An Analysis of Apps with a Medication List Functionality for Older Adults with Heart Failure: Evaluation using the Mobile Application Rating Scale (MARS) and the IMS Institute for Healthcare Informatics Functionality Score

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Abstract

Background: Managing the care of older patients with heart failure (HF) largely centres on medication management. Due to their frequent medication or dosing changes, an app supporting them to keep an up-to-date list of medication could be advantageous. During COVID-19 times, HF outpatients' consultations are taking place virtually or by phone. An app with the capability to share the medication list with healthcare professionals before consultation could support the clinic efficiency, for example, reducing consultation time. However, the influence of apps on maintaining an up to date medication history for older adults with HF in Ireland remains largely unexplored.

Objective: The objectives of this review are twofold: to review apps with a medication list functionality and to evaluate the quality of the apps included in the review using the Mobile Application Rating Scale (MARS) and the IMS Institute for Healthcare Informatics functionality scale.

Methods: A systematic search of apps was conducted in June 2019 using the Google Play StoreTM and iTunes App StoreTM. The MARS was used independently by four researchers to assess the quality of the apps using an Android phone and an iPad. Apps were also evaluated using the IMS Institute for Healthcare Informatics functionality score.

Results: Google play and iOS app stores searches identified 483 potential apps (292 from Android stores and 191 from Apple stores). Six apps met the inclusion criteria. Medisafe app had the highest overall MARS score (4/5) and the medication list & medical records app had the lowest overall score (2.5/5). Five out of the six apps achieved an acceptable quality MARS score (>3.0). Two apps scored the maximum number of features (n=11) according to the IMS Institute for Healthcare Informatics functionality score and two scored the lowest (n=5). The apps had on average 8 functions based on the IMS functionality criteria (range 5 to 11).

Conclusions: The quality of current apps with a medication list functionality varies regarding their technical aspects. Most of the apps reviewed have an acceptable MARS objective quality. However, the subjective quality or satisfaction with the apps was poor. Only three apps are based on scientific evidence and have been previously tested. Two apps featured all the IMS Institute for Healthcare Informatics functionalities and half do not provide clear instructions on how to enter medication data, do not display vital parameters data in an easy to understand format and do not guide users on how or when to take their medication. Clinical Trial: N/A

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Abstract

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Conclusions: The quality of current apps with a medication list functionality varies regarding their technical aspects. Most of the apps reviewed have an acceptable MARS objective quality (refers to the overall quality of an app). However, the subjective quality (refers to satisfaction with the apps) was poor. Only three apps are based on scientific evidence and have been previously tested. Two apps featured all the IMS Institute for Healthcare Informatics functionalities and half do not provide clear instructions on how to enter medication data, do not display vital parameters data in an easy to understand format and do not guide users on how or when to take their medication.

Keywords: mobile application, mHealth, medication app, heart failure, Mobile Application Rating Scale

Introduction

Managing the care of older adults with heart failure (HF) largely centres on symptom and medication management [1]. Medication management in HF patients is described as challenging due to the frequent medication or dosing changes [2,3] and polypharmacy as some HF patients typically take on average 10 to 25 tablets daily [4]. Polypharmacy is associated with poor adherence to pharmacological therapies, drug interactions, inappropriate drug prescription, and other adverse effects [5]. A recent report by the World Health Organization

[6] argues that technology can improve patient experiences and medication adherence and enable patients to become active participants in medication reviews. Mobile apps offer the potential to augment care for HF patients. Apps can potentially support older adults to find information on the medications (i.e. drug interactions), track their medication, communicate with healthcare providers, keep a daily record for their blood pressure and weight measurements and facilitate an accurate medication history. However, there is a dearth of literature on apps specifically to support medication history. An accurate medication list prevents adverse drug events [7] increase patients' care outcomes, decrease hospitalisation and mortality rates [8,9], and support medication adherence for patients self-managing at home.

Given the complexity of HF self-care, assisting older adults to manage their own care at home is critical to the success of HF management. Emerging evidence suggests that mobile health (mHealth), particularly mobile technologies, can serve as a form of support for patients with HF and may enhance patient-provider collaboration for self-management [1,10]. By their nature, mobile devices, such as phones are carried by people and therefore are always with them, offering opportunities beyond simple remote monitoring towards assisting with the management of care. In the current context of the COVID-19 pandemic, when the community (and especially older adults) are requested to maintain social distancing, the public health landscape is changing and mHealth has never been so important for treatment (10,11].

For older adults, social isolation and loneliness increases the risk of anxiety, depression symptoms, heart disease, reduction of activities of daily living, morbidity and mortality [12,13]. Government recommendations to self-isolate during this pandemic has undoubtedly had a detrimental effect on older adults, including those that previously had a wide social connection ties with the community and relatives [14]. Older adults previously attending outpatients' appointments have seen their access restricted. In Ireland, the Health Service Executive (HSE) website notes that all out-patient appointments are postponed until further notice [15]. Healthcare professionals (HCP) working in outpatient clinics are seeing a much-reduced number of patients, with most consultations now taking place over the phone, bar medical emergencies. In Ireland, (McGlynn 2020) [16] has drawn attention to the sharp decline in cardiac outpatients' appointments during the period March to April 2020 (300,000 appointments) compared to the same period in 2019. Therefore, the need for new models of care in this changed environment to support older adults at home to alleviate their mental and physical burden as well as providing medical care are especially timely [10,11].

Across many countries, emerging evidence is confirming the important role mHealth can play in community care, especially during COVID-19 times. In the United States, there has been a ten-fold virtual consultations in the space of just a few weeks, 'as big a transformation as any ever before in the history of US health care' [17]. Likewise, Canada, South Africa, India and UK are conducting healthcare virtual consultations at an exponential rate (ibid). In Ireland, the platform "Attend Anywhere", endorsed by the HSE, is now widely available for HCPs to conduct virtual consultations [18]. However, the use of this platform is

not even across Irish clinical settings (some healthcare professionals are actively using it and others are not). Many outpatient services are consulting patients over the phone during the COVID-19 pandemic [19,20], with the exception of patients with exacerbated symptoms.

The process of medication review over the phone is difficult and time consuming [21]. HCPs have to listen attentively to the information the patient is conveying while lacking visual cues (i.e. printed medication list, medication blister provided by pharmacist). Instead, each patient has to spell each medication list over the phone, raising confusion over similarities of medication name or dose thus increasing the length of the consultation. An app sharing an up to date medication list with HCPs pre consultation, could reduce medication and dosing errors, making the consultation process more efficient. A usability study of an app developed for HF self-management was conducted in Australia [22]. Eight participants tested the app over a 14-days period and six of them assessed the app using the MARS tool (widely used to assess the quality of mobile apps). The app was found to be of acceptable quality and beneficial for HF self-management. Interestingly, the medication list feature on the app was considered by the patients to be beneficial, however, none of the patients used it during the 14 days. The authors suggested that participants found it difficult to incorporate the use of the app in to their self-care routine (ibid).

Emerging evidence suggests that apps can support patients by checking drug interactions, tracking medication intake and facilitating an up-to-date list of medications. However, while some app interventions have explored HF self-management [23,24], app interventions focusing on older adults with HF maintaining an accurate medication list has been limited and largely unexplored. This paper will explore the benefits of apps with a medication list functionality, their role in COVID-19 pandemic context and asses their quality using the MARS tool and the IMS Institute for Healthcare Informatics functionality score.

Objectives

The objectives of this review are twofold: to review apps with a medication list functionality and to evaluate the quality of the apps included in the review with a validated scale. To assess the quality and functionality of the apps, two tools were used: the MARS tool and the IMS Institute for Healthcare Informatics functionality score. For the purpose of this paper, an app with a medication list functionality is an app that generates a comprehensive medication history, allowing the patient to email or share the list in real time with HCPs.

Methods

A systematic search of apps, accessible in Ireland, was conducted in June 2019 using the Google Play and iTunes App stores. The purpose was to identify apps with a medication list functionality. The search term “medication list” was used to identify apps with a medication list functionality. The term “medication app” was excluded from the search because it identified apps with a different primary purpose (e.g., medication alarm, medication tracker, medication reminder, apps providing educational information only, medical decision support systems for clinicians, medication adverse effect, pharmacy locator and prescription refills). After initial identification of apps containing a medical list function, the apps

were tabulated. If the same app was available on different platforms (iOS or Android), both versions were retained for analysis as apps behave differently depending on the platform as seen in previous work by [25]. Inclusion and exclusion criteria (see below) were applied to each app to determine whether it should be retained for further analysis.
Apps that met the inclusion criteria were downloaded and evaluated by a team of four researchers. The MARS was used to assess the quality of the apps using an Android phone and an iPad. Apps were also evaluated using the IMS Institute for Healthcare Informatics functionality scores.
A Google Scholar search of the apps was conducted to identify apps included in this review that have been evaluated and published in peer reviewed journals.

Inclusion / Exclusion Criteria

Apps were included if they had a medication list function; if they were updated in the last two years; were free of charge, reflecting popular trends in app downloads [26]; were available in English and had a strict privacy policy written in their website or app store. Although a strict privacy policy is not an ultimate standard, given the sensitivity nature of health information, the presence of a transparent privacy policy on medication apps was deemed of high importance [27].
Apps were excluded from evaluation if they were a game app; were not available in Ireland; focused solely on a particular medical condition (e.g., asthma); were a mobile clinical decision support system; were designed primarily for self-care management of a condition (e.g., COPD, diabetes); were not available for patients to use at home; and had a barcode scanner that did not recognise medication used in Ireland.

Data extraction

The following information for each app with a medication list function was downloaded: developer, the number of downloads of the app, last update and description of the app in the App store. The apps were downloaded from the app store and scientific support was evaluated by investigating their content. Scientific support provides information on the app's evidence of validity as apps which are not supported by evidence are associated with decrements in quality and safety [28]. For example, issues relating to patient confidentiality, inadequate content present in the app and malfunctioning clinical decision making apps could result in negative health outcomes for patients [29]. Apps which fulfilled the inclusion criteria were assessed using the MARS and the IMS Institute for Healthcare Informatics functionality scoring criteria [30].

Rating tools

MARS description

All apps were subjected to in-depth analysis and evaluation using the MARS. To the best of our knowledge, there are no published studies using the MARS to assess the quality of apps with a medication list functionality. MARS was developed by a team of researchers at the University of Queensland, Australia, to provide a systematic means of assessing, classifying and rating the quality of mobile health apps [31].

Within this framework, apps are rated according to four objective measures (engagement, functionality, aesthetics, information quality) and one subjective measure (see Table 1 below). More specifically, engagement involves determining whether the app is fun, interesting, customisable, interactive and well-targeted to its audience. Functionality assesses whether the app is easy to learn, navigate, and flow logically. The aesthetics category evaluates the graphic design, overall visual appeal, colour scheme, and stylistic consistency of the app. Information quality involves evaluating whether the app contains high quality information from a credible source. Subjective quality reflects user satisfaction, app endorsement and continuity of use (ibid). The complete description of the MARS items and subscales can be seen in Multimedia Appendix 1.

The apps were independently reviewed by four reviewers using a five-point scale (1 = inadequate, 2 = poor, 3 = acceptable, 4 = good, 5 = excellent), ratings of include apps can be seen in Multimedia Appendix 2. Scores for each category were obtained by calculating the mean of the ratings for each subscales according to the five measures described above. The total score for each app were determined by the average of the four objective measures. The overall mean app quality total score and the total score for the subjective measure (subjective quality, worth recommending, repeat use of the app and overall satisfaction) were also calculated.

The reviewers carefully read the MARS instructions, independently review the apps and provide a rationale for their ratings. Subsequently, they compared results and reached a consensus on each of the ratings for each of the MARS subscales [31]. Prior to rating the included apps, each reviewer rated two randomly selected apps for training purposes (from those apps who were excluded from the review). The results were discussed to ensure all reviewers had an understanding of the MARS items and the rating process.

IMS Institute for Healthcare Informatics functionality score description [30]

To complement the MARS quality assessment, another tool was used to independently evaluate the apps functionalities. This evaluation focused on scope of functions and the potential role each functionality plays in supporting self-management for patients with HF.

This tool, unlike MARS, only assesses objective quality and it has been used previously to evaluate app capabilities [32,33]. The functionality score consists of 7 functionality criteria and 4 functional subcategories. The complete structure of the IMS Institute for Healthcare Informatics functionality scoring criteria can be seen in Multimedia Appendix 3. If a function was present, it was coded as 1, if not it was coded as 0. A functionality score ranging from 0 to 11 was generated for each app.

Results

Google Play and iTunes App stores searches identified 483 potential apps (292 Google Play stores and 191 iTunes stores), the app selection process for both app stores can be seen in Multimedia Appendix 4 and 5. Six apps (three across both stores) met the inclusion criteria. Four out of the six apps reviewed achieved an acceptable quality (MARS score 3/5), one achieved a good quality score (4/5) and one a poor quality score (2.5/5). The median overall MARS score

was 3.5/5, ranging from 2.5/5 to 4/5. As stated earlier, the apps are rated according to four objective measures: engagement, functionality, aesthetics and information. The functionality dimension mean score achieved the highest score (3.7), whereas the information and engagement dimensions mean score resulted in the lowest (3.2). The total mean subjective MARS score (2.8/5) was lower than the total mean objective MARS score (3.4/5).

The apps had on average 8 functions based on the IMS criteria (range 5 to 11). Two apps achieved the highest IMS functionality criteria score (n=11) whereas two apps achieved the lowest score (n=5). All functions (n=11) are listed below in Table 4: IMS Institute for Healthcare Informatics functionality score results. All apps have a collecting, sharing and recording functionality. However, half of the apps do not provide clear instructions on how to enter medication data, do not display vital parameters data in an easy-to-understand format and do not guide or provide users with advice on how or when to take their medication. Only two apps have the capability of allowing users to communicate with healthcare professionals or family and friends in real time.

Table 3: MARS section scores, overall mean, subjective quality results and mean total

App name	Developer	Engage	Function	Aesthetics	Information	Overall	Subjective
Dosecast*	Montuno Software, LLC	3.3	3.4	3.3	3.1	3.3	2.5
MyTherapy*	Smart patient GmbH	3.4	4.0	3.8	3.4	3.7	3.4
Medication list & medical records*	LSD infotech	2.1	2.9	2.6	2.3	2.5	1.6
Medisafe*	MediSafe	3.6	4.5	3.9	4.0	4.0	4.0
Medlist Pro*	Ramtin Software Solutions	3.2	3.1	2.8	2.7	3.0	1.5
Dosecast†	Montuno Software, LLC	3.1	3.2	3.2	2.8	3.1	2.2
My Therapy†	Smart patient GmbH	3.4	3.9	3.6	3.2	3.5	2.9

Medisafe†	MediSafe Inc	3.6	4.5	3.9	4.0	4.0	3.8
Pill reminder†	Sergio Licea	3.5	4.1	3.9	3.1	3.7	3.6
Mean total		3.2	3.7	3.4	3.2	3.4	2.8

*Android Platform †iTunes platform

Table 4: IMS Institute for Healthcare Informatics functionality score results

IMS Functionality scoring criteria	Dosecast (Google play & iTunes)	My Therapy (Google play & iTunes)	Medication list & medical records	Medisafe (Google play & iTunes)	Pill reminder (iTunes)	Medlist Pro (Google play)
Inform	--	✓	--	✓	--	--
Instruct	--	✓	--	✓	✓	--
Record	✓	✓	✓	✓	✓	✓
Collect data	✓	✓	✓	✓	✓	✓
Share data	✓	✓	✓	✓	✓	✓
Evaluate data	--	✓	✓	✓	✓	--
Intervene	✓	✓	--	✓	✓	✓
Display	--	✓	✓	✓	--	--
Guide	--	✓	--	✓	--	✓
Remind/ Alert	✓	✓	--	✓	✓	✓
Communicate	--	✓	--	✓	--	--
Total	**5**	**11**	**5**	**11**	**7**	**6**

Quality Assessment Using the Mobile App Rating Scale

Four out of the six apps achieved an acceptable quality suggesting that most apps are of acceptable quality. None of the apps presented any major technical issues during the review and all were updated in the last two years. Features included in most apps reviewed were: medication reminder, medication history log with the ability to share a medication report with others, vital parameters tracking and syncing the account to other devices.

Only one app (Medisafe) achieved the highest objective and subjective overall MARS score. One of the distinctive features of this app was the ability to educate users on how and when to take their medication, drug to drug interaction information and medication side effects. This information was presented in videos using a clear and concise language and text format. Also, there is evidence of effectiveness as the Medisafe app has been previously tested in two randomised control trials [34,35], as a medication adherence tool

using scheduled reminders [36] and as a medication reminder related to patients' intention to use the app [37].

The overall subjective quality dimension was significantly lower (2.8/5) than the overall objective mean of all apps (3.4/5). Only one app (medication list & medical records), achieved a lower objective overall score (2.5/5) than the subjective overall score. The subjective quality represented the opinion of the user on level of satisfaction with the app, willingness to pay for it and the extent to which the user will recommend it to others. It appears that the apps reviewed, to a certain extent, are well designed as most apps achieved an acceptable objective quality. However, the subjective quality was poor as the reviewers provided lower scores on continuity of use and willingness to recommend the apps to others.

The functionality dimension mean score achieved the highest score (3.7), indicating a trend to higher scores of response on a timely manner, intuitiveness and ease of use and navigation across all apps. However, the information and engagement dimensions mean score resulted in the lowest (3.2). The information dimension represented the quality and quantity of information present in the app and the way this information is provided, for example, through the use of different formats: videos, text and or graphs. The quality of the information on the apps reviewed varied, as some provide good quality medication information and in others there was a very poor level of information or none present at all.

None of the apps included in the review performed very well in the engagement dimension (if the app is fun or interesting to the user). Medication apps as a rule are not fun and entertaining, however, most apps allowed interactivity (ability to input information and prompting) and for customisation (sending notifications and setting up medication reminders). Another category in engagement, target group, evaluated if the apps content (i.e. visual information, language and design) was appropriate for the user. Most of patients diagnosed with HF are older adults. The apps reviewed were not specifically designed for use by older adults and do not have an age friendly interface. An example of an age friendly interface is when an app facilitates older adults to enlarge the font size of the screen if required. Avoiding information overload and providing detailed instructions on how to use the app are also age friendly interface examples [38]. Three of the apps reviewed (Dosecast, Medication list & medical records and Medlist Pro) did not provide clear instructions on how to use the app or how to input medication. App developers should consult with and take older adult's views, needs and preferences into consideration to make apps more age friendly and increase usability [38].

IMS Institute for Healthcare Informatics functionality score evaluation and implications for HF patients

Inform: Only two apps (Medisafe and MyTherapy) communicate effectively to users, offering an educational component about medication and the medical condition associated to each medication. Also, both apps inform users about the medication they are taking and possible drug to drug interactions. Due to the frequent medication or dosing changes in patients with HF, this is a critical function. Medication adherence and continuous education on the condition and

symptom management is vital to reduce re-hospitalisation, illness progression and exacerbation of symptoms for HF patients [39].

Instruct: Some of the apps reviewed (Dosecast, Medication list & medical records and Medlist Pro) were not intuitive and did not provide clear instructions on how to enter medication strength, time of the day, route and setting up medication reminders. In others, the level of detailed instructions varied. Providing clear instructions on the use of an app is vital for older adults with HF. HF patients are predominantly patients over the age of 65 [40] and old age has been cited as a barrier to app use and uptake [41]. Therefore, app designers should take into consideration the needs of older adults using apps and include basic usability advice and easy to understand content [38,42].

Record: All apps allow users to record their medication and a history of usage. Most apps also have the capability of recording vital parameters. For HF patients, blood pressure and weight measurements are useful to monitor their illness progress and identify when symptoms exacerbate. One of the main goals in HF care is to avoid rehospitalisation and major cardiac adverse events [32]. One app in particular offers the possibility of tracking mental well-being, another key area that needs particular attention. Individuals diagnosed with HF, depression and anxiety are not uncommon, leading to re-hospitalisation, poorer quality of life and increased morbidity and mortality [43].

Evaluate data: Four apps (MyTherapy, Medication list & medical records, Medisafe and Pill reminder) allow data entered to the app to be analysed and evaluated by the user, a relative or a healthcare professional. This functionality allows for information to be shared easily and in a timely manner for healthcare professionals to evaluate it and act accordingly. For example, relatives and clinicians can evaluate if the person is adhering to medication or not.

Intervene: Five out of the six apps (except Medication list & medical records) have the capability to recommend the user, a relative or a medical practitioner to intervene based on the data collected. Building from the example provided in “evaluate data” once the health information is evaluated, an intervention can be put in place. Examples of interventions for HF patients could be to reduce or increase a medication dose, reduce fluid intake, and attend the clinic or emergency department on the day. Other examples are the ability of the app to communicate effectively to provide a positive intervention i.e. reminders to refill their medication or a suggestion to engage on physical activity to achieve their daily activity goal.

Display: Apps with a cluttered or bland display do not engage users and they are less likely to offer a positive user experience. In three of the apps reviewed (MyTherapy, Medication list & medical records and Medisafe) the data was displayed in a clear and colourful graphical representation format. This function could potentially be effective for patients with HF as they can generate easy to understand health reports, i.e. medication, weight and blood pressure [22]. Consequently, health reports will highlight behavioural change, for example, to adhere to the medication prescribed, reduce fluid intake or ring the clinic regarding weight gain.

Guide: Half of the apps (Dosecast, Medication list & medical records and Pill reminder) do not provide comprehensive guidance or training about the correct administration of medication or advice on the time of day medication should be administered, for example, before or after a meal. HF medication management

is complex and continuous education and advice on regular medication use is vital for HF self-management [32].

Reminder / Alert: All apps issue an alert to remind users to take their medication and most allow the user to tick off their medication once they take it or record it as a missed dose. Most apps also had the capability of reminding users of upcoming medical appointments. Apps with a reminder function improve medication adherence, enhancing HF patients' complex medication management [32]. One of the apps, Medisafe, alert users and their relatives of drug to drug interactions and of missed medication doses.

Communicate: this function offers the option to communicate with healthcare professionals or with an online support group in real time. Medisafe app offers users the possibility to communicate with unlimited Medfriends supporters (relatives, friends or caregivers). Another app, MyTherapy, provides healthcare professionals with an overview of patients' data to plan for their treatment between visits through the Web Dashboard function.

Google Scholar search

A search was conducted to identify apps included in this review that have been evaluated and published in peer reviewed journals. Three of the apps reviewed were identified in the search: Dosecast, MyTherapy and Medisafe app.

Discussion

To our knowledge, this is the first study assessing the quality of apps with a medication list functionality using the MARS and the IMS Institute for Healthcare Informatics functionality scale available to Irish consumers. The most common functionalities found on the apps reviewed were medication reminder, medication history log and the ability to share the medication report with others, vital parameters tracking and syncing the account to other devices. However, half do not provide clear instructions on how to enter medication data, do not display vital parameters data in an easy to understand format and do not guide users on how or when to take their medication.

App users prefer apps that are effective, useful and easy to use [44]. From the apps reviewed, Medisafe app achieved the highest objective and subjective overall MARS score and the highest IMS Institute for Healthcare Informatics functionality score. One of the distinctive features of this app is the ability to educate users on how and when to take their medication, drug to drug interaction information and medication side effects. This information was presented in videos using a clear and concise language and text format. The app was found to be very intuitive and has an age friendly interface.

The quality and efficacy of health apps is another important factor to be considered by users, apps with better quality provide positive user experiences and a higher uptake [45]. Most of the apps included in this review had an acceptable quality. However, for users it is not easy to determine the quality, performance and trustworthiness of apps. The number of apps available in app stores has been growing exponentially in the last decade [30,46] impacting the user ability to distinguish app quality and performance. Therefore, the need for

a reliable and easy to use tool to facilitate this process is warranted [47].

Mobile health applications use is growing at an exponential rate but there are questions about their efficacy. One of the methods to check evidence of efficacy is to conduct a search for academic peer-reviewed evidence. For the purpose of this paper, a search was conducted for each app in Google Scholar to identify any published peer reviewed article. Three of the apps reviewed were identified in the search. The Medisafe app has been previously tested in two randomised control trials: a medication adherence study [34] and a medication adherence and blood pressure control study [35]. MyTherapy app was tested on a study [48] as a medication tracker and reminder whereas the Dosecast app was included in the IMS Institute for Healthcare Informatics review [30], a MARS review [49] and on a feasibility and acceptability medication adherence experimental trial [50]. However, many widely used apps have not yet been scientifically tested. Therefore, there is a need for more apps to be tested scientifically and the outcomes to be disseminated to inform the mHealth research community [22,51].

The mHealth research community have been actively searching for self-management solutions to support older adults shielding at home during the COVID-19 pandemic. One of their focus areas is to support self-management and medication adherence [52]. Apps with a medication reminder functionality may have a potentially important role to play in promoting greater self-management of vulnerable older adults living at home. In Ireland, as per March 2021, older adults are shielding and movement are restricted to a 5 km radius. The monotonous routine makes each day very similar to the previous one and daily routines such as taking medication at scheduled times might become easy to forget. All apps reviewed, with the exception of one, have the capability of reminding users to take their medication. Medication reminder apps have been found to be effective and to increase medication adherence [48,49,53,54,55] even for HF patients [56]. Another app feature that might be of benefit during the COVID-19 pandemic is the ability for older adults with HF to communicate with their medical team or relatives via the app. As mentioned earlier, in Ireland, the number of in person HF outpatients' consultations have considerably decreased in 2020 [15,16]. As per March 2021, the probability of contracting the virus for healthcare personnel remains high [57] and HF patients are shielding as they are considered one of the most vulnerable group [58].

Lastly, this paper identified a small number of apps that could be suitable for HF patients sharing their medication list with healthcare professionals prior to consultation. Due to the sensitive nature of healthcare data and in an era where GDPR legislation considerations are increasingly important, a strict data policy was a criterion for selection. For example, one of the frequent concerns app users have is how their health data is processed. Under GDPR legislation, app users are encouraged to ask and obtain information in relation to data security and data processing [59]. However, after the introduction of the General Data Protection regulation in 2018, no specific guidance on privacy has been developed for apps widely available to consumers [60]. Therefore, the need for transparent and easy to understand strict privacy policies in health apps should be mandatory if consumers are expected to download and use mobile health apps [60,61] and if clinicians are expected to recommend apps to their patients [62].

Conclusions

The quality of current apps with a medication list functionality varies regarding their technical aspects. Most of the apps reviewed have an acceptable MARS objective quality. However, the subjective quality or satisfaction with the apps was poor. The objective quality assesses whether an app is interesting, easy to navigate and overall visual appeal among other characteristics. Whereas the subjective quality reflects user satisfaction, app endorsement and continuity of use. Only three apps are based on scientific evidence and have been previously tested. Two apps featured all the IMS Institute for Healthcare Informatics functionalities and half do not provide clear instructions on how to enter medication data, do not display vital parameters data in an easy to understand format and do not guide users on how or when to take their medication.
To our knowledge, this is the first study using the MARS to assess the quality of apps with a medication list functionality available in the Irish app stores. The need for an app to support older adults with heart failure to keep an accurate medication list is warranted. We recommend that app developers display either in the app or in the website, a transparent and easy to understand privacy policy to increase patients and healthcare professionals trust and usage.

Limitations

One of the limitations of this review is the limited numbers of apps, as only those with a strict privacy policy written in their website or app store were included. Furthermore, due to the fast pace of app development, it is possible that by the time this article is published, there may be new apps with a medication list functionality available to Irish consumers.

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Conflicts of Interest

None declared.

Multimedia Appendix 1

Multimedia Appendix 2

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Abbreviations

COVID-19: coronavirus disease of 2019
HCP: healthcare professional
HF: heart failure
HSE: Health Service Executive
MARS: Mobile Application Rating System
mHealth: mobile health
WHO: World Health Organisation

Supplementary Files

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Multimedia Appendixes

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