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Review

Scoping Review of Digitally Delivered Physical Activity and Exercise Programs for Older Adults

Junsheng Leslie Teo [1], Stephen Richard Bird [2], Kerryn Butler-Henderson [3] and Zhen Zheng [1,*]

[1] School of Health and Biomedical Sciences, RMIT University, Melbourne 3083, Australia; s3556810@student.rmit.edu.au
[2] School of Health and Biostatistics, Swinburne University of Technology, Melbourne 3122, Australia; srbird@swin.edu.au
[3] School of Nursing, Paramedicine and Healthcare Sciences, Charles Stuart University, Bathurst 2678, Australia; kbutler-henderson@csu.edu.au
* Correspondence: zhen.zheng@rmit.edu.au

Abstract: Physical inactivity among older adults is a major public health concern linked to various chronic conditions. Digitally delivered physical activity (PA) programs offer a promising solution to overcome traditional barriers. This scoping review aimed to explore the feasibility, acceptability, and engagement factors of these programs for older adults. A comprehensive search was conducted on PubMed, Embase (OVID), and Scopus on 22 May 2024, adhering to PRISMA guidelines. Inclusion criteria targeted older adults (≥60 years) engaged in healthy digital PA interventions. Data analysis was guided by the FAME Framework, TSQ, and the COM-B model. A total of 16 studies met the inclusion criteria, involving 901 older adults. Most studies reported moderate to high adherence rates with programs being well-received. However, several implementation challenges were found, such as inadequate digital literacy, concerns regarding program quality, participant safety, and lack of perceived relevance. Despite these implementation challenges, they may be overcome using the TAM and UTAUT frameworks for technology acceptance and usage to address digital literacy, ensuring high-quality interactions and participant safety, and incorporating social support. Future interventions should leverage similar theoretical frameworks to enhance design and implementation.

Keywords: review; exercise; older adults; digital health

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1. Introduction

Physical inactivity is a major public health concern globally, particularly among older adults. The World Health Organisation (WHO) identifies physical inactivity as the fourth leading risk factor for global mortality, contributing to an estimated 3.2 million deaths annually (Bull et al. 2020). In older adults, sedentary behaviour is associated with increased risks of chronic diseases such as cardiovascular disease, diabetes, and osteoporosis, as well as mental health issues like depression and cognitive decline (Lee et al. 2012). Conversely, engaging in regular physical activity has numerous benefits for older adults, including improved cardiovascular health, better weight management, enhanced mental health, and reduced risk of falls and fractures (Liguori 2020). Exercise can also improve muscle strength, flexibility, balance, and endurance, which are essential for maintaining independence and quality of life in older age. The American College of Sports Medicine (ACSM) recommends that older adults engage in at least 150 min of moderate-intensity aerobic activity, or 75 min of vigorous-intensity aerobic activity, per week, along with muscle-strengthening activities on two or more days per week (Liguori 2020).

2. Barriers to Physical Activity

Despite the well-documented benefits of physical activity, older adults face several barriers to participating in traditional exercise programs. These barriers include physical

limitations, such as arthritis or mobility issues, lack of transportation, financial constraints, and limited access to fitness facilities (Bethancourt et al. 2014). Additionally, psychological factors, such as fear of injury and lack of confidence, can deter older adults from engaging in physical activity (Allison et al. 2020; Wilson et al. 2021). Social isolation and lack of social support further compound these challenges, making it difficult for older adults to maintain regular exercise routines (Gell et al. 2015).

3. Digital Alternatives

The advent of digital technology presents a novel solution to overcoming many of the barriers associated with traditional exercise programs. Digitally delivered physical activity programs offer the flexibility and convenience needed to engage older adults in regular physical activity while being accessible at home (Wilson et al. 2021; Cimperman et al. 2013; Cimperman et al. 2016). Digital platforms also enable opportunities for social interaction, which are critical for maintaining motivation and adherence in older adults (Cimperman et al. 2013; Bethancourt et al. 2014). Thus, understanding the factors that influence the adoption and effective use of digitally delivered PA programs is essential for their successful implementation.

4. Theoretical Frameworks

The increasing prevalence of physical inactivity among older adults is a global concern, contributing to heightened risks of chronic illnesses and reduced quality of life (Lee et al. 2012). Digitally delivered physical activity (PA) programs have emerged as innovative solutions to address traditional barriers such as limited mobility, geographic constraints, and social isolation. However, their effectiveness hinges on understanding key factors that influence adoption and sustained engagement, such as digital literacy, access to technology, and subjective individual motivations. While theoretical frameworks such as the Technology Acceptance Model (TAM) (Davis and Davis 1989) and the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al. 2003) provide a critical lens for examining the usability and perceived utility of digital interventions from the perspective of the users, these frameworks do not account for behavioural determinants of engagement, which are critical in maintaining adherence to PA programs. Previous studies (Gell et al. 2015; Wilson et al. 2021) have highlighted the role of digital infrastructure and social support in promoting engagement in digital health interventions. Yet a detailed exploration of these factors in digitally delivered PA programs remains underdeveloped. This review seeks to fill this gap by systematically examining the feasibility, acceptability, and engagement variables within these programs, integrating insights from these theoretical frameworks to provide actionable recommendations for practice and policy.

5. Review Questions

Given the potential benefits and challenges of digitally delivered PA programs for older adults, this study aimed to explore their feasibility, acceptability, and engagement factors by examining the following review questions:

What factors influence the feasibility of digitally delivered PA programs for older adults, specifically related to technology access, participant safety, and cost-effectiveness?

How acceptable are these programs to older adults, considering satisfaction, perceived quality, and user experience?

What engagement variables facilitate or hinder adherence to these programs, including intrapersonal and environmental factors?

6. Methods

This scoping review was conducted following the scoping review framework proposed by Arksey and O'Malley (2005), and adhered to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines (Moher et al. 2009) for reporting. The process involved five key stages: identifying the research questions, searching for relevant

studies, selecting studies based on predefined criteria, charting the data, and collating, summarising, and reporting the results. This review was registered with the Open Science Framework (OSF) Centre for Open Science Registry database [https://doi.org/10.17605/OSF.IO/9EGW4].

6.1. Inclusion Criteria

The inclusion criteria, displayed in Table 1 below, were determined based on the PICOS (Population, Interest, Comparisons, Outcomes) Framework (Methley et al. 2014).

Table 1. PICOS criteria.

Criteria	Inclusion	Exclusion
Population	Older adults (aged 60 years old or over) living in the community.	Non-Older adult participants (<60 years); inmates; institution patients; hospitalised patients; palliative care patients, assisted-care facility residents; participants that require specialised assistance for locomotion (e.g., loss of vision, restricted mobility, etc.); participants with severe cognitive impairment.
Interest	Any program delivered using digital delivery methods to increase healthy physical activity among older adults.	Studies that did not involve physical activity or exercise; studies that only used face-to-face delivery; studies that focused on delivering rehabilitation programs for health conditions.
Context	Digital delivery methods included live-streaming services (e.g., Zoom, FaceTime, Skype, etc.), or pre-recorded forms of media (e.g., YouTube, video- clips, DVDs, etc.). The setting in which the telehealth program takes place was not limited. Studies that involved both face-to-face and telehealth deliveries were considered only if the results were reported separately.	Studies that only delivered physical activity or exercise in face-to-face settings.
Outcomes	The main outcomes are the feasibility, acceptability, and related participant engagement variables to using telehealth for increasing healthy physical activity or exercise. With regards to this study, (a) feasibility refers to the considerations for initial implementation of the program such as technological availability/accessibility, participant safety and adherence, and costs for program start-up; (b) participant engagement refers to the factors that influence adherence with the program such as intrapersonal factors (Education, physical capacity, motivation, etc.) and socio-environmental factors (social support, accessibility, etc.), and; (c) Acceptability refers to the participant/provider perceptions towards the program and factors that affect program perception.	Studies that did not report any of the aforementioned outcome measures.
Study design	Peer-reviewed studies that provided original data. This may be in the form of Qualitative; Quantitative; Mixed methods.	Conference or seminar abstracts, incomplete studies.
Language	Only articles available in English or available as English translations.	Articles not available in English.
Publication year	No limits.	

6.2. Search Strategy

A comprehensive search was performed on 22 May 2024 using the following databases: PubMed (Medline), Embase (OVID), and Scopus. The search strategy, depicted in Table 2, included a combination of Title, Abstract, keywords, and MeSH terms (if available), related to physical activity, digital interventions, older adults, and feasibility, acceptability or engagement.

Table 2. Sample search strategy of Title, Abstract, keywords, and MeSH terms (if available).

Search	Physical Activity/Exercise	Online Intervention	Older Adults	Feasibility/Acceptability/ Engagement
Title, Abstract, keywords	Physical Activity OR Exercise	Telemedicine OR Telehealth OR Telerehabilitation OR eHealth OR mHealth OR Mobile health OR Online Intervention OR Internet-Based Intervention OR Web-based Intervention	Aged OR Older adult OR elderly	Patient attitude OR feasibility OR engagement OR acceptability OR Satisfaction
MeSH terms	Exercise	Telemedicine OR Internet-Based Intervention	Aged OR elderly	Patient Acceptance of Health Care OR Feasibility Studies

6.3. Study Selection

All identified records from the database searches were exported to EndNote 20 for duplicate removal. Titles and abstracts of the identified studies were then screened against the predetermined eligibility criteria. Studies that potentially met the inclusion criteria were retrieved and full-text screening was conducted independently by two researchers. Discrepancies between researchers were discussed until a consensus was reached and the final list of included studies was compiled.

6.4. Data Extraction and Transformation

Articles were extracted onto a Microsoft Excel spreadsheet in a matrix format as recommended by Garrard (2020). The extracted data included study characteristics (author, year, country, study design), participant demographics (age, gender, health status), intervention details (type of exercise, duration, frequency, digital delivery method), and outcome measures (feasibility, acceptability, engagement). The data extraction process was verified independently by a second reviewer using the same Microsoft Excel spreadsheet to extract data from the included articles. Reviewers were blinded to each other's decisions. A third reviewer was consulted for any articles where a consensus could not be reached.

7. Data Synthesis and Integration

Due to the lack of a specific framework for assessing digitally delivered PA programs at the point of time in writing, data synthesis was guided by three frameworks: The Joanna Briggs Institute's FAME (Feasibility, Appropriateness, Meaningfulness, Effectiveness) framework for evaluating interventions (Pearson et al. 2005), the Telemedicine Satisfaction Questionnaire (TSQ) (Yip et al. 2003), and the COM-B (Capability, Opportunity, Motivation-Behaviour) Framework for behavioural analysis (Michie et al. 2011). The feasibility aspect of FAME assessed the practicality of implementation, including technology requirements, participant safety, and cost-effectiveness. The FAME framework was chosen for its comprehensive approach to the assessment of various dimensions of intervention implementation and outcomes, and its validity has been established in numerous studies across different healthcare contexts (Pearson et al. 2005). Acceptability sub-themes were designed based on the TSQ, which was selected for its validated constructs in evaluating user satisfaction with telehealth services (Yip et al. 2003). The TSQ includes measures such as quality of care, similarity with face-to-face programs, and communication experiences, making it particularly suitable for assessing the nuanced perceptions of older adults and their PA providers engaging in digital PA programs. Both Feasibility and Acceptability data were further categorised according to their relevance for participants or providers. For participant engagement, the COM-B model provides a comprehensive approach to understanding the intrapersonal (Capability and Motivation) and environmental (Opportunity) behavioural aspects influencing engagement with digital PA programs (Michie et al. 2011). This model categorises the factors affecting behaviour change into

three components: Capability (both physical and psychological), Opportunity (both social and physical), and Motivation (both reflective and automatic). The validity of the COM-B model has been supported in various behavioural studies related to PA, demonstrating its effectiveness in identifying and addressing barriers to behaviour change (Teo et al. 2022). Subsequently, a narrative synthesis approach was employed to integrate findings from qualitative, quantitative, and mixed-method studies, highlighting common themes and discrepancies.

8. Results

Referring to Figure 1, the initial database search resulted in the identification of 622 records. After various screening steps, 16 articles were included in the review.

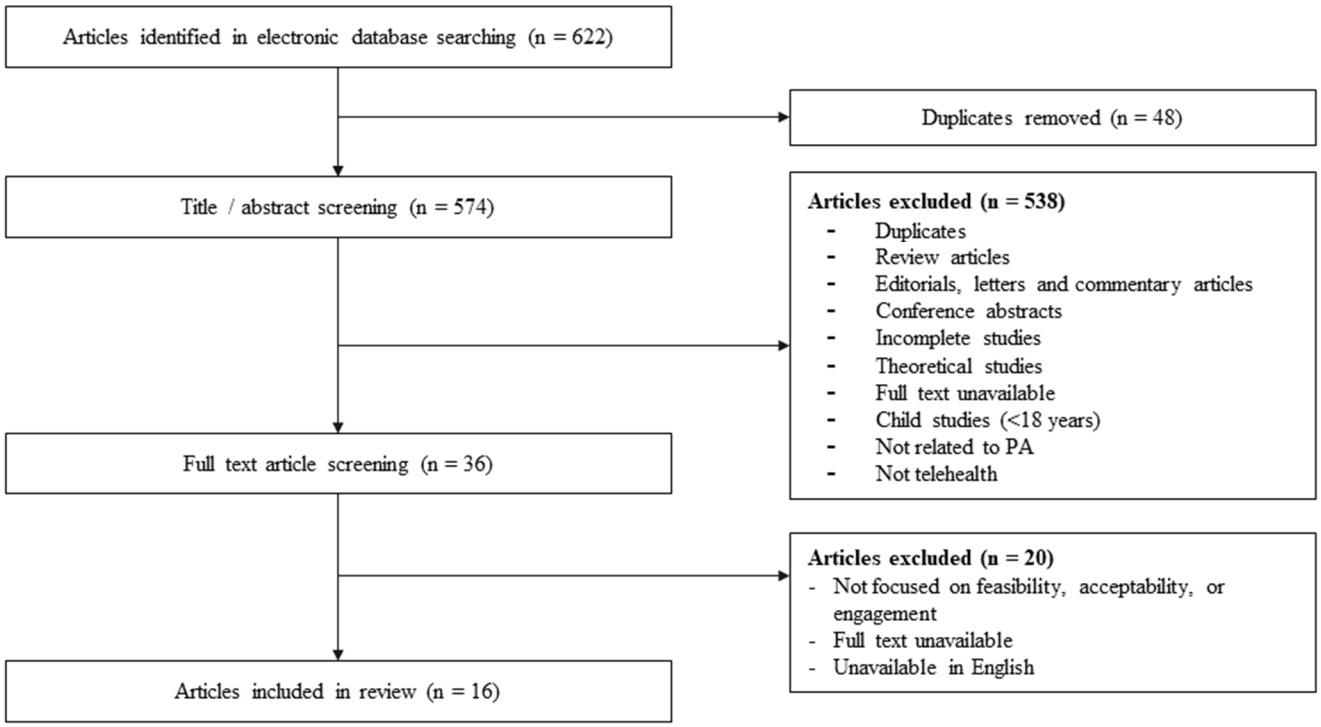


Figure 1. PRISMA flow diagram of scoping review methodology.

8.1. Included Studies

Referring to Table 3, a total of 16 studies were included in this review. Seven studies were quantitative (Li et al. 2022; Daly et al. 2021; Cadmus-Bertram et al. 2015; Granet et al. 2023; Mikolaizak et al. 2022; Thompson et al. 2023; da Silva et al. 2022), three were qualitative (Lyons and Lewis 2014; Bosco et al. 2022; Cabrita et al. 2019), and six were mixed-method studies (Li et al. 2020; Saquib et al. 2016; Hong et al. 2014; Pischke et al. 2022; Wu and Keyes 2006; Cohen-Mansfield et al. 2021). Study locations included the United States (Cadmus-Bertram et al. 2015; Li et al. 2022; Lyons and Lewis 2014; Li et al. 2020; Saquib et al. 2016; Hong et al. 2014; Wu and Keyes 2006; Thompson et al. 2023), Australia (Daly et al. 2021), Germany (Pischke et al. 2022; Mikolaizak et al. 2022), the United Kingdom (Bosco et al. 2022), Brazil (da Silva et al. 2022) The Netherlands (Cabrita et al. 2019; Mikolaizak et al. 2022), Norway (Mikolaizak et al. 2022), Canada (Granet et al. 2023), and Israel (Cohen-Mansfield et al. 2021). The majority of digital programs reported either high (≥80%) participation rates (Daly et al. 2021; Li et al. 2020; Cadmus-Bertram et al. 2015; Granet et al. 2023) or moderate (≥70%) participation rates (Bosco et al. 2022; Li et al. 2022; Saquib et al. 2016; Wu and Keyes 2006; Thompson et al. 2023). One program had a low (≤60%) participation rate (Pischke et al. 2022).

Table 3. Details of included studies (n = 16).

			Participants			Program Delivery	
Study *	**Cohort**	**Recruitment Location**	**Subjects/Mean Age/Gender**	**Intervention Group**	**Control Group**	**Session Duration/Weekly Frequency/Total Program Duration**	**Telehealth Delivery Method**
Quantitative							
Li et al. (2022)	Older adults living in the community with Mild Cognitive Impairment	Oregon, USA	69/74.6 ± 5.6/39 Female; 30 Male	Group 1: Cognitively enhanced Tai Chi Quan delivered via Zoom (n = 23) Group 2: Standard Tai Chi delivered via Zoom (n = 22)	Stretching delivered via Zoom (n = 24)	60 min sessions/2× per week/16 weeks	Delivered via Zoom link, class sizes taught by exercise instructors recruited from community with 10 years of teaching exercise or Tai Chi.
Daly et al. (2021)	Older adults living independently in the community	Melbourne, Australia	20/70.4 ± 4.2/10 Female; 10 Male	Group 1: Owned tablets (n = 10) Group 2: Provided tablets by researchers (n = 10)	None	30 min sessions/3× per week/8 weeks	PhysiApp—Digital platform that allows health professionals to assign exercise programs remotely, track progress, and provide feedback in real time. Program delivered by an accredited exercise physiologist.
Cadmus-Bertram et al. (2015)	Postmenstrual older adults	California, USA	51/60 ± 7.1/51 Female	Web-based tracking group (n = 25)	Pedometer group (n = 26)	Self-administered/ 16 weeks Cardio: Work up to 150 min per week of MVPA	Web-based platform to provide feedback from Fitbit wearable accelerometer and assist in behavioural regulation.
Granet et al. (2023)	Non-physically active individuals aged 60 and older.	Montreal, Canada	83/70.7 ± 5.2 years (LG); 69.6 ± 5.1 years (RG)/68 Female; 15 Male	Live Group (LG) (n = 38) Recorded Group (RG) (n = 45)	None	55 min sessions/3× per week/12 weeks	Web-based physical activity interventions delivered via Zoom for LG, and secure website for RG.
Mikolaizak et al. (2022)	Older adults at risk of functional decline	Norway, Germany, and the Netherlands	120/66.2 ± 2.3 years/64 Female; 56 Male	Digital physical activity program group (n = 120)	None	Self-administered/ 8 weeks	Digital physical activity program using smartphones and smartwatches.
Thompson et al. (2023)	Community-dwelling older adults with low-to-moderate PA levels	USA	13/82.6 ± 7.0 years/10 Female; 3 Male	Virtual fitness training group (n = 13)	None	45 min sessions/2× per week/8 weeks	Virtual fitness training program delivered via videoconferencing platform Zoom.

Table 3. *Cont.*

			Participants			Program Delivery	
Study *	**Cohort**	**Recruitment Location**	**Subjects/Mean Age/Gender**	**Intervention Group**	**Control Group**	**Session Duration/Weekly Frequency/Total Program Duration**	**Telehealth Delivery Method**
Qualitative							
Lyons and Lewis (2014)	Community-dwelling older adults	USA	40/61.5 ± 5.6/34 Female; 6 Male	Walking intervention with idle alerts to decrease SB (n = 20)	Waitlist (n = 20)	No structured sessions/ 12 weeks	Tablet mobile device and wearable electronic activity monitor. Weekly telephone counselling provided by a team and a postdoctoral fellow with extensive training in behavioural counselling.
da Silva et al. (2022)	Increase PA during COVID-19 pandemic	Brazil	20/70.5 ± 4.4/18 Female; 2 Male	Intervention group (n = 20)	None	60 min sessions/3× per week/36 weeks	Online and live exercise training program delivered via Facebook group, supported by WhatsApp group chats for updates and reminders.
Bosco et al. (2022)	Increase PA and reduce SB during COVID-19 pandemic	Manchester, UK	41/68.4 ± 8.9/34 Female; 7 Male	OA participating in Make Movement Your Mission digital health initiative (n = 41)	None	No fixed structure 15 min sessions/ 3 sessions offered daily	Delivered live via Facebook, one-way streaming. Facebook platform allows interactions outside of sessions on Facebook page.
Cabrita et al. (2019)	Older adults living independently	Overijssel, Netherlands	12/69/7 Female; 5 Male	OA interviewed on the topic of PA delivered digitally (n = 12)	None	7500 daily step goal/ 4 weeks No fixed structure	Step counter linked with mobile application "Activity Coach" to provide PA feedback.
Mixed methods							
Cohen-Mansfield et al. (2021)	Older adults with restricted contact and social interaction	Tel Aviv, Israel	105/74.6 ± 7.8/88 Female; 17 Male	Web-based exercise activities (n = 49)	Waitlist (n = 56)	30 min sessions/5× per week	Delivered via Zoom.
Li et al. (2020)	Sedentary older adults	Baltimore, US	8/74 ± 5.4/6 Female; 2 Male	Self-administered PA program (n = 8)	None	Reduce SB; increase PA PA: 3000–6000 steps per day Exercise: 7–12 resistance, balance, and flexibility movements Self-administered/daily sessions/4 weeks	Technology learning session provided pre-test, followed by 2 h personalised PA session. PA self-monitoring was then conducted using a smartwatch with feedback and prompts along with weekly phone consultations and financial incentives.

Table 3. *Cont.*

			Participants			Program Delivery	
Study *	**Cohort**	**Recruitment Location**	**Subjects/Mean Age/Gender**	**Intervention Group**	**Control Group**	**Session Duration/Weekly Frequency/Total Program Duration**	**Telehealth Delivery Method**
Saquib et al. (2016)	Older women 65 and above	California, USA	27/76 ± 5.7/27 Female	Self-administered PA program (n = 27)	None	Self-administered/ 10 weeks Cardio: Work up to 150 min per week of MVPA Exercise: At least twice a week of strengthening and balance/flexibility exercises	Telephone-based systems with wearable pedometer for self-tracking and feedback.
Hong et al. (2014) *	Community-dwelling older adults	Texas, USA	10/67.6 ± 6.3/3 Female; 7 Male	Utility testing of web-based program (n = 10)	None	No fixed structure	Web-based platform to promote PA (iCanFit).
Hong et al. (2014) *	Community-dwelling older adults	Texas, USA	23/67.6 ± 6.5/19 Female; 4 Male	User-experience survey of web-based program (n = 23)	None	No fixed structure/ 2–3 weeks	Web-based platform to promote PA (iCanFit).
Pischke et al. (2022)	Physically inactive Community-dwelling older adults	Bremen, Germany	242/68.7 ± 5.4/135 Female; 107 Male	Digital intervention group (n = 78) Digital and print intervention group (n = 36) Print only group (n = 90)	None	No fixed structure/ 36 weeks	Web-based platform and accelerometer.
Wu and Keyes (2006)	Older adults at risk of falls	Vermont, USA/January 2006 to September 2006	17/81 ± 8/13 Females; 4 Males	Yang style Tai Chi Quan (n = 17)	None	60 min sessions/3× per week/15 weeks.	Digital videoconferencing program delivered via broadband internet connection and videoconferencing device was installed in each subject's home.

* Studies that had involved more than one stage with more than one participant cohort.

8.2. Participant Demographics

A total of 901 older adults (Mean age = 68.6 ± 5.8 years; Female = 626; Male = 275) were included in the 16 reviewed articles, as displayed in Table 3. Participants were generally of good health, with one study involving participants with mild cognitive impairment (Li et al. 2022), and another focused on postmenstrual older women (Cadmus-Bertram et al. 2015).

9. Program Dosage

Referring to Table 3, nine studies (Cadmus-Bertram et al. 2015; Mikolaizak et al. 2022; Lyons and Lewis 2014; Bosco et al. 2022; Li et al. 2020; Saquib et al. 2016; Hong et al. 2014; Pischke et al. 2022; Cabrita et al. 2019) had participants self-administer their own exercise sessions throughout the study, which ranged from 2 to 36 weeks. Four studies had set daily or weekly goals for the self-administered exercise participants, such as a minimum required daily step count (Cabrita et al. 2019; Li et al. 2020) or a total duration of 150 min of moderate to vigorous physical activity per week (Cadmus-Bertram et al. 2015; Saquib et al. 2016). Seven studies (Li et al. 2022; Daly et al. 2021; Thompson et al. 2023; da Silva et al. 2022; Cohen-Mansfield et al. 2021; Wu and Keyes 2006) had delivered a fixed digital exercise program structure ranging from 30 min to 60 min per session (Mean = 46 ± 14 min), for 2 to 5 times per week (Mean = 3 ± 1), and a range of 8 to 36 weeks (Mean = 16 ± 10).

10. Exercise Programs

Referring to Table 4, seven out of 16 studies delivered a combination of different types of physical activities, while the remaining 9 focused on a single type. The majority of studies (75%) involved cardiovascular exercise (Lyons and Lewis 2014; Bosco et al. 2022; Granet et al. 2023; Mikolaizak et al. 2022; Thompson et al. 2023; Cabrita et al. 2019; Daly et al. 2021; Saquib et al. 2016; Cadmus-Bertram et al. 2015; Hong et al. 2014; Pischke et al. 2022; da Silva et al. 2022), followed by resistance exercises (41%) (Saquib et al. 2016; Granet et al. 2023; Mikolaizak et al. 2022; Thompson et al. 2023; Pischke et al. 2022; Li et al. 2020; da Silva et al. 2022), balance exercises (44%) (Pischke et al. 2022; Mikolaizak et al. 2022; Thompson et al. 2023; Li et al. 2020; Saquib et al. 2016; da Silva et al. 2022), flexibility exercises (31%) (Pischke et al. 2022; Granet et al. 2023; Li et al. 2020; Saquib et al. 2016; da Silva et al. 2022), and Tai Chi (20%) (Li et al. 2022; Cohen-Mansfield et al. 2021; Wu and Keyes 2006). The majority of studies (63%) focused on delivering programs to the individual participant (Bosco et al. 2022; Mikolaizak et al. 2022; Thompson et al. 2023; Lyons and Lewis 2014; Cabrita et al. 2019; Daly et al. 2021; Saquib et al. 2016; Li et al. 2020; Cadmus-Bertram et al. 2015; Hong et al. 2014), while six studies (38%) involved group digital PA programs (Pischke et al. 2022; Wu and Keyes 2006; Granet et al. 2023; Cohen-Mansfield et al. 2021; Li et al. 2022; da Silva et al. 2022).

Table 4. Intervention components of included studies.

Study	Type of PA [1]						Social	
	US	C	R	B	F	TC	Single	Group
Granet et al. (2023)		√	√		√		√	√
Mikolaizak et al. (2022)		√	√	√			√	
Thompson et al. (2023)		√	√	√			√	
Wu and Keyes (2006)						√	√	√
Li et al. (2022)						√		√
Lyons and Lewis (2014)		√					√	
da Silva et al. (2022)		√	√	√	√			√
Cohen-Mansfield et al. (2021)						√		√
Bosco et al. (2022)		√					√	
Cabrita et al. (2019)		√					√	
Daly et al. (2021)	√	√					√	
Saquib et al. (2016)		√	√	√	√		√	

Table 4. *Cont.*

Study	Type of PA [1]						Social	
	US	C	R	B	F	TC	Single	Group
Cadmus-Bertram et al. (2015)		√					√	
Hong et al. (2014)		√					√	
Pischke et al. (2022)		√	√	√	√		√	√
Li et al. (2020)			√	√	√			

[1] US = Unstated; C = Cardiovascular exercise; R = Resistance exercise; B = Balance exercise; F = Flexibility exercise; TC = Tai Chi.

11. Digital Delivery Methods

Referring to Table 5, out of the 16 included studies, the majority of studies (69%) utilised mobile applications or online web platforms (Cohen-Mansfield et al. 2021; Bosco et al. 2022; Cabrita et al. 2019; Li et al. 2020; Pischke et al. 2022; Hong et al. 2014; Daly et al. 2021; Cadmus-Bertram et al. 2015; Granet et al. 2023; Mikolaizak et al. 2022; da Silva et al. 2022) to deliver digital PA programs. Several studies (44%) also supplemented their exercise programs with wearable technology (Daly et al. 2021; Saquib et al. 2016; Cadmus-Bertram et al. 2015; Lyons and Lewis 2014; Cabrita et al. 2019; Mikolaizak et al. 2022; Pischke et al. 2022), such as pedometers and accelerometers, to monitor PA frequency among participants. Other methods used included phone calls (Lyons and Lewis 2014; Daly et al. 2021; Saquib et al. 2016), DVD recordings of PA programs (Saquib et al. 2016; Granet et al. 2023), and the use of videoconferencing software (Li et al. 2022; Cohen-Mansfield et al. 2021; Granet et al. 2023; Thompson et al. 2023; Wu and Keyes 2006; da Silva et al. 2022). Five studies had a pre-intervention education session for participants on technology usage (Lyons and Lewis 2014; Saquib et al. 2016; Granet et al. 2023; Wu and Keyes 2006; Li et al. 2020).

Table 5. Digital components of included studies.

Study	Digital Aspects				
	Pre-Session Education	Phone Call	Videoconferencing Software	Mobile Application/ Web-Based Platform	Wearable Technology
Granet et al. (2023)	√		√	√	
Mikolaizak et al. (2022)				√	√
Thompson et al. (2023)			√		
Wu and Keyes (2006)	√		√		
Li et al. (2022)			√		
Lyons and Lewis (2014)	√	√			√
da Silva et al. (2022)			√	√	
Cohen-Mansfield et al. (2021)			√	√	
Bosco et al. (2022)				√	
Cabrita et al. (2019)				√	√
Daly et al. (2021)		√		√	√
Saquib et al. (2016)	√	√			√
Cadmus-Bertram et al. (2015)				√	√
Hong et al. (2014)				√	
Pischke et al. (2022)				√	√
Li et al. (2020)	√			√	

Table 6 displays the Feasibility variables to digital PA program implementation extracted from the reviewed literature.

Table 6. Feasibility data extracted from reviewed literature [1].

Measure	Theme	Affect	Issues	Non-Issue
Feasibility	Technology	Participant	Digital literacy (Cohen-Mansfield et al. 2021; Li et al. 2020; Hong et al. 2014; Granet et al. 2023; Mikolaizak et al. 2022; Thompson et al. 2023; Wu and Keyes 2006) Accessing technology hardware for program (Lyons and Lewis 2014)	Digital literacy (Lyons and Lewis 2014; Li et al. 2022; Daly et al. 2021; Saquib et al. 2016; Cadmus-Bertram et al. 2015; Hong et al. 2014; Granet et al. 2023; da Silva et al. 2022) Accessing technology hardware for program (Cadmus-Bertram et al. 2015; Li et al. 2022)
		Provider	Accessing technology hardware for program (Mikolaizak et al. 2022; Thompson et al. 2023; Granet et al. 2023)	Digital literacy (Li et al. 2022) Accessing technology hardware for program (Li et al. 2022)
	Safety	Participant	Mild adverse events reported during delivery (Li et al. 2022; Daly et al. 2021)	No intervention-related adverse events reported (Cohen-Mansfield et al. 2021; Li et al. 2020; Hong et al. 2014; Granet et al. 2023; Mikolaizak et al. 2022; Thompson et al. 2023; Wu and Keyes 2006; Cadmus-Bertram et al. 2015; Lyons and Lewis 2014; Bosco et al. 2022; Cabrita et al. 2019; Saquib et al. 2016; Pischke et al. 2022; da Silva et al. 2022)
		Provider	NR	NR
	Cost Effectiveness	Participant	NR	Cost-saving (Granet et al. 2023; Thompson et al. 2023)
		Providers	NR	Cost-saving (Wu and Keyes 2006; Granet et al. 2023)

[1] NR = Not reported.

11.1. Technological Requirements

Digital literacy was found to be a common hurdle for older adults commencing a digital PA program in some but not all studies (Cohen-Mansfield et al. 2021; Li et al. 2020; Hong et al. 2014; Granet et al. 2023; Mikolaizak et al. 2022; Thompson et al. 2023; Wu and Keyes 2006). In those where it was identified as a barrier, it was reported that many older adults were found to struggle with understanding the required procedures and handling the necessary equipment for digital technologies. Older adults were reported to need additional time at the beginning of the intervention to learn the procedures to receive telehealth, with some continuing to struggle with technology use throughout the study (Cohen-Mansfield et al. 2021). Other studies had noted digital literacy to not be an issue for older adults or their PA providers, with some reporting that older adults were able to develop the necessary skills to handle digital technologies quickly after some usage (Lyons and Lewis 2014; Li et al. 2022; Daly et al. 2021; Saquib et al. 2016; Cadmus-Bertram et al. 2015; Hong et al. 2014; Granet et al. 2023). Both older adults and providers may also have issues with access to the necessary hardware or infrastructure (e.g., devices for videoconferencing, suitable internet connection, etc.) for participating in digital programs (Mikolaizak et al. 2022; Thompson et al. 2023; Granet et al. 2023; Lyons and Lewis 2014).

11.2. Safety Concerns

Two studies (Li et al. 2022; Daly et al. 2021) reported adverse events occurring during intervention delivery. Li et al. (2022) reported a total of 11 cases of adverse events during intervention delivery (11/69; 16% of participants). Five were classified as moderate events unrelated to the intervention, instead due to medical surgeries or health conditions. Six were classified as mild, four of which were suspected to be intervention-related events—

one participant in the main intervention group reported a hernia pain caused by the exercise; three participants complained about muscular discomfort or pain. Of these 11 cases of adverse events, only 3 successfully proceeded with and completed the assigned intervention. From the study of Daly et al. (2021), two participants reported mild adverse events that were possibly intervention-related. One participant reported musculoskeletal knee pains from a pre-existing condition but was able to continue with the PA using a modified program. The second participant suffered a strained calf injury and sought treatment, subsequently withdrawing from the study. No intervention-related adverse events were reported by other studies (Cohen-Mansfield et al. 2021; Li et al. 2020; Hong et al. 2014; Granet et al. 2023; Mikolaizak et al. 2022; Thompson et al. 2023; Wu and Keyes 2006; Cadmus-Bertram et al. 2015; Lyons and Lewis 2014; Bosco et al. 2022; Cabrita et al. 2019; Saquib et al. 2016; Pischke et al. 2022; da Silva et al. 2022).

11.3. Cost Effectiveness

Participants and providers noted reduced costs of sessions and travel (Granet et al. 2023; Thompson et al. 2023; Wu and Keyes 2006). Providers also highlighted reduced costs of physical infrastructure required (Granet et al. 2023). There was no reported data on issues regarding cost-effectiveness.

12. Acceptability

Table 7 below displays the acceptability factors extracted from the reviewed literature.

Table 7. Acceptability data extracted from reviewed literature [1].

Measure	Theme	Affect	Negative Perceptions	Positive Perceptions
Acceptability [2]	Quality of care provided	Participant	Scepticism regarding quality of digital programs (Thompson et al. 2023; Hong et al. 2014; Saquib et al. 2016)	Satisfied with quality of care (Lyons and Lewis 2014; Cohen-Mansfield et al. 2021; Li et al. 2022; Daly et al. 2021; Li et al. 2020; Saquib et al. 2016; Pischke et al. 2022; Granet et al. 2023; Mikolaizak et al. 2022; Thompson et al. 2023; Wu and Keyes 2006; da Silva et al. 2022)
		Provider	Scepticism regarding quality of digital programs (Granet et al. 2023)	Satisfied with quality of care (Mikolaizak et al. 2022; Thompson et al. 2023; Li et al. 2022; Wu and Keyes 2006; Granet et al. 2023)
	Comparisons with face-to-face	Participant	Digital perception of the provider is limited (Thompson et al. 2023; Granet et al. 2023)	Comparable to face-to-face delivery (Mikolaizak et al. 2022; Thompson et al. 2023; Wu and Keyes 2006; Granet et al. 2023) Participant interest in digital delivery • Overall program (Lyons and Lewis 2014; Cohen-Mansfield et al. 2021; Daly et al. 2021; Pischke et al. 2022; Wu and Keyes 2006) • Interest in continuing digital delivery post study (Lyons and Lewis 2014; Cohen-Mansfield et al. 2021; Daly et al. 2021; Hong et al. 2014; Thompson et al. 2023; Wu and Keyes 2006; Granet et al. 2023)
		Provider	Limited feedback and monitoring (Granet et al. 2023)	Comparable to face-to-face (Mikolaizak et al. 2022; Thompson et al. 2023; Wu and Keyes 2006; Granet et al. 2023)

Table 7. *Cont.*

Measure	Theme	Affect	Negative Perceptions	Positive Perceptions
	Digital communication	Participant	NR	No issues with digital communication (Mikolaizak et al. 2022; Thompson et al. 2023; Granet et al. 2023; da Silva et al. 2022)
		Provider	NR	No issues with digital communication (Mikolaizak et al. 2022; Thompson et al. 2023; Granet et al. 2023)

[1] NR = Not reported. [2] Following the TSQ constructs by Yip et al. (2003), Quality of care provided = items related to delivery of healthcare, accessibility, reliability, and attention; Similarity with face-to-face = similarity of telehealth program to face-to-face encounter; Telehealth communication = Communication.

12.1. Quality of Care Provided

In some studies, participants (Thompson et al. 2023; Hong et al. 2014; Saquib et al. 2016) and providers (Granet et al. 2023) had reservations regarding the quality of care and overall experiences using telehealth. However, participants (Lyons and Lewis 2014; Cohen-Mansfield et al. 2021; Li et al. 2022; Daly et al. 2021; Li et al. 2020; Saquib et al. 2016; Pischke et al. 2022; Granet et al. 2023; Mikolaizak et al. 2022; Thompson et al. 2023; Wu and Keyes 2006; da Silva et al. 2022) and providers (Mikolaizak et al. 2022; Thompson et al. 2023; Li et al. 2022; Wu and Keyes 2006; Granet et al. 2023) from 11 studies were satisfied with quality of services provided.

12.2. Comparison with Face-to-Face Delivery

When compared with face-to-face delivery, the scepticism of both participants (Thompson et al. 2023; Granet et al. 2023) and providers (Granet et al. 2023) mainly pertained to a perceived decrease in the ability to view another individual through a digital medium, compared with in-person encounters. Providers specifically mentioned limited feedback and monitoring of participants as an issue when it came to using digital delivery (Granet et al. 2023). However, these perceptions were not universal and the participants and providers from several studies felt the level of interaction and support were similar to that of face-to-face sessions (Mikolaizak et al. 2022; Thompson et al. 2023; Wu and Keyes 2006; Granet et al. 2023). Older adults showed positive interest in the use of digital alternatives (Lyons and Lewis 2014; Cohen-Mansfield et al. 2021; Daly et al. 2021; Pischke et al. 2022; Wu and Keyes 2006) and many expressed further interest in continuing the use of digital alternatives post intervention (Lyons and Lewis 2014; Cohen-Mansfield et al. 2021; Daly et al. 2021; Hong et al. 2014; Thompson et al. 2023; Wu and Keyes 2006; Granet et al. 2023). Specifically, several participants mentioned the convenience appeal of a digitally delivered PA program (Lyons and Lewis 2014; Daly et al. 2021).

12.3. Digital Communication

The majority of studies did not mention issues with digital communication, with several studies noting participants appreciated the instantaneous feedback and information exchange (Mikolaizak et al. 2022; Thompson et al. 2023; Granet et al. 2023; da Silva et al. 2022).

13. Engagement

Table 8 displays the extracted engagement factors categorised according to the COM-B Framework.

Table 8. Engagement factors categorised according to the COM-B Framework.

COM-B	Sub-Theme		Facilitator	Barrier
Capability	Psychological	Knowledge	Technology access support to improve digital literacy (Li et al. 2020; Lyons and Lewis 2014; Saquib et al. 2016; Granet et al. 2023; Hong et al. 2014; Mikolaizak et al. 2022; Thompson et al. 2023; Wu and Keyes 2006) Improving health knowledge by providing educational materials (Lyons and Lewis 2014; Bosco et al. 2022)	Lack of digital literacy (Bosco et al. 2022; Hong et al. 2014; Cohen-Mansfield et al. 2021; Daly et al. 2021; Granet et al. 2023; Thompson et al. 2023; Wu and Keyes 2006; Mikolaizak et al. 2022) Lack of health knowledge (Bosco et al. 2022)
		Skills	Developing behavioural regulation skills (Lyons and Lewis 2014; Saquib et al. 2016; Bosco et al. 2022)	NR
	Physical	Physical	NR	Cognitive impairment (Cohen-Mansfield et al. 2021) Negative health conditions (Cohen-Mansfield et al. 2021; Bosco et al. 2022; Mikolaizak et al. 2022; Thompson et al. 2023; Wu and Keyes 2006)
Opportunity	Physical	Environment	Opportunity to participate in exercise from home (Cohen-Mansfield et al. 2021; Granet et al. 2023; Wu and Keyes 2006; Thompson et al. 2023; da Silva et al. 2022)	
		Time	Convenience of telehealth (Lyons and Lewis 2014; Cohen-Mansfield et al. 2021; Bosco et al. 2022; Thompson et al. 2023; Wu and Keyes 2006; da Silva et al. 2022)	Lack of time (Cohen-Mansfield et al. 2021; Bosco et al. 2022)
		Technology access support	Technical access support (Li et al. 2020; Lyons and Lewis 2014; Saquib et al. 2016; Granet et al. 2023; Hong et al. 2014; Mikolaizak et al. 2022; Thompson et al. 2023; Wu and Keyes 2006; da Silva et al. 2022)	Technical hardware issues (Cohen-Mansfield et al. 2021) Limited access to required hardware (Mikolaizak et al. 2022) Costs of accessing resources (Cohen-Mansfield et al. 2021)
	Social	Social influences	Availability of social interaction functions (Cohen-Mansfield et al. 2021; Bosco et al. 2022; Hong et al. 2014; Granet et al. 2023; Mikolaizak et al. 2022; Thompson et al. 2023; Wu and Keyes 2006; da Silva et al. 2022) Friends and family support (Bosco et al. 2022; da Silva et al. 2022) Instructor/provider support (Bosco et al. 2022; Granet et al. 2023)	Lack of social interactions (Wu and Keyes 2006) Lack of friends and family support (Mikolaizak et al. 2022)

Table 8. *Cont.*

COM-B	Sub-Theme		Facilitator	Barrier
Motivation	Reflective	Program relevance	Positive health outcomes (Lyons and Lewis 2014; Cohen-Mansfield et al. 2021; Bosco et al. 2022; Saquib et al. 2016; Granet et al. 2023; Mikolaizak et al. 2022; Thompson et al. 2023; Wu and Keyes 2006) Age appropriate (Cohen-Mansfield et al. 2021; Bosco et al. 2022; Granet et al. 2023; Thompson et al. 2023; Wu and Keyes 2006), Social interaction (Cohen-Mansfield et al. 2021; Bosco et al. 2022; Hong et al. 2014; Granet et al. 2023; Wu and Keyes 2006) Overcome loneliness and boredom (Cohen-Mansfield et al. 2021; Bosco et al. 2022; Thompson et al. 2023; Wu and Keyes 2006; Granet et al. 2023) Enjoyment (Cohen-Mansfield et al. 2021; Granet et al. 2023; Thompson et al. 2023; Wu and Keyes 2006; da Silva et al. 2022). Using a participatory approach to program design (Bosco et al. 2022; Cabrita et al. 2019)	Program was perceived to be incongruent with participant's needs (Li et al. 2022; Bosco et al. 2022; Cohen-Mansfield et al. 2021; Mikolaizak et al. 2022; Thompson et al. 2023; Wu and Keyes 2006; Granet et al. 2023) Previous negative experiences (Mikolaizak et al. 2022)
		Digital self-efficacy	General self-efficacy (Bosco et al. 2022) Technology access support (Li et al. 2020; Lyons and Lewis 2014; Saquib et al. 2016; Granet et al. 2023; Hong et al. 2014; Mikolaizak et al. 2022; Thompson et al. 2023; Wu and Keyes 2006; da Silva et al. 2022)	Averse perceptions to use new technologies (Bosco et al. 2022; Thompson et al. 2023)
		Social aspects	Simulating face-to-face settings (Daly et al. 2021) Online group class (Bosco et al. 2022; Pischke et al. 2022; Cabrita et al. 2019; Granet et al. 2023; da Silva et al. 2022)	Perceived peer pressure (Bosco et al. 2022) Reluctance to participate in PA with a camera (Cohen-Mansfield et al. 2021) Reluctance to take part in group activities (Cohen-Mansfield et al. 2021)
		Reinforcement	Goal setting (Lyons and Lewis 2014; Cabrita et al. 2019; Li et al. 2020; Saquib et al. 2016; Mikolaizak et al. 2022; Granet et al. 2023) Periodic reminders and motivational messaging (Lyons and Lewis 2014; Li et al. 2020; Thompson et al. 2023; Granet et al. 2023)	
		PA Provider	Supportive and encouraging (Bosco et al. 2022; Granet et al. 2023; Mikolaizak et al. 2022; Wu and Keyes 2006)	
	Autonomic	Routine	Building a daily routine (Cohen-Mansfield et al. 2021; Thompson et al. 2023; Wu and Keyes 2006) Autonomous motivation (Daly et al. 2021; Li et al. 2020; Saquib et al. 2016)	

13.1. Capability

In terms of psychological capability, some studies reported a lack of digital literacy regarding the use of required digital technologies as a barrier to older adult engagement (Bosco et al. 2022; Hong et al. 2014; Cohen-Mansfield et al. 2021; Daly et al. 2021; Granet et al. 2023; Thompson et al. 2023; Wu and Keyes 2006; Mikolaizak et al. 2022). A lack of understanding of PA requirements (e.g., recommended frequency of PA for older adults) was also noted to be a barrier for some older adults (Bosco et al. 2022). Improvements in technology access through pre-program education or employing user-friendly platforms assisted with the facilitation of engagement (Li et al. 2020; Lyons and Lewis 2014; Saquib et al. 2016; Granet et al. 2023; Hong et al. 2014; Mikolaizak et al. 2022; Thompson et al. 2023; Wu and Keyes 2006). Providing relevant educational materials to participants to raise general health knowledge on the importance of healthy PA and the benefits of the intervention also facilitated engagement (Lyons and Lewis 2014; Bosco et al. 2022). The development of behavioural regulation skills, such as incorporating the use of pedometers, scheduling, logging progress, and activity planning, enabled older adults to develop habits and facilitate engagement (Lyons and Lewis 2014; Saquib et al. 2016; Bosco et al. 2022). Physical capability barriers identified were primarily negative health conditions that affected the ability to participate in activities in general, such as cognitive or physical impairments and chronic disease (Cohen-Mansfield et al. 2021; Bosco et al. 2022; Mikolaizak et al. 2022; Thompson et al. 2023; Wu and Keyes 2006).

13.2. Opportunity

Older adults appreciated the opportunity to partake in PA from the safety of their homes, which facilitated participation in their digital interventions (Cohen-Mansfield et al. 2021; Granet et al. 2023; Wu and Keyes 2006; Thompson et al. 2023; da Silva et al. 2022). The convenience and timing flexibility of receiving digital programs was also well-received by older adults (Lyons and Lewis 2014; Cohen-Mansfield et al. 2021; Bosco et al. 2022; Thompson et al. 2023; Wu and Keyes 2006; da Silva et al. 2022). Technical access support (e.g., Technology education lessons, use of user-friendly interfaces, ongoing technical assistance etc.) provided during the study aided in facilitating adherence (Li et al. 2020; Lyons and Lewis 2014; Saquib et al. 2016; Granet et al. 2023; Hong et al. 2014; Mikolaizak et al. 2022; Thompson et al. 2023; Wu and Keyes 2006; da Silva et al. 2022). Assessing and maintaining the required hardware for digital delivery was noted as a potential barrier (Cohen-Mansfield et al. 2021; Mikolaizak et al. 2022). Participants frequently cited having online social interactions with peers to greatly influencing their willingness to engage with the digital alternatives (Cohen-Mansfield et al. 2021; Bosco et al. 2022; Hong et al. 2014; Granet et al. 2023; Mikolaizak et al. 2022; Thompson et al. 2023; Wu and Keyes 2006; da Silva et al. 2022). Additionally, social support from friends, family, and their PA providers aided in program engagement (Bosco et al. 2022; Granet et al. 2023; da Silva et al. 2022). Conversely, a lack of social interaction and social support was noted to be barriers to engagement (Mikolaizak et al. 2022; Wu and Keyes 2006).

13.3. Motivation

High perceived relevance was associated with increased program engagement in multiple studies (Lyons and Lewis 2014; Cohen-Mansfield et al. 2021; Bosco et al. 2022; Saquib et al. 2016; Cabrita et al. 2019; Granet et al. 2023; Mikolaizak et al. 2022; Thompson et al. 2023; Wu and Keyes 2006; da Silva et al. 2022). Reasons for increased personal relevance were highly varied and included: perceiving the program to have a positive impact on their health (Lyons and Lewis 2014; Cohen-Mansfield et al. 2021; Bosco et al. 2022; Saquib et al. 2016; Granet et al. 2023; Mikolaizak et al. 2022; Thompson et al. 2023; Wu and Keyes 2006), feeling that the program was suitable and age-appropriate (Cohen-Mansfield et al. 2021; Bosco et al. 2022; Granet et al. 2023; Thompson et al. 2023; Wu and Keyes 2006), being able to socially interact with other participants (Cohen-Mansfield et al. 2021; Bosco et al. 2022; Hong et al. 2014; Granet et al. 2023; Wu and Keyes 2006), overcoming

loneliness and boredom (Cohen-Mansfield et al. 2021; Bosco et al. 2022; Thompson et al. 2023; Wu and Keyes 2006; Granet et al. 2023), and enjoyment (Cohen-Mansfield et al. 2021; Granet et al. 2023; Thompson et al. 2023; Wu and Keyes 2006; da Silva et al. 2022). Using a participatory approach to program design also aided in program facilitation by improving participants' perceived relevance (Bosco et al. 2022; Cabrita et al. 2019). On the other hand, participants who perceived the program to be incongruent with their needs had lower levels of engagement (Li et al. 2022; Bosco et al. 2022; Cohen-Mansfield et al. 2021; Mikolaizak et al. 2022; Thompson et al. 2023; Wu and Keyes 2006; Granet et al. 2023).

Technology access support to minimise digital literacy requirements was found to facilitate motivational engagement, as older adults were less hesitant to try utilising new technologies (Li et al. 2020; Lyons and Lewis 2014; Saquib et al. 2016; Granet et al. 2023; Hong et al. 2014; Mikolaizak et al. 2022; Thompson et al. 2023; Wu and Keyes 2006; da Silva et al. 2022). On the other hand, an aversion to trying new technologies was associated with lower levels of digital self-efficacy and lower levels of engagement (Bosco et al. 2022; Thompson et al. 2023).

An online group exercise program reported higher participant engagement related to the social aspects of a group setting (Bosco et al. 2022; Pischke et al. 2022; Cabrita et al. 2019; Granet et al. 2023; da Silva et al. 2022). However, several participants were concerned about group-related issues such as peer pressure and a lack of privacy, leading to unwarranted anxiety or demotivation (Bosco et al. 2022; Cohen-Mansfield et al. 2021).

Reinforcement through the use of goal setting (Lyons and Lewis 2014; Cabrita et al. 2019; Li et al. 2020; Saquib et al. 2016; Mikolaizak et al. 2022; Granet et al. 2023) was highlighted by multiple studies as a facilitator for motivation. The use of periodic reminders and motivational messaging (e.g., the use of text prompts, phone calls, inspirational messaging, etc.) also facilitated participation (Lyons and Lewis 2014; Li et al. 2020; Thompson et al. 2023; Granet et al. 2023).

Several studies highlighted that the role of the PA provider was important for facilitating participation (Bosco et al. 2022; Granet et al. 2023; Mikolaizak et al. 2022; Wu and Keyes 2006). A PA provider who could provide positive support and encouragement was seen as important for older adults (Bosco et al. 2022; Granet et al. 2023; Mikolaizak et al. 2022; Wu and Keyes 2006).

With regards to automatic motivation, developing and maintaining a daily routine that led to habit development was cited as a facilitator by participants (Cohen-Mansfield et al. 2021; Thompson et al. 2023; Wu and Keyes 2006). Individual intrinsic sources of autonomous motivation were reported to be the major source for continued engagement as well as sustained long-term adherence post-program completion (Daly et al. 2021; Li et al. 2020; Saquib et al. 2016).

14. Discussion

This scoping review synthesised data from 16 studies to investigate the feasibility, acceptability, and engagement of digitally delivered physical activity (PA) programs for older adults. In terms of feasibility for initial implementation, significant barriers in digital literacy were identified with many older adults struggling to use the necessary technology. With proper precautions, safety concerns were minimal, and the programs proved to be cost-effective by reducing travel and infrastructure expenses. Acceptability was mixed, with some scepticism about the quality of care but overall high satisfaction due to convenience and flexibility. Engagement factors highlighted the importance of digital literacy support, social interactions, perceived program relevance, and behavioural regulation.

Findings regarding digital literacy from this review supported previous literature highlighting the need for addressing digital literacy among older adults (Kienle et al. 2021; Cimperman et al. 2013; Cimperman et al. 2016; Wilson et al. 2021). Furthermore, studies highlighted the need for additional time and support at the beginning of interventions to help participants develop the required skills (Granet et al. 2023; Wu and Keyes 2006; Li et al. 2020; Saquib et al. 2016). However, these studies reported that older adults could

quickly adapt to the technology after initial use, suggesting that with adequate support and preparation, digital literacy issues can be overcome. This finding aligns with previous literature, such as the work by Wilson et al. (2021) and Cimperman et al. (2016), which emphasised the importance of tailored support to improve digital literacy among older adults. Although access to digital tools and equipment was not found to be an issue, this finding may be due to the studies having provided the necessary hardware setup for the participants in their respective studies. Previous literature shows that different populations of older adults may face varying levels of access to technology, leading to differences in technology usage (Gell et al. 2015; Wilson et al. 2021). While the majority of studies in this review had not reported cases of adverse events, a study involving healthcare professionals and PA providers by Kienle et al. (2021) revealed concerns regarding the safety of participants engaging in remote digital PA programs. Furthermore, chronic health conditions and decreased physical capacity are valid concerns when considering the safety of older adults (Bethancourt et al. 2014). Hence, it is recommended that future programs consider incorporating safety management measures while designing digital PA programs for older adults.

Digital PA program acceptability was high amongst participants of reviewed studies. Nonetheless, these findings may be skewed due to the selection requirements for participants. The majority of included studies recruited participants who already had access to, or had been provided access to, resources to participate in digital PA studies. A study conducted by de Veer et al. (2015) on the determinants of intention to use e-Health presented the differences in online usage between participants as a result of technology familiarity and digital literacy. de Veer et al. (2015) showed that participants who had perceived the use of online health services as beneficial and had reported minimal difficulties regarding ease of use were more likely to express interest in using e-Health. It should also be noted that many older adults from the studies included in the review both expressed interest in the use of digital delivery and cited appreciating the benefits of these programs. Previous literature has also found that older adult technology usage was negatively impacted by physical (e.g., visual, cognitive, auditory) impairments that made it difficult to communicate online, especially without the appropriate equipment (Wilson et al. 2021; Gell et al. 2015). These findings were consistent with technology acceptance frameworks regarding perceived ease of use and perceived benefits, such as the Technology Acceptance Model (TAM) (Davis and Davis 1989). As a result, these review findings may not be indicative of the number of older adults expressing acceptance towards the use of digital delivery methods but may provide greater insight into the factors facilitating acceptance, primarily perceived benefits from the use of digital technologies and perceived ease of use. Future studies may consider incorporating the TAM to better understand factors affecting acceptability.

Participant engagement findings related to digital PA programs from this review generally aligned with that of previous research on engagement with in-person PA programs, with social support, program relevance, reinforcement, PA provider support, and the development of behavioural control and regulation, being highlighted as influences on participation (Bethancourt et al. 2014). However, several notable differences were exclusive to digital PA programs. The theme of digital literacy was a prevalent influence identified in both intra-personal (Capability and Motivation) and environmental (Opportunity) factors. Previous studies found similar results regarding digital literacy issues with older adults facing a significant barrier in the uptake of digital PA programs, emphasising the need for consideration while designing online programs (Wilson et al. 2021; de Veer et al. 2015; Cimperman et al. 2013; Cimperman et al. 2016). Moreover, an aversion of older adults to utilising digital technologies was noted in previous literature but was only briefly mentioned in two studies in this review (Bosco et al. 2022; Thompson et al. 2023). Older adults of different sociodemographic and health statuses expressed varying reasons for a reluctance to use novel technologies, such as disbelief in digital delivery efficacy, lack of perceived need to change, and high perceived usage difficulties (Cimperman et al. 2016; Wilson et al. 2021; de Veer et al. 2015; Allison et al. 2020; Gell et al. 2015; Nymberg et al.

2019). The Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al. 2003) further validates the need for addressing these factors exclusively affecting behavioural intentions towards engaging in digital PA programs.

15. Research Implications

Table 9 displays a summary of the implementation recommendations based on the findings of this review and the recommendations of previous literature. These recommendations were guided by the TAM and UTAUT (Davis and Davis 1989; Venkatesh et al. 2003). These technology acceptance and behavioural intent frameworks were selected due to the relevance of the various digital-related factors found in this review to affect the feasibility, acceptability, and engagement of digital PA programs.

Table 9. Program implementation recommendations.

Program Component	Description
Digital literacy	• Implement a thorough orientation prior to program commencement that covers technology use, navigation of digital platforms, and troubleshooting common issues. • Provide continuous technical assistance to address any digital literacy issues and ensure smooth program delivery.
High-quality interactions	• Facilitate program communication through effective provider communication skills for online delivery. • Ensuring access for participants to necessary digital tools for online programs. • Regularly check in with participants to provide personalised feedback and adjust their goals as needed.
Participant safety	• Requiring emergency contact list from participants • Provide clear guidelines on safe exercise practices • Ensure adequate physical space for exercise
Incorporating social support	• Facilitate opportunities for online social interactions through virtual group sessions and online community-building platforms.

15.1. Addressing Digital Literacy

Providing comprehensive, user-friendly training sessions at the beginning of digital PA programs may enhance participants' ability to engage with the technology, thereby decreasing their aversion towards participating in an online program. This approach is supported by the TAM and UTAUT, which emphasise the importance of ease of use of digital technologies (Davis and Davis 1989; Venkatesh et al. 2003). Thus, comprehensive digital literacy training should be implemented as part of the program orientation. These training sessions can cover basic technology use, navigation of digital platforms, and troubleshooting common issues. Such sessions can be conducted in various formats, including in-person workshops, online tutorials, and one-on-one support. Moreover, ongoing technical support should be made available throughout the program to ensure ongoing smooth program delivery.

15.2. Ensuring High-Quality Interactions

Perceptions towards performance, benefits, and ease-of-use, were found to contribute significantly towards intentions and acceptance of digital technologies (Venkatesh et al. 2003). As such, ensuring high-quality interactions through effective PA provider communication, personalised program feedback and seamless real-time communication may enhance older adults' perceptions of digitally delivered PA programs, resulting in greater acceptance and usage. Physical activity providers are recommended to learn the appropriate communication skills to effectively deliver PA or exercise online, such as focusing on verbal cues rather than visual to guide participants (Kienle et al. 2021). Moreover, personalised feedback online is crucial for maintaining participant motivation and engagement, aligning with previous findings highlighting the importance of personalised and engaging content in PA interventions online and in-person (Liguori 2020; Wilson et al. 2021). Incorporating

motivational messaging, goal-setting features, and regular progress tracking may enhance the quality of interactions, such as regularly scheduled virtual check-ins with exercise providers to assist participants with staying on track and adjusting their goals as needed (Wilson et al. 2021). Furthermore, ensuring access to the necessary hardware and a stable internet connection is critical to allow for seamless real-time feedback, especially to older adults with limitations in seeing, hearing, or processing information (Allison et al. 2020; Wilson et al. 2021; Kienle et al. 2021). However, some studies highlighted barriers related to technology access, suggesting that providing devices or subsidies for internet costs could be beneficial. This approach is supported by previous studies that have shown improved outcomes when participants are provided with the necessary technological infrastructure (Gell et al. 2015; Wilson et al. 2021). Programs can partner with community organisations, libraries, and local governments to provide devices or offer subsidies for internet services. Establishing technology-lending libraries or offering low-cost rental options may help overcome financial barriers while providing access to adequate digital tools for high-quality videoconferencing.

15.3. Ensuring Participant Safety

Safety is a paramount concern for older adults engaging in physical activity. This review showed that safety considerations were relevant. Participants could provide an emergency contact list to their PA provider in the case of emergencies. Adequate physical space was a requirement for PA programs, especially for older and more vulnerable participants to minimise the risk of tripping and head-on collisions with peripheral objects (Kienle et al. 2021). Furthermore, programs must ensure that exercises are safe and suitable for participants with varying levels of fitness and health conditions. Programs should provide guidance on creating a safe exercise space at home, such as offering checklists and instructional videos on setting up a safe exercise area, including recommendations on appropriate footwear, removing tripping hazards, and ensuring adequate lighting.

15.4. Incorporating Social Support

The importance of social support in promoting usage of digital PA programs is well-documented in the literature and supported by the UTAUT (Allison et al. 2020; Gell et al. 2015; Venkatesh et al. 2003), with this review similarly showing that participants who had received encouragement from friends, family, and PA providers were more likely to remain engaged. Digital PA programs should therefore include mechanisms to facilitate either physical or online social interaction, such as offering family-friendly exercise routines. Additionally, incorporating social interaction elements, such as virtual group exercises and online forums, may reduce feelings of isolation and increase motivation, resulting in increased acceptability and engagement.

16. Strengths and Limitations

This scoping review adhered to PRISMA guidelines to systematically synthesised data from a diverse range of studies, providing a comprehensive overview of digitally delivered PA programs for older adults, providing novel insights into the implementation factors of digital PA programs for older adults. While previous reviews had investigated the implementation factors of either PA programs or the use of e-health, this review was the first to focus on the use of digital methods for healthy PA for older adults living within the community. The use of established theoretical frameworks, such as the FAME framework (Pearson et al. 2005), TSQ (Yip et al. 2003), and the COM-B model (Michie et al. 2011), enhanced the robustness and applicability of the findings. The review incorporated a wide array of study designs, including qualitative, quantitative, and mixed-methods studies, allowing for a nuanced understanding of various factors affecting digital PA program implementation and participation. Practical recommendations for improving the design and implementation of these interventions were also provided. Despite these strengths, the review faced several limitations. Participants in the reported studies were volunteers

and thereby had an existing interest in PA and perhaps an existing amenability for digital delivery. Therefore, they may not be a true representative sample of the wider spectrum of older adults. Moreover, the participants may not be indicative of populations with limited access to digital technologies, which may have differing implementation barriers. This review also identified a lack of longitudinal evaluations within the included studies, limiting insights into the long-term effectiveness and sustainability of digital PA programs.

17. Future Research Recommendations

While this review focused on key factors influencing the feasibility, acceptability, and engagement of digitally delivered PA programs for older adults, the authors acknowledge that there may be other variables that play a significant role in participation in digital PA programs but lacked sufficient data to be properly captured and evaluated. For instance, included studies varied in program delivery mode (i.e., self-administered, guided exercise programs, etc.), program dosage, types of PA (i.e., resistance exercise, aerobic exercise, flexibility, etc.), and types of technology (i.e., videoconferencing platforms, mobile applications, computer programs, wearable technologies, etc.) used. Perceived program relevance, digital literacy, and digital self-efficacy were highlighted as key findings in this review; thus program structure may be an important consideration for future studies to evaluate to better understand their relationship towards participation. Moreover, review findings also highlighted the importance of having program access convenience and flexibility while needing strategies for reinforcing behaviour and facilitating routine building for sustained engagement. However, there was insufficient evidence to compare differences between self-administered exercise programs and guided exercise programs between studies. Future research should include measures to evaluate the effects of program structure on participation and explore the optimal balance between structured exercise guidance and self-administered exercise programs for participant autonomy. Additionally, future studies should include follow-up assessments to determine the participation in PA post-interventions.

18. Conclusions

In conclusion, this scoping review highlighted the potential of digitally delivered PA programs for older adults to overcome traditional barriers such as mobility limitations, access to facilities, and social isolation. Despite growing interest in the use of digital delivery methods, the findings underscore the importance of addressing digital literacy, ensuring high-quality interactions and participant safety, and incorporating social support, to enhance the feasibility, acceptability, and engagement of these interventions among both older adults and their PA providers. By utilising theoretical frameworks such as the TAM and UTAUT models, future digital PA programs may be more effectively designed to cater to the needs of the older adult population, ultimately contributing to improved public health outcomes.

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