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6 Mobile phone apps' support for people with mild dementia: a systematic review

Abstract

Introduction: Dementia is a general term for various disorders characterized by loss of at least one cognitive domain. People living with mild dementia are faced with different difficulties in their daily life activities. Modern technologies, such as mobile phone apps – often called mHealth apps – can alleviate their difficulties. This paper aimed to systematically search, analyse, and synthesize mobile phone apps designed to support people living with mild dementia in daily activities in two mobile stores: Apple App and Google Play Store.

Methods: A search was conducted in May 2019 following Preferred Reporting Items for Systematic Reviews and Meta-Analyses recommendations. Results were analysed and displayed as tables and graphs. Results were synthesized using an inductive coding approach from 14 components of daily life activities for categorized nursing activities. Mobile phone apps were assessed for quality using the System Usability Scale.

Results: A total of 15 of 356 mobile phone apps were identified, applying inclusion and exclusion criteria. The inductive coding analysis identified five major themes: multi-component daily life activities, communication and feelings, recreation, eating and drinking, and movement. Most identified mobile phone apps (73%) were not mentioned in the scientific literature.

Discussion: Mobile phone apps for people living with mild dementia are mainly focused on providing information and maintaining communication skills and life activities. To a lesser extent, the apps focus on solving the problems and challenges people living with mild dementia face due to their condition.

Conclusion: Many mobile phone apps are available in the app store to support people living with mild dementia, yet only a few are focused on daily life challenges. Most of the available apps were not evaluated nor assessed for quality.

Keywords: dementia, mobile health, healthcare, everyday activities

6.1 Introduction

6.1.1 Mobile phone apps used in healthcare

In the past decade, many improvements in technology have been made. Especially, improvements are visible in using mobile phone devices, nowadays called smartphones. Smartphone ownership is growing globally; it is estimated that more than 5 billion people own mobile devices, with more than half of these connections being smartphones [1]. Due to this vast growth in ownership, stakeholders in this industry are capitalizing by building mobile phone software applications (apps) for various uses. Advancement has led to many apps being developed available in social media, games, aid shopping or travel, and so on [2]. Depending on the operating system (OS), different platforms are available, which enable the use of the apps. A mobile OS is a software platform where apps run on mobile devices. Companies dominating the mobile OSs market are Apple Store with iOS and Google Play with Android OS [3, 4].

While the first apps initiated were for organizational and later recreational use [5], many apps have since been developed for use in healthcare, both for professionals and patients. Apps in the healthcare field are gaining high popularity in recent years [6, 7]. These apps are specialized for conditions including diabetes management, alleviating gastrointestinal problems, HIV/AIDS treatments, assisting with learning difficulties, promoting mental health and women's health [2, 8]. Mobile health (mHealth) has shown improvements in the quality, access to, and delivery in terms of sourcing health information, accessing services and skilled help, and promoting positive changes in health-related behaviours to prevent the onset of acute and chronic diseases [9].

6.1.2 Challenges of mild dementia

Dementia is a chronic condition that is associated with ageing. Consequences are evident for patients, significant others, and healthcare systems [10]. Dementia is a term for various disorders characterized by memory impairment and at least one other cognitive domain (executive function, aphasia, apraxia, and agnosia). There are numerous subtypes of dementia, including Alzheimer's disease and frontotemporal lobar dementia [11]. Different stages of dementia bring different challenges. Mild dementia is recognized as a cognitive impairment that represents the potential to grow into serious types of dementia. Patients with mild dementia are independent in simpler activities of daily living (ADLs) [12]. The number of people living with mild dementia continues to grow globally [13]. Thus, many studies focus on dementia prevention [14, 15], treatment, and healthcare [16]. Few focus on helping people living with mild dementia in their ADLs. Virginia Henderson [17] was the

first theorist that focused on ADLs and categorized nursing activities into 14 components based on human needs.

6.1.3 Prior work in the field of dementia and technology use

Dementia affects people with mild dementia and their families, has a significant impact on their lives and health outcomes, and presents a daily challenge [18]. One of the most challenging symptoms of dementia is losing the ability to live independently. Thus, many patients struggle with basic ADLs, including movement, dressing, recreation, communication, eating, and drinking. ADLs such as recreation and movement are usually neglected yet important in maintaining the quality of life [19]. Apps can provide adequate support for people living with mild dementia in their ADLs [20], encouraging their independence, but available apps show limited functions [21]. There are many apps available for people with severe types of dementia. However, little is known about their usability and health outcomes [22].

The app industry is growing rapidly, and new apps are available almost daily. As these apps saturate the market, there is a need to evaluate these apps in usability and content. The review aims to identify and evaluate apps available to support people living with mild dementia throughout their daily lives, specifically with their ADLs. People living with mild dementia are still living in a community setting, and mobile apps help them to manage ADLs independently and are important in this respect to improve their quality of life and relieve the burden on healthcare staff.

6.2 Methods

6.2.1 Design

A systematic review, analysis, and synthesis of apps for mild dementia were conducted. The steps of the review were: (1) app review through an initial screening of all retrieved apps; (2) review of the included apps; (3) data extraction; (4) data analysis; and (5) data synthesis [23].

6.2.2 Search strategy

The search for apps was done in May 2019 using inclusion and exclusion criteria. A search was performed in iOS OS in iPhone (12.3.1 software version) and Android in Samsung S8 (Pie 9.0 software version). Apps that were developed for helping

people living with mild dementia were included. Moreover, we included apps available in mobile stores in Slovenia and the English language.

6.2.3 App selection process

The review process was followed by Preferred Reporting Items for Systematic Reviews and Meta-analyses – PRISMA recommendation [24]. A search was conducted by a researcher (LC) in App Store (for iOS) and Google Play Store (for Android) using the keyword “dementia”. Next, the names of mobile phones from each store were transferred into a Microsoft Excel spreadsheet for duplication removal. Two independent researchers (LG and NF) have reviewed the titles and icons of mobile apps in the Google Play Store, and two independent researchers (LC and GS) have reviewed the titles and icons of mobile apps in the App Store. This approach has been used previously in similar papers [25, 26]. A discussion between members of the research team resolved inconsistencies in the review of apps. Moreover, apps were reviewed by the full description, which included a review of the information about the app characteristics, written information, pictures, and videos. We also investigated if apps were mentioned in scientific literature. In the final phase, we excluded paid apps, as we wanted to include in the final analysis only those apps that are accessible to all users. We have also excluded apps that only targeted specific groups and not people living with mild dementia. We also excluded apps that were only for learning.

6.2.4 Data exclusion

Apps that did not fit the inclusion criteria in App Store were excluded. Apps were excluded if they were games, not adapted for people living with mild dementia, in different languages, commercial, designed for practitioners and caregivers, testing and screening tools, and other apps not relevant to dementia. Moreover, in the full review of installed apps, the exclusion criteria included ADL – learning (information, diaries, orientation, reminders) and only general information about dementia.

6.2.5 Data synthesis

Data were synthesized using mapping coding approach [27] steps in a systematic review of articles. Five major themes were used for mapping codes: multi-ADL, communication and emotions, recreation, eating and drinking, and movement, conducted from 14 components of ADLs [17].

6.2.6 Quality assessment

App quality was assessed using System Usability Scale (SUS) [28], which has been previously used in a similar paper relating to app reviews [29]. The result of SUS was obtained by calculating the score contribution from each item. Each item ranged from 0 to 4 for items 1, 3, 5, 7, and 9 and from 4 to 0 for items 2, 4, 6, 8, and 10. The overall value was obtained by multiplying the score by 2.5.

6.3 Results

6.3.1 General characteristics of included apps

There were 448 apps identified in both App Stores. After removing 92 duplicates, apps were reviewed by name and icon, with 69 apps remaining for review by description. Using the PRISMA recommendations [24] and inclusion and exclusion criteria, 15 apps (4.21% of all identified) were extracted and analysed (Fig. 6.1).

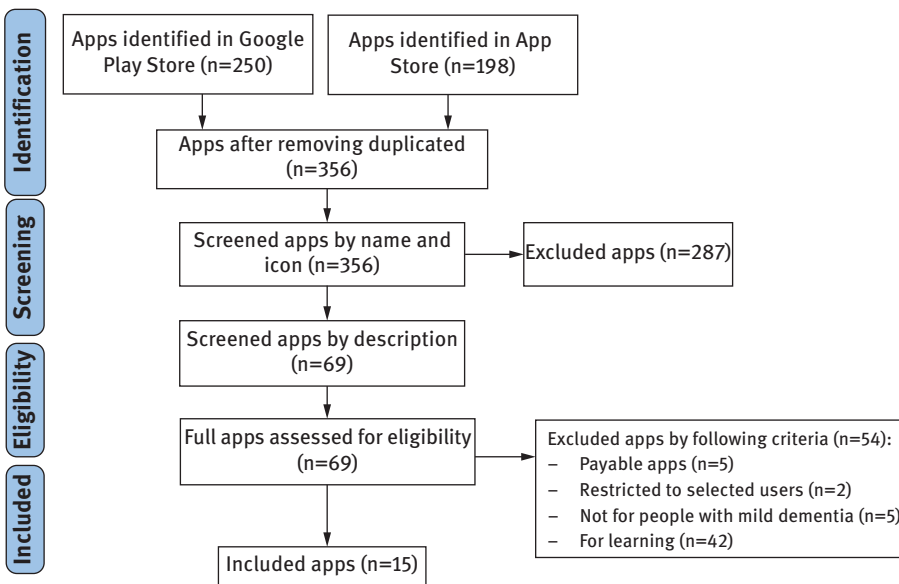


Fig. 6.1: PRISMA flow chart.

Table 6.1 presents the main characteristics of 15 included apps (app name, platform, price, version, category, scientific based-literature, developer, and rating). One app was payable, but the trial version was available. We used information from the Apple App Store for apps that were available on both platforms.

Tab. 6.1: Characteristics of included apps.

Apps name	Target group and target disease	Short description	Operating system	Developer	Version	Category	Price	Mentioned in the scientific literature	Rating (0–5)	SUS
9zest Parkinson's Therapy	The app is primarily aimed at Parkinson's patients and anyone who needs help with eating, drinking, dressing, and other daily activities	App helps users with everyday activities such as eating, drinking, writing, dressing, and walking	iOS, Android OS	9zest, Inc	3.2.0	Medical	\$11.49 monthly plan	Yes	4.5	95
Activities for care: elderly dementia LD seniors	Elderly people with dementia LD	App allows you to monitor patients' electronic vital records from images to videos	iOS, Android OS	RemindMecare	1.0.1	Medical	Free of charge	No	4.8	75
Alzheimer's Daily Companion	For family carers of patients with Alzheimer's disease or other forms of dementia	App includes practical tips for different situations that dementia patients or their carers face on a daily basis	iOS, Android OS	Home Instead, Inc.	2.0.4	Lifestyle	Free of charge	Yes	4.4	85

Talk Around It USA Free	It is aimed at people with word-finding difficulties and has been used to treat conditions such as aphasia, anomia, stroke, dementia, Alzheimer's disease, and autism	App helps with speech and language problems	iOS, Android OS	Neuro Hero Ltd	2.01	Medical	Free of charge	No	Not enough ratings	72.5
Brain Injury – One Skill Videos	For patients with brain injuries	App includes a variety of videos for patients	Android OS	Neuro Hero Ltd	1.0	Medical	Free of charge	No	3.8	72.5
LookBack VR	For people with dementia	App includes VR to stimulate reminiscence and encourage techniques for making contact and improving well-being	iOS, Android OS	VRTU Inc	1.2	Health and fitness	Free of charge	Yes	5.0	57.5
DemKconnect – Dementia Care App	For dementia care providers	App provides access to care, contact with a professional, and access to useful information	iOS, Android OS	Nightingales Medical Trust	1.0.12	Health and fitness	Free of charge	No	Not enough ratings	90

(continued)

Tab. 6.1 (continued)

Apps name	Target group and target disease	Short description	Operating system	Developer	Version	Category	Price	Mentioned in the scientific literature	Rating (0–5)	SUS
Dementia – Cuomo	For dementia patients	App encourages social activity and communication between patients, carers, and healthcare professionals	iOS	Cuomo Limited	1.02	Social networking	Free of charge	No	Not enough ratings	90
Memory Helper Carer Assistance	For carers of people living with memory loss, Alzheimer's disease, or dementia	App facilitates communication with family, carers, and provides useful reminders	iOS, Android OS	Judy Handel	1.3	Medical	Free of charges	No	5.0	77.5
Approach Staffordshire	Patients with memory loss	App includes various reminders, news, and questionnaires for the patient	iOS, Android OS	More IT Ltd.	6.99	Education	Free of charges	No	Not enough ratings	77.5

Most ($n = 9$; 60%) of the identified apps were available for both OSs (iOS and Android). Four (26.66%) apps were available only on Android OS and two (13.33%) on iOS. Apps were categorized in both OS as follows: social networking ($n = 2$), medical ($n = 5$), education ($n = 1$), utilities ($n = 1$), lifestyle ($n = 3$), or health and fitness ($n = 3$). Only four apps (9zest Parkinson's Therapy, Alzheimer's Daily Companion, LookBack VR, and Care and Connect) were mentioned in the scientific literature. The highest SUS score was 95 (9zest Parkinson's Therapy), and the lowest was 57.5 (LookBack VR). None of the analysed apps scored 0 (minimum) or 100 (maximum).

6.3.2 Synthesis

The data synthesis followed the steps of mapping coding. Five major themes were used for mapping codes: multi-ADL, communication and emotions, recreation, eating and drinking, and movement, conducted from 14 components of ADLs [17] (Tab. 6.2).

Tab. 6.2: Mobile apps are categorized by components of ADLs – the synthesis.

MA	Free codes	Subcategory	Main category
1	Balance and posture, eating and drinking, speech, reducing falls, dressing	Multicomponent	Multi-ADL
2	Personal profile, photos, videos, music conversation recording, activity creation tool, family engagement, calendars, alerts, home Integration, hydration alerts, monitoring		
3	Tips and practical advice for all behaviours and situations they face daily		
4	Word retrieval, speech, and language techniques	Communicate with others	Communication and emotions
5	Words, speech, language		
6	Help connect	Connect with others	
7	Communication, support		
8	Community, support, friendships, expressing feelings	Expressing emotions, needs, fears, or opinions	
9	Communication tool, information, reminders, notes		
10	Communication, messages		
11	Sending meaningful messages, pics, and posts enhances social interactions		

Tab. 6.2 (continued)

MA	Free codes	Subcategory	Main category
12	Outside recreation, communities, places, wayfinding	Play or participate in various forms of recreation	Recreation
13	Integration, independence, restaurants, home, calmness, wayfinding, friendly places		
14	Diet, lower blood pressure, reduce risk of diseases, eating barriers, fruit consumption, BMI	Eat and drink adequately	Eating and drinking
15	Movement, move outside home	Maintain desirable postures	Movement

MA, mobile app.

The outcomes of identified apps were heterogenic; thus, further analysis was impossible.

Five main categories and seven sub-categories were identified in the mobile apps. The ADL category referred to multi-components emphasizing breast profile, videos, falls, etc. The Communication and emotions category included three sub-categories referring to communicating with others, connecting with others and expressing emotions. There were also categories relating to exercise, recreation, drinking, and eating.

Three apps (20%) were identified that included more than one category of ADLs (9zest Parkinson's Therapy, Activities for care: elderly dementia LD seniors and Alzheimer's Daily Companion). Most of the identified apps ($n = 8$) focused on communication and expressing feelings. Moreover, two apps focused on recreation: one on eating and drinking and one on movement.

6.4 Discussion

Involvement in the daily activities of people with mild dementia significantly influences their quality of life and overall well-being [30]. However, there is limited research to investigate how to ensure their involvement in ADLs. Five main themes were identified through systematic review, analysis, and synthesis of apps for people living with mild dementia: multi-components; communication and feelings; recreation; eating and drinking; and movement.

People living with mild dementia are often excluded from social activities due to memory loss, loss of confidence, negative reactions from other people, or understanding issues. Possible solutions are dismantling external barriers to participation in society and enabling people living with mild dementia to participate in

social life in a meaningful way [31]. Giebel et al. [19] found that impairments related to social activities caused by dementia significantly affect people's well-being with dementia. Moreover, people living with mild dementia pointed out that one of the most meaningful activities in daily life is being connected with self, others, and the environment [32]. Communication and feelings apps focus on speech and language, word retrieval (Talk Around It USA Free), support, friendship, expressing feelings, sending messages, and enhancing social interactions (Brain Injury – One Skill Videos, LookBack VR, and DemKonnnect – Dementia Care App). Identified apps support people living with mild dementia to stay active and connect with significant others (e.g. writing with peers). DemKonnnect – Dementia Care App also allows video calls, but only with an expert.

Therapeutic recreation has a positive impact on people living with mild dementia in terms of behaviour and well-being [33]. The study conducted in 2016 among Chinese older people living with mild dementia, showed potential improvement in cognitive function, daily living ability, and behavioural and psychological symptoms after implementing a program based on recreation. Interventions included art activities, games, and music activities [34]. Promising results were demonstrated using an interpersonal program for people with dementia, indicating significant correlations between engagement types, behavioural outcomes, and quality of life of people living with mild dementia [35]. This review yielded the following codes associated with recreation in people living with mild dementia: places; communities; integration; independence; restaurants; home; calmness; wayfinding; and friendly places (Care and Connect, and AidEye).

The risk of dehydration and malnutrition in people living with mild dementia is higher than in healthy older people. People living with mild dementia often have difficulties with their eating and drinking habits. This may occur due to their memory loss, resulting in, amongst other things, forgetting about eating and drinking, problems with swallowing, institutionalization, lack of caregivers, and lack of time. Hooper [36] found in their study that people with dementia are often dehydrated. Bunn et al. [37] concluded that this could be decreased if people living with mild dementia eat meals with caregivers, has family-style meals, soothing mealtime music, constant access to snacks, and has longer mealtimes and constant support from caregivers. This cannot always be established; thus, mobile phone apps show significant opportunities with alarms and reminders. Identified apps have the following features linked to eating and drinking: diet, BMI measurements, and fruit consumption (MIND Diet Plan).

People living with mild dementia may be frequently inactive, influencing their mood, social interaction, and overall health. Tobiasson et al. [38] found that physical activity in people living with mild dementia increases satisfaction with life and has positive health outcomes. Going out of the house may be challenging for people with memory loss; thus, apps with an integrated Global Positioning System – GPS may potentially support people living with mild dementia and their caregivers.

Only one app was identified that supports people living with mild dementia in their daily movements – MyAreas. This app encourages a person living with mild dementia to move around and not get lost. It is available only for iOS OS.

6.4.1 Limitations of the review

A possible limitation in this systematic review of apps for people with mild dementia is that not all OSs were included in the search. Dementia is a term used for various symptoms and stages of memory impairment, and people with long-term dementia may not be able to use a mobile phone or mobile phone apps. Moreover, mobile phone apps were evaluated by researchers included in the study and not by people with mild dementia; thus, the app's estimated usability might be biased. Outcome measures used supported in ADLs for people living with mild dementia. Mobile phone apps showed various results (heterogeneity); thus, any further analysis or synthesis was not conducted.

6.5 Conclusion

Mobile phone apps can provide adequate support for people with mild-to-moderate dementia in ADLs. Many available phone apps focus on giving information about dementia; fewer are available to support them in ADLs. The most valuable apps compose more ADLs (9zest Parkinson's Therapy, Activities for care: elderly dementia LD seniors, and Alzheimer's Daily Companion) because it is easier to have one app for multiple activities, especially for those targeting individuals with memory loss problems. The research does not well support mobile phone apps in connection to dementia and ADLs. Moreover, there is no sufficient evidence or quality appraisal tools for evaluating mobile phone apps that would allow us to recommend quality apps for older people living with mild dementia.

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