100%)	0	1.5 (.55)
…watching recorded videos using a smartphone or a tablet	6 (100%)	0	1.33 (.52)
…upload pictures or videos from your device to different applications	6 (100%)	0	2.33 (1.0)
…download pictures or videos from different applications on your device	4 (66.7%)	2 (33.3%)	2 (.89)

Digital Health Literacy Survey (WHO HLS19)

Use of digital devices for health (HL-DIGI-DD)

The overall mean score for this section (HL-DIGI-DD) is 3.72 (SD = 0.27) out of 5. The findings reveal varied engagement with digital health resources among participants, with most interactions occurring less frequently than once a week (Table 10). Websites and

digital interactions with health systems show some regular use, though not on a daily basis. Health apps stand out as the most commonly accessed resource, yet the majority of participants use them less than once a week, with no reported usage beyond this frequency. This suggests that while health apps are widely available, they are not actively or frequently utilised by most participants. Similarly, digital devices like fitness trackers and smartwatches follow this trend, with most participants using them less than once a week, highlighting a potential gap between ownership and consistent engagement. Social media platforms related to health also demonstrate limited use, with most participants engaging less than once a week.

Overall, the data indicating that while there is some engagement, it remains sporadic and may not be sufficient to drive significant health behaviour changes. Perhaps, further exploration may be needed to understand the barriers to more consistent use of these digital tools, as well as to identify strategies that could enhance their integration into participants' daily health routines. The study has a very small sample size so it will not represent patient populations, but it gives indication on areas that require further research.

Table 10 Digital Health Literacy: Frequency and method of accessing health information

		Less than once a week	**1-3 days per week**	**4-6 days per week**	**More than once per day**
DHL1.1	Websites	33.3%	33.3%	16.7%	16.7%
DHL1.2	Social Media including online forums	50%	16.7%	16.7%	16.7%
DHL 1.3	A digital device related to health or health care [e.g. pedometer, smart watch, fitness bracelet, etc.).	83.3%	0	0	16.7%

DHL 1.4	Health app on your mobile phone [e.g. to calculate calorie consumption, support medication intake, measure physical activity, promote healthy sleep, etc.]	100%	0	0	0
DHL 1.5	Digital interaction with your health system [e.g. online appointments, access to personal health records, electronic delivery/transmission of medical tests, digital communication with a provider, etc.]	83.3%	16.7%	0	0
DHL 1.6	Other	66.7%	33.3%	0	0

Digital Health Literacy – dealing with digital health information (HL-DIGI)

The overall mean Digital Health Literacy for Health Information score was 64.8 (SD = 28.8) out of 100 in this section (HL-DIGI), reflecting participants' experiences with searching for health-related information online. While many found the initial stages of searching manageable, challenges arose in assessing the quality and relevance of the information obtained. Using appropriate search terms was generally easy (mean = 3.17), and understanding retrieved information was rated positively (mean = 3.0), with 66.7% finding it "easy." However, locating exact information proved more difficult (mean = 2.83), with 33.3% of participants reporting this task as "difficult."

Participants reported that judging the reliability of information (mean = 2.83), determining whether it was influenced by commercial interests (mean = 2.67), and assessing its applicability to personal health needs (mean = 2.67) were moderately difficult, with 50% finding these tasks "difficult." Participants reported that verifying the consistency of information across multiple websites was generally manageable (mean = 2.83), with 66.7% finding this task "easy." However, applying the acquired information to address their health problem was more challenging (mean = 2.5).

Table 11 Digital Health Literacy effort in identifying and judging for health information

		Easy [very or fairly]	**Difficult (fairly or very]**	**Mean (SD)**
DHL2.1	… to use the proper words or search query to find the information you are looking for?	100%	0	3.17(.41)
DHL2.2	… to find the exact information you are searching for ?	66.7%	33.3%	2.83(.75)
DHL2.3	… to understand the information?	83.4%	16.7%	3 (.63)
DHL2.4	… to judge whether the information is reliable?	83.4%	16.7%	2.83(.75)
DHL2.5	… to judge whether the information is offered with commercial interests?	50%	50%	2.67 (.82)
DHL2.6	… to visit different websites to check whether they provide similar information about a topic?	83.4%	16.7%	2.83 (.75)
DHL2.7	… to judge whether the information is applicable to you?	50%	50%	2.67 (.82)
DHL2.8	… to use the information to help solve a health problem?	8.34%	16.7%	2.5 (.84)

Interaction with digital resources for health (HL-DIGI-INT)

The overall mean Interaction with digital resources for health score was 58.3, SD =49) out of 100 in this section The findings highlight participants' perceptions of their written communication abilities in two distinct contexts: interactions with health providers and engagement on social media platforms (Table 12). Participants reported varying levels of ease in written communication across two contexts: interactions with healthcare providers and engagement on social media (Table 12). Communicating clearly with health providers was rated as moderately easy (mean = 2.83), with 50% finding this task easy. However, 33.3% found it difficult, indicating that some individuals struggle with effectively conveying their questions or personal information. In contrast, expressing opinions, thoughts, or feelings on social media was more challenging (mean = 2.25), with higher variability in responses. While some participants feel relatively comfortable, others struggle with clarity and confidence, particularly in digital social settings.

Table 12 Effort of communicating through technology

	Easy [very or fairly]	**Difficult (fairly or very]**	**Don't know/ prefer not to say**	**Mean (SD)**
clearly write your written message when communicating with a health provider (i.e. question or statement, add personal information)?	50%	33.3%	16.7%	2.83 (.75)
express your opinion, thoughts or feelings, ask a question in writing on social media including online forums?	16.7%	66.7%	33.3%	2.25 (1.47)

Digital health literacy levels, as measured using the WHO HLS19 tool, have a maximum score of 100. Table 13 presents the overall scores across different dimensions of digital

health literacy, generally reflecting a moderate level of digital literacy across the three domains.

Table 13 Overall score of Digital Literacy

	N	Median	Mean (SD)	Minimum	Maximum
HL_DIGI	6	56.5	64.8 (28.8)	38	100
HL_DIGI_INT	6	75	58.3 (49)	0	100
DIGI_DD	6	-	3.72 (0.27)	3.33	4

HL-DIGI-DD: Use of digital devices for health

HL-DIGI : Digital Health Literacy – dealing with digital health information

HL-DIGI-INT: Interaction with digital resources for health

There was no significant correlations and difference in participants' digital literacy, ease of use, or confidence in using digital technologies based on their level of education, age, sex, or frequency of digital technology use

Summary

The findings indicate that while participants generally own digital devices and are confident in their usage, targeted efforts are needed to increase the adoption of specific digital health services. For example, while health apps and portals are moderately utilised, engagement with digital health resources such as the NHS app and video appointments remains limited. Participants reported a moderate level of digital health literacy, with some challenges in assessing the quality and relevance of online health information. Addressing challenges in recording and sharing health information digitally, as well as promoting the benefits of these tools, could further support patient engagement and healthcare service delivery. The study findings highlight the need for further research on patient digital literacy to improve the adoption and integration of digital technology into daily health routines.

WP3b: Staff Survey level of digital literacy, acceptance and perceived usefulness of technology for information sharing and patient discharge

Summary of staff survey

This study explored healthcare professionals' perspectives on using technology in their work, focusing on video-based patient discharge methods. The sample included 13 participants, mostly female, from nursing and midwifery backgrounds, with an average age of about 36 years and an average of nearly 10 years of professional experience. Most participants were employed full-time in secondary or tertiary healthcare settings.

Key Findings

Confidence and use of technology: most participants frequently used computers, laptops, and smartphones, with high confidence levels reported in using these devices. However, their confidence in using more specific tools like video conferencing and certain Microsoft applications was lower. Video discharge methods were viewed as less practical compared to other technology-based methods.

Perceived usefulness and ease of use: participants generally believed that technology enhances their productivity and job performance. They found information systems to be relatively user-friendly and beneficial to their roles and quality of patient care. Video recording for patient discharge was seen as less useful compared to other digital tools for information sharing, such as the digital apps. Although technology-based approaches for patient discharge were seen as potentially improving information sharing including the use of videos.

Impact of demographics on technology use: younger participants, those working in secondary care settings, and medical professionals showed greater confidence and perceived knowledge in using technology. This suggests that targeted training and support may be necessary to increase confidence and promote technology adoption among older staff, those in primary care.

Social influence and managerial support: The study found moderate levels of social influence on practitioners' use of technology, with a lack of strong managerial support noted by participants. While organisational support for information systems was somewhat present, consistent encouragement from leadership could improve staff engagement with technology. There could be many reasons for this, but the survey did not collect data on staff rationale for their opinions.

Conclusion

The study indicates that while healthcare professionals generally view technology as valuable in their work and patient care, challenges like lower confidence in specific tools and lower levels of support for video discharge methods need to be carefully considered. Enhancing training, providing consistent managerial support, and addressing system compatibility issues will be crucial in optimising the use of technology in patient care. These findings suggest that a more tailored approach is needed to encourage technology adoption, particularly in video-based discharge, to ensure it aligns with clinical needs and staff capabilities. The survey did not identify the reasons why staff perceived the usefulness and ease of use of video discharge as lower than other types of technologies. Perhaps seeking further clarification could help improve future interventions.

Methods

Aim: To investigate staff digital readiness and acceptability of employing digital technology for patient discharge

Design: This study employed a self-report and cross-sectional survey design.

Sample and recruitment

Staff recruitment was facilitated through various channels to ensure maximum reach. Invitations were sent via the intranet by the head of communications at MSEFT and the heads of R&D for all participating sites. During face-to-face visits to Basildon, Broomfield, and Southend hospitals, physical posters were distributed, and the project was introduced during morning staff handovers.

Further recruitment efforts included distributing physical copies of the invites to clinicians and heads of departments. Approximately four to six reminder emails were sent to staff by the head of communications. Similar recruitment strategies were used in primary care settings, with team leads and R&D heads coordinating the dissemination of invitations and posters to both staff and patients. The project was also presented in meetings with Healthwatch, community leadership groups, patient groups, and Thurrock TOCH. After obtaining ethical approval from ARU and relevant Research and Development (R&D) approval from the participating clinical sites (MSENFT, EPUT, PROVIDE, NELFT NHS Foundation Trust), the recruitment process for both patients and staff commenced.

Data collection

The survey's first two sections included a Participant Information Sheet (PIS), a consent form, and the researcher's contact details. Prior to answering survey questions, participants were required to read these sections and sign the consent form. Data was gathered using an anonymised self-report questionnaire administered through a secure online survey (the Joint Information Systems Committee (JISC) (https://www.onlinesurveys.ac.uk/)) between May to August 2024.

A review of the literature found that digital literacy is most commonly assessed by measuring (1) users' frequency of use and (2) users' confidence levels, often using a Likert-type scale. Self-

efficacy, defined as the belief in one's capabilities to organize and execute the actions required to accomplish a task, was also identified as a critical factor distinguishing digitally literate users from novices, with prior experience being the strongest predictor of self-efficacy. Therefore, the first section of our survey includes 22 questions related to users' confidence levels and frequency of use for commonly used hardware and software devices. These were assessed using a scale which measures digital literacy, including confidence in audio and video recording.

The survey included eight items on the frequency of use of hardware and software devices, rated on a five-point Likert-type scale, with response options ranging from 'never' to 'very often.' Similarly, 19 items measured confidence levels, including questions on the use of video and audio recording, also rated on a five-point Likert-type scale with response options ranging from 'not at all confident' to 'completely confident.' The reliability of the frequency of use items in our study was high (Cronbach's alpha = 0.94), and the reliability of the confidence items was also strong (Cronbach's alpha = 0.86).

The second section of the survey employed a validated questionnaire based on the Technology Acceptance Model and the Unified Theory of Acceptance and Use of Technology (UTAUT) model to assess healthcare staff attitudes toward clinical information systems, the use of technology for discharge, and information sharing. The TAM is a measurement scale for predicting user acceptance of computers, with two dimensions: perceived usefulness and perceived ease of use. Each dimension comprised six items rated on a seven-point Likert-type scale, with responses ranging from 'extremely unlikely' to 'extremely likely.' Seven additional questions were included to focus on technology and video use in discharge.

The UTAUT model, which is based on the theory of planned behaviour, aims to explain and predict user acceptance and use of information technology. In this study, we utilised 15 questions from the UTAUT model to focus on staff acceptance of clinical information systems and the factors influencing their use of technology. These questions were adapted to include aspects of video discharge and technology for information sharing. We also added two specific questions focused on video discharge. The questions were rated on a seven-point Likert-type scale, with responses ranging from 'strongly disagree' to 'strongly agree.' The reliability of the items on acceptance and the perceived usefulness of video discharge in our study was acceptable (Cronbach's alpha = 0.83), and for the broader questions on the usefulness, acceptance, and

factors affecting the use of technology and information systems, reliability was excellent (Cronbach's alpha = 0.95).

Overall, the questionnaire covered the following domains: frequency and confidence in the use of hardware and software, attitudes towards technology, social influence, facilitating conditions, anxiety, perceived usefulness, perceived ease of use of technology, and the practicality of video-recorded discharge. These questions provided a broader understanding of healthcare staff attitudes, abilities, and acceptance of different types of technology and information systems. This information could help identify factors impacting their confidence and use of these technologies, with specific questions on their perceptions of the usefulness of video-based hospital discharge and their acceptance of its use.

Ethical considerations

The study received ethical approval from the Faculty of Health, Medicine, and Social Care Research Ethics Panel at Anglia Ruskin University, approval number ETH2324-3660. The study is considered a quality improvement project by the NHS organisations' Research and Development departments, as it focuses on patient and staff experiences in MSEFT and partner community services.

Data analysis

Data analysis was performed using Version 28 of the Statistical Package for Social Sciences (SPSS). Categorical data are reported as frequencies and percentages, while continuous data were analysed using the mean, range, and standard deviations (SDs). Spearman's correlation coefficients were utilised to assess the correlations between demographical variables and key study variables (refer to the Results section). To investigate the impact of demographical factors on organisational readiness for SBE, Kruska-Wallis's test was conducted. The statistical significance was set at an alpha level of $p < 0.05$.

Results

Sample characteristics

The study sample consisted of 13 participants, predominantly female (69.2%) (Table 14). Most participants (76.9%) held a first degree as their highest level of education. The majority were from the nursing and midwifery profession (84.6%) and were employed on a full-time basis (84.6%). Regarding their work environment, 61.5% of participants were employed in secondary or tertiary healthcare settings, while 38.5% worked in primary healthcare settings, such as community care or general practice. The average age of participants was 35.92 years (SD= 10.6), ranging from 24 to 58 years and most of them are younger than 50 years old (84.6%). They had an average of 9.83 years of experience in their profession (SD = 6.71), with a range from 2 to 25 years, and had been in their current role for an average of 5.23 years (SD = 3.81), ranging from 1 to 15 years.

Table 14 sample characteristics

		Number (%)
Age Group (years)	< 50 years ≥ 50 years	11 (84.6%) 2 (15.4%)
Sex	Male	4 (30.8%)
	Female	9 (69.2%)
	Prefer not say	0 (0%)
Highest level of education	Diploma	2 (15.4%)
	First Degree	10 (76.9%)
	Post-graduate degree	1 (7.7%)
Profession	Nursing and Midwifery	11 (84.6%)
	Medicine	2 (15.4%)
	Allied Health	0 (0%)
Type of contract	Full time	11 (84.6%)
	Part time	1 (7.7%)
	Bank/agency	1 (7.7%)
Healthcare settings	Secondary or tertiary healthcare setting or equivalent	8 (61.5%)
	Primary healthcare setting [e.g., community, GP, rehabilitation or equivalent]	5 (38.5%)

Characteristics	**Mean (SD)**	**Range**	
		Minimum	Maximum
Age (years)	35.92 (10.65)	24	58
Total years of experience	9.83 (6.71)	2	25
Years of experience in the current role	5.23 (3.81)	1	15

Digital Literacy levels

Frequencies in using technology

Figure 11 shows that he majority of participants reported frequent use of computers or laptops, with 46.2% using them very often and 30.8% often. Smartphones were the most commonly used device, with 76.9% of participants indicating they use them very often. Tablets were less frequently used, with only 7.7% using them very often, while 38.5% reported often using them. Video conferencing tools like Teams or Zoom were used sometimes by 46.2% of participants, while 23.1% reported using them often. Email was a frequently used tool, with 46.2% using it very often and 23.1% often. The internet was also a significant resource, with 69.2% using it very often. Social media usage was moderately high, with 38.5% of participants using it very often and 30.8% often. Microsoft applications or their equivalents were also commonly used, with 38.5% of participants reporting often using them and 30.8% using them very often.

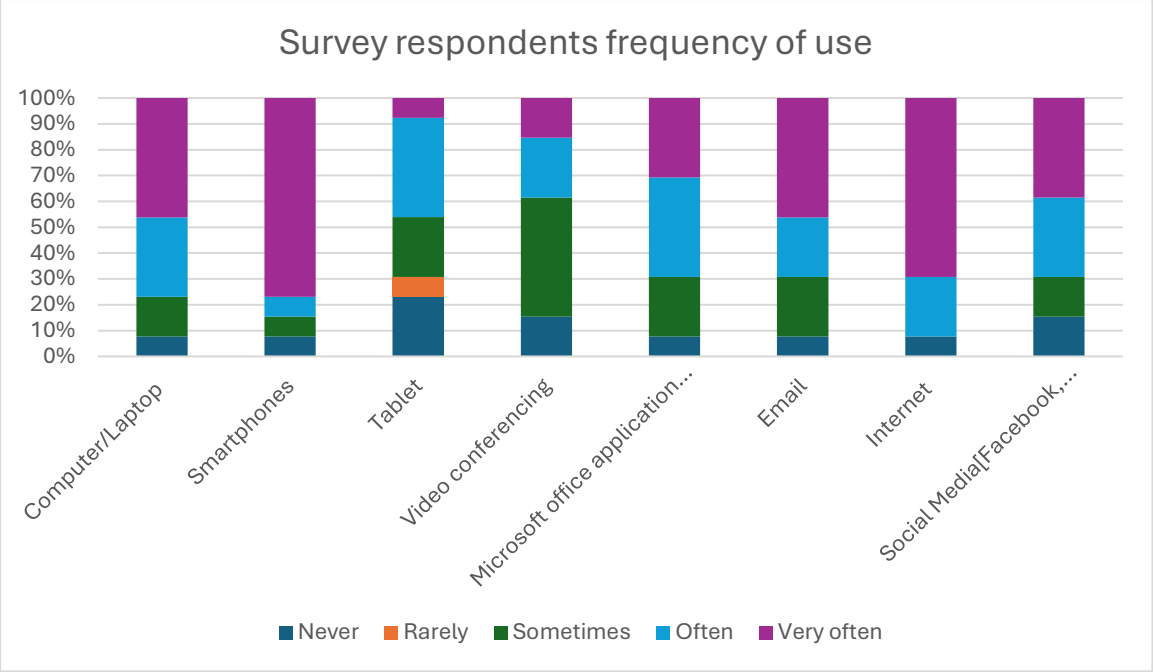

Figure 11 Survey respondents' frequency of use

Confidence in the use of technology

Figure 12 shows that the majority of participants reported high levels of confidence in using computers or laptops, with 69.2% feeling completely confident. Similarly, 61.5% of participants were completely confident using smartphones, with another 23.1% feeling moderately confident (Appendix 2). Confidence in using tablets was lower, with 38.5% feeling completely confident. For video conferencing tools like Teams or Zoom, 53.8% of participants felt moderately confident, while only 15.4% were completely confident. Email usage showed a high level of confidence, with 46.2% of participants being both moderately and completely confident. Most participants also felt completely confident using the internet (69.2%).

Confidence levels in social media were moderate, with 38.5% feeling completely confident and 30.8% moderately confident. Regarding Microsoft Word or its equivalents, 38.5% of participants felt completely confident, while confidence was more varied for Microsoft PowerPoint, with 53.8% moderately confident and only 15.4% completely confident. In contrast, participants felt less confident using Microsoft Excel, with 30.8% not at all confident and another 30.8% slightly confident. Confidence in using Microsoft Access was the lowest, with 53.8% not confident at all. For Microsoft OneDrive or its equivalents, 46.2% were somewhat confident, while 15.4% felt completely confident.

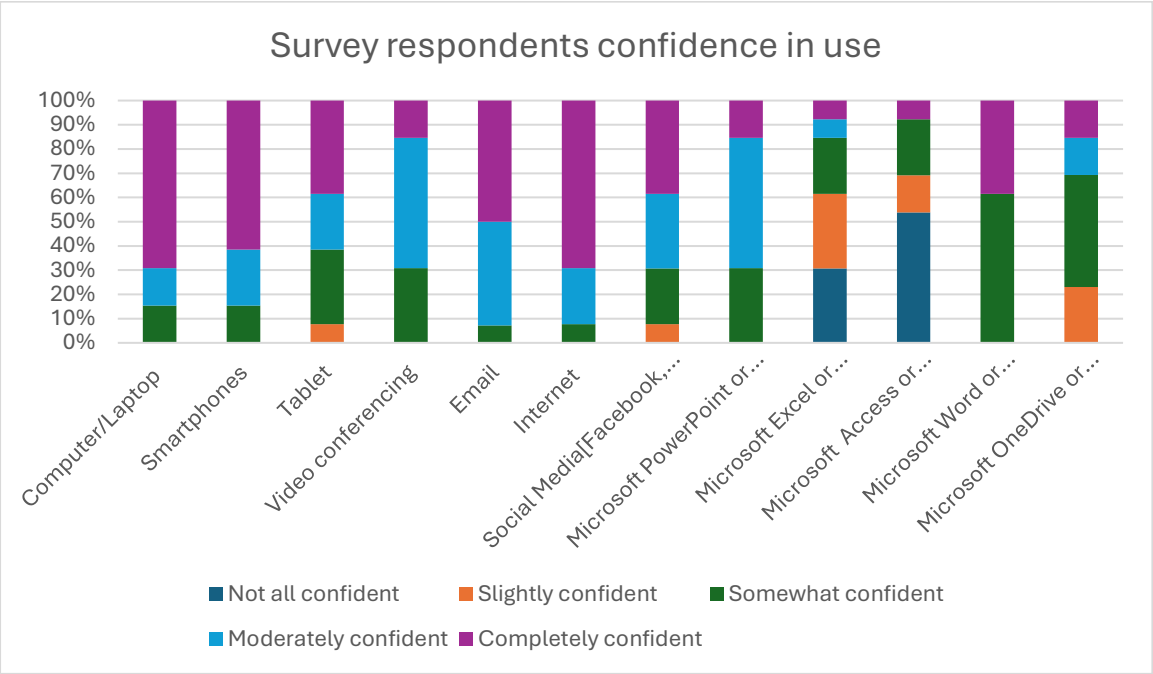

Figure 12 Confidence in use of technology

Perceived usefulness and ease of use of technology

The results show that participants perceive information systems as beneficial to their job performance, productivity, and overall effectiveness, with mean scores consistently above 5 on a 7-point scale, including an ability of use technology score of 5.64 (SD = 0.55) (Table 15). This high level of perceived usefulness indicates a strong belief in the value of technology in enhancing workplace efficiency. Similarly, perceived ease of use scores was also relatively high, suggesting that participants generally find information systems to be user-friendly, flexible, and conducive to skill development.

Participants generally perceived information systems as highly useful in their roles. The highest ratings were for statements about using information systems to accomplish tasks more quickly (mean = 5.33, SD = 0.49) and to increase productivity (mean = 5.25, SD = 0.62). They also believed that information systems would improve job performance and enhance effectiveness on the job, both with a mean of 5.17 (SD = 0.72). The perceived usefulness of using video recording for patient discharge was rated lower (mean = 4.13, SD = 1.16) compared to using applications like "Patient Knows Best" to share discharge information (mean = 4.75, SD = 0.62).

In terms of perceived ease of use, participants felt confident about becoming skilful at using information systems, with a mean rating of 5.17 (SD = 0.39). They generally found the systems easy to learn (mean = 5.08, SD = 0.52) and to interact with flexibly (mean = 5.00, SD = 0.43). While they rated their interaction with information systems as clear and understandable (mean = 4.91, SD = 0.51), they were slightly less confident in getting the systems to do exactly what they wanted (mean = 4.83, SD = 0.72).

Table 15 Overall level attitudes, ease of use, perceived usefulness and factors affecting us of technology

	Mean (SD)
Ability of use technology and information system	5.64 (.55)
Anxiety with technology and information system	4.29 (1.15)
Facilitated conditions for the use of technology and information system	4.56 (.94)
Social influence for the use of technology and information system	4.44 (.87)
Attitudes toward use of technology and information system	4.61 (.79)
Usefulness of technology for discharge	3.86 (.79)
Ease of use technology for discharge	4.12 (1.24)
Practicality of use of technology for discharge	4.23 (1.15)

Use of technology for discharge

Participants expressed mixed feelings about the use of technology-based approaches for patient discharge. While the perceived usefulness of using technology-based discharge for enhancing information sharing scored reasonably well (Mean = 4.12, SD = 1.24), the concept of using video recordings for discharge had lower acceptance (Mean = 3.86, SD = 0.79) (Table 16). Practicality was a key concern, with the mean score for the practicality of video-recording discharge at 4.23 (SD = 1.15), indicating doubts about its feasibility in clinical settings. The higher mean score for the practicality of other forms of technology suggests that while video recording may face resistance, other technology solutions are perceived as more practical and implementable.
Overall, participants showed a positive attitude towards both the usefulness and ease of use of information systems in their work.

Table 16 Survey responses to the perceived usefulness and ease of use questions.

	Mean (SD)
Perceived usefulness	
Using information systems would enable me to accomplish tasks more	5.33 (.49)

quickly	
Using information systems in my job would improve my job performance	5.17 (.72)
Using information systems in my job would increase my productivity	5.25 (.62)
Using information systems would enhance my effectiveness on the job	5.17 (.72)
Using information systems would make it easier to do my job	5.00 (.63)
I would find information systems useful in my job	5.08 (.67)
Perceived usefulness of video discharge and technology for information sharing	
Using technology-based discharge will enhance the quality of hospital discharge for patient/relatives	4.54 (1.13)
Using technology-based discharge will enhance information sharing about patient discharge across health care services	4.69 (1.18)
Using technology-based discharge would enable me to accomplish the discharge more quickly	4.69 (1.48)
Using video recording discharge is a good idea	4.13 (1.16)
Using application to share information about patient discharge (i.e. Patient Knows Best) is a good idea	4.75 (.62)
Perceived ease of use	
Learning to operate information systems would be easy for me	5.08 (.52)
I would find it easy to get information systems to do what I want them to do	4.83 (.72)
My interaction with information systems would be clear and understandable	4.91 (.51)
I would find information systems to be flexible to interact with	5.00 (.43)
It would be easy for me to become skillful at using information systems	5.17 (.39)
I would find information systems easy to use	5.08 (.52)
Perceived ease of use technology for discharge	
I would find it easy to use video-recording patient discharge from hospital	4.08 (1.38)
I would find it easy to use other forms technology patient discharge from hospital	4.15 (1.28)
Practicality of use technology for discharge	
I would find it practical to use video-recording patient discharge from hospital	3.62 (1.45)
I would find it practical to use other forms technology patient discharge from hospital	4.85 (1.28)
SD: standard deviation. 1 = extremely unlikely; 2 = quite unlikely; 3 = slightly unlikely; 4 = neither unlikely nor likely; 5 = slightly likely; 6 = quite likely; 7 = extremely likely.	

Attitudes and acceptance on the use of technology

Social Influence

The survey results indicated a moderate level of social influence regarding the use of information systems, with participants slightly agreeing that their professional peers and organizational culture support their use (Mean = 4.44, SD = 0.87) (Table 17). The statement "The senior management of the organisation have been helpful in the use of information systems" had a mean score of 4 (SD = 1.54), suggesting a neutral perception of leadership support, with wide

variation in responses indicating inconsistent experiences. By contrast, the statement "In general, the organisation has supported the use of information systems" scored higher, with a mean of 4.83 (SD = 0.84), reflecting more consistent institutional backing. Although peers and policies are perceived as supportive, the lack of strong managerial assistance indicates an area for potential improvement to enhance the overall social influence on technology adoption.

Facilitating Conditions

Participants generally agreed that they have the necessary resources and knowledge to operate information systems, as reflected by the facilitated conditions score of 4.56 (SD = 0.94) (table 17). However, the concern about compatibility was highlighted by the score for "Information systems are not compatible with other systems I use," which had a mean of 4.83 (SD = 0.72). This compatibility issue could serve as a significant barrier to the effective use of technology, pointing to the need for improved integration with existing systems. While support structures are somewhat adequate, resolving these compatibility challenges will be crucial for optimising the use of information systems.

Anxiety

The anxiety score related to the use of technology was 4.29 (SD = 1.15), indicating moderate levels of anxiety among users, with concerns about making irreversible errors or losing data affecting their confidence in using information systems. Despite only slightly above neutral levels of apprehension, the fear of mistakes could limit the adoption and use of technology. This indicates a need for robust training and error recovery mechanisms to enhance user confidence and reduce anxiety around technology use.

Table 17 Survey responses to the questions on attitudes and factors affect the use of technology

	Mean (SD)
Attitude towards technology	
Using information systems is a good idea	4.75 (1.6)
Working with information systems is fun	4.08 (1.24)
I like working with information systems	4.58 (0.9)
Social influence	

People who influence my behaviour think that I should use information systems/ technology	4.5 (.91)
People who are important to me think that I should use information systems/technology	4.42 (1.08)
The senior management of the organisation have been helpful in the use of information systems/ technology	4 (1.54)
In general, the organisation has supported the use of information systems	4.83 (.84)
Facilitating conditions	
I have the necessary resources to use information systems (including technology-based discharge)	4.25 (1.22)
I have the knowledge necessary to use information systems (including technology-based discharge)	4.33 (1.50)
Information systems are not compatible with other systems I use (including technology-based discharge)	4.83 (.72)
A specific person (or group) is available for assistance with information system difficulties (including technology-based discharge)	4.81 (1.12)
Anxiety	
I feel apprehensive about using information systems	4.5 (1.00)
It scares me to think that I could lose a lot of information using information systems by hitting the wrong key	4.33 (1.23)
I hesitate to use information systems for fear of making mistakes I cannot correct	4.25(1.22)
Information systems are somewhat intimidating to me	4.08 (1.38)

UTAUT: unified theory of acceptance and use of technology; SD: standard deviation.

1 = strongly disagree; 2 = disagree; 3 = slightly disagree; 4 = neither disagree nor agree; 5 = slightly agree; 6 = agree; 7 = strongly agree.

Difference between the demographical factors and digital literacy variables

Table 18 shows that the age and total years of experience were negatively correlated with social influence regarding the use of technology for work, as well as with attitudes toward using information systems and technology, including for patient discharge. In other words, the higher the age or total years of experience, the lower the staff's attitudes toward using information

systems and technology for work, including patient discharge, and the lower the social influence encouraging them to use technology. Additionally, total years of experience were negatively correlated with the perceived usefulness of information systems and technology for work. No other significant correlation identified between other demographical factors and digital literacy variables.

Table 18 Correlation between demographic factors and DL variables

Variable	**Age**	**Total year of experience**	**Profession**
1. Social influence to use technology	-.582*	-.716*	.640*
2. Attitudes toward the use of technology	-.638*	-.604*	.598*
3. Perceived usefulness of use to technology	-.230	-.652*	.328
* p value ≤ 0.05			

Table 19 significant difference between demographic factors and DL variables

	Age mean rank	**Healthcare Settings** mean rank	**Profession** mean rank	Test of difference
Confidence in using Tablets	<50 =7.86 >50 =2.25			H (1) =3.88, p=.049.
Confidence in using OneDrive or equivalent	<50 =7.91 >50 =2			H (1) =4.39, p=.036.
Confidence in using Tablets		Secondary = 8.63 Primary =4.40		H (1)= 3.99, p = .046
Confidence in using internet		Secondary =9 Primary= 3.8		H (1) = 8.32, p .004
Confidence in using MS word		Secondary =8.56 Primary =4.50		H (1)= 4.69, p .030
Tech use of clinical information system			Medicine= 12 Nursing and Midwifery = 6.09	H (1) = 5.16, p =.023
I have the knowledge necessary to use IS and technology			Medicine= 11.50 Nursing and Midwifery = 5.5	H (1) = 5.37, p =.021
People important to me thinks I should use technology			Medicine= 2 Nursing and Midwifery = 10	H (1) = 4.94, p = .026

The analysis reveals notable differences in confidence and perceptions related to technology use based on age, care setting, and professional background (Table 19). Younger individuals (under 50 years) showed significantly higher confidence in using tablets and cloud storage systems like OneDrive, with mean ranks of 7.86 and 7.91, respectively, compared to their older counterparts,

whose mean ranks were 2.25 and 2 (p-values .049 and .036). In terms of care settings, participants from secondary settings were more confident in using tablets, the internet, and MS Word than those from primary settings, with significant differences in mean ranks for each (p-values .046, .004, and .030). Furthermore, professional differences were observed between Nursing and Midwifery versus Medicine. Medical professionals demonstrated higher confidence and perceived knowledge in using clinical information systems, with mean ranks of 12 and 11.50 compared to 6.09 and 5.5 for Nursing and Midwifery (p-values .023 and .021). Interestingly, social influence seemed to have a stronger impact on technology use among Nursing and Midwifery staff, with a mean rank of 10 versus 2 for those in Medicine (p = .026). In conclusion, these findings suggest that younger professionals, those in secondary care settings, and those in Medicine have greater confidence and perceived knowledge in technology use. This highlights the need for targeted strategies to support technology adoption among older staff, those in primary care settings, and Nursing and Midwifery professionals, addressing both confidence and social influence factors.

Summary

The study reveals a generally positive perception of information systems among participants, particularly in terms of their usefulness and ease of use. However, challenges persist in the areas of social influence, managerial support, and facilitating conditions, specifically system compatibility. Anxiety about using these systems is also notable, pointing to the need for more tailored training and user support. The mixed responses to technology use in patient discharge highlight a gap between perceived usefulness and practicality, particularly with video-based approaches.

Despite a relatively positive attitude toward the overall use of technology (Mean = 4.61, SD = 0.79), the lower acceptance of technology for discharge processes suggests that while the general integration of technology is welcomed, its specific application in discharge procedures needs further examination. The moderate anxiety scores also highlight that participants are still apprehensive about fully engaging with technology, which could limit the full potential of information systems to improve productivity and patient care.

WP4: Feasibility RCT of the use of video discharge

Challenges in conducting the feasibility study

In the final three months of the project, the team identified a challenge: the Patient Knows Best application lacked the functionality to share information between secondary and primary care settings, limiting digital information sharing across the system. Moreover, Patient Knows Best was not ready for testing at the time of ethical approval. As a result, the team identified an alternative application in the last three months of the project (Ortus-iHealth). However, Ortus-iHealth was restricted to cardiology departments at MSEFT and was not accessible to other departments or primary care services. The team modified the documentation and sought a research ethics amendment to use Ortus-iHealth. The delayed readiness of Patient Knows Best for practical implementation required a clinical plan by the digital team to develop the necessary functionality. Additionally, multiple iterations in the ethics process and reduced clinical capacity further impacted the feasibility study, making it ethically challenging to begin recruitment within such a limited timeframe.

Section 1: Trial design

Primary Research Question

What is the feasibility and acceptability of using video-recorded hospital discharge hosted in a digital application in improving patients' experience?

Study Design

A feasibility randomised control study investigating the feasibility and acceptability of video discharge using a Patient Knows Best / Ortus-iHealth app with patients discharged from two acute wards within two NHS Trusts.

Study registration:

The study protocol is registered in the Clinical Trials website. Video-recOrded hospItal dischaRge (VOIR): Feasibility Randomised Control Trial. Clinical Trial Registry. https://clinicaltrials.gov/study/NCT06512272

Primary Outcome

- Feasibility and acceptability of video-discharge

Secondary Outcome(s) (Table 20)

- Patient satisfaction
- Care of Transitions
- Staff satisfaction of the intervention

Table 20 Study endpoints and outcomes

Objectives	Outcomes/endpoints
Primary Objective Feasibility and acceptability of undertaking a larger study	- Willingness and eligibility of patients, i.e., the estimated number of patients targeted through study advertising, the number/proportion volunteering to take part, and the number/proportion eligible. - Recruitment of 60 participants and retention in follow-up within the study recruitment timeframe of 8 weeks. - Patient response rate on the intervention's acceptability. - Feasibility of other operational aspects not included above.
Secondary Objectives Patient engagement with digital application Patient confidence in using the intervention and provided information. Staff experience satisfaction on the practicality, and clinical usefulness of the intervention.	- Analysis of the frequency of patients viewing the uploaded video and using the Patient Knows Best/ Ortus-iHealth App. Conducting association analysis against their demographics and the acceptability of the intervention. - Proportion of patients who completed the questionnaire. - Proportion of invited staff participants who complete an online qualitative questionnaire.

Schedule of Events

The control group will receive the usual care of discharge that include receiving verbal advise by healthcare professional who have caring responsibility based on the medical discharge letter

(Figure 13). The intervention group: patients will receive a maximum of three-minute video discharge [capturing routinely verbally provided advice at the point of discharge] based on their medical discharge letter. The video will be recorded by a healthcare professional who have caring responsibility for the patient from the cardiac centre or elderly wards. The video-recorded discharge will be uploaded to the patient's smart device to the Patient Knows Best/ Ortus-iHealth) App by the patients/relatives before being discharged from hospital.

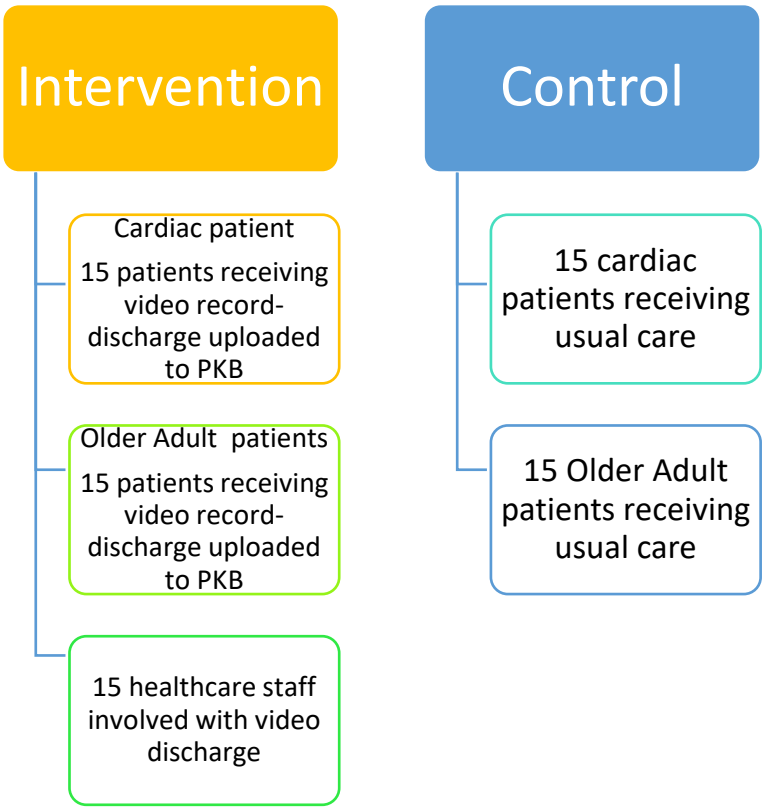

Figure 13 study design

After admission to eligible clinical departments.

- Screening eligibility of patient from the cardiothoracic centre-Basildon Hospital and Elderly wards-Southend Hospitals
- Allocation and Randomisation
- Control group will receive the usual discharge instructions from the clinical team, and they will be given the medical discharge letter.
- Intervention Group will receive the usual care of discharge from the clinical team including the discharge letter PLUS a video recorded discharge uploaded to their Patient Knows Best/ Ortus-iHealth account.

- **Post discharge**
- Patient can view the personalised video-recorded discharge on their PKB app account as many times as they require.
- After a week and after 30 days post discharge all patients (control and intervention groups) will receive a questionnaire to completed regarding their acceptability of the discharge, satisfaction and Care of Transition Measure [CTM-3].
- Patient will be sent the questionnaire link QR code through text, PKB app and where required by letter to their address.
- Staff involved with video-discharge will also receive a short questionnaire after the completion of the discharge.

Section 2. Patient Recruitment

Study Population

- 60 patients from a cardiothoracic surgical centre and elderly wards from two hospitals at the East of England.
- Cardiac wards (30 patients) and elderly wards (30 patients).
- Recruitment period: June 2024 – Sept 2024.
- Up to 15 healthcare workers directly involved in patient discharge.

Patient Inclusion

- Age >18 years old
- Anticipated to be discharged to their own home or that of a relative;
- Staying for at least one night on a participating hospital ward;
- Recently discharge (in the last 2 months) from the participating hospital ward with the same clinical problem as assessed by the care professionals;
- From cardiothoracic centre-Basildon or Elderly ward-Southend
- Have a personal digital device (e.g., mobile or tablet)/ or their close relative and Patient Knows Best/ Ortus-iHealth app
- Able to read and understand English.
- Relative or patient willing and able to give informed consent

- Clinical Frailty scale of ≤ 8 using Rockwood Frailty Scale

Patient Exclusion

- Patients live out of the area or plan to be transferred to another acute hospital;
- Discharged after recurrent admissions for the same clinical complaint as assessed by the care professionals;
- Patient or immediate carer don't have a personal digital device capable of hosting Patient Knows Best/ Ortus-iHealth app;
- Patient or relative unable or unwilling to upload the personalised discharge video to Patient Knows Best (PKB)/ Ortus-iHealth app;
- Admitted for psychiatric reasons (other than dementia/delirium);
- Identified as being at the end of life and whose care has become palliative / clinical Frailty scale of > 8 using Rockwood Frailty Scale

Staff inclusion

- Registered healthcare worker directly involved in patient video-recorded discharge;
- Willing to participate in this study

Staff exclusion

- Registered healthcare worker directly involved in patient video-recorded discharge

Recruitment period

The planned recruitment target dates:

- June – August 2024: 20 patients per month
- Recruitment review dates: June 2024, July 2024. August 2024

Section 3. Sample Size and Visit Schedule

Sample Size

A target recruitment goal of 60 patients was planned to determine feasibility, acceptability, and preliminary efficacy of our intervention. There was no formal calculation of sample size, due to the exploratory character of this feasibility study. The sample of 60 was based on the mean sample size for feasibility studies reported in the International Standard Randomised Controlled Trial Number (ISRCTN) registration website and as recommended by a comprehensive review and analysis of ISRCTN by Totton et al (2023).

Identifying

- Potential participants will first be approached by clinicians within the healthcare team who are directly involved in delivering care and treatment to the patients. Clinicians will refer potential participants to the main investigator or delegate, who will approach them for consenting purposes to take part in this study.

Randomisation, allocation and Follow-Up

- Sealed Envelope Software will be used for intervention allocation and randomisation.
- Each patient will be assigned a study number; the study numbers will be allocated sequentially starting at 001.
- Randomisation on a ratio of 1:1
    - A: allocated usual care
    - B: allocated intervention group which include usual care plus video-recorded discharge
- The form will also collect patient NHS number and contact details for follow up post hospital discharge.
- Follow up will be scheduled and performed according to table 20.
- Trial specific procedures *versus* routine procedures are detailed in table 23 *if appropriate to the study*. The trial specific procedures will be performed after written informed consent has been obtained. The procedures that can be performed prior to consent being obtained are detailed in tables 21-23 *(if appropriate)*.

Table 21 Follow Schedule of patients

	Screening and enrolment	**Randomisation and allocation**	**Participants follow up**		**Close up**	**End of the study**
TIMEPOINT (WEEKS)	0	1-4	4	8	9	
Participant eligibility	X	X				
Participant informed consent		X				
INTERVENTIONS						
Usual discharge		◆———				
Usual discharge plus video-recorded discharge via PKB/ Ortus-iHealth		◆———				
ASSESSMENT						
Participant baseline data		X				
Feasibility, *acceptability measure* and processes			X	X	X	
Patient outcome measures CTM-3 Satisfaction		X	X	X		31st August 2024

Clinical staff questionnaire to seek their experience and satisfaction with the video-recorded discharge (table 21).

Table 22 Clinical staff recruitment schedule

	Screening and enrolment	**Data collection**
TIMEPOINT (WEEKS)	1	1-4
Participant eligibility and invitation	X	X
Participant informed consent		X
Online questionnaire		X
End of study		30 Sept 2024

Table 23 Trial Specific Procedures versus Routine Procedures

Routine Discharge Procedures	**Study Specific Discharge Procedures**
Provide patient with a discharge letter	Provide patient with a discharge letter
Brief verbal explanation of the content of the discharge letter with patient and/or relative.	Brief verbal explanation of the content of the discharge letter with patient and/or relative.
	The routine brief explanation above is video recorded [up to three minutes]
	The video is uploaded by patient/ relative or healthcare worker to Patient knows Best/ Ortus-iHealth app for the patient
Electronic letter sent to patient's GP	Electronic letter sent to patient's GP

Statistical Analysis

Descriptive and exploratory statistical analysis will be conducted. Results will be presented in absolute and relative frequencies (for nominal data) and in means and standard deviation for interval scale data. To compare change scores between the intervention group and control group, we will use independent t-tests. To assess differences between groups, one-way ANOVA or Mann-Whitney test will be conducted based on the normal distribution of the independent variable. Finally, correlation analyses will be conducted to explore if higher patient engagement and use of PKB are associated with stronger intervention effects, patient satisfaction, and acceptability of the intervention.

Section 4. Consent Process

Informed Consent Procedure

- Patients will receive written and verbal information about the trial.
- A Written informed consent will be obtained by a member of the trial team after a suitable time has elapsed during which the patient has had ample time to read the information sheet, consider the trial and ask any questions (Consent form, appendix x). The Investigator will explain to each patient the nature of the study, its purpose, the procedures involved, the expected duration, the potential risks and benefits involved and any discomfort it may entail (*Ref. International Conference of Harmonisation of Good Clinical Practice (ICH/GCP)5 4.8.7*
- The ultimate responsibility for obtaining written informed consent lies with the Investigator but this responsibility may be delegated to a suitably trained, and experienced person.
- Prior to the patient's participation in the study, the written informed consent form must be signed and personally dated by the patient and by the clinician who conducted the informed consent discussion (*Ref. ICH/GCP 4.8.8*). Each box at the end of each statement on the consent form must be signed by the patient.
- Each subject must be informed that participation in the study is voluntary and that he/she may withdraw from the study at any time and that withdrawal of consent will not affect his/her subsequent medical treatment (*Ref. ICH/GCP 4.8.10*).
- A copy of the informed consent document will be given to the patient (*Ref. ICH/GCP 4.8.11*). One copy will be filed in the patient's hospital case notes and a copy filed in the Trial Management File by the Clinical Research Nurses.

- If a patient withdraws their consent a line will be drawn diagonally through the consent form and labelled 'consent withdrawn' and signed and dated by a member of staff (please refer to Section 8 re labelling of case notes).

Section 5. Follow-up Visits and Travel Expenses

Follow up

The follow up will be in accordance with the visit schedule in table 21. The patients will be contacted by the Researcher or Clinicians directly involved in the primary care for the patients for completing the provided questionnaire. Clinicians directly involved in the patient care include registered nurses and medical staff.

Travel Expenses

Participants are not required to travel to take part in the study as the data will be collected during in their home post discharged.

Section 6. Data Collection

Data Collection Form Completion

- The Investigator will ensure the accuracy, completeness, legibility and timeliness of the data recorded in the data collection forms (DCFs) and in all required reports to the Sponsor, R&D and REC. The data will be collected through Online Survey (www.jisc.ac.uk) as the recommended platform for research studies that complies with UK Data Protection and GDPR. The participant will be given a QR code or link to the DCF, promoted to write their names, NHS number and then they will complete the form digitally. The link to the survey is under the researcher's account and is a password protected account only known to the researcher. As soon as the data collection is completed, the data will be downloaded to a password protected computer accessible only to the researcher. After the complete download of the dataset, the raw data on the online survey account will be permanently deleted.

Source Documentation

- The investigator will maintain source documents (patient's hospital case notes) for each patient in the study, consisting of all demographics and used discharge method. A copy of the consent form and patient information sheet will also be filed in the patient's case notes. All information in the DCFs, apart from the questionnaires, must be traceable to and

consistent with the source documents in the patient's hospital case notes (Ref. ICH/GCP 4.9.2).

Errors and Corrections

- Any change or correction to the DCF will be dated, initialled, and explained (if necessary) and should not obscure the original entry.

Storage of Documents

- As soon as the data collection is completed, the DCF will be downloaded to a password protected computer accessible only to the researcher. After the complete download of the dataset, the raw data on the online survey account will be permanently deleted.
- Any paper based DCFs will be kept in a locked filing cabinet or a locked room.

Retention of Documents

- All study documentation will be stored for 5 years after the last patient has completed the study.

Monitoring and Audit

- Upon request of the monitor, auditor, Sponsor, R&D, REC, HRA or other regulatory authority, the Investigator will make available for direct access all requested study-related records.

Section 7. Adverse and Serious Adverse Events

The definition of an adverse event is: 'Any untoward medical occurrence in a patient which does not necessarily have a causal relationship with this treatment'. This includes 'any unfavourable and unintended sign (including an abnormal laboratory finding), symptom or disease temporally associated with the study drug'. This may include, for example, a cold or an accident.

The definition of a serious adverse event is one that fulfils at least one of the following criteria:

- Is fatal- results in death
- Is life threatening
- Requires inpatient hospitalisation or prolongation of existing hospitalisation
- Results in persistent or significant disability/incapacity

OR

- Is a congenital anomaly/birth defect

Section 8. Ethics approval and consent to participate

This protocol gained ethical approval from the Wales Rec 7 Research Ethics Committee, and the Health Research Authority [Reference 24/WA/0188]. Anglia Ruskin University Faculty Research Ethics Committee Approved the study

Conclusion

Scoping clinical data

Routinely collected MSEFT data offers a strong foundation for improving discharge quality. A gap still exists on how to integrate and utilised technology effectively across the system. By addressing gaps in communication, system integration, and feedback collection, the organisation can ensure safer, more efficient discharges aligned with patient needs and policy objectives.

Scoping literature review

Eight distinct types of technologies were identified, including apps, telephone follow up, telemonitoring, video, and wearable devices. These were often used in combination to support patient transitions from hospital to home. Digital application was the most frequently used alone or in combination with other types of technologies. Most studies were randomised controlled trials (79%), reflecting a strong focus on evidence-based evaluation. Technologies demonstrated potential in improving patient self-care, medication adherence, quality of life, and patient satisfaction. Gaps remain in establishing their impact on readmission rates and healthcare utilisation.

Patients interviews

Three themes identified

- Challenges with communication technology
- Barriers and facilitators in accessing health information.
- Enhancing patient experience with information sharing

Patients identified several challenges with communication technology, particularly with existing telephone systems, which lacked flexibility and made rescheduling appointments difficult. They also highlighted the limitations of one-way communication, which hindered clear follow-up. While patients saw potential benefits in using video for discharge information, especially for younger individuals more familiar with technology, concerns were raised about its accessibility for older adults, as the effectiveness of video largely depends on the patient's ability to access and navigate the technology.

Patient survey

The patient survey showed moderate engagement with webpages and text messages for information but lower use of the NHS app, video calls, and remote monitoring.

Participants reported high confidence in using computers and smartphones, particularly for touchscreen navigation and app usage, though confidence was lower for recording, uploading, and downloading videos. Typing on touchscreens and using certain digital applications, such as uploading and downloading media, were more challenging, while taking and watching videos were easier. These findings highlight both familiarity with digital tools and areas for improving usability.

Participants found searching for health information online relatively easy but faced challenges in assessing its quality, reliability, and relevance. While they were generally confident in using search terms and understanding information, difficulties arose in pinpointing specific details, identifying commercial bias, and applying the information to health decisions.
Digital health literacy indicated a moderate overall level based on the WHO HLS19 measure.

Staff survey

Most participants frequently used computers, smartphones, and the internet with high confidence, while tablets and video conferencing tools were used less frequently with lower confidence.
Information systems were generally perceived as useful and user-friendly but concerns about the practicality of video recordings for patient discharge were noted. Participants reported moderate support from peers and organisational culture, but leadership support was inconsistent, with concerns about system compatibility and anxiety over mistakes.
The analysis found that younger professionals, those in secondary care, and medical staff had higher confidence and perceived knowledge in using technology, with social influence playing a stronger role for Nursing and Midwifery staff.

While there is strong potential for digital technology to enhance patient discharge processes, targeted strategies are required to address barriers in system integration, usability, and leadership support. Enhancing confidence and digital literacy among older staff, primary care settings, and Nursing and Midwifery professionals will be key to ensuring the successful adoption and implementation of these technologies.

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Appendices

Appendix A1 Table Description of technologies to enhance patient discharge from hospital

	Author Year Country	Study design and participants	Aim	Type of technology	Description of technology	Key findings
1	Bal (2024) Turkey	RCT (n=98) stroke patients	To determine the effect of technology-based health promotion training on the daily life activities, quality of life, and self-care	**Combined Telephone/ Texts**	On discharge, patients received guidance, discharge education, a stroke education booklet, telephone follow-up, SMS reminders, contact details for researchers	Training interventions led to enhanced awareness and knowledge about stroke among the intervention group patients. They fostered the development of healthier lifestyle behaviors and bolstered both self-care abilities and quality of life.
2	Balakrishnan (2023) USA	Pilot RCT 44 COVID-19 pneumonia patients	To explore the feasibility of instituting a COVID-19 ARDS ICU survivor telemedicine clinic and to examine its effect on health care utilization post-hospital discharge	Telephone	Telemedicine visit for 30 -40 minutes within 14 days and 6 weeks of **discharge,** resembling a pulmonary outpatient clinic assessment.	Unanticipated visits to the emergency department occurred for 11% (2/18) of the SG compared with 6% (1/18) of the CG (>.99). primary care physicians (PCPs) and participants in the SG perceived the telemedicine clinic as a favorable model for post discharge critical illness follow-up. no statistically

						significant results in reducing health care utilization post discharge.
3	Barker (2020) UK	Mixed methods 200 COPD exacerbation patients	To study the effect of a codesigned education video as an adjunct to usual care on post hospitalization Pulmonary rehabilitation PR uptake.	Video	Education video delivered via hand held tablet. Secure internet link with password for access after **discharge.**	No differences in secondary (PR referral and completion) or safety (readmissions and death) endpoints. A codesigned education video delivered at hospital discharge did not improve posthospitalization PR uptake, referral, or completion.
4	Chen (2020) China	RCT 767 Chronic Heart Failure Patients	To investigate whether short message service (SMS) can improve death or readmission-free survival and self-care behaviour	Combined Telephone/ Texts	SMS patients and their caregivers received standardized educational and reminder messages automatically up to 180 days after discharge Educational SMSs sent within 10 days of discharge with knowledge of Heart Failure.Re-minder SMSs repeated weekly for 1 month prompted patients to e.g.take medicine or weight.	Better self-care behaviour was reported in the SMS and STS groups than in the control group. no significant difference seen between groups

5	Duchesne(2021)Canada	QI study 112 Post-transcatheter Aortic Valve Implant (TAVI) patients	To identify transitional care gaps, using various technologies	Combined App/email/ texts	TAVI specific mobile application TelASK Technologies Inc. offered to patients at follow-up included email and texting follow-up options. Post-TAVI patients were contacted on day two, day 10, day 30, six months, and 12 months post-discharge by the automated follow-up system.	Overall, generic health status improved from "fair" pre- TAVI to "good" post-TAVI similarly, the data suggested a reduction in anxiety and depression over time. 78% (n = 60) of patients were reportedly satisfied with their method of follow-up
6	Gou (2022) China	RCT pilot 36 Lumbar fusion surgery patients	To explore the effectiveness of a WeChat-based individualized post-discharge rehabilitation program	App	WeChat-based individualized rehabilitation program, electronic education manual **for discharged** patients. Solutions communicated through WeChat.	WeChat-based rehabilitation intervention can improve exercise compliance and self-efficacy, and help achieve greater pain relief compared to the routine intervention.
7	Habib (2021) Canada	RCT Pilot 49 patients covered by prescription insurance program	To assess the feasibility of a larger evaluation of Smart About Meds (SAM), a mobile application, and to evaluate SAM's potential to improve medication adherence and the occurrence of adverse events	App	Smart About Meds SAM app **used after patient discharge** generates patient-friendly list of prescribed and dispensed medications. Apps features include pill images, leaflets, pharmacist and caregiver connect, and a rate-my med.	In the 30 days of post-discharge, 15 (65.2%) intervention patients used the SAM app. A smaller proportion of intervention patients (8.7%) were readmitted to hospital during follow-up than control patients (15.4%).

8	Hanita (2022) Malaysia	Quasi experimental trial pilot 45 Coronary artery bypass surgery patients	To develop and test feasibility of MyEducation: CABG application as a learning tool to reduce anxiety and depression.	App	Web-based pre operation education application, MyEducation.. Gives insight on the procedure, and **postoperative self-care management**. The app extends the scope of nursing services for CABG patients, to **after hospital discharge**	Mean anxiety and depression scores among the intervention group were lower compared to the control. Intervention group were generally satisfied with design, content and usability of the application.
9	Hernandez-Quiles (2021) Spain	RCT 510 Advanced heart and lung failure patient Patients discharged from hospital (407 and clinic (103) included.	To determine the efficacy of a telemonitoring system added to coordinated clinical care.	Telemonitoring	Telemonitoring system (TELECARE**) discharged** patients given devices that collect symptoms and bio-parameters, and transfer data to a call-center, with a real-time health-care response. Patient inserted data daily during the first fifteen days and subsequently according to clinical situation. If there was clinical stability, data were inserted three days a week. if an incident occurred, the frequency was increased.	HRQoL significantly improved (TELECARE/ UCARE EuroQol baseline of 56.2±18.2/55.1±19.7, p=0.054, and 64±19.9/56.3±21.6; p < 0.01 at the end). Perceived satisfaction was also higher (6.77±0.52 vs. 6.62±0.81, p < 0.001; highest possible score=7). TELECARE globally needed less admissions with respect Usual CARE after 45 days of inclusion (35.4% vs. 46.9%, p < 0.05).
10	Indraratna (2022) Australia	RCT pilot 164 Heart failure and acute coronary syndrome patients	To investigate the feasibility, efficacy, and cost-effectiveness of a smartphone app–based model of care (TeleClinical Care) in patients discharged after acute coronary syndrome or heart failure	Combined App/wearable	TeleClinicalCare was applied **at discharge** via app and Bluetooth-enabled devices weight, blood pressure, and physical activity measured daily. Recordings automatically transmitted to patients' smartphones and central server a digital	Higher rates of cardiac rehabilitation completion (20/51, 39% vs 9/49, 18%; P=.03) and medication adherence (57/76, 75% vs 37/74, 50%; P=.002). The average usability rating for the app was 4.5/5. the

					sphygmomanometer, weighing scale, and a fitness band provided to patient to measure daily BP ,pulse rate, and weight.	intervention was associated with a significant reduction in unplanned hospital readmissions (21 in TCC vs 41 in the control arm; P=.02), including cardiac readmissions (11 in TCC vs 25 in the control arm; P=.03),
11	Johnson (2022) USA	RCT pilot 57 /31 Acute heart failure patients	To develop an mHealth program to enhance patients' self-management of heart failure	Combined Website/video	Website with content tailored to patients with chronic HF, including educational videos	Notable trends including a higher mean quality of life at 30 days posthospitalization among program users and a longer duration before Rehospitalization, which are suggestive of better HF prognosis. Feasible and acceptable by patients. Patients were readmitted within 90 days for a readmission rate of 30% (n=5, 31.3% in the intervention group vs n=4, 28.6% in the usual care group).
12	Kamel (2021) Egypt	RCT 200 myocardial infarction patients	To evaluate the value of telemedicine added to care after primary percutaneous coronary intervention (PCI).	App	Videoconferencing teleconsultation using a smartphone Zoom application for 3 months starting1 week after **discharge** and at least a single face-to-face (F2F) clinic visit. At least one virtual visit was arranged per month	Increasing their adherence to medications and healthy lifestyle measures without a significant difference in the short-term MACE. 87% of patients were satisfied with telemedicine.

13	Kang (2022) Australia	RCT pilot 85 (General Surgical patients)Alimentary tract, abdomenal, breast, skin soft tissue thyroid hepatobiliary, surgery patients	To assess the feasibility of implementing a web-based discharge education programme.	Combined Website/video/texts	Web-based education programme. login details on how to access the website. A personalised text message notification 2 days **after discharge** to remind patients to access the website at home.	28 (97%) of the intervention patients found the content easy to understand, 25 (86%) found it useful and 24 (83%) were satisfied with its content. not significant for self-care ability and unplanned healthcare utilisations.
14	Kavradim (2020) Turkey	RCT 66 Myocardial infarction patients	To evaluate the effect of education and telephone follow-up for improving patients' self-efficacy, quality of life and lifestyle adaptation	Telephone	Telephone follow-up consisted of a predischarge education programme and three structured telephone follow-up sessions.	Significant improvements in self-efficacy, quality of life and coping adaptation process. The intervention group also had more adaptation lifestyle changes
15	LaBedz (2022) USA	RCT 1029 Heart failure, pneumonia , MI, COPD, or sickle cell disease patients	To compare the effectiveness of a stakeholder supported Navigator intervention posthospital patient experience, outcomes, and healthcare utilization.	Telephone	Community health workers (CHWs) conducted in-person visits in the hospital and a single home visit 1–3 days post-discharge to assess barriers to patient-centered transitions from hospital to home; participants contacted via telephone at 1, 2, 3, 5, and 7 weeks	No improvements in post-hospital patient experience, outcomes, or healthcare utilization over 60 days. showed no improvement in participant anxiety or informational support. No

					post-discharge to continue support.	significant between-group differences in healthcare utilization
16	Leng Chow (2020) Singapore	Observation study 205 Heart Failure patients	To compare the effectiveness of telemonitoring over structured telephone support in reducing heart failure-related healthcare utilization	Telemonitoring	Tele-education; and telesupport. TM =daily measurement of weight, blood pressure and heart rate using blue-tooth enabled devices-transmitted to nurses and device configured to send advice to patients. Tele-education comprised educational videos Tele-support provided by nurses on a scheduled basis in the first six-months	Telemonitoring was associated with lower all-cause and heart failure-related total bed days at 180 days, lower heart failure-related total bed days and total cost of care at one year as compared with structured telephone support.
17	Li Y(2020) China	RCT 300 pilot Coronary Heart Disease patients	To investigate the effect of mobile app–based self-management digital therapeutics (DTx) on long-term use of medications	App	Mobile app installed on an Android 5 tablet. The app includes a physician portal, a health manager portal, and a patient portal and contains a **discharge** module, used before discharge.	self-management DTx in addition to traditional care resulted in a significant improvement in guideline-recommended medication adherence at 12 months. The intervention group had a significantly higher proportion of patients achieving blood pressure under control (systolic blood pressure <140 mm Hg and diastolic blood pressure <90 mm Hg) and low-density lipoprotein

18	Li,K (2023) USA	RCT pilot 49 Laparoscopic or open major abdominal or pelvic surgery patients	To estimate the feasibility and effect of continuous saturation monitoring with patient alerts on in-hospital and post-discharge saturation	Wearable technology	Wearable device that detects and alerts patients to hypoxemia. Monitoring continued during hospitalization and for up to six days and for **24 hours after hospital discharge**	There were not statistically significant or clinically important differences between the randomized groups on patients' attitudes towards the device. Willingness to use the device after the study (P=0.023) were a bit lower in the Monitor + Alert group than in patients assigned to Monitoring Only. There were several statistically significant differences between groups on nurses' attitudes toward the device, but none was clinically meaningful
19	Liang (2020) Taiwan	RCT 200 Chronic Illness patients	To evaluate the effectiveness of an integrated nurse-led tele-homecare program for patients with a high risk for readmission.	Telemonitoring	Smartphone, blood pressure (BP) monitor, medication dispenser, and necklace emergency call button given to patients. Smartphone linked with a nurse-led 24-hr call center and health care record system, reminders to check vital signs and to take medication.	No significant effect on readmission was observed. The readmission rate was 44% in the IG and 41% in the CG, and the difference was not significant (OR = 1.131, 95% CI = 0.645–1.981, p = .668).

20	Mallet (2022) Canada	RCT pilot 20 Stroke patients	To test telerehabilitation for patients with PSCD with mobile tablet to bridge gap between acute stroke care and outpatient speech-language therapy (SLT)	Combined App/telephone/ipad	Mobile tablet loaded with Face-Time (Apple Inc., 2010). 60 min weekly FaceTime sessions arranged at the time of one-on-one sessions.	telerehabilitation via mobile technology is feasible in the very early stages of acute stroke recovery. It is potentially an effective means of bridging the gap between discharge from the acute care setting to the start of outpatient SLT services
21	Mansouri (2020) Iran	RCT 80 Renal failure patients	To compare interactive multimedia and booklet methods on quality of life of kidney transplant patients	Compact Disc	interactive CD within formation on care after transplantation. audio, images and animations included 26 educational parts and 28 multiple-choice and true-false questions.	Quality of life score in both groups increased significantly, P=0.044 for the booklet group and P=0.039 for the multimedia group. In emotional, fatigue, uncertainty/fear domains, both groups showed improvement after the intervention (P<0.05).
22	Mou (2022) China	RCT pilot 40 dyads (20 per arm) 80 Stroke patients	To explore the feasibility, acceptability, and preliminary effects of a family-focused dyadic psychoeducational intervention for stroke dyads	Telephone	Four weekly **post-discharge** follow-up telephone counselling sessions	Qualitative interviews suggested that the intervention was acceptable and useful to stroke dyads. The intervention effects on survivors' functioning were significant in the memory and thinking (F = 8.39,

						p = 0.022, η = 0.18) and mobility (F = 5.37, p = 0.026, η = 0.12) domains, but not significant on their overall functioning (F = 2.39, p = 0.131). Caregiver burden in the intervention group was significantly greater reduced at post-test than the control group
23	Negarandeh (2020) Iran	RCT 80 Heart Failure patients	To assess the effects of (tele-monitoring) on self-care behaviors and readmission	Telephone	During the first month, two weekly 20-minute phone calls made that could vary based on the patients' needs and educational questions; in the second month, calls were made every week.	The percentage of patients' readmissions in the intervention group (20%) was less than that in the control group (42.2%); however, the results were not statistically significant. scores of self-care behaviors showed that the difference between both groups after the intervention was still significant (p < 0.001).
24	Neumayr (2019)Germany	RCT pilot 40 Anorexia nervosa patients	To evaluate a therapist-guided smartphone-based aftercare intervention following inpatient treatment	App	APP (German version of "Recovery Record") with: self-monitoring, positive reinforcement, meal planner, setting and tracking of individual goals, reminders, coping strategies, motivational slogans, positive affirmations, guided meditations, monthly in-app	High level of adherence and a very high acceptance of the app and the aftercare intervention. Increase readmission in the control group. The difference in rehospitalization was nonsignificant

					outcome questionnaires, and the ability to link with a clinician. **Used as an aftercare tool**	
25	Ngoma (2021) Tanzania	RCT 98 Cancer patients, carers and healthcare workers	To assess the effectiveness of a smartphone- or Web-based app, mPalliative Care Link (mPCL), to extend specialist access with local health workers.	Combined App/telephone	mPalliative care link app Twice weekly responses collected and managed via mPCL or phone contact with clinician study personnel for up to 4 months.	Care satisfaction was generally high in both groups. Overall symptom severity was significantly lower in the phone-contact group (P , .0001), and symptom severity decreased over time in both groups (P = .0001);
26	Noel (2020) USA	RCT 102 patients with 2 or more chronic disease processes	To evaluate Telehealth feasibility in improving transitions of care	Telemonitoring	Telehealth kit, included a smart phone device a Bluetooth-enabled blood pressure monitoring cuff, pulse oximeter, weighing scale. Patients measured their vitals daily	Telehealth patients were more likely to have medicine reconciliation (p = 0.013) and were 7 times more likely to adhere to medication than the control group (p = 0.03). Telehealth patients exhibited enthusiasm (p = 0.0001), and confidence that Telehealth could improve their healthcare (p = 0.0001) . unable to show the effect of Telehealth on reduced healthcare utilization

27	Passaglia (2020) Brazil	RCT 180 Acute Coronary System patients	To evaluate whether the use of SMS text messages increases risk factor control after hospital discharge for ACS	Text messages	The first SMS sent immediately after hospital **discharge.**	Rehospitalization occurred in 39 participants (26%), with a trend to lower hospitalization rates in the intervention group (p=0.062)
28	Pickens (2019)USA	Observation study 165 Enhanced Recovery After Surgery (ERAS) patients	To implement a mobile health application for patient reported outcomes (PRO) collection in an ERAS program	App	App customized to the ERAS program. Accessible by smartphone/tablet. patient- and surgeon-specific portals to individual perioperative ERAS surgical plan.	High level of engagement in using the app. The satisfaction rate was very high with 86 per cent (43/ 50) recommending the application.
29	Piette (2020) USA	RCT 283 Chronic conditions patients	To improve post-hospitalization outcomes through self-care education via interactive voice response (IVR), fax alerts to primary care providers	Telephone	IVR Interactive voice response Calls. During the initial two weeks **after discharge,** patients received daily IVR calls, with up to three attempts per day. After the initial two weeks, patients received IVR calls three times per week for two weeks, and then weekly for nine weeks.	11.4% of intervention patients and 17.9% of controls were rehospitalized within thirty days after discharge (hazard ratio [HR]: 0.59; CI: 0.31, 1.11; p=.102).The CP intervention did not improve 30-day readmission rates overall
30	Pooni (2020) Canada	RCT 282 patients who underwent laparoscopic colorectal surgery	To evaluate the effect of a post discharge app on 30-day readmissions and patient reported outcomes	Combined App/email	Home to Stay app on postoperative day App features (1) a "Daily Health Check" for participants to (2) picture taking capability for participants to photograph their incisions and stoma to share with the health care team, and (3) educational information on postoperative care and self-management at home.	All patient reported outcomes were significantly improved. median scores higher with the app for Well-being (7, IQR: 6–8 vs 6, IQR: 5–7, P=0.001) and significantly lower for anxiety (3, IQR: 2–

					Daily Health Check completed via email on **post discharge day** #1 to 14, #21, and #30.	5 vs 5, IQR: 3–6, P=0.001). higher with the app for satisfaction. no difference between groups for 30-day readmission (14.8% vs 17.6%, P= 0.55), ER visits (25.0% vs 28.8%, P=0.49), primary care visits (12.5% vs 8.8%, P=0.34) or unplanned healthcare visits (34.4% vs 35.2%, P= 0.89).
31	Qiao-Ping Li (2021) China	RCT 80 Spinal cord injury patients with open reduction, spinal fusion and internal fixation	To explore the effects of an online home nursing care model application	App	We Chat patients given online home nursing care. Three days before **discharge,** internet platform established on WeChat, The online nursing model comprised a WeChat group, public account, microblog, QQ, etc., where nurses and doctors regularly push health knowledge and answer patients' questions at any time.	The incidence of complications, such as constipation, joint stiffness, muscle atrophy, foot drop, and pressure sores, were significantly lower in the observation group than in the control group ($p < 0.05$).
32	Quinn (2023) USA	RCT 174 Primary caregivers of stroke patients	To test the effects of a web-based, problem-solving caregiver intervention on stroke survivor activities of daily living.	Combined Telephone/ website	Orientation session conducted over the phone followed by eight online messaging sessions weekly. 40 messaging center sessions	The web-based caregiver intervention improved stroke survivor activities of daily living by 11 weeks, but intervention effects were undetectable after 19 weeks.

33	Reeves (2019) USA	RCT 265 Stroke patients	To test whether access to home-based social worker–led case management (SWCM) or SWCM program with a website providing stroke-related information improves patient-reported outcomes.	Combined Telephone/ website	Follow-up phone calls. provide services for 60 days (±8 days) **after return to home** and **access to the MISTT website, information and support resource. Content on 7 topics:** stroke-related education, medication information, provider contact lists, patient portals, social and community services, stroke support groups, and caregiver resources.	Hospital readmission occurred in 55 (20.8%) of the 265 subjects, but rates did not differ between treatment groups. Increases in physical-health quality-of-life and patient activation but no changes in mental-health quality-of-life.
34	Riegel (2019) USA	RCT pilot 130 Acute coronary syndrome, patients on aspirin	To test the efficacy of a telehealth intervention based on behavioral economics to improve aspirin adherence following hospitalization	App	Wellth mobile phone application. Ater **hospital discharge** daily electronic messages reminded participants to take their aspirin at a time prespecified by the participant. Within a 12-hour window, participants required to upload a photo of the pill in their hand through the Wellth app on the phone.	After 90 days, adherence to aspirin remained high in the intervention group (median adherence 81% vs 90%, P = .18). Rehospitalization was higher in the control group (24% vs 13%, P = .17)
35	Ross (2020) Canada	RCT Pilot 76 Acute coronary syndrome patients	To test a SMS text messaging intervention (Txt2Prevent)	Text messages	Automated 1-way SMS text messages 48 unique, automated, one-way messages over 60 days at a time specified by the patient **after hospital discharge**. An additional 4 messages relating to study administration also sent. Messages were sent daily for the first 36 days	Participants reported they were satisfied with the program. The intervention appeared acceptable, hospitalization text to prevent 3 (9%) usual care group 3 (8%) 1.00 All-cause hospitalization

					and then every other day until day 60.	text to prevent 4 (13) usual care group 6 (16) .74
36	Rouzfarakh (2020) Iran	RCT 60 Burn patients	To investigate the effect of rehabilitation education through social media on quality of life.	App	WhatsApp channel called "**Postdischarge** distant rehabilitation", WhatsApp., general educational texts, photos, and audio or video files were posted on the channel and to the group.	Significant effect of the intervention both 1 and 2 months post-intervention on the QOL score and all the domains ($P < 0.05$). The post-discharge rehabilitation education of burns patients through social media improves their quality
37	Schenkel (2020) USA	Observation study 28 Lung transplant patients	To observe a home monitoring program after discharge and compare outcomes to matched controls during a 2-year period.	Telemonitoring	**Postdischarge** home monitoring program via Bluetooth-enabled devices measuring blood pressure, heart rate, weight, blood glucose, oxygen saturation, pulmonary function, and activity levels were delivered directly to patients' homes. Patients given Microsoft Surface (Microsoft Inc, Redmond, WA) tablets to report signs and symptoms, track appointments and medication compliance, and access educational videos and other materials.	Intervention associated with reduced readmissions (incidence rate ratio [IRR]: 0.56; 95% confidence interval [CI]: 0.41-0.76; $P <$ .001), days readmitted (IRR: 0.46; 95% CI: 0.42-0.51;

38	Shah (2020) USA	QI study 91 Head and neck cancer operations or laryngectomy patients	To evaluate a telephone call within 72 hours of discharge on reducing unnecessary ER visits and hospital readmissions	Combined telephone/video	Patients contacted within 72 hours of hospital **discharge.** patients given opportunity to video conference with and/or send pictures to the provider with additional questions via a designated wound care phone.	18 patients (21.7%) reported that the phone call survey prevented them from going to the ER. When compared to the prior year, there was as statistically significant decrease in ER visits (P < .05), and no change in readmissions.
39	Spaulding (2022) USA	Mixed methods 292 Abdominal wall reconstruction, gastric bypass, hepatectomy, pancreatectomy, aortic operation, lower extremity bypass, esophagectomy, and colectomy patients	To determine how postsurgical remote patient monitoring (RPM) influences readmissions and emergency visits within 30 days of discharge after operation	Telemonitoring	Digital tablet, digital blood pressure cuff, thermometer, weight scale, and pulse oximeter. 30-day monitoring after **discharge.** Patients collected and reported blood pressure, blood oxygen level, temperature, weight, and concerns regarding incision/wound infection, chills, incision/wound infection, new-onset/irregular heart rate, chest pain, worsening pain not relieved with available pain medications, nausea/vomiting/obstipation, jaundice, and scleral icterus drain volume and color changes. If any of these measures fell outside normal parameters or the patient did not send in the measures, they received a nurse call or were escalated to receive appropriate care	No difference in 30 day readmission. well-accepted from the patient's perspective

40	Tian (2020) China	RCT 58 Gynecology patients	To investigate the effect of "WeChat public platform + self-care model" for the management and intervention of patients after discharge	Combined App/telephone	WeChat platform before discharge and for four weeks after **discharge**. Patients who underwent vNOTES and their family included in the platform, Specialist follow-up nurses in charge of tracking the follow-up details of patients during the post-discharge transition period, contacting and interacting with patients through the WeChat public platform and telephone.	No statistical differences between the two groups in the number of patients who had an unscheduled visit/admission 1 month after discharge. quality of life improved, (P = 0.491).
41	Timmers (2019) Netherlands	RCT 213 Total knee replacement patients	To determine whether educating patients with postoperative care information through an app leads to decreased pain compared to standard information through an app	Combined Texts/Photos/videos/App	Patient Journey App smartphone/tablet to guide patients **after discharge**. Information accessed by a personal code. The text, photos, and videos received were developed specifically for this trial.	Improved, functional capacity and QOL improved

42	Uslu (2020) Turkey	RCT 45 Schizophrenia patients	To determine the effects of "Telephone Intervention Problem Solving" (TIPS) on medication adherence	Telephone	Weekly Telephone Interviews Problem Solving (TIPS)telenursing application that supports solutions for daily life problems among patients with schizophrenia offering coping alternatives. Program reminds patients to utilize these alternatives and evaluates their efficiency. first TIPS applied **After discharge,**. Nurse initiated by planning a patient interview at a specific day and hour. A manual is used for guidance.	Good concordance with medication
43	Wallstrom (2020) Sweden	RCT 77 Congestive heart failure patients	To evaluate the effects of structured telephone support on self reported fatigue	Telephone	Telephone follow-up for person centered care (PCC) plan. First call 1–4 weeks after **hospital discharge**	More motivated no impact on Fatigue
44	Wang (2023) China	Qualitative 25 Total hip and total knee replacement patients	To investigate patients' experiences using a mobile app-based rehabilitation programme	Combined App/video	App-based 6 week rehabilitation programme via WeChat®. Exercises demonstrated in videos to improve patients' joint mobility, muscle strength, balance, and performance in daily activities. The intervention commenced immediately **after hospital discharge.**	Improved access to health care, (b) encouraged postoperative recovery, (c) established supportive relationships, (d) facilitated learning, and (e) future directions.
45	Wang (2023) China	RCT 86 Total hip and total knee replacement patients	To evaluate the effectiveness of a rehabilitation programme delivered via a mobile application.	Combined App/video	App-based 6 week rehabilitation programme via WeChat®. With exercises demonstrated in videos to improve patients' joint mobility, muscle strength, balance, and performance in daily activities. The	Demonstrated potentially positive effects on patients' self-efficacy, patient-reported physical function, health-related quality of

					intervention commenced immediately **after hospital discharge**.	life, and levels of anxiety and depression
46	Wei (2019) Hongkong &China	RCT 84 Stroke patients	To examine the effects of "Remind to-Move" (RTM) wearable devices on upper limb activities at home	Wearable technology	Wearable devices "Remind to-Move" (RTM) using vibration cueing to increase use of the affected upper limb **after inpatient discharge.** device emitS a rhythmic vibration every 10 minutes.	Promote more arm recovery and, produce an optimal functional improvement
47	White (2023) USA	RCT 200 Individuals in labor	To determine whether video education improves patients' knowledge of warning signs for postpartum maternal mortality	Video	12-minute educational video, QR code to view video **after discharge.**	Video education was "very helpful" (83.9% vs 72.5%, P5.23) and that they were "very satisfied" with their education (86.1% vs 75.5%, P5.29).
48	Xiao (2020) USA	Observation study 1067 patients discharged from hospital	To assess the impact of post discharge telephone calls from discharging hospitals on readmission, patient ratings of hospital care and hospitalist communication	Telephone	**Post discharge** telephone call	Increased patient satisfaction. The intervention was associated with a statistically significant improvement in the responses to HCAHPS overall hospital rating. 30-day readmission rates improved after patients received

						a post discharge telephone call, but this outcome was not statistically significant
49	Zhu (2023) China	RCT 189 COPD patients	To investigate use of a video pharmaceutical education program to guide the use of the inhalation device	Video	2–3-minute instructional video on correct use of inhalation devices . QR codes to access during and after **discharge.**	Improved inhaler use accuracy . improved satisfaction
50	Rad (2020) Iran	RCT 66 Caregivers of COVID-19 patients discharged from COVID-19 wards	To determine the effect of education through telenursing on the caregiver burden	Telephone	Daily telephone follow-up in the first two weeks and once every two days in the second two weeks after **discharged** from hospital. In the phone calls, the caregivers' questions related to the disease and how to care and the problems that arose were answered.	Burden decreased
51	Jehloh (2024) Thailand	Observation study 50 Chronic Obstructive Pulmonary Disease patients	To develop and test the Transitional Care Based e-Health Program (TCeHP)to evaluate the feasibility and efficiency of the TCeHP to improve dyspnea symptom management and reduce ED visits	App	COPD-C App five modes of the app: 1) video-guide; 2) alarm timing to assess health record, take medication and attend appointments ; 3)reports 4) a red flag to alert 5) the emergency contact numbers. Family and care givers encouraged to assess and monitor relatives symptoms using the app. For use at home after **discharge from day 3-30** p 107	Could improve the ability to manage dyspnea. Those scores were still at the highest level of satisfaction. Only three of 50 cases had emergency department visits

52	Hart (2020) USA	QI study 36 Heart Failure patients	To determine if 60 minutes of standardized HF education and 30-day scripted telephone follow-up, administered by staff nurses trained in HF, could reduce 30-day hospital readmissions	Combined Telephone/ video	Telephone contact within 48-72 hours of **discharge** subsequent calls weekly, for five calls. up to three education videos accessed on-demand in pt room.	Improved their knowledge and self-management of HF. all rated being "highly" satisfied with their care. Regarding 30-day readmissions, a 24.8% decrease was seen in the group receiving standardized education versus control.