Optimizing smartphone intervention features to improve chronic disease management: A rapid review

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Abstract
While there are an increasing number of mobile health applications to facilitate self-management in patients with chronic disease, little is known about which application features are responsible for impact. The objective was to uncover application features associated with increased usability or improved patient outcomes. A rapid review was conducted in MEDLINE for recent studies on smartphone applications. Eligible studies examined applications for adult chronic disease populations, with self-management content, and assessed specific features. The features studied and their impacts on usability and patient outcomes were extracted. From 3661 records, 19 studies were eligible. Numerous application features related to interface (e.g. reduced number of screens, limited manual data entry) and content (e.g. simplicity, self-tracking features) were linked to improved usability. Only three studies examined patient outcomes. Specific features were shown to have a higher impact. Implementing them can improve chronic disease management and reduce app development efforts.

Keywords
chronic disease, health outcomes, mHealth, mobile applications, usability

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Introduction

Chronic diseases, including cardiovascular and respiratory diseases, cancer, and diabetes, are a significant cause of morbidity and mortality worldwide. Despite the existence of many therapies for these diseases, adherence and self-management are often suboptimal, resulting in a large annual financial burden to health systems. With the advancement of digital technology, individuals and companies have made an effort to address chronic disease management. One example is the use of mobile health applications (app(s))—computer programs on smartphones—to improve patient self-management.

Current literature supports the use of mobile app interventions for chronic disease management. Many studies show statistically significant improvements in clinically relevant indicators of chronic disease management with mobile app interventions; for example, one meta-analysis clearly indicated these interventions can reduce HbA1c% levels in diabetics, a common indicator of appropriate diabetic management. Moreover, research also provides evidence of app “usability,” defined by the International Standardization Organization as the “extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction, in a specified context of use.” For example, patient populations rate most hypertension apps as “usable.”

However, a vast amount of mobile health interventions have been reported to fail during clinical implementation. Given the large number of apps available, the frequency at which apps are developed, and the cost of development, it is important to identify the specific features that are more promising. Little is known about the specific app features that are responsible for improvements in chronic disease management. Typically, investigators hypothesize about desirable features. For instance, Lee Jungh et al., analyzed several mobile interventions to determine whether they improved disease outcomes or usability and then discussed several app features shared by successful interventions in common.

To our knowledge, no review has focused on specifically studying the app features of smartphone interventions targeting chronic disease management. We found one meta-analysis on text messaging interventions that showed that personalized messages, scheduled less than daily, were most effective at improving chronic disease management. However, as the mobile world has advanced beyond text messaging, a deeper understanding of new mobile features is due. Given app diversity, it is important to know what makes a given mobile app intervention effective at improving chronic disease management. This information could help end users, such as development teams, design interventions with the most favorable app features.

Objective

The goal of this review was to determine the impact of specific mobile app features on chronic disease management or usability.

Methods

Design

We conducted a convergent mixed study rapid review, where qualitative, quantitative, and mixed method studies were integrated to better understand the complex and new phenomenon of mobile app use in health management. Rapid reviews are essentially less comprehensive than systematic
reviews and aim to uncover results quicker and with less divergent accompanying findings.\textsuperscript{15} They are particularly appropriate for the study of mobile apps, given the rapid evolution of technology.\textsuperscript{16}

\textbf{Information source and search strategy}

A literature search was conducted on 13 May 2018 in a single major database (MEDLINE) for relevant original studies on app features. The intentionally broad preliminary search terms were: “Mobile Applications (Mesh)” Or “Smartphones” Or “Mobile Apps” Or “Cell Phones Or iPhones.” Search terms beyond the MeSH term were required, given the frequent delay in assigning MeSH categories to new studies. To further narrow the search, additional filters for English papers, human subjects, adult populations (18–44 years), and publication year (past 5 years) were applied. The search strategy was discussed with a health science librarian. We opted not to limit the search with terms for specific chronic diseases such as diabetes or human immunodeficiency virus (HIV) infection. This resulted in more records to screen but prevented us from missing potential studies.

\textbf{Study selection}

One reviewer (A.G.) conducted study selection as per rapid review norms.\textsuperscript{17} Selection was completed in two rounds. First, records were screened by title and abstract and second, by full text. A second reviewer resolved any uncertainties (I.V.). The following eligibility criteria were applied:

\textbf{Population.} We included original studies conducted with adults who were clinically diagnosed with a chronic disease, such as diabetes, HIV infection, heart failure, or depression.

\textbf{Intervention.} To be included, studies needed to investigate interventions based on smartphone mobile apps to help patients self-manage their conditions. Self-management was defined as the “active participation by a patient in his or her own health care decisions and interventions.\textsuperscript{18}” Interventions strictly based on text messaging have been studied extensively and were excluded. Interventions utilizing computers, tablets, and other wearable devices were also excluded to focus on widely available portable devices, that is, smartphones. Interventions that only provided information to clinicians were excluded, as our interest was in what helps patients themselves manage their disease(s).

\textbf{Outcomes.} Eligible studies examined the impacts of specific app features on disease management or usability. Studies that measured outcomes of an app without narrowing in on specific app features were excluded.

There were no additional exclusion criteria for the number of apps studied or the number of participants in each study as we wanted to be comprehensive and extract the maximum amount of both quantitative and qualitative information.

\textbf{Data extraction}

Each study’s authors, date, country, population examined, design, duration, and number of participants were extracted to provide context for how each app feature was studied. The reviewer then extracted (1) a description of each app feature considered and (2) the study’s quantitative or qualitative findings on the reported impact of each feature on chronic disease management or usability.
Synthesis

The raw results include, per study, each app feature studied and the impact described on chronic disease management or usability. These data were then synthetized using qualitative synthesis methods. More precisely, we used grouping and clustering to divide features into meaningful categories for interpretation. During the synthesis process, we used several steps to regroup studies inductively. The first distinction was made between app features relating to content and those concerned with interface. Content refers to what is delivered by the intervention, while interface concerns how the content is accessed. Content features were further broken down into information presentation features, personal data tracking and tailoring features, communication with health worker features, and social support features. Interface features were divided into screen features, data entry features, and security features.

Results

Study selection process

From 3661 initial search records, 19 original studies were included in the review (see flowchart in Figure 1). The most common reason for article exclusion during the title and abstract screen was because the app being studied was not designed for chronic disease management. During the full-text review, studies were mostly excluded for failure to study a specific mobile app feature. This exclusion criterion was applied with caution, since some studies provided relevant data on specific mobile app features as secondary outcomes and were eligible.

Characteristics of included studies

Specific chronic diseases represented by the retained studies were diabetes (n = 4 studies), HIV infection (n = 4), mental illness (n = 2), hypertension (n = 2), chronic pain (n = 1), thalassemia (n = 1), chronic obstructive pulmonary disease (n = 1), and rheumatoid arthritis (n = 1). Three additional studies concerned patient populations with multiple chronic diseases. Study designs varied. Approximately half (n = 11) were quantitative studies, whereas seven were qualitative and one was mixed. Prevalent among the quantitative studies were surveys on specific features (n = 6), quasi-experimental cohort studies where several features were implemented and outcomes such as depression scores or viral loads were measured (n = 3), and quasi-experimental cohort studies where several features were implemented and usability outcomes were measured (n = 2). Prevalent among the qualitative studies were interviews (n = 5) and focus groups (n = 2) that inquired with open-ended questions, about patient preferences for proposed features or for suggestions on what features to include. The characteristics of each included study can be found in Table 1.

Results of included studies

As per our eligibility criteria, each retained study examined several app features and resulted in findings for each feature. The raw features and findings, per study, are presented in Table 2 (Main findings for interface features) and Table 3 (Main findings for content features).

Interface-related app features. Interface features (i.e. screen features, data entry features, and security features) were examined in approximately one-third of the studies (n = 6, 32%).
Regarding screen features, two studies identified the need to minimize the number of screens one must encounter per task.\textsuperscript{20,21} Two studies identified the need for clean visuals\textsuperscript{22,23} and one identified the benefit of a “welcome wizard” with instructions, the first time an app is used.\textsuperscript{23} An additional study showed that light colors and ornate fonts were most beneficial.\textsuperscript{24}

As to data entry features, one study identified the need to limit the use of manual data entry.\textsuperscript{20} One study showed that input data should be limited to meaningful values (i.e. within the possible range of values).\textsuperscript{23} Moreover, this study highlights the benefit of an error notification function that signals erroneous inputs.\textsuperscript{23}

For security features, one study examined authentication methods and found that password protection is essential and that PIN entry is preferred to other methods.\textsuperscript{25} Another study
Table 1. Characteristics of included studies.

| Title                                                                 | Author                  | Date   | Country | Type of study | Population | Study design                                                                 | Study length | No. of participants |
|----------------------------------------------------------------------|-------------------------|--------|---------|---------------|------------|-------------------------------------------------------------------------------|--------------|---------------------|
| Evaluating authentication options for mobile health applications in younger and older adults | Grinrod et al.          | 2018   | Canada  | Quant         | Multiple   | Participants attempted various authentication methods, and the following outcomes were measured: (1) time to authenticate, (2) mean number of errors before login, and (3) satisfaction with the method. | Cross-sectional | 102                 |
| mHealth applications for diabetes: User preference and implications for app development | Conway et al.           | 2016   | UK      | Quant         | Diabetes   | Participants answered a survey on the desirability of common app features.    | Cross-sectional | 226                 |
| Supporting the self-management of hypertension: Patients’ experiences of using a mobile phone-based system | Hallberg et al.         | 2015   | Sweden  | Qual          | Hypertension | Participants used an app for 8 weeks and were then interviewed on the utility of the self-management system. | 8 weeks      | 51                  |
| Developing an interactive mobile phone self-report system for self-management of hypertension. Part 2: Content validity and usability | Bengtsson et al.        | 2014 (Part 2) | Sweden | Qual          | Hypertension | Interviews were conducted to evaluate various self-reporting questions a mobile app posed. | Cross-sectional | 21                  |
| Usability Pitfalls of Diabetes mHealth Apps for the Elderly         | Isakovic et al.         | 2016   | Slovenia| Qual          | Diabetes   | Participants were asked to perform a task in an app and were then retrospectively probed to inquire about the usability of the features. | Cross-sectional | 10                  |
| Smartphone application for rheumatoid arthritis self-management: cross sectional study revealed the usefulness, willingness to use and patients needs | Azevedo et al.          | 2015   | Portugal| Quant         | Rheumatoid arthritis | Participants completed a survey about the usefulness of several proposed mobile app features. | Cross-sectional | 100                 |
| Development of a mental health smartphone app: perspectives of mental health service users | Goodwin et al.          | 2016   | Ireland | Qual          | Mental health | Interviews were conducted and participants were asked about the usefulness of several suggested app features. | Cross-sectional | 8                   |
| Beta Testing a Novel Smartphone Application to Improve Medication Adherence | Ly et al.               | 2014   | USA     | Quant         | Depression | 2 cohorts tried apps with different intervention contents. Beck’s Depression Scores were conducted before and after in each cohort. | 8 weeks      | 81                  |
| Effect of a smartphone application incorporating personalized health-related imagery on adherence to antiretroviral therapy: a randomized clinical trial | Perera et al.           | 2014   | New Zealand | Quant       | HIV        | 2 cohorts either underwent a standard intervention or an enhanced intervention with added features. Viral load and self-reported adherence was measured in both groups at baseline and after 3 months. | 3 months      | 26                  |
| Feasibility and Preliminary Outcomes of a Web and Smartphone-Based Medication Self-Management Platform for Chronically Ill Patients | Anglada et al.          | 2016   | Spain   | Quant         | Multiple   | Participants tried an intervention and then completed a survey. The % of participants who used each intervention feature and the % of participants who found the feature useful were presented. | 6 months      | 42                  |

(Continued)
| Title | Author | Date | Country | Type of study | Population | Study design | Study length | No. of participants |
|-------|--------|------|---------|--------------|------------|--------------|--------------|-------------------|
| Development and testing of a mobile application to support diabetes self-management for people with newly diagnosed type 2 diabetes: a design thinking case study | Peterson et al. | 2017 | Denmark | Qual | Diabetes | Users tested an app and were then interviewed about usability and perceptions. | 4 weeks | 14 |
| Assessing the quality and usability of smartphone apps for pain self-management | Reynoldson et al. | 2014 | United Kingdom | Quant | Pain | Users tested two apps and reported their preferences for certain usability characteristics. | Cross-sectional | 41 |
| Usability of Commercially Available Mobile Applications for Diverse Patients | Sarkar et al. | 2016 | USA | Quant | Multiple | Participants were given tasks to complete, and statistics about their ability to achieve the tasks were obtained. | Cross-sectional | 26 |
| Using Persuasive Technology to Increase Physical Activity in People With Chronic Obstructive Pulmonary Disease by Encouraging Regular Walking: A Mixed-Method Study Exploring Opinions & Preferences | Bartlett et al. | 2017 | UK | Quant | COPD | Participants tried three interventions and then answered a questionnaire about the relative persuasiveness of each. | Cross-sectional | 54 |
| The Use of Mobile Health Applications Among Youth and Young Adults Living with HIV: Focus Group Findings | Saberi et al. | 2016 | USA | Qual | HIV | 4 focus groups were conducted to determine features of the ideal app for an HIV intervention. The most recurrent findings were presented. | Cross-sectional | 17 |
| Use of Design Science for Informing the Development of a Mobile App for Persons Living with HIV | Schnall et al. | 2014 | USA | Qual | HIV | A focus group was conducted to discover the features participants desired most in a mobile intervention. | Cross-sectional | 5 |
| Mobile technology use and desired technology-based intervention characteristics among HIV+ Black men who have sex with men | Senn et al. | 2017 | USA | Mixed | HIV | A questionnaire and phone interview were conducted to inquire about the features participants desired most in a mobile intervention. | Cross-sectional | 22 |
| Patient Involvement as Experts in the Development and Assessment of a Smartphone App as a Patient Education Tool for the Management of Thalassemia and Iron Overload Syndromes | Ward et al. | 2016 | Canada | Quant | Thalassemia | A questionnaire was used to assess participants’ desires for certain design options. Participants were asked questions and then had to rank potential answers in order of preference. | Cross-sectional | 35 |
| Randomized Controlled Trial of Super Better, a Smartphone-Based/Internet-Based Self-Help Tool to Reduce Depressive Symptoms | Roepke et al. | 2015 | USA | Quant | Health | Participants with depression were either assigned to use the SB Social Media app, a cognitive behavioral therapy and psychotherapy enhanced SB app, or were assigned to the control group. Depression scores were measured at baseline and at 6 weeks. | 8 weeks | 283 |

Quant: quantitative study, Qual: qualitative study, Mixed: mixed methods study; COPD: chronic obstructive pulmonary disease.
| Author          | Date  | Characteristics                                           | Findings                                                                 |
|-----------------|-------|-----------------------------------------------------------|--------------------------------------------------------------------------|
| Grinrod et al.  | 2018  | PIN authentication, Fingerprint authentication, Pattern authentication, Graphical authentication | Fastest, least errors, most preferred                                     |
|                 |       |                                                           | Slowest, most errors, least preferred                                     |
|                 |       |                                                           | Irritating for older population                                          |
|                 |       |                                                           | Irritating for younger population                                        |
| Isakovic et al. | 2016  | App welcome screen, Application buttons, Error notification function, Input data | Should have a welcome wizard with instructions                          |
|                 |       |                                                           | Need to look like buttons, not pictures                                |
|                 |       |                                                           | Needs to identify when there is an erroneous input                      |
|                 |       |                                                           | Needs to be limited to meaningful values                                |
| Reynoldson et al. | 2014  | Preferred colors, Preferred font                          | Light blue and white > darker colors                                     |
|                 |       |                                                           | Ornate and non-standard > standard font                                  |
| Sarkar et al.   | 2016  | Data entering tasks, Data retrieval tasks                | 50%–89% success rate                                                    |
|                 |       |                                                           | 43% success rate                                                        |
|                 |       |                                                           | Recommendations:                                                        |
|                 |       |                                                           | Reducing the number of screens                                           |
|                 |       |                                                           | Reducing manual entry                                                   |
|                 |       |                                                           | Using simple language                                                   |
|                 |       |                                                           | Having clear rationale for each part of the design                      |
| Ward et al.     | 2016  | Ease of use > clean visuals > fast loading > offline availability > search functionality > Security details > provider credentials > how to optimize usability > Frequently updated > reliability > password protection > Advertisement/spam > push notifications > pop-ups | Most liked app features ranked in priority of importance to users        |
|                 |       |                                                           | Information about app desired ranked in priority of importance to users |
|                 |       |                                                           | Features needed for continued app use ranked in priority of importance to users |
|                 |       |                                                           | Least liked features ranked in priority of importance to users          |
| Shnall et al.   | 2014  | Limiting the number of screens, User interface and information presented simply, Confidentiality and privacy | Usability factors which would make users more likely to use an app       |
Table 3. Main findings for content features.

| Author          | Date | Characteristics                                                                 | Findings                                                                                     |
|-----------------|------|---------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| Conway et al.   | 2016 | Password protection<br>Ratio wizard and glucose monitoring function<br>Insulin logging<br>Social media integration | Most desirable feature overall<br>More desirable in type I > type II diabetes users<br>More desirable in Type I > Type II diabetes users<br>Least desirable feature overall |
| Hallberg et al. | 2015 | Symptom self-reporting questions<br>Motivating messages<br>Visualization of self-reported data | Irrelevant according to patients without frequent symptoms<br>Should be tailored based on results or user preferences<br>Graph of results versus adherence is key at showing the relationship between user effort and results |
| Bengtsson et al.| 2014 | Phrasing of self-reporting questions                                             | Supplementary written information is required for a few brief questions that can be ambiguous. (e.g. “How do you feel today?” vs. “Heart palpitations today?”) |
| Azevedo et al.  | 2015 | Information on disease and treatment in simple format<br>Monitoring of the disease activity and quality of life over time<br>Alerts for taking medication or other tasks such as doctor visits<br>Register of therapeutic, adverse, and side effects of medications<br>Register of medications and compliance<br>Practical tips to improve the disease condition and quality of life<br>Actualizations of the recent scientific articles in area<br>Chat for contacting peers | Score of 327/490<br>Score of 312/490<br>Score of 297/490<br>Score of 296/490<br>Score of 234/490<br>Score of 7/490<br>Score of 1/490<br>Score of 1/490 |
| Goodwin et al.  | 2016 | Includes contact information for resources<br>Includes self-reporting questions that identify triggers<br>Includes diaries for sleep, food, or exercise<br>Includes rating scales for mood and anxiety levels<br>Demonstrates relaxation and breathing techniques | Score of 8/8<br>Score of 7/7<br>Score of 7/7<br>Score of 7/7<br>Score of 7/7 |
| Ly et. al.      | 2014 | Mindfulness as the intervention content<br>Behavioral activation as the intervention content | Better for lower levels of depression<br>Better for higher levels of depression |
| Perera et al.   | 2014 | Graphical representation of the patient’s plasma concentration of medications<br>Pictorial representation of the patient’s CD4 counts and viral load | Leads to increased self-reported adherence and decreased viral load |

(Continued)
| Author          | Date | Characteristics                                                                 | Findings                                                                 |
|-----------------|------|---------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| Anglada et al.  | 2016 | Medication log                                                                  | 79% found useful                                                         |
|                 |      | Pending reminders                                                               | 81% found useful                                                         |
|                 |      | Extending confirmation interval of these reminders (they normally disappear after 24 h) | 57% found useful                                                         |
|                 |      | Over-the-counter meds section to notify provider                               | 79% used                                                                 |
|                 |      | Search bar for drug information                                                 | 26% used 81% found useful                                                |
|                 |      | Bidirectional contact with provider                                             | 62% used 98% found useful                                                |
|                 |      | Download facts into PDF feature                                                 | 7% used 50% found useful                                                 |
| Peterson et al. | 2017 | “My health data” (input of blood pressure, glucose)                            | Most used; most favored by men                                            |
|                 |      | “Status” (input of stress and feeling scores)                                  | Most used: most favored by women                                          |
|                 |      | New habits (methods to encourage self-reflection)                              | Least used feature                                                        |
| Bartlett et al. | 2017 | Dialogue support intervention content                                           | Most likely to be persuasive (score of 41/60)                            |
|                 |      | Primary task support intervention content                                      | Intermediate level of persuasiveness (~36/40)                            |
|                 |      | Social support intervention content                                             | Least likely of the 3 to be persuasive (~31/60)                           |
|                 |      | Tips and advice on performing activities with COPD                              | Score of >130/140                                                         |
|                 |      | Identifying local sporting facilities                                          | Score of <10/140                                                          |
|                 |      | Getting stars and trophies for tasks                                           | Score of <10/140                                                          |
|                 |      | Getting coupons for tasks                                                       | Score of <10/140                                                          |
|                 |      | Displaying achievements for others                                              | Score of <10/140                                                          |
| Saberi et al.   | 2016 | Connecting to a community                                                       | Factors considered important in a mobile health app                      |
|                 |      | Accessing healthcare providers in lieu of visits                               |                                                                          |
|                 |      | Tracking data (CD4, viral loads, medications)                                  |                                                                          |
|                 |      | Obtaining news and education on disease                                         |                                                                          |

(Continued)
| Author          | Date  | Characteristics                                                                 | Findings                                                                 |
|-----------------|-------|---------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| Senn et al.     | 2017  | Connecting with other HIV men                                                   | Important features for a mobile app                                      |
|                 |       | Anonymity                                                                      |                                                                          |
|                 |       | Tailoring                                                                       |                                                                          |
| Ward et al.     | 2016  | Keep track of health records > up-to-date information on thalassemia > side effects of meds > info on symptoms and how to deal with them | Content desired in an app, ranked by order of preference                 |
|                 |       | Appointment times > relevant studies' access > nutritional tips > reminders for meds > thalassemia specialist information > FAQ page | Supplemental features desired in an app, ranked by order of preference   |
|                 |       | Interactivity with professionals > forums with other patients > social networking capability | Interactivity desired in an app, ranked by order of preference           |
|                 |       | As needed > 1 × week > 1 × month > 1 × day                                      | Desired frequency of use for an app, ranked by order of preference       |
| Roepke et al.   | 2015  | Social media leveraged intervention content                                    | Symptom score reduction by 49%                                           |
|                 |       | Cognitive behavior therapy and psychotherapy enhanced social media leveraged intervention content | Symptom score reduction by 46%                                           |
|                 |       | Control group                                                                   | Symptom score reduction by 23%                                           |

COPD: chronic obstructive pulmonary disease.
Content-related app features. Content features (i.e. information presentation features, self-tracking features, communication with health worker features, social support features) were examined in three quarters of the studies (n = 14, 74%).

- Regarding information presentation features, two studies demonstrated the need to present information on disease and treatment in a simple format.21,26 Another showed that a dialogue support approach was the content most likely to be persuasive over the primary task support approach and the social support approach.27
- Considering self-tracking features, five studies showed that tracking personal data and information was beneficial.21,28–31 Four additional studies demonstrated that tailoring content to each user based on their profile and past data is beneficial.19,24,32,33 For example, symptom self-report questionnaires should be automatically tailored to the patients’ frequency of symptoms to avoid burdening respondents.32 In addition, one study showed that graphical presentations and visuals increased medication adherence and improved outcomes.34
- As to communication with healthcare worker features, a method to communicate with healthcare providers, in lieu of a clinic visit, was deemed helpful in three studies.21,24,31
- Regarding social support features, there were contrasting findings on their desirability, depending on the disease. For people living with HIV (PLHIV), connection to other users was suggested as an important feature, if anonymity was respected.31,33 However, users with diabetes or rheumatoid arthritis did not deem these features helpful.26,28 In addition, the ability to obtain media news and education in a distilled manner was suggested for PLHIV.31 However, this was not deemed helpful for rheumatoid arthritis patients.26

Discussion

Many commercial apps have been found to be effective and useful in patient populations, without any determination of which app features were responsible.5,7,11 To our knowledge, this
review contributes the first summary of the benefits of specific smartphone app features for use in the self-management of chronic diseases. It is, thus, unique and complimentary to past research on mobile apps. It is also one of the first reviews to draw on the newer capabilities offered by smartphones beyond text messaging.

Results of our review showed that numerous app features related to interface (e.g. reduced number of screens, limited manual data entry, simple authentication methods) and content (e.g. simplicity, self-tracking features, communication with healthcare workers) were linked to improved usability. With regard to social support features, results were mixed. Figure 2 summarizes the most frequently valued features.

Given the significant global burden of prevalent chronic diseases, achieving improved chronic disease management is of paramount importance. These study results could help optimize app design and increase app usability. In an expanding market of apps for chronic disease management, it is important to identify promising features and prevent implementation failure, a common challenge.

While this review was conducted in accordance with predefined and recognized review methods, there are some limitations. The validity of the results may be limited by an adherence bias. Patients who agreed to participate in the included studies may be more likely to self-manage their health conditions. Should this be the case, the perspective of poor self-managers may be underrepresented. Future research should ensure users from all spectrums of compliance are included. In addition, this study is a rapid review, not a systematic review, and focuses on records from a sole database. Once additional studies accumulate on this topic, it may be worthwhile to efficiently conduct a systematic review.

Regarding next steps, there is a need to continue researching specific app features, given the many apps and features that are continuously developed. Particular effort should be devoted to investigating newly emerging trends in mobile health such as gaming. It should also be noted that most studies (n=16) assessed usability and not improvements in markers of chronic disease management. Although the assumption is that usability leads to improved chronic disease management, future intervention studies should include patient outcomes directly such as depression scores or viral loads.

Conclusion

In summary, this study overviews the current status of research assessing the effectiveness of specific app features in smartphone intervention for chronic disease self-management. Several specific features are important to include in app interventions. Doing so can reduce wasted app development efforts, maximize intervention efficacy, and lead to overall better chronic disease management for patients. Further research is needed in this domain, as there are numerous apps and features in development. Moreover, studies assessing patient outcomes directly are needed.

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