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A rapid review of reviews

Patience Kunonga, Gemma Spiers, Fiona Beyer, Elisabeth Boulton, Alex Hall, Peter Bower, Barbara Hanratty, Dawn Craig

Full Report

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Main messages:

Policy context

Digital technologies have the potential to play a vital role in health and social care, but implementation pre-Covid-19 had been slow. The UK government has set out its aim to become a world leader in serving its citizens online, using digital technology to improve services in the UK. The Covid-19 pandemic has moved forward the implementation of many novel digital technologies, to ensure that health and social care is accessible during the current period of lockdown.

Prior to the pandemic NHS England had developed the NHS Roadmap, setting out the milestones for 'digital first care.' However, despite progress towards a digitally inclusive society, people who are not equipped with digital skills are disadvantaged. This remains true in the current pandemic situation. Older adults are one such group and any move towards 'digital first care' needs to ensure that no group is left behind.

We reviewed seven systematic literature reviews, to assess if digital technology can improve access to health and social care for older adults. We sought to identify three types of digital technologies used by both healthcare professionals and older adults that:

1) Enable first contact access (e.g. online GP appointment scheduling)
2) Are used as platforms for consultations and therapy interventions
3) Are used in the remote care of patients

Key Messages

Digital technologies being implemented into the NHS need to be underpinned by evidence and mapped to the NHS Digital Roadmap, an initiative which addresses the objectives and timelines for the uptake of digital patient services.

We found that benefits to the older population in access are poorly measured and not clearly reported in studies of digital technology. There is a focus on reducing hospital admissions, and little account of whether these technologies are enabling older people to more effectively interact with the NHS.

We found no good quality evidence to support the hypothesis that digital interventions improve access to health and social care in older populations. This could be because

there was a lack of review evidence reporting the effect of digital technologies on access to services.

There was weak evidence to suggest that replacing face-to-face delivery of services and therapies with a digital technology intervention may reduce use of hospital services (including admissions and readmissions). It was not clear if reduced admissions were related to more appropriate or timely initial treatment (i.e. improved access to services).

All the evidence identified focused on health care rather than social care.

Further mapping of primary studies may offer an opportunity to gain additional insights into the effectiveness of digital technologies to enhance access for older people.

Additionally, the widespread use of digital technologies to facilitate access to health and social care throughout the Covid-19 pandemic may offer an opportunity to better understand the barriers, facilitators and limitations of their use.

Executive summary:

Digital technologies are playing a growing role in health and social care, however until recently wide scale use has been limited to a few key areas. In the UK, for some time it has been possible to book appointments via the GP online service; issue electronic prescriptions to eliminate the need to collect paper copies; and to access NHS 111 online, which provides a digital version of the urgent call line. The emergence of a novel coronavirus (COVID-19) has resulted in the implementation of nationwide social distancing measures to contain the virus, including limiting people's physical access to health and social care services. This has necessitated a nationwide move to using digital technologies to communicate and support the delivery of, and access to, health and social care. However, despite progress towards a digitally inclusive society, people who are not equipped with digital skills are disadvantaged. The ability of older adults to use or access digital technologies may prevent equitable access to services, both during the COVID-19 pandemic and in the future. It is therefore extremely important to understand the extent to which digital technologies can support access to health and social care services for older adults. This review aimed to synthesise high-level available evidence, to answer the questions of

a) Do digital technologies enhance access to health and social care for older people, and
b) What are the characteristics of digital interventions that are effective at enhancing access to care?

We conducted a rapid review of reviews following established guidelines. Five bibliographic databases were searched, for English language publications (January 2000 to October 2019). We searched for evidence on digital technologies that facilitate interaction at different parts of the care pathway between older people and health and social care professionals. We looked for evidence on the following types of digital technologies a) technologies facilitating first contact with services, b) technologies replacing face-to-face care with remote service delivery, and c) technologies that provide access to professional support through remote patient

monitoring. Reviews evaluating a range of devices were eligible, including telemonitoring equipment, videophones/conferencing, smart phones, personal computers, laptops, tablets and smart televisions. The outcome of interest was the impact of technologies on access to health and social care.

Findings

- Seven reviews met the inclusion criteria, providing data from 77 randomised controlled trials (RCTs) and 50 observational studies.
- Two of the seven systematic reviews used robust methods, but synthesised findings from poor quality studies. The remaining 5 reviews were considered to be low quality.
- Five out of the seven reviews judged the research they had synthesised to be of low quality.
- No reviews were found on digital technologies that facilitate first contact with services (e.g. online or app-based appointment scheduling).
- There is limited, poor quality evidence that replacing face-to-face delivery of services and therapies with digital technology *may* reduce use of hospital services, including admissions and readmissions.
- No reviews were found on whether digital technologies improved older people's access to services either in an appropriate, or inappropriate manner.

Current systematic review evidence on the potential for digital technologies to improve access to health and social care for older adults is limited in scope and quality. It raises the possibility that providing digital interventions in addition to, or as a replacement for face-to-face services may reduce demands on hospitals. The current evidence base is not well aligned to the NHS RoadMap.

Further work is required to fully explore and understand the aims and outcomes that the NHS digital strategy post the Covid-19 pandemic, revisiting what it is seeking to achieve, and available technologies to support these aims. This research should include consideration of how we can demonstrate improved access for older adults to appropriate services, what we have learnt from the pandemic for this population

and how we can identify those areas that would benefit most from robust primary research. This would include consideration of relevant outcomes to demonstrate improved access to appropriate services.

1. Context:

1.1 Policy Issue/Problem

The UK government aims to become a world leader in serving its citizens online, using digital technology to improve services.[1] However, although there has been progress towards a digitally inclusive society, people who are not equipped with digital skills are disadvantaged. This disproportionately affects older people, low-income groups, and the more marginalised communities in society.[2] Out of a total UK population of 66.4 million,[3] approximately 11 million (20%) lack digital skills and 4.8 million (8.5%) never go online. The latest data suggest that just over half (51%) of people who are digitally excluded are aged over 65.[2]

Digital technologies are electronic tools, systems and resources that generate, store or process data. They have a vital role to play in achieving health and social care priorities, including access to health and social care, and there is a growing evidence base to support their effective use. Technologies such as hand-held devices (mobile and smart phones, tablets); SMS and instant messaging, email; apps and websites can facilitate access to services such as:[4]

- booking appointments,
- ordering repeat prescriptions,
- providing information that impacts on treatment decisions,
- checking treatment/diagnostic results, and
- monitoring physical activity and diet.[5]

The most recent national GP Patient Survey completed by 770,000 people showed that uptake of digital health services as a means of access is increasing. More people are booking appointments (14.9% in 2019, up from 12.9% in 2018) and ordering repeat prescriptions online (16.2% in 2019, up from 14.3% in 2018). Supporting people to get online and use digital health resources may help ameliorate poor access to services,

improve physical and mental wellbeing and encourage shared decision-making.[2] Research has shown that an increasing number of older adults are searching the web for health information.[6] However, around two in five (39.8%) of GP Patient survey respondents were unsure if they had access to GP online services.[7] Other reasons for not engaging with online services may include poor internet access, a lack of interest in using the services or a reluctance to change the way they interact with general practices.[2] A lack of skills or confidence with digital health technologies may be additional barriers to accessing health services digitally. Concerns have been expressed about the acceptability and usability of digital technology in older age groups, because devices may be unaffordable and many have been developed without the involvement of older people.[8] Given the increased focus on digital solutions to enable access, it is vital that we understand how digital technologies actually enhances access for older people.

1.2 Scoping of the evidence

We conducted a scoping exercise to examine the available evidence in digital health on access to services. We sought to understand how this evidence aligns with UK government efforts to create equitable access to health and social care services for older people.

1.2.1 Typology of interventions:

Initial scoping of the literature suggested that a number of international and national frameworks have been developed to describe the uses of digital technology in health, the stakeholders who may benefit from the technology, and the places in clinical pathways that the technology might fit. The frameworks most relevant for our research were the World Health Organisation (WHO) taxonomy of Digital Health Interventions (DHI)[9] and the NHS Empower the Person Roadmap.[10]

The DHI taxonomy organises interventions into four categories based on specific users:

1. Current users of health services, and their caregivers;
2. Healthcare providers: health and social care professionals (Figure 1);
3. Managers involved in the administration of public health systems;

4. Data services: activities related to data collection, management, use, and exchange.

The NHS Roadmap (Figure 2) sets out the milestones for digital health and social care to support people to live healthier lives and use fewer care services. This will be achieved by ensuring the delivery of health and social care at a large scale, securing a seven-day service and transforming care in line with key clinical priorities.[11] It includes NHS digital health and wellbeing apps that are currently available to download. Examples include the NHS app, which provides access to a range of NHS services via smartphones or tablets; NHS login, which allows patients to view and access their personal health information online; and apps that are in development.[12]
We used a combination of items from category 2 of the DHI taxonomy (healthcare providers) and interventions described in the NHS roadmap to: map these items and interventions with current digital interventions, to identify goodness of fit, gaps and potential unmet need in the older population.

1.3 Research Aims

This review addressed the following research questions:
1. Do digital technologies improve access to health and social care for adults?
2. What are the characteristics of digital interventions that are effective at increasing access to services for older adults?

We focused on identifying:

- Technologies that enable first contact with and access to services e.g. online platforms to book appointments;
- Technologies that replace a face-to-face health or social care service, (e.g. outpatient appointment, computerised cognitive-behavioural therapy) delivered in digital format
- Technologies that monitor patients' health, and where health or social care professionals then recommend action in response to the data collected.

Figure 1: WHO DHI – Category 2: Interventions for healthcare providers (World Health Organisation, 2018)

2.0 HEALTHCARE PROVIDERS

2.1 CLIENT IDENTIFICATION AND REGISTRATION

- 2.1.1 Verify client unique identity
- 2.1.2 Enrol client for health services/clinical care plan

2.2 CLIENT HEALTH RECORDS

- 2.2.1 Longitudinal tracking of clients' health status and services
- 2.2.2 Manage client's structured clinical records
- 2.2.3 Manage client's unstructured clinical records
- 2.2.4 Routine health indicator data collection and management

2.3 HEALTHCARE PROVIDER DECISION SUPPORT

- 2.3.1 Provide prompts and alerts based according to protocol
- 2.3.2 Provide checklist according to protocol
- 2.3.3 Screen clients by risk or other health status

2.4 TELEMEDICINE

- 2.4.1 Consultations between remote client and healthcare provider
- 2.4.2 Remote monitoring of client health or diagnostic data by healthcare provider
- 2.4.3 Transmission of medical data to healthcare provider
- 2.4.4 Consultations for case management between healthcare provider(s)

2.5 HEALTHCARE PROVIDER COMMUNICATION

- 2.5.1 Communication from healthcare provider(s) to supervisor
- 2.5.2 Communication and performance feedback to healthcare provider(s)
- 2.5.3 Transmit routine news and workflow notifications to healthcare provider(s)
- 2.5.4 Transmit non-routine health event alerts to healthcare provider(s)
- 2.5.5 Peer group for healthcare providers

2.6 REFERRAL COORDINATION

- 2.6.1 Coordinate emergency response and transport
- 2.6.2 Manage referrals between points of service within health sector
- 2.6.3 Manage referrals between health and other sectors

2.7 HEALTH WORKER ACTIVITY PLANNING AND SCHEDULING

- 2.7.1 Identify client(s) in need of services
- 2.7.2 Schedule healthcare provider's activities

2.8 HEALTHCARE PROVIDER TRAINING

- 2.8.1 Provide training content to healthcare provider(s)
- 2.8.2 Assess capacity of healthcare provider(s)

2.9 PRESCRIPTION AND MEDICATION MANAGEMENT

- 2.9.1 Transmit or track prescription orders
- 2.9.2 Track client's medication consumption
- 2.9.3 Report adverse drug events

2.10 LABORATORY AND DIAGNOSTICS IMAGING MANANGEMENT

- 2.10.1 Transmit diagnostic result to healthcare provider
- 2.10.2 Transmit and track diagnostic orders
- 2.10.3 Capture diagnostic results from digital devices
- 2.10.4 Track biological specimens

Figure 2: NHS Empower the Person Roadmap (NHS England, 2019)

2. Approach:

We employed a rapid evidence 'review of reviews' methodology.[13] A rapid review is a type of systematic review done in a shortened timeframe in order to provide more timely evidence for stakeholders and decision-makers. Such reviews require a trade-off between the time taken to complete the review, and procedures to maintain robustness and transparency.[14] The rapid review adheres to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) checklist for the reporting of systematic reviews.[15] A protocol was registered on PROSPERO (CRD42019161421).

2.1 Search Strategy

An experienced information specialist designed the search strategy in collaboration with the project team. We based the strategy on the following concepts:
Digital technologies AND [Specified access concepts (as listed in 'outcomes' below) OR Older people] AND systematic reviews

During the scoping exercise, we discovered that not all papers of interest necessarily contained index terms around access and older people, so we specified *either* access *or* older people in the search. We used only index terms to pick up records about older people, to reduce the screening burden. We used the CADTH systematic reviews filter.[16] The digital technologies component of the strategy was designed to be comprehensive, and contained all computerised and mobile communications technologies in the two frameworks. The MEDLINE strategy can be found in appendix A.

We searched the following databases: Epistimonikos (a source of systematic reviews relevant to health decision-making), MEDLINE (OVID), Cochrane Database of Systematic Reviews (Wiley), ASSIA (ProQuest), Health Management Information Consortium (HMIC) (OVID), and PROSPERO (registry of ongoing systematic reviews). Searches were limited to English language and material published from 2000 to October 2019.

2.2 Inclusion and Exclusion Criteria

The inclusion and exclusion criteria were based on the PICOTS criteria[17] as follows:

2.2.1 Inclusion Criteria

Participants: reviews of studies with older adults aged ≥ 65 or mixed older/younger aged populations (where we can compare effects of digital technologies on access between younger and older people)

Intervention: any form of digital technology intended to facilitate access to appropriate health and social care services e.g.:

1) To enable first contact access to health and social care user portals, in order to acquire or share information. For example:
   - health and social care documents such as letters, treatment results, care plans and care pathways
   - appointment scheduling
   - electronic prescription services etc.
2) To enable discussion with a service for triage or treatment to be offered/delivered digitally – GP or social care appointment or urgent care/emergency care for example:
   - video/online consultations
   - therapy delivered in digital format e.g. Cognitive Behavioural Therapy
   - preventative digital therapy e.g. NHS diabetes prevention programme
3) To enable ongoing remote monitoring, increasing contact between patients and professionals by more regular exchange of information to inform treatment decisions, improve health outcomes or help with all aspects of their day to day living (replacing face-to-face) for example:
   - monitoring of older adults with chronic illnesses or complex care needs, provided data are viewed by health and social care professionals to prompt appropriate action
   - monitoring older adults to improve their ability to maintain independent living by providing advice on personal care or dietary requirements

Outcomes: impact on access to health and social care, including changes in access use of services and the cost-effectiveness of interventions to facilitate access and delivery of health and social care.

Study designs: Any type of review

2.2.2 Exclusion criteria

- Digital interventions/studies where the results for older adults are not reported separately.
- Monitoring technologies where the data are not reviewed by a health or social care professional
- Passive technologies (technologies that do not require continuous engagement by health and care professionals) e.g. fall devices/sensors
- Case studies, case series, non-controlled before and after studies
- Abstracts and studies not available in full form

2.3 Data Collection

2.3.1 Study selection

The selection process consisted of two stages of screening, conducted by two reviewers: (1) the title and abstract and (2) full-text papers. We exported citations from Endnote X9 into Rayyan,[18] a web application used to expedite the screening process. We tested and refined the inclusion and exclusion criteria on a sample of titles and abstracts to ensure that they were robust enough to capture relevant articles. We screened the titles and abstracts of the reviews against the refined inclusion criteria. We included the articles selected at this stage in the full-text assessment. We resolved disagreements between the reviewers either by discussion between the reviewers or with arbitration from another member of the review team.

2.3.2 Data Extraction

We used a tailored data extraction form based on the Cochrane Data Extraction and Assessment Template[19] to record the relevant review characteristics. Data extracted from the included reviews included: (i) author and year of publication; (ii) title; (iii) objective of the review; (iv) description of included population; (v) total number of older people; (vi) intervention; (vii) technology type; (viii) what the intervention is enhancing; (ix) primary outcomes; (x) secondary outcomes; (xi) overall statement on quality appraisal; and (xii) review authors' summary. We used an excel spreadsheet for

recording and analysis. To ensure comprehensiveness, we piloted the abstraction form on two reviews, which identified a need for minor modifications.

2.4 Risk of Bias Assessment

One reviewer assessed the risk of bias of each included review and another reviewer checked for consistency and accuracy. We resolved disagreements through discussion or with arbitration from a third member of the review team. We assessed the reviews using the Risk of Bias in Systematic Reviews (ROBIS) tool.[20] Assessment of relevance was omitted, as this had already been completed during the screening process. This left two of the three phases of the tool to complete:

1) We identified concerns with the review process across four domains: (i) study eligibility criteria, (ii) identification and selection of studies, (iii) data collection and study appraisal, and (iv) synthesis and findings; and
2) We judged the risk of bias.

The tool includes signalling questions to help judge concerns with the review process and the overall risk of bias in the review. Each domain is then judged to be at low, high or unclear risk of bias. An overall risk of bias was judged based on the following criteria:[20]

1) Low risk of bias: The findings of the review are likely to be reliable. Phase 2 did not raise any concerns with the review process, or concerns were appropriately considered in the review conclusions. The conclusions were supported by the evidence and included consideration of the relevance of included studies
2) High risk of bias: One or more of the concerns raised during the Phase 2 assessment was not addressed in the review conclusions, the review conclusions were not supported by the evidence, or the conclusions did not consider the relevance of the included studies to the review question
3) Unclear risk of bias: There is insufficient information reported to make a judgement on risk of bias

It is important to note that we did not exclude reviews based on methodological quality alone.

2.5 Data Analysis

We presented our main results in tabular format with a narrative synthesis. We grouped the results according to the three types of technology, mapped alongside category 2 of the DHI taxonomy (healthcare providers). This provided us with a bespoke framework which we used to identify, explore and synthesise the evidence included in our review. Due to the absence of data we were unable to map the results according to the interventions presented in NHS roadmap or conduct a subgroup analysis of the effects of interventions in different age groups over 65years.

3. Results:

3.1 Number of Reviews Identified

Database searches identified 2,809 unique records. Initial screening of title and abstracts excluded 2,616 records, leaving 193 for full text assessment (Figure 3). We identified seven reviews eligible for inclusion. A list of the excluded reviews (with reasons) is available in appendix B.

3.2 Characteristics of Included Reviews

Seven reviews published between 2006 and 2019 met the inclusion criteria.[21-27] The review by Inglis and colleagues (2016)[24] was an update of an earlier review.[28] A descriptive summary of review characteristics is presented in Table 1. They included a total of 77 randomised controlled trials (RCTs) and 50 observational studies. We assessed the overlap across the reviews and identified seven RCTs reported in more than one review, but no observational studies that were included in multiple reviews. Studies in the reviews included 49 from the USA, 6 from Canada, 9 from Australia, 40 from Europe (including 7 from the UK), 3 from South America, 2 from Asia and 1 from the Middle East. Country of origin was not stated for the remaining 17 studies. All studies reported outcomes for older adults aged 65 and older, and two reviews included participants aged over 18 years.[21, 27] None of the reviews reported outcomes relating to changes in access to services. Six reviews[21-26] reported on hospital admissions, one[26] reported on healthcare costs and another on cost-effectiveness of digital technology.[27]

Figure 3. PRISMA Flow Diagram

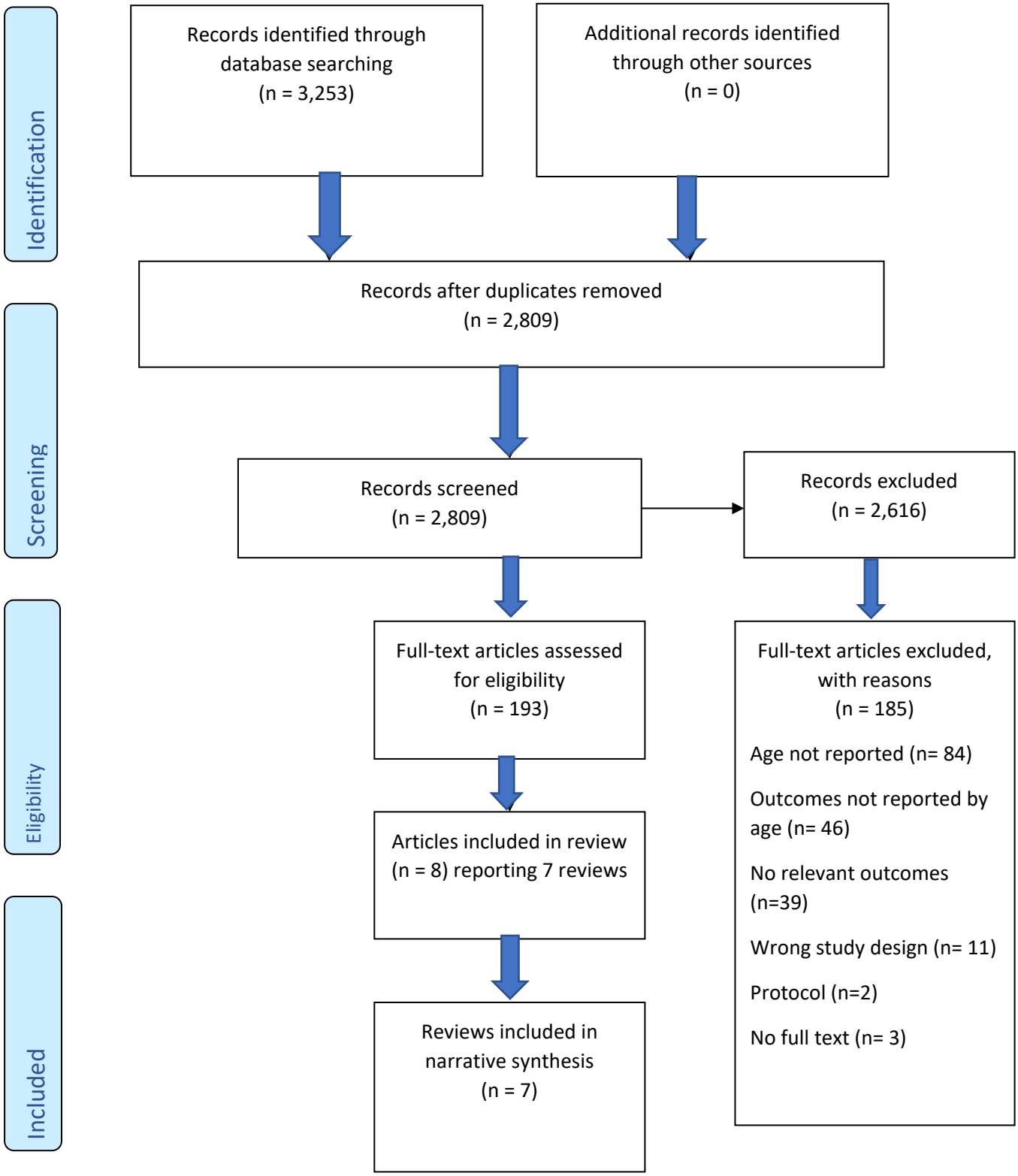
Identification
Screening
Eligibility
Included
Records identified through database searching (n = 3,253)
Additional records identified through other sources (n = 0)
Records after duplicates removed (n = 2,809)
Records screened (n = 2,809)
Records excluded (n = 2,616)
Full-text articles assessed for eligibility (n = 193)
Full-text articles excluded, with reasons (n = 185)
Age not reported (n= 84)
Outcomes not reported by age (n= 46)
No relevant outcomes (n=39)
Wrong study design (n= 11)
Protocol (n=2)
No full text (n= 3)
Articles included in review (n = 8) reporting 7 reviews
Reviews included in narrative synthesis (n = 7)

Table 1. Summary of included systematic reviews

Study	Type of review	Study designs included in reviews	Population	Type of intervention(s)	Type of technology	Outcome(s)	Risk of Bias
Bauce 2018[21]	Integrative Review	RCTs, observational	Older adults	Telemonitoring	Technologies that allowed 'two-way synchronous audio and video communication for measuring and transmitting physiological data'	Hospital admissions, emergency department visits	HIGH
Harerimana 2019[22]	Systematic Review	RCTs, observational	Adults aged ≥65 years with a diagnosis of depression or self-reported depressive symptoms	Telehealth* (mental health)	Electronic messaging, used to deliver educational content and questionnaires. Participants responded electronically to questions, with data transmitted to provider.	Hospital admissions, emergency department visits	HIGH
Husebo 2014[23]	Integrative Review	Observational	Older adults	Telehealth	Videophones, Personal computers/laptops, and TV	Hospital admissions and readmissions	HIGH
Inglis 2016, 2015[24, 28]	Systematic Review	RCTS	Adults with heart failure. Eight studies included people with mean age of ≥70 years.	Structured telephone support or telemonitoring (heart failure)	Telephone	Heart failure and all-cause hospitalisations	LOW

Study	Type of review	Study designs included in reviews	Population	Type of intervention(s)	Type of technology	Outcome(s)	Risk of Bias
Martinez 2006[25]	Systematic Review	RCTs, observational	Adults with heart failure. 11 studies included people with a mean age of ≥ 65 years.	Home telecare	Not reported	Hospital readmissions	HIGH
Marx 2018[26]	Systematic Review and Meta-analysis	RCTs, observational	Older adults with a mean age of ≥ 65 years living independently, in receipt of intervention for management risk of malnutrition	Telehealth for managing risk of malnutrition	Telephone, internet	Hospital readmission, healthcare costs	LOW
Sanyal 2018[27]	Systematic Review	RCTs, observational	Older adults. 11 studies included people with a mean age of ≥ 65 years.	Telehealth, computerised decision support, telemonitoring, web-based physical activity, telecare, internet CBT.	Telehealth, computerised decision support, telemonitoring, web-based physical activity, telecare, internet CBT.	Not reported	HIGH

***Telehealth** is understood to refer to the provision of healthcare remotely by means of telecommunications technology. **Telemedicine** refers to the remote diagnosis and treatment of patients by means of telecommunications technology. **Telecare** is a term used to describe remote monitoring in a range of different contexts and is not specific to health.

3.3 Risk of Bias Assessment of Included Reviews

Details of the risk of bias assessment can be found in Table 2. Overall, we rated the risk of bias as high for five of the included reviews,[21-23, 25, 27] and low for two reviews.[24, 26] Six reviews formally assessed the risk of bias of the primary studies that they included, using varying methods. Two reviews used the Cochrane Risk of Bias tool and the Grade approach to assess the quality.[24, 26] Harerimana and colleagues assessed the methodological quality of included studies using different versions of the Joanna Briggs Institutes appraisal checklist, depending on study type.[22] Studies were assessed for the presence or absence of items in the checklists. To give an overview of quality, authors converted the score of each study into percentages. In Bauce and colleagues' review,[21] the included studies were assessed for risk of bias using the National Heart, Lung and Blood Institute's Quality Assessment of Controlled Intervention Studies tool. The 14-question assessment tool provides guidance on assessing risk of bias by analysing key elements of a study relating to internal validity. Martinez and colleagues (2006)[25] assessed the level of evidence by classifying study designs using the nine-level criteria developed by Jovell and Navaro-Rubio. Level of evidence ranged from Level I (very good, in meta-analysis) to level IX (poor, in anecdotes or case reports).

3.3.1 Study eligibility criteria

We assessed concerns regarding specification of the study eligibility criteria and five reviews were judged to be of high risk.[21-23, 25, 27] The main issues were the absence of clear inclusion criteria, and/or the lack of publicly available protocols with predefined criteria. Protocols help to reduce bias in the conduct of the review and promote consistency and transparency.

3.3.2 Identification and selection of studies

We assessed concerns regarding methods used to identify and select studies and two of the reviews in this domain were judged to be high risk,[23, 25], two as unclear,[21, 22] and three as low risk.[24, 26, 27] The main concerns in this domain were the restriction to English language studies,[23] a lack of information about study selection,[25] failure to specify date ranges for study searches,[21] and insufficient detail on the numbers of reviewers involved in study selection.[22] Unbiased selection criteria would ensure that all relevant studies are included in the reviews, regardless of language or age of study.

Ideally, study selection would include independent assessment of the studies for inclusion by at least two reviewers. Not only does this minimise bias, it also ensures that decisions are checked for accuracy.

Table 2. Risk of bias using ROBIS assessment

Review	Phase 2				Phase 3
	1. STUDY ELIGIBILITY CRITERIA	2. IDENTIFICATION AND SELECTION OF STUDIES	3. DATA COLLECTION AND STUDY APPRAISAL	4. SYNTHESIS AND FINDINGS	OVERALL RISK OF BIAS
Bauce, 2018[21]	High	Unclear	High	High	High
Harerimana, 2019[22]	High	Unclear	High	High	High
Husebo, 2014[23]	High	High	High	High	High
Inglis, 2016, 2015[24, 28]	Low	Low	Low	Low	Low
Martinez, 2006[25]	High	High	High	High	High
Marx, 2018[26]	Low	Low	Low	Low	Low
Sanyal, 2018[27]	High	Low	Unclear	High	High

3.3.3 Data collection and study appraisal

We assessed concerns regarding methods used to collect data and appraise studies and we rated four reviews as being at high risk of bias,[21-23, 25] one as unclear,[27] and one as low risk.[26] The main problem within this domain was the failure to specify whether data collection and quality assessment were undertaken independently by more than one person. An unbiased data extraction process would ensure that mistakes are identified and there is no deviation from an agreed extraction form. As with data extraction, it is important for at least two reviewers to carry out risk of bias assessments to minimise errors.

3.3.4 Synthesis and findings

We assessed concerns regarding the synthesis and findings and five of the reviews were rated as high risk of bias,[21-23, 25] and two as low risk.[24, 26] The absence of clear outcome criteria and publicly available protocols made it difficult to be confident that the synthesis and reporting of outcomes was unbiased. Bias may be introduced if

reviewers decide to synthesise outcomes based on their interpretation of the data. A pre-defined approach to analysis and synthesis ensures that bias is minimised.

4. Overview of evidence:

4.1 Assessment of Digital Interventions used to Improve Access to Health and Social care

Table 3 summarises the identified evidence, presenting it according to the purpose of the digital technology and the reported outcomes. No systematic reviews reported evidence about the impact of digital technology to facilitate first contact access with health services, such as online appointment scheduling. Most of the evidence (six reviews) focused on digital technologies designed to facilitate remote delivery of care, including consultations and therapy. Outcomes relating to health service use were reported in most reviews. One review reported evidence about cost effectiveness. We identified limited evidence (two systematic reviews) on digital technologies for remote monitoring of health to prompt action by healthcare professionals.

Table 3. Overview of identified evidence by type of digital technology and outcome

Purpose of digital technology	WHO digital health category	Outcome	
		Health service utilisation	Costs and cost effectiveness
Digital technology to enable first contact access (e.g. online GP appointment scheduling)	None	No reviews identified.	No reviews identified.
Digital technologies or platforms for consultations and therapy interventions	2.4.1 Consultations between remote client and healthcare provider	Harerimana 2019;[22] Marx 2018;[26] Husebo 2014;[23] Inglis 2016;[24] Martinez 2006[25]	Sanyal 2018[27]
Digital technology for remote monitoring interventions	2.4.2 Remote monitoring of client health or diagnostic data by provider	Bauce 2018[21]	Sanyal 2018[27]

4.2 Digital technology to enable first contact access (e.g. online GP appointment scheduling)

None of the included reviews evaluated digital technologies that enable first contact access services.

4.3 Types of technologies identified in the reviews

A variety of digital technologies were used by healthcare professionals and older adults to support interventions for telemonitoring or telecare. Digital technologies used for the delivery of these interventions were: videophones or video conferencing equipment, internet-based applications and smart phones. One review assessed the use of a standard telephone to provide structured support for heart failure patients.[24]

4.3.1 Digital technologies for consultations and therapies

4.3.1.1 Service use outcomes

Replacing face-to-face delivery of services and therapies with digital technologies may reduce use of hospital services, including admissions and readmissions. Five reviews reported on health care service utilisation[22-26] as an outcome of digital technologies but we judged only two to be at low risk of bias, and thus of higher quality.[24, 26]

Evidence from the higher-quality reviews:

Marx and colleagues reported weak evidence for the efficacy of telehealth interventions to address malnutrition amongst community-dwelling older adults.[26] They identified nine studies (seven RCTs; two observational). Two of the nine studies reported significant reductions in hospital readmissions in the intervention groups. However, when the data were pooled, the reduction of hospital admissions was not significant (Odds ratio (OR): 0.52 [95%CI: 0.24–1.16] P=.11; n=160 participants; I^2=0%).

Inglis and colleagues (2016)[24] focused on whether structured telephone support and telemonitoring were effective for older people with heart failure. They found 41 RCTs that assessed heart failure related hospitalisations. A meta-analysis of 16 of these studies showed that structured telephone support reduced heart failure-related hospitalisations. The study reported a 15% reduction in risk for heart failure related hospitalisations (Relative Risk (RR) 0.85, 95% CI 0.77 to 0.93; participants=7030; I^2=27%). The authors reported that there were no impacts on all-cause hospitalisations, but the quality of this evidence was rated very low.

Evidence from the lower-quality reviews:

Martinez and colleagues reviewed 42 articles on the value of home monitoring for heart failure patients in both older and younger populations.[25] Five of these 42 articles were non-controlled trials that reported findings for older people. Interventions included consultations and providing follow up care for heart failure patients. Evidence from the five studies, rated as poor in quality in the review, indicates that readmission rates or number of admissions were lower in the telecare intervention group compared to control group.

Husebo and colleagues sought to understand the care content and utilisation of virtual visits, particularly the uses and experiences of older adults aged 65 and over, and health care providers.[23] Of the 12 observational studies included in the review, one reported that patients who received telehealth had fewer hospital admissions compared to patients who received usual home health care. Another found that the numbers of readmissions within 30 days and at six months were lower for patients in the telehealth group; but the findings did not reach significance. No formal risk of bias assessment was conducted on any of the studies included in the Husbeo review.

Harerimana and colleagues (2019)[22] assessed the effects of mental healthcare delivery using telehealth (telemental health) in older adults with depressive symptoms. They identified nine studies (four RCTs; one quasi-experimental; four observational), however only one (quasi-experimental) addressed the effect of home telemental health on hospital admissions and emergency room use. It showed that emergency department visits and hospital admissions decreased by 60 and 80% following the intervention ($p<0.001$ for both outcomes; no effect size or confidence intervals reported). This evidence was rated as medium quality.

4.3.1.2 Costs or cost-effectiveness outcomes

One review evaluated economic outcomes of ehealth technologies in the management of chronic diseases that included older adults.[27] Eleven studies (nine RCTs; two observational) were identified, focused on: telehealth, computerised decision support, telemonitoring, web-*based physical activity, telecare and internet cognitive behavioural therapy (iCBT), compared to usual care. Overall, the information about costs was limited. The incremental cost-effectiveness ratio (ICER) varied between studies and was reported in different currencies. The review authors concluded that

evidence was too limited to ascertain cost effectiveness of the interventions. The quality of the included studies was variable.

4.3.2 Digital technologies for remote monitoring

Remote monitoring has the potential tom improve access to care by increasing contact between patients and professionals by more regular exchange of information. Two reviews reported evidence about technologies for remote monitoring, both of which we judged to be poor in quality.

4.3.2.1 Service use outcomes

Bauce and colleagues (2018)[21] assessed the efficacy of telemonitoring interventions on heart failure outcomes in 11 studies (ten RCTs; one single group study). Interventions included videoconferencing. Health service use was measured in seven studies; five reported significant reductions in hospital admissions and two reported significant reductions in emergency department visits. However, these studies demonstrated a high degree of bias. All seven studies used different outcome measures to report service use. For example, one trial reported lower probabilities of admissions and visits and another reported the reduction in heart failure hospitalisation rates, compared to the national benchmark. Overall, the review found that compared to usual care, the reduction in healthcare service was likely to be due to early detection and treatment of symptoms and can probably attributed to the intervention.

4.3.2.2 Costs or cost-effectiveness outcomes

Only one review assessed the cost effectiveness of the intervention,[27] but there were insufficient data for the review authors to draw clear conclusions.

5. Discussion:

5.1 Summary of Findings

This rapid review synthesised seven systematic reviews, which sought to determine whether digital technologies improve access to health and social care services for older people. The reviews were all published since 2006. No evidence was found to support the hypothesis that digital interventions improved or increase access in the

older population. We identified a variety of digital technologies with a focus on reducing other types of service utilisation (especially hospital use).

Six of the seven reviews presented evidence on service use outcomes. They reported reductions in hospital admissions, readmissions and emergency department visits, compared to usual care. Evidence from one high quality review indicated that digital interventions reduced hospital readmission rates for older people. However, the evidence within this review was weak. These findings are supported by the other five, lower-quality reviews, which suggested that digital technologies employed for consultations and therapies in health and social care may reduce service use. Overall, our work suggests that digital interventions may be associated with reductions in health service use, but the quality of evidence is poor, and this finding should be treated with caution.

Evidence in support of the cost-effectiveness of digital health technologies is also limited. A single low quality review included studies that examined the cost-effectiveness of digital technologies.[27] The paucity of economic data in the review findings means no clear conclusions could be drawn. We found no robust evidence regarding technologies that allow patients to access a range of NHS services, including first contact access.

This rapid review has identified different types of platforms used to facilitate interaction between older people and service providers at different parts of the care pathway. Some of the digital technologies used are similar to those publicly available via the NHS. For example, the use of personal computers or laptops to conduct videoconferencing is comparable to the NHS online consultations platform. This is a service used by both patients and healthcare professionals to conduct clinical consultations using online chat or video services, such as GP at Hand. The Covid-19 pandemic has moved these infrequently used technologies to the forefront of health and social care delivery, which during lockdown have been routinely used to provide access to services. Our rapid scoping searches for primary studies did not identify any evaluations of the platforms currently in use in the NHS, suggesting that the evidence base may be limited; despite need necessitating their use. We also failed to identify any review evidence for new technologies such as smartphone apps (like the NHS

apps), which were already in widespread use pre-Covid-19 It is also important to emphasise that we were unable to determine whether any reductions in hospital admissions, readmissions and emergency department visits are due to more appropriate care being accessed in a timely manner, facilitated by the digital health technology.

5.2 Review quality

The existing evidence base for digital technologies to improve access to health and social care for older adults appears limited in scope and quality. The reviews did not report whether digital technologies facilitate first contact with services or whether they improved older adults' access to services. Overall, there are major limitations to all seven of the reviews, in both the quality of the reviews themselves, and the quality of the research included within each review. Five of the seven reviews had a high risk of bias, meaning that they are of low quality. Five out of the seven reviews judged the research they had reviewed as low quality. Therefore, the picture we have synthesised is drawn from reviews of high risk of bias that have reviewed research of low quality. This means that caution must be applied to any conclusions drawn from this synthesis.

5.3 Comparisons of findings with other reviews

Our search strategy retrieved a review of reviews that investigated the use of technologies in the remote care of patients with long-term conditions.[29] Conditions such as diabetes, congestive heart failure, chronic obstructive pulmonary disease and mental disorders appear to be the most commonly studied, and possibly most suitable, for the use of remote care technology. Compared to usual care, remote care technology helps to reduce both the number of hospitalisations and use of other healthcare services. However, no formal assessment of the methodological quality or risk of bias was addressed by the authors. Although Queiros and colleagues[29] did not identify the age of the population under investigation, the technologies assessed and the conclusions drawn are similar to those in our review.

5.4 Strengths and Limitations of our rapid review

To the best of our knowledge, this is the first rapid synthesis of reviews on digital technology to enhance access to health and social care services for older adults.

Although we followed a rapid evidence synthesis approach, we adhered to published guidelines for undertaking a robust standard systematic review in terms of our approach to database searching, handling of data, and reporting. We excluded reviews published prior to 2000, and the rapidly evolving nature of digital technologies means that it is unlikely that we excluded reviews of relevant and contemporary interventions. We can therefore be confident that our review offers a comprehensive and reliable picture about digital technologies' ability to reduce service use outcomes. However, the limitations of how these studies quantify and measure access outcomes, if at all, make it difficult to be clear about the relationship between the reductions in service utilisation and improved access. Three limitations should be noted. First, we adopted a rapid review methodology to assess the impact of digital technology on access to care. The rapid review focussed on systematic reviews, which in turn tend to be focussed on randomised trials. The focus of trials is primarily on effectiveness and cost-effectiveness. Although trials can be used to assess the impact of interventions on access to care, our review found that this has rarely been the focus of published papers. Second, due to time constraints, our searches were restricted to English language reviews only. This means that potentially relevant reviews published in other languages may have been excluded. We anticipate that the impact of this is likely to be minimal. Third, most of the reviews identified did not adequately report their findings, and authors were not contacted with requests for further information. Formal assessments of the methodological quality of included reviews indicated a low-quality evidence base. This has limited our interpretation of the evidence and the extent to which we can draw firm conclusions about digital technologies and access to health and social care.

5.5 Impact and Implementations

This rapid review provides the current available evidence to inform practice and research. The Covid-19 pandemic has created a rapid, necessary, implementation and use of some of these technologies across the NHS. However, the issue of their suitability and ability to routinely enhance access to services for the older population remains valid.

5.5.1 Practice

The evidence in this review suggest that most interventions were concerned with remote monitoring of older people's long-term conditions by healthcare providers. Although some of the interventions used a digital platform to aid engagement, some patients communicated with healthcare providers by telephone. The small number of studies and poor reporting mean that it is unclear how representative these findings are for older people.

5.5.2 Further Research

Technology is rapidly evolving and Covid-19 has excelled its rollout across the NHS. However, the impact for the older population (and other digitally excluded groups) will still need to be carefully considered and fully evaluated. Future mapping of primary studies in this area would help us to understand the impact of interventions on different age groups. We identified a gap in the literature for studies assessing the impact of technologies to enable first point contact for health and social care services, for example online platforms to book appointments. Further research is required to understand the effectiveness of digital technologies to improve equitable access to health and social care services. This should encompass access to appropriate care, which may lead to reductions in use of other services, and health outcomes. We also recommend future research on the economic implications of using digital health interventions with older adults. Moreover, due to the lack of evidence, we are yet to understand the characteristics of digital technologies that might be effective in enhancing access to healthcare services for older people. The reviews identified in this study lacked rigour and consistency in methodology. This contributed to the overall weakness in the evidence base. We recommend that future reviews of digital technologies in health and social care, aim to follow more robust methodological practice. Post the Covid-19 pandemic further evaluation of the NHS roadmap and it's primary aims and objective may support areas for further research.

6. References:

1. Department for Digital Culture Media and Sport. Policy Paper: UK Digital Strategy 2017. 2017.

2. NHS Digital. Digital inclusion for health and social care : What we mean by digital inclusion 2019 [cited 2020 27 January]. Available from:

https://digital.nhs.uk/about-nhs-digital/our-work/digital-inclusion/what-digital-inclusion-is.

3. Office for National Statistics. Estimates of the population for the UK, England and Wales, Scotland and Northern Ireland 2017 [cited 2020 27 January]. Available from: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/populationestimatesforukenglandandwalesscotlandandnorthernireland.

4. Bhavnani SP, Narula J, Sengupta PP. Mobile technology and the digitization of healthcare. European heart journal. 2016;37(18):1428-38.

5. World Health Organisation. What you need to know about digital health systems 2019 [cited 2020 27 January]. Available from: http://www.euro.who.int/en/health-topics/Health-systems/pages/news/news/2019/2/what-you-need-to-know-about-digital-health-systems.

6. Cohen RA, Stussman B. Health information technology use among men and women aged 18–64: early release of estimates from the National Health Interview Survey, January–June 2009. National Center for Health Statistics. 2010.

7. NHS England. GP Patient Survey 2019 2019 [cited 2020 27 January]. Available from: https://www.england.nhs.uk/statistics/2019/07/11/gp-patient-survey-2019/

8. Deloitte Centre for Health Solutions. Connected Health: How digital technology is transforming health and social care. 2015 [cited 2019 18 December]. Available from: https://www2.deloitte.com/content/dam/Deloitte/ie/Documents/PublicSector/deloitte-uk-connected-health-sm1.pdf.

9. World Health Organisation. Classification of Digital Health Interventions V1.0 2018 [cited 2020 27 January]. Available from: https://apps.who.int/iris/bitstream/handle/10665/260480/WHO-RHR-18.06-eng.pdf;sequence=1.

10. NHS England. Empower the Person: Roadmap for Digital Health and Care Services 2019 [cited 2020 27 January]. Available from: https://indd.adobe.com/view/119c9ee5-6acb-4f52-80c2-d44fc03fdc91.

11. NHS England. The Forward View into Action: Paper-free at the Point of Care Guidance for Developing Local Digital Roadmaps. 2016 [cited 2020 27 January]. Available from: https://www.england.nhs.uk/digitaltechnology-old/wp-content/uploads/sites/31/2016/11/develp-ldrs-guid.pdf.

12. NHSX. Apps and tools for patient care 2020 [cited 2020 29 Janaury]. Available from: https://www.nhsx.nhs.uk/key-information-and-tools/apps-and-tools.

13. Hunt H, Pollock A, Campbell P, Estcourt L, Brunton GJSr. An introduction to overviews of reviews: planning a relevant research question and objective for an overview. 2018;7(1):39.

14. World Health Organisation. Rapid reviews to strengthen health policy and systems: a practical guide 2017 [cited 2020 27 January]. Available from: https://apps.who.int/iris/bitstream/handle/10665/258698/9789241512763-eng.pdf;jsessionid=202A94DF70858DD0A9203C7A0A37BBC1?sequence=1.

15. Moher D, Liberati A, Tetzlaff J, Altman DGJAoim. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. 2009;151(4):264-9.

16. CADTH Evidence Driven. Strings Attached: CADTH's Database Search Filters 2019 [cited 2020 15 January]. Available from: https://www.cadth.ca/resources/finding-evidence/strings-attached-cadths-database-search-filters

17. Whitlock EP, Lopez SA, Chang S, Helfand M, Eder M, Floyd N. AHRQ series paper 3: identifying, selecting, and refining topics for comparative effectiveness systematic reviews: AHRQ and the effective health-care program. Journal of clinical epidemiology. 2010;63(5):491-501.

18. Ouzzani M, Hammady H, Fedorowicz Z, Elmagarmid AJSr. Rayyan—a web and mobile app for systematic reviews. 2016;5(1):210.

19. Cochrane Public Health. Resources/Info: Data Extraction and Assessment Template 2020 [cited 2020 27 January]. Available from: https://ph.cochrane.org/review-authors.

20. Whiting P, Savović J, Higgins JP, Caldwell DM, Reeves BC, Shea B, et al. ROBIS: a new tool to assess risk of bias in systematic reviews was developed. Journal of clinical epidemiology. 2016;69:225-34.

21. Bauce K, Fahs DB, Batten J, Whittemore R. Videoconferencing for Management of Heart Failure: An Integrative Review. Journal of gerontological nursing. 2018;44(4):45-52.

22. Harerimana B, Forchuk C, O'Regan T. The use of technology for mental healthcare delivery among older adults with depressive symptoms: a systematic literature review. International journal of mental health nursing. 2019;28(3):657-70.

23. Husebo AM, Storm M. Virtual visits in home health care for older adults. Thescientificworldjournal. 2014;2014:689873.

24. Inglis SC, Clark RA, Dierckx R, Prieto-Merino D, Clel, JG. Structured telephone support or non-invasive telemonitoring for patients with heart failure. Cochrane Database of Systematic Reviews. 2016(10):CD007228.

25. Martinez A, Everss E, Rojo-Alvarez JL, Figal DP, Garcia-Alberola A. A systematic review of the literature on home monitoring for patients with heart failure. Journal of Telemedicine & Telecare. 2006;12(5):234-41.

26. Marx W, Kelly JT, Crichton M, Craven D, Collins J, Mackay H, et al. Is telehealth effective in managing malnutrition in community-dwelling older adults? A systematic review and meta-analysis. Maturitas. 2018;111:31-46.

27. Sanyal C, Stolee P, Juzwishin D, Husereau D. Economic evaluations of eHealth technologies: A systematic review. PloS one. 2018;13(6):e0198112.

28. Inglis SC, Conway A, Clel, JG, Clark RA. Is age a factor in the success or failure of remote monitoring in heart failure? Telemonitoring and structured telephone support in elderly heart failure patients. European Journal of Cardiovascular Nursing. 2015;14(3):248-55.

29. Queirós A, Alvarelhão J, Cerqueira M, Silva AG, Santos M, Pacheco Rocha N. Remote care technology: A systematic review of reviews and meta-analyses. Technologies. 2018;6(1):22.

7. Appendices:

Appendix A: MEDLINE search strategy

Database(s): **Ovid MEDLINE(R) and In-Process & Other Non-Indexed Citations** 1946 to October 17, 2019

Searched 18th October 2019

#	Searches	Results
1	Internet/	70118
2	Social Media/	6511
3	Mobile Applications/	4654
4	Wearable Electronic Devices/	1422
5	Computers/	50449
6	exp Microcomputers/	20907
7	Minicomputers/	979
8	Therapy, Computer-Assisted/	6590
9	Computer-Assisted Instruction/	11599
10	exp Cell Phone/	9827
11	Electronic Mail/	2592
12	(e-BI or e-SBI or ehealth or e-health or electronic health or mhealth or m-health or mobile health or virtual health or digital health or digital technolog* or technological aid? or wearable*).ti,ab.	32276
13	((email* or e-mail* or electronic mail* or text messag* or SMS or MMS or phone? or cellphone? or cell-phone? or smartphone? or smart-phone? or digital tablet? or pda or personal digital assistant? or social media or social networking or facebook or twitter or skyp* or app?) adj2 (deliver* or generat* or based or provid* or facilitat* or support* or treatment? or therap* or intervention? or program* or feedback)).ti,ab.	11486
14	((Internet* or electronic* or digital* or online or on-line or computer* or laptop? or software or web*) adj2 (deliver* or generat* or based or provid* or facilitat* or support* or treatment? or therap* or intervention? or program* or feedback)).ti,ab.	116926
15	exp Telemedicine/	26136
16	(telecare or tele care or telehealth or tele health or telemedicine or tele medicine or teleconsultation* or tele-consultation* or tele monitor* or telemonitor*).ti,ab,kw.	15975
17	or/1-16	306305
18	Cost-Benefit Analysis/	78206
19	exp "Patient Acceptance of Health Care"/	144454
20	exp Health Services Accessibility/	106406

21	Electronic Prescribing/	976
22	exp "Appointments and Schedules"/	19476
23	Healthcare Disparities/	15183
24	Digital Divide/	42
25	((access* or utiliz* or utilis* or accept*) adj3 (health care or healthcare or primary care or secondary care or social care or community or service? or hospital* or clinic? or appointment* or referral* or consultation? or prescribing or prescription*)).ti,ab.	74717
26	or/18-25	394871
27	17 and 26	18279
28	(digital* adj3 (inclusion or exclusion or divide or monitor* or deliver*)).ti,ab.	1396
29	((digital* or online or internet* or computeri*) adj3 (access or engag* or disengag* or healthcare or health care or social care or service? or hospital* or clinic? or appointment* or referral* or consultation? or prescribing or prescription*)).ti,ab.	10587
30	(remote* adj3 (access or monitor*)).ti,ab.	3772
31	or/28-30	15476
32	27 or 31	32344
33	exp Aged/	3002833
34	Health Services for the Aged/	17328
35	or/33-34	3004177
36	17 and 35	28230
37	32 or 36	56106
38	meta-analysis.pt.	106529
39	meta-analysis/ or systematic review/ or meta-analysis as topic/ or "meta analysis (topic)"/ or "systematic review (topic)"/ or exp technology assessment, biomedical/	199881
40	((systematic* adj3 (review* or overview* or analys*)) or (methodologic* adj3 (review* or overview* or analys*))).ti,ab,kf,kw.	177440
41	(((quantitative or narrative*) adj3 (review* or overview* or synthes*)) or (research adj3 (integrati* or overview*))).ti,ab,kf,kw.	22041
42	((integrative adj3 (review* or overview*)) or (collaborative adj3 (review* or overview*)) or (pool* adj3 analy*)).ti,ab,kf,kw.	23610
43	(data synthes* or data extraction* or data abstraction*).ti,ab,kf,kw.	23918
44	(handsearch* or hand search*).ti,ab,kf,kw.	8743

45	(mantel haenszel or peto or der simonian or dersimonian or fixed effect* or latin square*).ti,ab,kf,kw.	24102
46	(met analy* or metanaly* or technology assessment* or HTA or HTAs or technology overview* or technology appraisal*).ti,ab,kf,kw.	8475
47	(meta regression* or metaregression*).ti,ab,kf,kw.	7596
48	(meta-analy* or metaanaly* or systematic review* or biomedical technology assessment* or bio-medical technology assessment*).mp,hw.	269525
49	(medline or cochrane or pubmed or medlars or embase or cinahl).ti,ab,hw.	194565
50	(cochrane or (health adj2 technology assessment) or evidence report).jw.	19576
51	(comparative adj3 (efficacy or effectiveness)).ti,ab,kf,kw.	12073
52	(outcomes research or relative effectiveness).ti,ab,kf,kw.	8603
53	((indirect or indirect treatment or mixed-treatment) adj comparison*).ti,ab,kf,kw.	1941
54	((meta-narrative or meta-ethnograph* or mixed method* or critical or thematic or realist or framework) adj3 (review* or synthes*)).ti,ab,kf,kw.	24483
55	or/38-54	455644
56	37 and 55	2895
57	limit 56 to (english language and humans and yr="2000 -Current")	2293

Appendix B: List of excluded studies

Author	Reasons for exclusion

Abbott 2013	Age: not 65+/not reported
AbuDagga 2010	Does not separate outcomes for those >65 years.
Achelrod 2014	Does not separate outcomes for those >65 years.
Adamson 2016	Does not separate outcomes for those >65 years.
Adebayo 2017	No relevant outcomes
Ahern 2017	Full text unavailable
Akiyama 2016	Age: not 65+/not reported
Alghamdi 2015	No relevant outcomes
Ammenwerth 2015	Does not separate outcomes for those >65 years.
Andrews 2010	Age: not 65+/not reported
Ansell 2017	Age: not 65+/not reported
Arnberg 2014	Does not separate outcomes for those >65 years.
Banbury 2018	Age: not 65+/not reported
Banbury 2014	Age: not 65+/not reported
Baratloo 2018	Age: not 65+/not reported
Barlow 2007	Does not separate outcomes for those >65 years.
Bashi 2017	Does not separate outcomes for those >65 years.
Basu 2017	Age: not 65+/not reported
Beratarrechea 2014	Age: not 65+/not reported
Berrouiguet 2016	Age: not 65+/not reported
Blackburn 2011	Age: not 65+/not reported
Boksmati 2016	Age: not 65+/not reported
Bolle 2015	No relevant outcomes
Bonet 2017	Age: not 65+/not reported
Boniface 2019	Does not separate outcomes for those >65 years.
Botsis 2008	Does not separate outcomes for those >65 years.
Bowles 2007	Does not separate outcomes for those >65 years.
Brebner 2006	Age: not 65+/not reported
Bunn 2005	Age: not 65+/not reported
Caffery 2016	Age: not 65+/not reported
Carter 2018	Wrong study design
Chaudhry 2007	Age: not 65+/not reported
Chesser 2016	No relevant outcomes
Clark 2018	Full text unavailable
Clark 2007	Does not separate outcomes for those >65 years.
Clarke 2011	Does not separate outcomes for those >65 years.
Crabb 2012	No relevant outcomes
Cruz 2014	Does not separate outcomes for those >65 years.
Cruz 2014 (2)	Does not separate outcomes for those >65 years.
Dang 2009	Does not separate outcomes for those >65 years.
Devi 2011	Does not separate outcomes for those >65 years.
Donker 2015	Age: not 65+/not reported
Donker 2013	Age: not 65+/not reported
du Toit 2017	Age: not 65+/not reported

Durrani 2009	Age: not 65+/not reported
Ekel 2010	Age: not 65+/not reported
Elbert 2014	Age: not 65+/not reported
Fortuin 2016	Protocol
Foster 2014	No relevant outcomes
Garcia-Lizana 2010	Age: not 65+/not reported
Garcia-Lizana 2007	Age: not 65+/not reported
Garg 2016	Age: not 65+/not reported
Goldzweig 2013	Age: not 65+/not reported
Grustam 2014	Does not separate outcomes for those >65 years.
Guo 2017	Age: not 65+/not reported
Gurol-Urganci 2008	Age: not 65+/not reported
Gurol-Urganci 2013	Age: not 65+/not reported
Guy 2011	Does not separate outcomes for those >65 years.
Hakansson 2000	Age: not 65+/not reported
Hall 2015	No relevant outcomes
Hamilton 2018	Does not separate outcomes for those >65 years.
Han 2014	Wrong study design
Hanlon 2017	Age: not 65+/not reported
Hasvold 2011	Age: not 65+/not reported
O. Health Quality 2013	Does not separate outcomes for those >65 years.
O. Health Quality 2019	Does not separate outcomes for those >65 years.
Hedman 2012	Age: not 65+/not reported
Hemlata 2014	Does not separate outcomes for those >65 years.
Holmes 2018	No relevant outcomes
Househ 2014	Age: not 65+/not reported
Howard 2018	Wrong study design
Howren 2014	No relevant outcomes
Inglis 2010	Does not separate outcomes for those >65 years.
Iribarren 2017	Age: not 65+/not reported
Jackson 2016	Age: not 65+/not reported
Jennett 2003	Does not separate outcomes for those >65 years.
Joe 2013	Does not discuss impact on access or cost
Johansen 2012	Does not separate outcomes for those >65 years.
Johansson 2010	Age: not 65+/not reported
Kairy 2009	Does not separate outcomes for those >65 years.
Kaltenthaler 2006	Age: not 65+/not reported
Kaltenthaler 2008	Age: not 65+/not reported
Kampel 2016	No relevant outcomes
Kampmeijer 2016	No relevant outcomes
Kannisto 2014	Age: not 65+/not reported
Kapadia 2015	No relevant outcomes
Khosravi 2016	No relevant outcomes
Kidhol 2017	Age: not 65+/not reported

Klack 2013	Wrong study design
Klersy 2016	Age: not 65+/not reported
Klersy 2009	Does not separate outcomes for those >65 years.
Klersy 2011	Does not separate outcomes for those >65 years.
Kolovos 2018	Age: not 65+/not reported
Krick 2019	Does not separate outcomes for those >65 years.
Kruse 2016	Does not separate outcomes for those >65 years.
Lee 2018	Age: not 65+/not reported
Liu 2016	Does not separate outcomes for those >65 years.
Louis 2013	Does not separate outcomes for those >65 years.
Lu 2018	Does not separate outcomes for those >65 years.
Maric 2009	Age: not 65+/not reported
Massoudi 2019	Age: not 65+/not reported
McCabe 2017	Does not separate outcomes for those >65 years.
McDougall 2018	No relevant outcomes
McLaughlin 2010	Age: not 65+/not reported
McLean 2010	Age: not 65+/not reported
McLean 2011	Age: not 65+/not reported
McLean 2013	Age: not 65+/not reported
Meijer 2017	No relevant outcomes
Melville 2010	Age: not 65+/not reported
Michaud 2018	Age: not 65+/not reported
Mistry 2011	Age: not 65+/not reported
Moffatt 2010	No relevant outcomes
Mold 2015	Does not separate outcomes for those >65 years.
Mold 2012	Protocol
Mold 2018	Age: not 65+/not reported
Moman 2019	Does not separate outcomes for those >65 years.
Moraitou 2017	Wrong study design
Mougalian 2018	Age: not 65+/not reported
Moussa 2017	No relevant outcomes
Muellmann 2016	No relevant outcomes
Munro 2013	Age: not 65+/not reported
Narasimha 2016	Does not separate outcomes for those >65 years.
Oliver 2012	Age: not 65+/not reported
Omboni 2013	Age: not 65+/not reported
Opoku 2017	No relevant outcomes
Ownsworth 2017	Age: not 65+/not reported
Paganini 2018	Does not separate outcomes for those >65 years.
Pandor 2013	Age: not 65+/not reported
Pandor 2013 (2)	Age: not 65+/not reported
Pare 2007	Age: not 65+/not reported
Pare 2013	Wrong study design
Pedone 2015	Age: not 65+/not reported

Pedrozo 2018	No relevant outcomes
Peetoom 2014	No relevant outcomes
Peretz 2016	Does not separate outcomes for those >65 years.
Pfaeffli 2016	No relevant outcomes
Pietrzak 2014	No relevant outcomes
Pinto-Bruno 2016	No relevant outcomes
Polisena 2009	Does not separate outcomes for those >65 years.
Polisena 2010	Does not separate outcomes for those >65 years.
Priya Verma	Full text unavailable
Queiros 2017	Age: not 65+/not reported
Ramos-Rios 2012	No relevant outcomes
Ramprasad 2017	No relevant outcomes
Ramsey 2014	No relevant outcomes
Rathbone 2017	No relevant outcomes
Rawstorn 2016	No relevant outcomes
Reardon 2005	Wrong study design
Reeder 2016	Does not separate outcomes for those >65 years.
Reiners 2019	Does not examine an intervention(s)
Rising 2018	No relevant outcomes
Robotham 2016	Age: not 65+/not reported
Roine 2001	Age: not 65+/not reported
Rush 2018	Does not separate outcomes for those >65 years.
Saleh 2018	No relevant outcomes
Scuffham 2002	Wrong study design (Letter)
Shigekawa 2018	Age: not 65+/not reported
Shuwandy 2019	Age: not 65+/not reported
Sieverink 2017	Age: not 65+/not reported
Sinclair 2015	Does not separate outcomes for those >65 years.
Stefanov 2004	Wrong study design
Stellefson 2013	Does not separate outcomes for those >65 years.
Swartwout 2016	No relevant outcomes
Talal 2019	No relevant outcomes
Tate 2009	Age: not 65+/not reported
Timpano 2013	Wrong study design
Unni 2018	Age: not 65+/not reported
Unverzagt 2016	Does not separate outcomes for those >65 years.
Vallury 2015	Age: not 65+/not reported
van Ballegooijen 2014	Age: not 65+/not reported
van den Berg 2012	No relevant outcomes
Vergara 2018	No relevant outcomes
Verhoeven 2007	Age: not 65+/not reported
Vimalanda 2015	Age: not 65+/not reported
Wade 2010	Age: not 65+/not reported
Walker 2017	No relevant outcomes

Wallace 2012	Age: not 65+/not reported
Walsh 2016	Age: not 65+/not reported
Ward 2015	Age: not 65+/not reported
Wasilewski 2017	Age: not 65+/not reported
Whitten 2002	Age: not 65+/not reported
Winkler 2010	Wrong study design (Commentary)
Yu 2017	No relevant outcomes
Zhao 2017	Age: not 65+/not reported
Zhao 2019	No relevant outcomes

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Email: pru-manager@manchester.ac.uk

Telephone: 0161 306 7797

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