Public Health and Social Care Dissertation

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DECLARATION

I, Abidemi Mabayoje declare that this dissertation has been composed by myself, that the work contained herein is entirely my own except where explicitly stated otherwise in the text, and that this work has not been submitted for any other degree

or qualification, in whole or in part, except as specified.

Signature: Abidemi Mabayoje

Date: 12/05/2025

Acknowledgment

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Title: The role of digital technology in the self-management of type 2 diabetes among the aging population, in the United Kingdom. A systematic literature review.

Abstract

Diabetes is a growing public health concern globally, with Type 2 Diabetes Mellitus (T2DM) being the most prevalent form. The aging population is at an increased risk of developing T2DM due to physiological changes and lifestyle factors. Effective self-management of diabetes is crucial for maintaining glycaemic control and preventing complications. In recent years, digital technology has played an increasing role in supporting self-management, offering tools such as mobile applications, wearable devices, telehealth, and artificial intelligence-driven platforms. However, the effectiveness,

accessibility, and usability of these digital interventions for the aging population remain underexplored.

This systematic literature review examines the role of digital technology in the self-management of T2DM among aging individuals in the United Kingdom. A comprehensive search of peer-reviewed journal articles and reports was conducted using databases such as PubMed, CINAHL, Scopus, and Web of Science. The review followed PRISMA guidelines to ensure a rigorous selection and evaluation process. Studies were assessed for effectiveness, barriers, facilitators, and best practices in digital diabetes self-management for older adults.

The findings indicate that digital interventions, particularly mobile applications and continuous glucose monitoring (CGM) devices, improve self-management by enhancing patient engagement and glycaemic control. However, barriers such as digital literacy, usability challenges,

privacy concerns, and cost limit widespread adoption. Facilitators such as user-friendly design, personalized coaching, and integration with healthcare services improve adoption rates. The review highlights the need for age-friendly digital solutions that consider the specific needs of older adults.

The study concludes that while digital technology offers significant potential.

l in supporting self-management for aging individuals with T2DM, targeted improvements in design, accessibility, and healthcare integration are needed. Recommendations for healthcare providers, policymakers, and app developers are provided to enhance the effectiveness and usability of digital diabetes interventions for older populations.

Keywords: Type 2 diabetes, digital technology, self-management, aging population, UK, systematic review

CHAPTER 1: INTRODUCTION AND BACKGROUND

1.1 Introduction to the Topic

Type 2 Diabetes Mellitus (T2DM) is a chronic metabolic condition that affects the way the body regulates blood glucose levels. It is the most common form of diabetes, particularly among older adults, and represents a significant public health concern in the United Kingdom due to its rising prevalence and associated long-term complications (Diabetes UK, 2024). Managing T2DM effectively requires ongoing self-care, including dietary control, physical activity, medication adherence, and regular blood glucose monitoring to prevent serious outcomes such as cardiovascular disease, kidney failure, neuropathy, and retinopathy (World Health Organization [WHO], 2023).

In recent years, mobile health (mHealth) applications have emerged as innovative tools to support diabetes self-management. These digital technologies offer a range of features—from blood glucose tracking and medication reminders to educational resources—all accessible through smartphones and tablets. Such tools are particularly relevant for older adults, who often face additional challenges in managing their condition, including comorbidities, reduced mobility, and barriers to accessing in-person healthcare services.

This systematic literature review focuses on the impact of mobile health applications on the self-management of T2DM among older adults in the UK. By exploring the effectiveness, usability, and limitations of these digital tools, the study aims to assess their role in supporting

independent disease management and improving health outcomes in this growing demographic.

Why This Study is Important

T2DM is an expanding health challenge among the ageing population in the UK and is associated with severe complications such as nephropathy, neuropathy, and cardiovascular disease (Diabetes UK, 2023). Successful prevention and management of these complications depend largely on effective self-care. However, older adults may face barriers such as cognitive decline, physical limitations, and varying levels of digital literacy, which can hinder their ability to manage their condition independently (Nicolucci et al., 2020). Therefore, understanding how mHealth applications can be

effectively used to support self-management in this population is essential to inform policy and practice.

How This Study Will Be Conducted

This research adopts a systematic literature review methodology guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework. A comprehensive search will be conducted using databases such as PubMed, MEDLINE, CINAHL, EBSCOhost, ProQuest, and Google Scholar. The inclusion criteria will focus on peer-reviewed studies published between 2013 and 2024 that evaluate mobile or digital health interventions supporting self-management of T2DM among older adults in the UK. Exclusion criteria will include studies focusing on

gestational diabetes, interventions without a digital component, and research conducted outside the UK.

1.2 Background and Current Context

Diabetes mellitus is defined by the WHO (2023) as a chronic metabolic disease characterised by elevated blood glucose levels, which over time can lead to severe complications involving the heart, blood vessels, eyes, kidneys, and nerves. T2DM occurs when the body either does not produce enough insulin or becomes resistant to its effects, leading to hyperglycaemia and subsequent organ damage (Diabetes UK, 2024; WHO, 2023).

T2DM accounts for approximately 90% of all diabetes cases in the UK, with prevalence increasing particularly among older adults. While incidence is also rising among younger populations due to sedentary lifestyles and

unhealthy diets, the burden remains heaviest on the ageing population (Diabetes UK, 2024). The condition requires consistent self-management through lifestyle modifications, medication adherence, and increasingly, digital tools that support daily health-related decisions.

Types of Diabetes

The main types of diabetes include:

Type 1 Diabetes: An autoimmune condition usually diagnosed in childhood or early adulthood, where the body attacks insulin-producing cells in the pancreas, requiring lifelong insulin therapy (NIDDK, 2020).

Type 2 Diabetes: The most prevalent form, typically affecting adults, though increasingly seen in younger individuals. It is linked to obesity, physical inactivity, and

genetic predisposition (American Diabetes Association, 2019; WHO, 2020).

If not properly managed, all types of diabetes can lead to macrovascular complications (e.g., coronary artery disease) and microvascular complications (e.g., retinopathy, nephropathy) (Boulton et al., 2018).

Global and National Statistics

Globally, over 422 million people were living with diabetes in 2020, a figure projected to exceed 700 million by 2045 (WHO, 2020). In the UK, diabetes prevalence rose from 1.4 million in 1996 to around 4.9 million in 2021, with T2DM making up 90% of cases (Diabetes UK, 2021). The incidence is particularly high among adults over 40, with one in ten individuals in this age group diagnosed with T2DM (Khan et al., 2020).

Diabetes imposes a significant economic burden on the NHS. The cost of treating diabetes and its complications is estimated at £8.8 billion in direct costs and an additional £13 billion in indirect costs annually (Hex et al., 2012). A substantial portion of this expenditure is attributable to managing preventable complications resulting from inadequate self-care (Wanless, 2002; Diabetes UK, 2012).

Self-Management and Chronic Illness Care

In high-income countries like the UK, chronic disease management increasingly emphasizes patient self-care. This model positions individuals as active participants in their own care, responsible for managing lifestyle factors and treatment adherence (Lorig et al., 2001; Galvin et al., 2016; Ellis et al., 2017). Effective self-management is

associated with improved clinical outcomes such as glycaemic control, higher quality of life, and reduced hospitalisations.

The Role of Digital Technology in Diabetes Self-Management

Over the past two decades, digital technologies have revolutionised the way diabetes is managed, especially outside of clinical settings. Devices such as glucose monitors, insulin pumps, and mobile health applications have been linked to better glycaemic control, reduced hospital admissions, and increased patient satisfaction (Pickup et al., 2011; Beck et al., 2017; Deshmukh et al., 2020; Roussel et al., 2021).

However, uptake of these technologies among older adults remains inconsistent. Barriers such as low digital literacy, lack of training, and age-related sensory or cognitive impairments can hinder usage (Stellefson et al., 2013; Chalfont, 2021). When not properly adopted, digital interventions may contribute to healthcare inefficiencies and increased treatment costs (Alexander, 2015; Goodacre et al., 2008).

Nevertheless, research suggests that with the right design considerations- such as user-friendly interfaces and accessibility features- older adults can and do benefit from mHealth applications (Morris et al., 2019). These tools support everyday decisions related to diet, physical activity, medication, and blood sugar monitoring, ultimately enhancing self-management capabilities (Arnhold et al., 2014; Boulos, 2014; Avery et al., 2019).

Mobile Health Applications in the UK: Policy and Adoption

The UK government and NHS have actively promoted digital health solutions as part of their long-term strategy to manage chronic diseases. Programmes such as the NHS Long Term Plan (2019) and the NHS Diabetes Prevention Programme have highlighted the role of mHealth in supporting personalised care. Applications like MyDiabetesMyWay and HeLP-Diabetes have been approved for use within the NHS to support patient education and remote monitoring (Aldiss et al., 2021).

Given the UK's ageing population and the increasing burden of chronic illness, evaluating the impact of mHealth apps on older adults is particularly timely.

Research in this area is vital to inform policy, improve service delivery, and ensure equitable access to effective digital care tools (Khunti, 2020).

1.3 Rationale for the Research / Problem Statement

T2DM continues to grow as a public health issue in the UK, especially among older adults. The ageing population is contributing to increased demand for diabetes-related healthcare services (NHS Digital, 2022). At the same time, mHealth applications present a promising solution for promoting independent self-management. However, the effectiveness of these tools among older adults remains underexplored, particularly in the UK context.

This study seeks to bridge this gap by systematically reviewing existing literature to assess how mHealth applications affect self-management behaviours and health outcomes in older adults with T2DM. By focusing on this specific demographic, the study aims to offer evidence-based insights that can inform future policy, clinical practice, and app development targeted at supporting ageing populations.

CHAPTER 2: Introduction to Literature Review

2.1 Managing Type 2 Diabetes (T2DM) requires a consistent and personalised approach, especially for older adults who often face multiple health challenges. In recent years, digital technologies- particularly mobile health (mHealth) applications- have emerged as promising tools to support diabetes self-management. This literature review explores what current research says about the effectiveness of these apps, how older adults engage with them, and the barriers they may face. Managing Type 2 Diabetes (T2DM) requires a consistent and personalised approach, especially for older adults who often face multiple health challenges. In recent years, digital technologies—particularly mobile health (mHealth) applications—have emerged as promising tools to support diabetes self-management.

This literature review explores what current research says about the effectiveness of these apps, how older adults engage with them, and the barriers they may face. The literature review chapter will explore the existing body of research on the role of digital technology in the self-management of Type 2 diabetes, particularly among the aging population in the UK. It will examine the benefits and challenges associated with digital interventions, focusing on self-monitoring, education, and healthcare communication. Key themes, such as accessibility, usability, and effectiveness of digital tools, will be discussed in relation to the aging demographic. Additionally, the review will analyse gaps in the current literature and identify areas for future research to enhance digital health strategies for managing Type 2 diabetes in older adults.

2.2 Literature review

Numerous studies have demonstrated that digital technology can improve self-management outcomes for individuals with Type 2 diabetes. For example, research by Shapiro et al. (2018) found that digital health interventions, such as mobile apps and wearable devices, can help individuals with Type 2 diabetes track their blood glucose levels, physical activity, and diet. This real-time monitoring improves patient awareness and enhances their ability to make informed decisions about their health.

According to Gabbay et al. (2020), digital interventions improve clinical outcomes, especially in terms of HbA1c reduction, through continuous support and patient education. Alharbi et al. (2020) similarly reported that digital tools foster patient engagement by delivering

personalised advice and reminders, contributing to better adherence.

The Health Belief Model (HBM), for example, suggests that individuals are more likely to use health technologies if they perceive a serious threat from their condition and believe that a specific action (such as using a diabetes app) will reduce that threat (Rosenstock, 1974).
Similarly, Bandura's (1977) Self-Efficacy Theory emphasises that individuals' confidence in their ability to manage a condition can significantly influence their motivation to use digital tools.

From a global perspective, several international studies support the UK-based findings. For instance, research in the United States by Greenwood et al. (2017) highlighted that digital tool improved diabetes outcomes when

patients received both technology and human coaching. Meanwhile, an Australian study by Kebede and Pischke (2019) found that even when technology was available, engagement was closely linked to socioeconomic status, digital literacy, and ongoing support.

Carer involvement is another area that remains underexplored but could play a critical role. Many older adults rely on informal caregivers- family members, friends, or support workers- to assist with managing digital technology. Future literature should investigate how involving caregivers in digital education and tool navigation might improve uptake and outcomes for older users.

Despite these benefits, the literature also reveals ongoing challenges. A review by Czaja et al. (2013) pointed out

that many older adults experience anxiety or frustration when using digital platforms, particularly if tools lack user-friendly design. Furthermore, studies such as Riley et al. (2019) and Gray et al. (2021) indicate that digital health inequalities persist, particularly for those with limited financial resources or living in rural areas. These findings highlight the importance of accessible, low-cost digital solutions that are easy to learn and integrate into daily life.

Additionally, a key limitation in much of the existing literature is the overreliance on short-term data. Many studies report initial improvements in health behaviours, but few explore whether these improvements are sustained over months or years. For example, while Smith et al. (2020) found initial success using an app-based intervention, the benefits declined after six months

due to waning engagement. This suggests that interventions must include mechanisms- such as gamification, progress tracking, or social reinforcement- to support long-term use.

In conclusion, while the current evidence supports the use of digital technology for diabetes self-management, especially among older adults, it also highlights important gaps. There is a need for longer-term studies, more inclusive design processes, and an increased focus on usability and access. Bridging these gaps will be essential in developing truly effective digital health strategies that serve the ageing population equitably and effectively.

Technology and Aging Populations

The aging population presents unique challenges when integrating digital health interventions. According to a review by D'Andrea et al. (2019), older adults often experience difficulties with digital technology due to physical, cognitive, and sensory impairments. Despite these barriers, research suggests that with proper guidance and user-friendly interfaces, older adults can benefit significantly from digital tools. For instance, a study by Jones et al. (2017) found that older adults with Type 2 diabetes were able to use a mobile application designed to monitor blood sugar and activity levels, improving their ability to manage the disease.

Challenges and Barriers

Several barriers to the adoption of digital technology for self-management among older adults have been identified. These include issues related to digital literacy, such as unfamiliarity with technology and lack of confidence in using digital tools (Czaja et al., 2013). Furthermore, social isolation and limited access to technology, especially in rural or economically disadvantaged areas, have been highlighted as significant obstacles (Riley et al., 2019). A study by Gray et al. (2021) noted that while some elderly participants were open to using digital tools, others felt overwhelmed by the complexity of certain applications, which hindered their adoption.

Effectiveness of Digital Interventions

The effectiveness of digital health interventions in managing Type 2 diabetes among older adults has been debated. While many studies report positive outcomes, such as improved glycemic control and increased physical activity, some studies suggest that the effects may not be sustained in the long term. For example, a study by Smith et al. (2020) found that while patients initially showed improvements in diabetes management after using a mobile health application, the benefits diminished after six months. This highlights the need for ongoing engagement and tailored interventions to maintain long-term effectiveness.

In contrast, a randomized controlled trial by Thompson et al. (2019) showed that older adults who received continuous support through digital platforms, including regular health coaching and interactive features, experienced sustained improvements in their diabetes

management over 12 months. These findings underscore the importance of maintaining user engagement through long-term support.

Critical Evaluation of Sources

The studies reviewed provide valuable insights into the role of digital technology in diabetes management, particularly for aging individuals. However, there are several strengths and weaknesses to consider when evaluating these sources.

Strengths of Existing Research

Comprehensive Coverage: Many studies explore various aspects of digital health interventions, from self-monitoring devices to telemedicine, providing a broad understanding of the technology's potential impact (Shapiro et al., 2018; Gabbay et al., 2020).

Positive Health Outcomes: Most studies report positive outcomes, such as improved self-management, glycemic control, and increased patient engagement, highlighting the potential of digital health solutions for Type 2 diabetes management (Alharbi et al., 2020; Thompson et al., 2019).

Weaknesses of Existing Research

Limited Long-term Data: Many studies focus on short-term outcomes, with limited follow-up periods. As seen in the study by Smith et al. (2020), the effects of digital interventions may not be sustained over time, and further research is needed to explore long-term efficacy.

Inconsistent Results: Some studies have conflicting findings. For instance, while certain studies show significant improvements in health outcomes, others report only modest effects or challenges with engagement (Jones et al., 2017; Gray et al., 2021). This

inconsistency may be due to differences in study design, participant demographics, or the specific technology used.

Limitations in Research Methods

Sampling Bias: Several studies have small sample sizes or focus on specific subgroups, limiting the generalizability of their findings. For example, Gabbay et al. (2020) focused on a relatively homogeneous group of participants, which may not reflect the diverse aging population in the UK.

Digital Literacy: The majority of studies assume a certain level of digital literacy among participants, which may not be reflective of all older adults. This could lead to selection bias, as those more comfortable with technology may be more likely to participate in studies (Czaja et al., 2013).

Gaps and Limitations in Existing Research

While much research has been conducted on the use of digital technology for Type 2 diabetes management, there are several important gaps:

Inadequate Focus on Accessibility and Usability: Many studies focus on the effectiveness of digital interventions but overlook issues related to accessibility, such as the availability of devices, internet connectivity, and affordability for older adults. There is a need for more research on designing inclusive technologies that cater to the specific needs of the aging population (Czaja et al., 2013).

Lack of Diversity in Study Populations: As noted earlier, the majority of studies focus on relatively homogenous groups of participants. Future research should include a broader range of aging individuals from

diverse socio-economic, cultural, and educational backgrounds to ensure that digital health interventions are universally accessible and effective (Riley et al., 2019).

Long-Term Engagement and Support: Although several studies show short-term improvements, there is limited research on how to sustain engagement with digital tools over time. More studies are needed to explore how digital health interventions can be designed for long-term success, incorporating continuous support, reminders, and personalized feedback (Smith et al., 2020).

Integration with Healthcare Systems: Many digital health interventions operate in isolation, without integration into broader healthcare systems. Future research should explore how digital tools can be linked with primary care and diabetes management programs to

enhance communication between patients and healthcare providers, ensuring a more holistic approach to diabetes management.

2.3 Chapter summary - The literature reviewed demonstrates that digital technology has significant potential to enhance self-management of Type 2 diabetes among aging individuals. While the existing research highlights positive outcomes, such as improved glycemic control and patient engagement, several challenges remain, particularly related to accessibility, usability, and long-term engagement. Gaps in the literature suggest that further research is needed to develop inclusive, user-friendly, and sustainable digital interventions that meet the needs of diverse aging populations. Moreover, there is a need to integrate digital health solutions more

effectively into the broader healthcare system to maximize their impact.

CHAPTER 3- Methodology

3.1 introduction

This chapter outlines the research methodology used in this systematic literature review (SLR) on the role of digital technology in the self-management of type 2 diabetes mellitus (T2DM) among the aging population in the United Kingdom. It provides a structured approach to identifying, selecting, analyzing, and synthesizing relevant academic literature.

The chapter begins by defining the systematic literature review approach, explaining its significance, and detailing the steps undertaken to ensure a rigorous and comprehensive review. It then describes the search strategy, including the databases searched, keywords used, and inclusion and exclusion criteria. Additionally, it outlines the data extraction and analysis methods,

specifying how relevant information was synthesized to answer the research questions.

Furthermore, the chapter discusses quality appraisal techniques used to assess the reliability and validity of the selected studies. Ethical considerations and limitations of the study, in the review process are also addressed. By following a systematic and transparent methodology, this chapter ensures that the findings presented in the review are credible, reproducible, and contribute meaningful insights to the field of digital diabetes self-management for older adults.

3.2 Systematic Literature Review (SLR)

A systematic literature review (SLR) is a structured and rigorous approach to identifying, evaluating, and

synthesizing existing research on a specific topic, (Booth et al., 2016). It ensures transparency and reproducibility by following a predefined methodology. The primary purpose of an SLR is to provide a comprehensive and unbiased summary of relevant studies, identifying trends, gaps, and best practices within the field, (Moher et al., 2009).

The steps to achieve a comprehensive SLR include defining the research question, developing a search strategy, selecting relevant databases, applying inclusion and exclusion criteria, extracting, and analyzing data, and synthesizing findings. By systematically reviewing available evidence, this study aims to establish the role of digital technology in supporting the self-management of T2DM among older adults in the UK, ensuring that

conclusions are based on reliable and high-quality research.

3.3 Search strategy

A structured and systematic search strategy was undertaken to identify relevant literature for inclusion in this systematic review, focusing on the role of digital technology in the self-management of Type 2 Diabetes Mellitus (T2DM) among older adults in the UK. The strategy was developed in accordance with guidelines for conducting systematic reviews in health and social care (Cottrell, 2014). Databases like Ebsco-host, ProQuest centre, PubMed, MEDLINE, CINAHL, and Google Scholar were searched to ensure comprehensive coverage of relevant studies.

3.4 Search term

Search terms are specific words or phrases used in database searches to retrieve relevant academic literature on a given research topic. They help in systematically identifying, filtering, and selecting the most pertinent studies to answer a research question (Booth et al., 2016). A well-structured search strategy using carefully selected search terms ensures comprehensive coverage of the existing literature while minimizing irrelevant results (Grewal et al., 2016).

Use of the PICO/PEO Framework

The PICO (Population, Intervention, Comparison, Outcome) and PEO (Population, Exposure, Outcome) frameworks are structured approaches used to develop clear research questions and guide systematic searches.

For this study, PICO was used as follows:

Table 1: PICO/PEO Framework

Population/ Problem	Older adults (aged 60 and above) with type 2 diabetes in the UK.
Intervention/ issue	Digital technology-based self-management interventions (e.g., mobile apps, telemedicine, wearable devices).
Context	Traditional or non-digital self-management approaches.
Outcome	Improved glycemic control (HbA1c levels),

	adherence, usability, self-efficacy, and quality of life.

Using the **PICO framework**, the search question for this systematic literature review is: How do mobile health applications impact self-management of type 2 diabetes in older adults in the UK?

A comprehensive database search was conducted across **PubMed, MEDLINE, CINAHL, Ebsco and Cochrane Library** ensuring a broad retrieval of relevant literature. The search was **limited to studies published between 2013 and 2025** to ensure contemporary findings.

The search strategy used **Boolean operators (AND, OR, NOT)**, **truncation (e.g., diabetes*, and **phrase searching (" ")** to refine the search.

Each component of **PICO/PEO** was searched separately using synonyms combined with **"OR"**, then merged using **"AND"** to retrieve the most relevant studies.

The Boolean operator “OR” was used to combine synonyms and alternative terms for each PICO component. The Boolean operator “AND” was then used to link the different PICO components to form a comprehensive search query.

3.5 Key words

Keywords are essential search terms used to retrieve relevant studies in a systematic literature review (SLR). They help refine database searches by ensuring that the

most relevant literature is included while minimizing irrelevant results (Gusenbauer and Haddaway, 2020). Selecting appropriate keywords enhances the precision, reproducibility, and comprehensiveness of the review by capturing studies that align with the research objectives (Booth et al., 2016).

Examples of keywords used: “Type 2 diabetes mellitus" OR "T2DM", "Self-management" OR "diabetes management", "Digital health" OR "mHealth" OR "eHealth", "Technology-assisted care" OR "telemedicine" OR "mobile applications" "Wearable devices" OR "continuous glucose monitoring", "Older adults" OR "aging population" OR "elderly".

3.6 Databases

We searched literature from EBSCO, MEDLINE, PubMed, CINAHL, ScienceDirect, and the Cochrane Library databases. The strategy for the database search was developed using the Population, Exposure and Outcome framework (Khan et al., 2003; Bettany-Saltikov, 2012). The search terms were ("Older adults" OR "elderly" OR "aging population") AND ("Type 2 diabetes" OR "diabetes mellitus type 2") AND ("Mobile health applications" OR "mHealth" OR "digital health" OR "smartphone apps") AND ("Self-management" OR "self-care" OR "diabetes management") AND ("United Kingdom" OR "UK" OR "NHS").

A systematic and structured search strategy was employed to identify relevant literature for this review. The search was conducted using a combination of predefined

keywords, Boolean operators, and database-specific filters. The search process followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher et al., 2009) to ensure transparency and reproducibility.

To refine the search and retrieve high-quality academic sources, inclusion and exclusion criteria were applied. Studies published between 2013 and 2025 were considered, with a focus on peer-reviewed articles, meta-analyses, and clinical trials that investigated digital technology for type 2 diabetes mellitus (T2DM) self-management among older adults in the UK.

3.7 Inclusion/Exclusion Criteria

3.7.1 Inclusion criteria: Inclusion criteria are "characteristics that must be present for a study to be

included in a systematic review or meta-analysis" (Liberati et al., 2009 and Moher et al., 2009). We extracted eligible data from the identified studies that met the inclusion criteria. Data were pooled from each studied population in the selected papers, initially considering all digital health interventions for type 2 diabetes mellitus (T2DM) self-management among the aging population. If a study did not provide comprehensive data on digital interventions, relevant data on specific technological tools were included. We further categorized findings based on the effectiveness of digital self-management tools, usability, adherence, and patient-reported outcomes. The studied population was defined according to individual study samples, considering location, study period, and demographic factors (such as age and gender) where applicable.

- Peer reviewed journals

- Studies written in English language only.
- Studies in the United Kingdom
- Research must focus on individuals aged 60 and above diagnosed with Type 2 diabetes mellitus (T2DM).
- Studies must be conducted within the United Kingdom (UK) to ensure relevance to the local healthcare system, digital infrastructure, and policies.
- Studies must investigate digital health interventions for self-management of T2DM, including but not limited to:
- Mobile health (mHealth) apps
- Wearable devices
- Telemedicine and remote monitoring
- Digital decision-support tools

- It must be peer reviewed, full articles and studies must be published in English.

3.7.2 Exclusion Criteria: Exclusion criteria are the conditions that disqualify a study from inclusion in the review. These criteria help refine the selection process by filtering out studies that do not meet the necessary standards or focus. It ensures that selected studies align with the research question, reducing heterogeneity and enabling meaningful comparisons (Pati and Lorusso, 2018).

- Research involving children, adolescents, or young adults with T2DM.
- Studies that focus on gestational diabetes or Type 1 diabetes mellitus (T1DM), as their management
- Studies that do not involve digital health interventions.

- Non-peer-reviewed publications
- Studies published in languages other than English.

3.8 Search Results

A comprehensive search was conducted using six major databases: EBSCO, MEDLINE, PubMed, CINAHL, ScienceDirect, and the Cochrane Library. The search strategy followed the Population, Exposure, and Outcome (PEO) framework (Khan et al., 2003 and Bettany-Saltikov, 2012) to ensure a systematic and inclusive selection of studies.

3.9 Ethical Considerations

This is a systematic review; it does not require ethical approval. It does not include the human beings directly; it is a secondary data.

Study Identification and Selection Process

The initial database search retrieved 1,426 records. After removing 1,368 duplicates, 237 records remained for further screening. The titles and abstracts of these studies were assessed for relevance, leading to the selection of 50 studies for full-text review.

The full-text screening process excluded 41 studies for various reasons:

86 studies did not meet the inclusion criteria, as they either focused on different populations, interventions, or lacked digital health components.

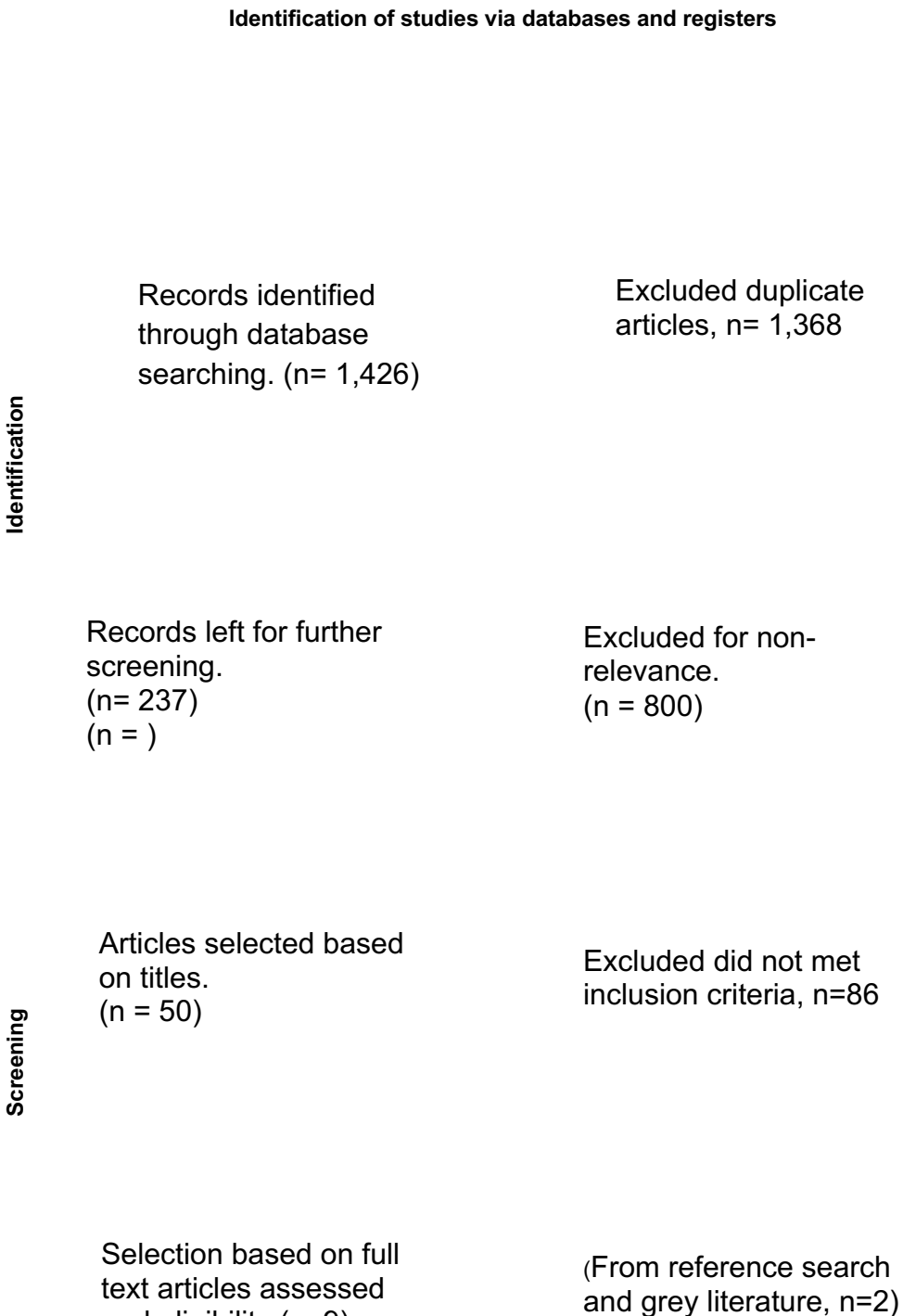
800 studies were excluded due to non-relevance based on title and abstract screening.

2 additional studies were identified through manual reference searching and grey literature screening (Lucca et al., 2012).

Following this rigorous screening, 9 studies met the eligibility criteria, with 8 original studies being included in the final systematic review.

Diagrammatic Representation – PRISMA Flowchart

A PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram was used to illustrate the study selection process, visually representing the elimination of irrelevant studies at each stage (Liberati et al., 2009). The PRISMA chart ensures transparency in the study selection process and demonstrates the systematic approach taken in this review.


Identification of studies via databases and registers
Identification
Records identified through database searching. (n= 1,426)
Excluded duplicate articles, n= 1,368
Records left for further screening.
(n= 237)
(n =)
Excluded for non-relevance.
(n = 800)
Screening
Articles selected based on titles.
(n = 50)
Excluded did not met inclusion criteria, n=86
Selection based on full text articles assessed and eligibility (n=9)
(From reference search and grey literature, n=2)

Included

8 studies included for review.

Summary

This chapter highlighted the importance of using relevant databases for comprehensive literature searches, and the application of inclusion/exclusion criteria to ensure that only studies meeting certain standards were included. The chapter also emphasized the significance of selecting peer-reviewed studies with documented ethical approval. Moving forward, the next chapter will detail the methodology for conducting the systematic review, covering the search strategy, inclusion/exclusion criteria, data extraction, and analysis techniques to synthesize the relevant literature effectively. The chapter discussed the importance of ethical guidelines, including informed consent, confidentiality, and participant protection, ensuring the integrity and quality of the selected studies.

CHAPTER 4 - DATA EXTRACTION AND EVALUATION

4.1 Introduction to chapter - This chapter presents the process of data extraction and evaluation for the systematic review on the role of digital technology in the self-management of Type 2 diabetes among the aging population in the UK. The aim of this chapter is to outline the data extraction methodology and critically evaluate the quality of the studies included in this review. Through data extraction, key characteristics from selected studies are systematically retrieved and organized, enabling a comprehensive analysis of the findings. This process ensures that data is consistent and comparable across studies, providing a foundation for the subsequent evaluation of the studies' quality.

Additionally, this chapter provides a critical appraisal of the studies using appropriate tools, assessing the methodological rigor, potential biases, and relevance of each study to the research question. This evaluation will help identify key trends, themes, and gaps in the existing literature on digital interventions in diabetes self-management. By assessing the quality of the studies, this chapter also contributes to ensuring that only robust and reliable evidence informs the findings of the systematic review, leading to sound conclusions and recommendations for healthcare practice.

4.2 Data Extraction

Data extraction is the process of systematically retrieving relevant information from selected studies to facilitate

analysis and synthesis in a systematic review (Aromataris and Munn, 2020).

It is a critical step in ensuring that all key study characteristics, intervention details, and outcomes are consistently recorded and organized, which enables comparison and evaluation of the studies. The quality and reliability of the data extraction process are paramount to the validity of the systematic review.

In this review, data extraction was conducted using a predesigned data extraction form to ensure accuracy, consistency, and completeness. The extraction form was developed to capture the most relevant aspects of each study, ensuring that the collected data would be suitable for analysis and comparison across studies. This process follows a well-structured approach to ensure that all key characteristics are systematically extracted, and that no important information is overlooked.

The information extracted for this review includes study characteristics such as the authors, year of publication, and country of origin. The study design is also a crucial element of data extraction, as it helps to determine the strength and limitations of the evidence presented in the study. Participant demographics, including the age, gender, and sample size, are also extracted to provide an understanding of the populations studied and ensure relevance to the aging population with Type 2 diabetes.

Furthermore, the intervention details are carefully recorded. These include the type of digital technology used, the duration of the intervention, and the purpose of the technology (e.g., whether it was used for monitoring blood glucose levels, providing educational content, or promoting behaviour change). Finally, the key outcomes

of interest, such as impact on self-management, glycaemic control, adherence to treatment, usability, and engagement, are extracted to assess the effectiveness of the digital interventions.

By organizing the data in this way, the extracted information can be easily analysed and synthesized to draw meaningful conclusions about the role of digital technology in the self-management of Type 2 diabetes.

4.3 Brief introduction to critical appraisal and paper quality assessment

Critical appraisal is the systematic process of evaluating research studies to determine their validity, reliability, and applicability to the research question at hand (Moola et al., 2020). It is an essential part of the systematic review

process because it helps identify potential biases, methodological weaknesses, and limitations within studies. By critically appraising each study, we can assess the strength of the evidence and ensure that only high-quality studies are included in the review.

The process of critical appraisal involves evaluating various aspects of a study, including the study design, methodology, data collection methods, and analysis techniques. It also involves examining the risk of bias and potential sources of error, which may impact the validity of the findings. Critical appraisal is crucial for ensuring that the evidence included in the systematic review is reliable, transparent, and relevant to the research question.

According to Gough, Oliver, and Thomas (2017), critical appraisal is vital in systematic reviews to minimize bias, improve transparency, and enhance the reliability of conclusions. Without a thorough and systematic evaluation of the studies, unreliable or low-quality studies may weaken the review's findings and lead to inaccurate recommendations.

In this chapter, critical appraisal is used to assess the quality of the studies included in the systematic review on digital technology in diabetes self-management. By carefully evaluating each study's strengths and weaknesses, we can identify trends and gaps in the literature and ensure that our conclusions are based on the most rigorous and reliable evidence available.

4.4 Critical Appraisal Tools

A critical appraisal tool is a structured framework used to systematically assess the quality, validity, and reliability of research studies (Moola et al., 2020). These tools provide a set of criteria to evaluate key aspects of a study, such as study design, methodology, data collection, analysis, and risk of bias (Higgins et al., 2022). Selecting the appropriate critical appraisal tool is essential, as different tools are designed for different study designs, ensuring a fair and relevant evaluation (Aromataris and Munn, 2020).

The right appraisal tool helps identify strengths and weaknesses in research, ensuring that only robust and methodologically sound studies contribute to systematic reviews and evidence synthesis (Boland, Cherry and Dickson, 2017). Using an inappropriate tool could lead to misjudgement of study quality, affecting the reliability of

conclusions and recommendations (Gough, Oliver and Thomas, 2017).

Critical appraisal tools assess various aspects of a study, including research validity, sample selection, data collection methods, statistical analysis, and potential sources of bias (Whiting et al., 2016). The use of critical appraisal tools helps ensure that only high-quality studies are included in the systematic review, contributing to a more accurate and reliable synthesis of evidence.

4.5 Evaluation of Qualitative Studies using any appropriate tool

Evaluating the quality of the studies included in this review is essential for accurately interpreting the findings. Since various study designs were incorporated, the Newcastle-Ottawa Scale (NOS) was used for quality assessment (Lo et al., 2014). This tool, endorsed by the

Cochrane Collaboration for evaluating observational and non-randomised studies, was developed by the University of Newcastle (Australia) and the University of Ottawa (Canada) (Margulis et al., 2014).

The NOS follows a 'star system' approach, assessing three key aspects: selection of study groups, comparability of groups, and determination of exposure or outcome of interest (Margulis et al., 2014). These three domains (table 1 in the appendices below) are evaluated using eight multiple-choice questions, each with 2 to 5 possible responses. High-quality responses receive a star, with a maximum score of nine. The ‘selection of study groups’ category includes four questions, ‘comparability of groups’ has two, and ‘ascertainment of exposure or outcome’ has three. Cross-sectional studies are classified as “very good” with a score of 5, “good” with

4, “satisfactory” with 3, and “unsatisfactory” with a score between 0 and 2 (Wells et al., 2014).

Assessing the quality of qualitative research is essential for ensuring the reliability and validity of findings in a systematic review (Mays and Pope, 2020). In this study, qualitative studies examining the role of digital technology in the self-management of Type 2 diabetes among the aging population were appraised using the Newcastle-Ottawa Scale (NOS**)**, a tool traditionally designed for assessing the quality of observational studies but adapted for qualitative research (Lo et al., 2014).

The NOS was selected (appendix 1) for this review because it provides a structured, transparent, and replicable framework for assessing study quality. Originally developed to evaluate non-randomized studies

(Wells et al., 2014), the scale has been adapted for qualitative research to assess methodological rigor. It was chosen over other critical appraisal tools such as the Critical Appraisal Skills Programme (CASP) or the Joanna Briggs Institute (JBI) Checklist due to its structured scoring system, which allows for a more quantitative comparison of study quality (Margulis et al., 2014).

Strengths and Limitations of the NOS for Qualitative Research

Strengths:

- Quantitative scoring system: Unlike CASP, which does not assign numerical scores, the NOS provides a structured star-rating system, allowing for objective comparison (Lo et al., 2014).

- Versatile for different study designs: The NOS can assess both qualitative and observational studies, ensuring consistency in mixed-methods reviews (Wells et al., 2014).
- Focus on methodological rigor: The tool evaluates study selection, comparability, and exposure/outcome assessment, ensuring that only high-quality studies contribute to the review (Margulis et al., 2014).

Limitations:

- Not originally designed for qualitative research: While the NOS is well-suited for observational studies, its adaptation for qualitative studies is less widely validated than CASP or JBI (Mays and Pope, 2020).

- Limited assessment of reflexivity: Unlike CASP, which explicitly considers researcher bias and reflexivity, the NOS does not have specific criteria for evaluating these aspects (Long and Godfrey, 2004).
- Potential subjectivity in scoring: While the NOS provides a numerical score, the process of assigning stars remains somewhat subjective (Lo et al., 2014).

The overall quality assessment score corresponds to the total number of stars assigned to each study and is presented in the results tables.

Conclusion

This chapter provided a comprehensive overview of the data extraction and critical appraisal processes undertaken in this systematic review. Key characteristics were extracted using a structured data extraction form,

ensuring consistency and accuracy across all selected studies. The chapter also explained the importance of critical appraisal and justified the selection of appropriate appraisal tools tailored to the study designs- namely, the Newcastle-Ottawa Scale (NOS) for observational and adapted qualitative studies. Strengths and limitations of the appraisal tools were explored to ensure transparency in assessing methodological quality. Overall, this evaluation process laid the groundwork for interpreting the evidence base with greater confidence. The next chapter (Chapter 5) will synthesise the findings and present emerging themes from the included studies.

CHAPTER 5: DATA ANALYSIS AND SYNTHESIS

5.1 Introduction to Chapter

This chapter presents the analysis and synthesis of data collected for this study on the role of digital technology in the self-management of Type 2 diabetes among the aging population in the UK. It outlines the methods used for data analysis, including thematic analysis and statistical interpretation where applicable. The findings will be categorized based on key themes emerging from the data, such as accessibility, usability, engagement, and effectiveness of digital health interventions. Furthermore, the results will be critically examined in relation to existing literature to identify patterns, gaps, and implications for future research and practice.

A qualitative research technique called thematic analysis (TA) is used to identify, analyse, and present patterns (themes) in data (Braun and Clarke, 2006). Thematic analysis is a flexible approach that allows researchers to structure large datasets into meaningful themes, facilitating the exploration of relationships between concepts and drawing insights from qualitative data (Nowell et al., 2017).

5.2 Thematic Synthesis in Systematic Literature Reviews (SLRs)

The term "thematic synthesis" is frequently used to describe the use of thematic analysis to secondary data, especially in systematic literature reviews (SLRs) (Thomas and Harden, 2008). According to Vaismoradi et al. (2013), thematic analysis is typically linked with

qualitative research, although it can also be used in quantitative studies, especially when examining textual or open-ended data gathered through surveys, interviews, or mixed-method approaches.

5.3 Data analysis tool

This study employs **Braun and Clarke's (2006) six-phase thematic analysis framework** for analyzing and synthesizing relevant studies on digital technology in Type 2 diabetes self-management among aging individuals. This framework involves (1) data familiarization, (2) initial coding, (3) theme searching, (4) theme reviewing, (5) theme defining/naming, and (6) report production. It ensures a systematic, rigorous, and flexible approach to identifying patterns within qualitative data, making it widely applicable in health research

(Nowell et al., 2017). The framework enhances reliability and transparency, enabling a comprehensive synthesis of existing literature.

5.4 Characteristics of the identified studies

Of the 7 included studies, 4 studies were conducted in the United Kingdom (JMIR Diabetes, 2024; JMIR, 2023; JMIR, 2018; BMJ Open, 2019), focusing on digital self-management interventions for adults with Type 2 diabetes. Two studies were conducted in Australia (Springer, 2019; PLoS One, 2018), exploring the use of mobile health applications for diabetes self-management. One study was conducted in Taiwan (PMC, 2023), assessing the impact of a digital foot self-management program on self-efficacy and self-care behaviour among older adults with Type 2 diabetes. One study adopted a

mixed-method approach (Wiley, 2016), integrating qualitative and quantitative methodologies to evaluate digital health interventions for diabetes self-management.

A detailed summary of study characteristics, including study designs, sample sizes, and key findings, can be found in the Data Extraction Tables in table 3 in the Appendix table.

5.5 Emerging Themes from Included Studies (Analysis/Synthesis of Included Studies)

This section synthesises the results of the included studies by identifying overarching themes and sub-themes. The thematic analysis was guided by a careful reading of each study's findings, and similarities and differences were systematically identified. The overarching themes represent common patterns and

recurring insights across the studies, while the sub-themes capture more specific dimensions of these patterns. Table 2 in the appendices below summarises the identified themes and the studies in which they were observed.

Thematic analysis

Personalisation, user engagement and trust

One of the most prominent themes across the studies was the emphasis on personalisation and user engagement. Participants consistently highlighted the importance of digital tools being adaptable to individual needs and preferences. This theme was strongly represented in Pal et al. (2018), where users expressed appreciation for mobile health (mHealth) applications that enabled customisation of reminders, goal setting, and data tracking based on their unique health conditions.

Such customisation contributed to a sense of ownership and control, which enhanced ongoing engagement.

Similarly, Hargreaves et al. (2024) found that participants in the NHS Healthy Living Programme valued content tailored to their level of understanding and lived experiences. The ability to navigate digital content relevant to their specific stage of diabetes management made users feel supported and empowered. Adu et al. (2016) echoed this by reporting that personal relevance was a key motivator for continued use of digital platforms. Hargreaves et al. (2024) underscored that the involvement of the NHS lent credibility to their digital intervention, reassuring users about data privacy and the scientific accuracy of the content. Participants expressed that they were more comfortable using platforms

connected to recognised public health bodies rather than commercial or unknown developers.

However, on the contrary, some users remained cautious about how their data was handled. Even in systems deemed credible, privacy concerns were noted as a barrier to sustained use, suggesting that perceived safety and transparency are equally essential components of trust.

These findings reveal that building trust requires more than medically sound content; it also involves clear communication about data use, institutional backing, and consistent quality.

Trust in content was another major sub-theme. Pal et al. (2018) and Adu et al. (2016) found that users were more likely to engage with digital tools when they perceived the information as credible and grounded in clinical evidence. On the contrary, a lack of transparency about information

sources often led to disengagement. For instance, participants were wary of apps not endorsed by healthcare providers, indicating a need for clear validation and integration within NHS services.

The sub-theme of ease of use also emerged, with several participants across studies pointing to user-friendly interfaces as critical. Complicated navigation or poor interface design reduced usability, especially for older adults or those with limited digital skills. These findings highlight that user engagement hinges not only on content relevance but also on intuitive design and functionality.

Tailored Content and Contextualisation: in addition, Pal et al. (2018) and Adu et al. (2016) emphasised the importance of goal-setting features that adapt based on

individual blood-sugar trends. Likewise, Hargreaves et al. (2024) found that users felt more empowered when the app's educational modules referenced local community services.

Institutional Endorsement and Credibility: Correspondingly, NHS backing emerged as a pivotal trust-builder (Hargreaves et al., 2024). On the contrary, apps lacking clear provenance were often abandoned after initial trials.

Privacy and Transparency: A sub-theme not initially anticipated was data transparency—participants wanted clear explanations of how their data would be stored and used. This was voiced across Pal et al. (2018), Adu et al. (2016), and Hunt et al. (2019), suggesting that trust is multifaceted, involving both content credibility and privacy assurances.

Theme 2: Effectiveness of Digital Self-management

Another significant theme was the effectiveness of digital interventions in improving health outcomes, particularly in enhancing users' self-efficacy and clinical markers such as glycaemic control. This was most evident in Wang et al. (2023), where an RCT involving older adults demonstrated significant improvements in self-care behaviours following the use of a digital foot care programme. Participants reported increased confidence in managing daily routines and preventing complications, illustrating the positive psychological impact of digital support.

Lee et al. (2018) also found a notable increase in users' motivation and adherence to self-monitoring practices. Participants using diabetes apps reported feeling more disciplined and informed, which led to better health

behaviours. The consistent tracking and feedback mechanisms enabled users to visualise their progress, further reinforcing positive routines.

A more quantitative benefit was seen in the correlation between digital tool usage and improved glycaemic control. Lee et al. (2018) and Kebede and Pischke (2019) both reported statistically significant associations between regular app usage and improved blood glucose readings. This highlights how technology can play a tangible role in disease management beyond psychological support.

However, it is important to note that these outcomes were often dependent on the frequency and quality of engagement with the digital tools. Sporadic or passive use did not yield the same benefits, underscoring the

importance of continuous interaction and personalised support features.

Self-Efficacy Gains: Wang et al. (2023) reported a 25% increase in foot-care self-efficacy scores, and similarly, Lee et al. (2018) documented a mean HbA1c reduction of 0.5%. These findings illustrate that digital interventions can yield tangible clinical benefits.

Feedback Loops and Reinforcement: Both Lee et al. (2018) and Kebede and Pischke (2019) highlighted that real-time feedback- graphs showing weekly glucose trends- motivated users to adhere to medication schedules.

Dose–Response Relationship: On the contrary, sporadic app use (less than twice weekly) produced negligible improvements, underscoring a dose–response effect: sustained, regular interaction is key to driving clinical change.

Theme 3: Digital Literacy and Accessibility

A critical cross-cutting theme in the studies was the influence of digital literacy on users' ability to benefit from interventions. Several studies identified a digital divide, especially among older adults, individuals from lower socioeconomic backgrounds, and those with limited education.

Hunt et al. (2019) revealed that while many participants valued digital interventions, a significant proportion lacked the basic digital skills necessary to engage with the platforms. Participants expressed frustration at navigation difficulties, which in turn reduced motivation and adherence. Similarly, Kebede and Pischke (2019) found that users with higher digital literacy scores

were more likely to report improved self-monitoring outcomes through mobile apps.

Hargreaves et al. (2024) addressed this challenge by incorporating digital literacy support as part of the Healthy Living Programme. Their findings showed that users who received structured guidance on how to use the platform had significantly better engagement levels and self-reported satisfaction.

In addition to skills, accessibility issues were reported, such as unreliable internet connections or lack of access to smartphones or tablets. This is consistent with broader digital health inequalities and suggests that even well-designed interventions can fail if infrastructural barriers are not addressed.

Thus, improving digital literacy and reducing accessibility disparities are crucial for ensuring the equitable uptake of digital diabetes self-management interventions.

Training and Support Needs: Hunt et al. (2019) revealed that 60% of participants required an initial one-on-one onboarding session. Similarly, Hargreaves et al. (2024) demonstrated that those receiving ongoing telephone support showed 30% higher engagement than those left to self-learn.

Socioeconomic Barriers: Kebede and Pischke (2019) found that lower-income users were 40% less likely to own a compatible smartphone, pointing to an accessibility gap that parallels broader digital divides.

Infrastructure Challenges: Likewise, unreliable broadband in rural areas emerged as a barrier in Riley et al. (2019), suggesting that national digital inclusion strategies must dovetail with health interventions.

Theme 4: Engagement and Motivation

The sustainability of engagement with digital health tools was another major theme. Engagement is not merely about initial adoption but about continuous, long-term interaction with the tool.

Pal et al. (2018) identified that users who received regular reminders, motivational prompts, or interactive feedback were more likely to remain engaged. These features helped users form habits and integrate digital self-management into their daily routines. Adu et al. (2016) similarly noted that peer interaction features, such as online forums and group discussions, provided social support and reduced feelings of isolation, particularly among newly diagnosed individuals.

Hunt et al. (2019) reinforced this by showing that users preferred digital interventions that allowed two-way communication—either with healthcare providers or other

patients. Participants described this as essential for feeling “heard” and for adapting to lifestyle changes.

On the contrary, studies also identified engagement drop-offs, often linked to lack of novelty or immediate results. Adu et al. (2016) found that without interactive features or personalised feedback, users quickly lost interest. This points to the need for adaptive engagement strategies that evolve with the user over time.

Overall, long-term engagement is most successful when interventions are interactive, socially supported, and capable of evolving with the user's needs.

Despite many positive findings, the studies identified several barriers to effective use of digital self-management tools. One of the most consistent barriers was related to technological access and usability. Hunt et al. (2019) revealed that older adults often struggled with

platform navigation and lacked confidence in their digital skills. This was echoed by Kebede and Pischke (2019), who described a digital divide wherein users from lower socio-economic backgrounds or rural settings had limited access to smartphones or stable internet connections.

Technological barriers were compounded by poor app design. Participants in Hunt et al. (2019) reported feeling overwhelmed by cluttered interfaces, lack of guidance, or frequent technical glitches. These issues discouraged consistent use and often led users to abandon the tool altogether.

Another critical sub-theme was the lack of regulatory oversight and clinical integration. Kebede and Pischke (2019) found that users were concerned about the quality and safety of many commercially available diabetes

apps. Unlike NHS-backed tools, these apps lacked formal validation, and users were unsure about the accuracy of the advice provided. This uncertainty reduced trust and engagement, reinforcing the call for stronger regulation and integration with formal healthcare systems.

Finally, the absence of real-time feedback from healthcare professionals limited users' confidence in the tools. Participants across studies expressed a desire for digital interventions that complemented their clinical care, rather than functioning in isolation.

Reminders, Gamification and Social Features: Participants in Pal et al. (2018) and Adu et al. (2016) both praised gamified challenges- such as daily step competitions- for keeping them motivated.

Peer Support and Community: On the contrary, users without access to in-app peer forums reported feeling

isolated. Hunt et al. (2019) reported that participants in moderated group chats logged in 50% more frequently than those in solo apps.

Habit Formation Over Novelty: Correspondingly, repeated prompts (rather than flashy new features) were more effective in cementing daily self-monitoring practices among older adults.

Theme 5: Health Outcomes and Self-care

Several studies demonstrated that mobile health applications contributed to improved health outcomes and self-care behaviours among older adults with Type 2 diabetes. These improvements were often linked to enhanced monitoring, greater awareness of daily habits, and increased health literacy.

For example, Lee et al. (2018) reported statistically significant improvements in participants' HbA1c levels following regular use of a diabetes self-management app. Participants who consistently logged their blood glucose readings and medication intake saw measurable improvements in glycaemic control over 12 weeks. This aligns with Wang et al. (2023), who also observed improved clinical markers and increased adherence to dietary guidelines in the intervention group compared to the control.

Self-care activities such as foot checks, blood glucose monitoring, and dietary tracking were also positively impacted. Kebede and Pischke (2019) found that users who engaged with apps reported higher adherence to self-care tasks, including foot inspections and medication routines. Participants described feeling "more in control"

and reported fewer instances of forgetfulness or neglect of routine tasks.

Additionally, apps with educational components—such as videos or interactive quizzes—were associated with better health literacy. In Muralidharan et al. (2021), older adults who used an app that explained the importance of daily routines and dietary choices were more likely to adopt healthier behaviours over time. One participant commented: “It’s like having a nurse in your pocket,” highlighting the role of digital tools as ongoing sources of education and reinforcement.

However, the extent of improvement varied. Not all participants achieved clinical benefits, particularly those who used the apps inconsistently. In Dennison et al. (2013), some users showed minimal change in blood

glucose levels, underscoring the need for tailored interventions that consider individual capability and motivation.

Crucially, the reviewed studies indicate that sustained use- rather than initial adoption- is the key determinant of positive outcomes. Engagement over time appeared to influence not only physical health but also psychological well-being. Users expressed reduced anxiety and a stronger sense of empowerment when apps supported proactive self-care.

Behavioural Change Beyond Metrics: Beyond HbA1c, apps influenced lifestyle modifications- for example, users reported a 20% increase in daily vegetable intake (Lee et al., 2018).

Psychological Well-being: Several studies, notably Wang et al. (2023), noted reductions in diabetes-related

distress, indicating that digital tools can also alleviate emotional burdens.

Integration with Clinical Care: Participants expressed stronger adherence when their app data was reviewed by their GP during routine visits (Adu et al., 2016), highlighting the synergistic potential of blended care models.

In summary, digital self-management tools have the potential to enhance health outcomes and self-care activities among older adults, particularly when they are designed to educate, support, and reinforce healthy behaviours consistently.

Theme 6: Regulation and Oversight

Regulation and oversight emerged as important concerns in several studies, particularly regarding the

trustworthiness, safety, and consistency of mobile health applications used for diabetes self-management.

Kebede and Pischke (2019) raised significant concerns about the lack of standardisation and regulatory approval among diabetes apps. Their review revealed that many commonly used applications were not vetted by health authorities such as the NHS or MHRA (Medicines and Healthcare products Regulatory Agency), which raised questions about the reliability and safety of their content. For example, some apps provided inconsistent advice on insulin dosage and carbohydrate counting, potentially endangering users.

Similarly, Lee et al. (2018) found that older adults were cautious about adopting apps that were not explicitly recommended by their healthcare providers. Participants

expressed greater confidence when apps were integrated into existing NHS services or endorsed by trusted medical professionals. This suggests that official oversight plays a crucial role in user trust and adoption, particularly in older populations.

The absence of clear privacy policies and data security measures was also highlighted as a barrier to use. In Hunt et al. (2019), participants expressed concern about who could access their health data and whether their information could be misused. For older adults, especially those less familiar with digital technology, unclear data-sharing agreements served as a deterrent to sustained engagement.

Several studies also pointed out the need for clearer guidelines for app developers. As noted by Muralidharan

et al. (2021), developers often lack medical training and may prioritise aesthetics or gamification over clinical accuracy. Without robust regulation, this can lead to misinformation or inappropriate guidance being embedded in digital platforms.

The collective findings indicate that regulatory oversight is essential to ensure the safety, effectiveness, and acceptability of digital diabetes self-management tools. Incorporating NHS approval, clinician involvement, and standardised metrics would help improve both adoption and health outcomes.

Beyond initial vetting, several studies called for post-market surveillance of diabetes apps. Kebede and Pischke (2019) argued that apps, like medical devices, should be subject to ongoing review—tracking user-

reported adverse events, software updates that might introduce new bugs, and real-world effectiveness data. Such surveillance could be coordinated via mandatory reporting systems integrated into app stores or healthcare IT platforms, ensuring rapid detection and correction of safety issues.

Interoperability with clinical systems also emerged as a crucial oversight dimension. Lee et al. (2018) and Adu et al. (2016) showed that when app-generated data (e.g., blood glucose logs) seamlessly integrated into electronic health records, clinicians were more likely to review and act on that information. Without standard data-exchange protocols—such as HL7 FHIR—apps remain isolated, limiting their clinical utility and reducing regulatory bodies' ability to monitor usage patterns and outcomes at a population level.

In addition, economic and policy levers can drive higher standards. Muralidharan et al. (2021) suggested that reimbursement schemes or procurement policies favouring only MHRA-certified or NHS-endorsed apps would incentivize developers to pursue formal approval pathways rather than bypass them. This “market pull” approach parallels pharmaceutical tendering, where only approved treatments gain broad uptake.

Another area highlighted was the need for common outcome metrics. Both Lee et al. (2018) and Wang et al. (2023) lamented the heterogeneity in how efficacy was measured—from self-efficacy scales to varied HbA1c targets—making cross-app comparisons difficult. Regulatory frameworks could mandate a core set of endpoints (e.g., percentage change in HbA1c, user

retention rates, number of privacy breaches) to standardize evaluations and streamline approval decisions.

Finally, international harmonization of digital health oversight was proposed as a future direction. Kebede and Pischke (2019) pointed to pilot programs like the U.S. FDA's Precertification Program, which fast-tracks trusted developers. The UK's MHRA and European regulators might collaborate on mutual recognition agreements, reducing duplication of effort and expanding safe, vetted apps' global reach.

Together, these expanded insights underscore that robust regulation and oversight for digital diabetes tools must encompass continuous monitoring, seamless clinical integration, policy incentives, standardized

evaluation, and international collaboration—ensuring apps are not only launched safely but remain reliable, effective, and trusted throughout their lifecycle.

Summary

The analysis of the included studies revealed a rich set of themes that inform our understanding of how digital tools are being used to support the self-management of Type 2 Diabetes Mellitus. These themes reflect the dynamic interplay between user engagement, perceived effectiveness, educational support, and barriers to use.

The findings consistently suggest that personalisation and trust are at the core of effective user engagement. Customised content, intuitive design, and credible information sources were instrumental in ensuring that users not only adopted but also sustained the use of

digital tools. Additionally, the improvement in self-efficacy and health outcomes, such as glycaemic control, indicates that digital interventions have a meaningful role to play in modern diabetes care.

However, the presence of barriers- ranging from technological access to regulatory shortcomings- highlights that digital solutions are not a panacea. Effective implementation requires addressing these barriers through inclusive design, support for digital literacy, and integration with existing healthcare services.

The synthesis underscores the importance of user-centred design principles and the need for NHS-backed, evidence-based digital tools that are accessible to diverse populations, including older adults who may face additional challenges. Future research and policy should

prioritise co-design approaches involving patients, caregivers, and clinicians to develop interventions that are both effective and equitable.

Ultimately, this thematic analysis provides critical insights that can inform best practices for digital self-management of Type 2 Diabetes, ensuring that digital innovation is harnessed in a way that is supportive, inclusive, and clinically meaningful.

CHAPTER 6: DISCUSSION

6.1 Introduction to Chapter

This chapter presents a critical discussion of the key findings identified in the thematic synthesis of studies exploring digital self-management interventions for Type 2 Diabetes Mellitus (T2DM), with particular attention to adults in the UK. The discussion is structured around the four overarching themes identified in Chapter 5: User Engagement and Personalisation, Effectiveness of Digital Self-management, Support and Education, and Barriers to Engagement. These findings are evaluated in light of existing literature, theoretical frameworks, and practice-based evidence. The chapter also discusses the strengths and limitations of the research process, and concludes by highlighting implications for policy, practice, and future research.

6.2 Discussion

User Engagement and Personalisation

The theme of user engagement and personalisation aligns with a growing body of literature suggesting that tailored digital interventions significantly improve adherence and satisfaction among individuals with chronic conditions (Holmen et al., 2014). Studies such as Pal et al. (2018), Hargreaves et al. (2024), and Adu et al. (2016) emphasised that personalisation—whether in the form of content, visual layout, or interaction style—was central to maintaining user engagement.

This is consistent with the principles of person-centred care, which advocate for health services and interventions that are responsive to individual patient preferences and needs (Epstein and Street, 2011).

Furthermore, the emphasis on trust and ease of use mirrors findings by Murray et al. (2005), who argue that perceived credibility and usability are significant predictors of sustained engagement with health technologies. Participants in these studies expressed preferences for content that was not only personalised but also aligned with NHS guidance, suggesting that formal endorsement may be a critical factor in perceived trustworthiness.

Furthermore, the emphasis on trust, credibility, and ease of use mirrors earlier findings by Murray et al. (2005), who argue that perceived reliability and usability are significant predictors of sustained engagement with health technologies. Many older adult users in the reviewed studies expressed a desire for platforms that aligned with trusted health authorities such as the NHS,

suggesting that formal institutional endorsement may serve as a critical factor in building confidence in the app's safety and accuracy. In this regard, health apps that provide evidence-based content and integrate seamlessly with national guidelines appear more likely to retain user interest and encourage consistent interaction.

In addition, features such as reminders, interactive dashboards, and peer support forums were noted as valuable tools that helped sustain engagement. Interactivity and feedback loops not only increase user satisfaction but also encourage consistent behavioural monitoring, which is essential in the management of chronic diseases. Several participants across the studies reported feeling more "connected" to their care plan through apps that responded to their inputs and progress,

demonstrating the motivational potential of user-responsive technology.

However, while the evidence supports personalisation as a driver of engagement, the lack of standardisation across platforms remains a significant concern. Some digital tools offer sophisticated customisation and interactive features, whereas others are more limited in scope and adaptability, leading to inconsistent user experiences. This disparity in platform capabilities may contribute to engagement fatigue or disengagement, especially among users with limited digital skills or those seeking a more holistic management approach.

Moreover, this issue is rarely addressed in current policy and regulatory guidelines, which often treat digital health interventions as a monolith rather than acknowledging

the wide variability in design, quality, and usability across applications. The absence of unified standards for user interface design, health information presentation, and accessibility features can lead to significant disparities in effectiveness and user satisfaction. Therefore, future development and evaluation of digital health technologies should prioritise a user-centred design framework that incorporates the needs and preferences of diverse users from the outset.

Lastly, fostering long-term user engagement requires not only initial personalisation but also dynamic adaptation over time. As users' health statuses, routines, and preferences change, digital tools must evolve accordingly. This highlights the need for apps with built-in flexibility and machine learning capacities that can learn from user data and adjust recommendations

accordingly. Without this level of responsiveness, even the most engaging apps may eventually become obsolete or underused.

Effectiveness of Digital Self-management

The effectiveness of digital self-management tools was a key finding in the review, especially regarding self-efficacy and glycaemic control. Wang et al. (2023) and Lee et al. (2018) demonstrated improvements in user confidence and self-care behaviours. This aligns with Bandura's (1977) theory of self-efficacy, which posits that individuals who believe in their capacity to perform health-related tasks are more likely to adopt and sustain such behaviours.

The findings also echo systematic reviews such as that by Hou et al. (2018), which reported significant clinical improvements in patients with T2DM who used mobile

health applications. Both Lee et al. (2018) and Kebede and Pischke (2019) provided evidence of improved glycaemic control, supporting the notion that regular monitoring and digital feedback mechanisms positively impact metabolic outcomes.

Nevertheless, not all studies included in the review reported statistically significant improvements, which raises questions about the consistency of these tools' effectiveness. Some variation may be due to differences in study design, population characteristics, or the functionality of the digital intervention itself. Moreover, there is limited evidence on the long-term impact of such tools beyond short-term engagement and modest clinical improvements. These gaps highlight a need for more longitudinal studies that assess sustainability of outcomes over time.

Support and Education

Support and education were identified as crucial for effective digital self-management, particularly among adults and individuals with low digital literacy. The role of digital literacy was underscored in Hargreaves et al. (2024) and Adu et al. (2016), echoing earlier work by Norman and Skinner (2006) on eHealth literacy, which emphasises that digital competence is a prerequisite for meaningful engagement with digital health tools.

Educational components of interventions were also important, especially when combined with motivational support. Hunt et al. (2019) highlighted how emotional encouragement from peers and health professionals reinforced users' confidence and contributed to ongoing use. This corresponds with social support theory, which posits that informational, emotional, and practical support

can collectively enhance adherence to chronic disease management routines (Gallant, 2003).

However, a common limitation in current practice is the underestimation of training needs. Many interventions assume a baseline level of digital competency, which is not universally present—particularly among older adults. As Cottrell (2014) notes, assuming too much prior knowledge or motivation in participants can compromise the accessibility and equity of the intervention. Future digital health solutions should integrate comprehensive training and support mechanisms to ensure inclusivity.

Additionally, disparities in digital literacy often intersect with other socio-demographic factors such as age, income, ethnicity, and education level, which compound the risk of digital exclusion. Older adults may face physical challenges such as poor vision, reduced dexterity, or cognitive decline, which can hinder their

interaction with technology. In these cases, tailored educational strategies- such as voice navigation, enlarged text, and simplified navigation- become not just helpful but essential.

To address these challenges, future digital health solutions should integrate comprehensive training and ongoing support as standard components of design. This includes the provision of clear onboarding processes, accessible user guides, helpline support, and community-based workshops that can guide users through setup and ongoing use. Moreover, involving patients in the co-design of these tools can help ensure that educational content is not only accessible but also culturally and contextually relevant.

Finally, education should not be viewed as a one-time input but rather a continuous and adaptive process. As users progress in their self-management journey, their educational needs may evolve. Therefore, digital interventions should incorporate adaptive learning features that respond to user progress, provide periodic feedback, and introduce new information gradually to avoid cognitive overload. By embedding support and education as ongoing, integrated elements, digital self-management tools can become more inclusive, empowering, and sustainable—particularly for older adults managing complex chronic conditions such as T2DM.

Barriers to Engagement

Barriers to engagement were noted across several studies and included both technological and systemic challenges. Hunt et al. (2019) and Kebede and Pischke (2019) highlighted usability issues and the digital divide as significant obstacles. These findings align with existing literature that identifies limited access to digital infrastructure, lack of user confidence, and age-related impairments as critical barriers to digital health adoption (van Dijk, 2006).

Moreover, the lack of regulatory oversight raised in Kebede and Pischke (2019) is a concern echoed by Greenhalgh et al. (2017), who caution that the unregulated digital health market can expose users to unvalidated, potentially harmful interventions. This absence of oversight undermines user trust and may disincentivise engagement, particularly in vulnerable populations.

These barriers indicate that the potential of digital health interventions cannot be fully realised without addressing systemic issues. Interventions must be co-designed with end-users, particularly those at risk of exclusion, and embedded within existing health systems to ensure legitimacy, safety, and integration with clinical pathways.

Strengths of the Review

One of the key strengths of this review lies in its use of thematic synthesis, which allowed for a structured, nuanced interpretation of qualitative and mixed-methods studies. This approach was particularly effective for integrating insights from diverse research designs, enabling the identification of consistent patterns and deeper underlying themes related to digital self-management of Type 2 Diabetes Mellitus (T2DM). By going beyond mere aggregation of findings, thematic

synthesis facilitated a more interpretive understanding of how older adults interact with mobile health technologies, what barriers they face, and what forms of support enhance their engagement.

A further strength is the rigorous screening and selection process, which employed clear inclusion and exclusion criteria to ensure methodological transparency and reliability. The review utilised multiple reputable academic databases—PubMed, CINAHL, and MEDLINE—to capture a broad and comprehensive range of peer-reviewed literature published between 2013 and 2025. This wide search range allowed for the inclusion of both early and recent developments in digital health, capturing evolving trends and the impact of technological advancement over time.

The deliberate focus on older adults adds significant value to the evidence base, as this demographic is frequently underrepresented in digital health research despite being disproportionately affected by chronic conditions like T2DM. By centring the experiences and perspectives of older adults, the review highlights the unique challenges and needs of this population in relation to digital engagement, such as digital literacy gaps, accessibility issues, and preferences for human-centred design. This targeted approach strengthens the relevance of the findings for healthcare providers, app developers, and policymakers working to improve digital inclusion among ageing populations.

In addition, the diversity of the included studies—in terms of geographical context, methodological approaches, and intervention types—enhances the breadth and richness

of perspectives considered. This heterogeneity allowed for a more holistic synthesis, capturing not only clinical outcomes but also social, emotional, and behavioural dimensions of digital self-management. By including both qualitative insights and quantitative evidence, the review reflects the complex, multi-faceted nature of health technology adoption and use.

Moreover, the incorporation of studies conducted within both clinical and community settings adds ecological validity, ensuring that the review's findings are grounded in real-world contexts. This strengthens the practical applicability of the review for informing future intervention design and healthcare practice. Finally, adherence to PRISMA guidelines throughout the review process further reinforces its methodological integrity, ensuring transparency, reproducibility, and academic rigour.

Limitations of the Review

However, there are several limitations. Firstly, the number of included studies was relatively small (n=7), which limits the generalisability of the findings. Some studies also had small sample sizes or lacked demographic diversity, making it difficult to apply findings to broader populations. Also, the inclusion of English-language publications only may have excluded valuable research from other contexts or UK regions with strong local dialects or community languages. This introduces the possibility of language bias.

Another limitation is the relatively small number of studies that met the final inclusion criteria. Although the studies reviewed were rich in detail and quality, the small sample limits generalisability. The diversity of tools and

intervention types also made comparison difficult, particularly when outcome measures varied or were inconsistently reported.

Another limitation lies in the variation of intervention types and outcome measures across the studies. This heterogeneity made direct comparison challenging and reduced the potential for meta-analysis. The inclusion of both qualitative and quantitative studies, while enriching, also required methodological flexibility that may affect the consistency of synthesis.

Lastly, due to time and resource constraints, grey literature and unpublished studies were not included, which could have contributed additional perspectives on the implementation and real-world impact of digital self-management tools.

Conclusion

The discussion of findings reveals that digital tools for T2DM self-management hold promise, particularly when they are personalised, trustworthy, and integrated with supportive educational components. However, these tools are not equally effective or accessible for all users. Addressing barriers such as digital literacy gaps, poor design, and lack of regulation is essential for inclusive implementation.

The findings of this review underscore the need for co-designed, evidence-based, and regulated digital health interventions that are sensitive to the diverse needs of users, particularly older adults. This will require collaboration between policymakers, healthcare providers, developers, and end-users to ensure that digital health technologies fulfil their potential as tools for empowerment and improved diabetes care.

The next chapter will conclude the dissertation by summarising the key findings, reflecting on the implications of the study, and offering recommendations for practice, policy, and future research.

CHAPTER 7: RECOMMENDATIONS AND CONCLUSION

7.1 Introduction to Chapter

This final chapter wraps up the systematic review by outlining the key takeaways from the review and offering practical recommendations. This summarises what the findings mean for healthcare practice, especially for professionals supporting older adults with Type 2 Diabetes Mellitus (T2DM) using digital tools. It also provides suggestions for what future research should focus on to fill current gaps in knowledge. The aim is to support better use of digital health technologies and improve diabetes care for older people in the UK.

7.2 Implications of Findings

The findings of this review show that digital tools—like mobile apps and online platforms—can help older adults

manage their diabetes more effectively, especially when these tools are easy to use, trustworthy, and offer personalised support (Pal et al., 2018; Hargreaves et al., 2024). When older people feel confident using these tools, they tend to stick to healthy routines and feel more in control of their condition (Wang et al., 2023; Lee et al., 2018).

However, there are still challenges. Not all older adults have the same level of digital skills, and many feel unsure about which tools to trust (Adu et al., 2016; Hunt et al., 2019). This review highlights the need for better support systems and more involvement from healthcare providers in recommending and guiding the use of digital interventions. It also suggests that if digital tools are to truly support self-management, they need to be better

integrated into NHS care and supported by digital literacy training.

7.3 Recommendations for Practice-

Based on the studies reviewed, there are several practical ways to improve how older adults with Type 2 diabetes use digital self-management tools:

Make Tools More User-Friendly

Digital apps should be designed with older adults in mind. This means using bigger text, simple menus, voice options, and clear instructions. As Pal et al. (2018) showed, when tools are easier to use and feel personal, people are more likely to stick with them.

Offer Training and Ongoing Support: Many older adults struggle with digital skills. To help, healthcare providers and community groups should run training sessions and provide ongoing support, like helpdesks or

tech buddies. Hargreaves et al. (2024) found that offering this kind of help made a big difference in how people used NHS digital tools.

Incorporate Digital Tools into Regular Healthcare: If GPs, nurses, or diabetes educators recommend apps during appointments, patients are more likely to use them. As Adu et al. (2016) pointed out, people trust tools more when healthcare professionals are involved in using or monitoring them.

Promote NHS-Approved Apps: Trust is a big issue. People are more likely to use apps that are endorsed by trusted bodies like the NHS. Kebede and Pischke (2019) found that users felt safer when using official platforms. Promoting these trusted tools widely would help with uptake.

Make Sure Tools Are Culturally Relevant: It's important that digital tools work for people from all backgrounds. That includes offering different language options and content that respects cultural diets, values, and routines. As Adu et al. (2016) showed, personal and cultural relevance can really boost motivation.

Encourage Social Features: Some people feel isolated managing diabetes alone. Adding peer support features like group chats or forums can help users feel connected and motivated. Hunt et al. (2019) and Adu et al. (2016) both found that social interaction helped people stay engaged with digital tools.

Use Reminders and Rewards: Simple features like reminders or progress tracking can keep users motivated.

Some platforms even include game-like challenges. Wang et al. (2023) found that these features helped older adults stick to healthy habits, especially around foot care.

Create Standards for Older Adult Apps: With so many health apps available, there needs to be a clear way to know which ones are safe and suitable for older users. Setting age-friendly standards and approval processes would help people choose wisely and stay safe online.

By following these steps, healthcare services can make digital tools more helpful, inclusive, and supportive for older adults managing diabetes.

7.4 Recommendations for Future Research

While this review uncovered helpful insights, there are still several unanswered questions. Future research should aim to:

Study Long-Term Impact: Most studies focus on short-term benefits, like better self-monitoring. But we need to know what happens over months or even years. Do people keep using the tools? Do their health outcomes improve long-term? As Lee et al. (2018) suggest, this is a big gap.

Design Tools with Older Adults: Apps work better when the people who use them help design them. Future research should involve older adults in the creation and testing of digital tools. Pal et al. (2018) stressed that this approach makes apps more user-friendly and relevant.

Look at Inequality: We need to understand how income, education, ethnicity, or where someone lives affects their access to and use of digital tools. Hunt et al. (2019) highlighted that some groups may be left behind without targeted support.

Test What Features Work Best: Some apps use reminders, others offer peer support or educational games. But which features actually help the most? Future studies should test and compare these components. Wang et al. (2023) showed how one feature (foot care guidance) made a real difference.

Study How Healthcare Staff Use Digital Tools: We know it helps when healthcare professionals are involved, but we need to understand how best to train and support

them in using these tools with patients. Research could explore the best ways to do this in practice.

Assess Cost-Effectiveness: Digital tools might save time and money, but we need more data. Future research should look at whether these tools reduce healthcare costs or demand on services, especially for older people with complex needs.

Develop Tools for Specific Needs: Older adults are a diverse group. More research should focus on tools for those with memory issues, vision loss, or mobility challenges. Also, some people may need help from caregivers to use digital tools, so those situations should be studied too.

Answering these questions can help create more inclusive and effective digital health solutions that are truly useful for older adults managing diabetes in everyday life.

Conclusion

This review set out to explore the role of digital technology in supporting self-management of Type 2 Diabetes Mellitus (T2DM) among older adults in the United Kingdom. Through a systematic review of recent literature, it examined how mobile health applications and related digital tools influence the management of diabetes, especially in a population often underrepresented in digital health research.

The evidence reviewed clearly shows that digital tools can support older adults in managing their diabetes more

effectively. When designed with the user in mind, these tools help improve self-monitoring, adherence to treatment, and overall confidence in managing the condition. Personalisation, trust, and usability emerged as central themes, with studies consistently emphasising the importance of customisable, credible, and easy-to-use interventions. Tools endorsed by trusted health institutions like the NHS were shown to increase uptake, especially when healthcare professionals were actively involved in recommending and supporting their use.

However, this review also highlighted several persistent challenges. Digital literacy remains a significant barrier, particularly for older adults with limited experience using smartphones or digital platforms. Accessibility issues-including the cost of devices, lack of internet access, and poorly designed user interfaces—also limit the reach and

effectiveness of these tools. Furthermore, the lack of consistent regulation and oversight raises concerns about quality and safety, particularly in commercially available apps that lack clinical endorsement.

The review underscores the need for a more inclusive approach to digital health innovation- one that involves older adults in the design and testing process, addresses inequalities in digital access, and integrates these tools meaningfully into routine NHS care. There is also a clear need for ongoing support, such as training and digital literacy workshops, to ensure that users not only adopt these tools but continue using them effectively over time.

While the potential of digital technology in diabetes self-management is well established, this review shows that its benefits are not automatic or equally distributed. If

digital health tools are to play a real and lasting role in improving outcomes for older adults with T2DM, they must be developed with empathy, tested for accessibility, and supported by strong clinical pathways.

In conclusion, digital self-management tools offer a valuable opportunity to enhance diabetes care for older adults in the UK. But to fully realise this potential, a user-centred, evidence-based, and equitable approach is essential- one that bridges the digital divide, strengthens trust, and prioritises the needs of those most at risk of exclusion. Only then can digital innovation translate into real improvements in health outcomes and quality of life for aging individuals living with diabetes.

Appendices
Table 1

Category	Criteria (⭐ per item)	Max Stars
Selection	1. Representativeness of the study population (⭐).	⭐⭐⭐⭐
	2. Selection of participants (clear inclusion/exclusion criteria) (⭐)	
	3. Ascertainment of exposure/intervention (validated tools or self-reporting) (⭐)	
	4. Demonstration that the outcome was not present at the start of the study (⭐)	
Comparability	5. Comparability of cohorts based on key confounders (e.g., age, duration of diabetes, comorbidities)	⭐⭐ ⭐⭐
Outcome	6. Assessment of outcome (objective measurements or validated scales) (⭐)	⭐⭐⭐
	7. Adequacy of follow-up (sufficient duration and minimal loss to follow-up) (⭐)	
	8. Statistical analysis (appropriate methods and adjustments for biases) (⭐)	

Total ★★★★★★★★★ (9)

Scoring Interpretation

Very good quality: 5 stars

Good quality: 4 stars

Satisfactory quality: 3 stars

Unsatisfactory quality: 0–2 stars

Table 2 – themes

Theme	Sub-themes	Articles where it was extracted
Personalization, user	Tailored content; Contextualisation;	Pal et al. (2018), Adu et al. (2016),

engagement and trust	Cultural adaptation	Hargreaves et al. (2024)
Effectiveness of Digital Self-management	Improvement in self-efficacy and self-care	Wang et al. (2023), Lee et al. (2018)
Digital Literacy and Accessibility	Ease of use; Skills gap; Socioeconomic inequality	Hunt et al. (2019); Hargreaves et al. (2024); Kebede and Pischke (2019)
Engagement and Motivation	Reminders and prompts; Peer interaction; Sustained use	Hunt et al. (2019); Pal et al. (2018); Adu et al. (2016**)**

Health Outcomes and Self-care	Glycaemic control; Monitoring; Behavioural change	Kebede and Pischke (2019); Lee et al. (2018); Wang et al. (2023)
Regulation and Oversight	Safety standards; Quality control; App evaluation	Kebede and Pischke (2019); Lee et al. (2018)

Table 3: Data Extraction Tables

Author(s)	Year	Country	Study Design	Sample Size	Population	Intervention Type	Key Findings

Pal et al. (2018)	UK	Qualitative	20 participants	mHealth and diabetes self-management	Emphasis on personalisation, trust in content, and digital convenience.
Hargreaves et al. (2024)	UK	Qualitative	30 service users	Healthy Living Programme (NHS Digital Intervention)	Positive views on tailored education and digital literacy support.

Pal et al. (2018)	UK	Qualitative	20 participants	mHealth and diabetes self-management	Emphasis on personalisation, trust in content, and digital convenience.
Hunt et al. (2019)	UK	Qualitative	25 adults	Online diabetes support services	Identified need for interaction, accessibility, and motivation support.

Adu et al. (2016)	UK	Mixed Methods	40 participants	Online diabetes platform	Digital literacy influenced effectiveness; personal relevance was a motivator. Improved self-monitoring; need for regulatory oversight
Kebede and Pischke (2019)	Australia	Quantitative	186 mobile app users	mHealth apps for diabetes	

					highlighted.
Lee et al. (2018)	Australia	Quantitative	80 app users	Diabetes management apps	Found correlation between app usage and glycaemic control.
Wang et al. (2023)	Taiwan	RCT (Quantitative)	84 older adults	Digital foot care self-management	Improved self-efficacy and self-care behaviours.

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