Community Preventive Services Task Force

Diabetes Management: Mobile Phone Applications Used Within Healthcare Systems for Type 2 Diabetes Self-Management

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Finding and Rationale Statement
Ratified August 2017

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CPSTF Finding and Rationale Statement

Context

Mobile phone (both cell phone and smart phone) ownership in the Unites States reached 95% in 2016 (Pew Research Center, 2017). With the near saturation of mobile phone ownership, massive number of mobile applications (apps) have been developed to help users managing chronic diseases, and about 70% of these apps are specific to diabetes (Fatehi, 2017). Mobile apps have the potential to help with chronic disease management by providing constant monitoring and tracking of self-management tasks, sending self-management tips, and delivering clinically accurate feedback when needed. Currently, however, there are no guidelines in the field on how to assess apps' effectiveness.

Intervention Definition

Mobile phone applications (apps) for diabetes self-management accept patient data and provide patients with feedback from healthcare professionals or automated systems. Patients may enter data into apps themselves or use medical equipment that transmits data directly. Interventions can use these mobile phone apps within healthcare systems to help facilitate coordinated diabetes care between patients and healthcare providers.

CPSTF Finding (August 2017)

The Community Preventive Services Task Force (CPSTF) recommends diabetes self-management mobile apps implemented in healthcare systems for patients with type 2 diabetes based on sufficient evidence of effectiveness in improving blood glucose outcomes. Apps considered for this recommendation provided patients with automated feedback or messages from healthcare providers.

Rationale

Basis of Finding

The Community Preventive Services Task Force (CPSTF) uses recently published systematic reviews to conduct accelerated assessments of interventions that could provide program planners and decision-makers with additional, effective options. The following published review was selected and evaluated by a team of specialists in systematic review methods, and in research, practice, and policy related to diabetes management.

> Hou C, Carter B, Hewitt J, Francisa T, Mayor S. Do mobile phone applications improve glycemic control (HbA1c) in the self-management of diabetes? A systematic review, meta-analysis, and GRADE of 14 randomized trials. *Diabetes Care* 2016; 39:2089-95.

In addition to the evidence summarized in the published review, the team examined the included intervention studies and collected additional data on study, intervention, and population characteristics. The CPSTF finding is based on results from the published review, additional information from the included studies, and expert input from team members and the CPSTF.

The CPSTF recommendation is based on evidence from 9 studies in which all or a majority of the patients had type 2 diabetes (search period January 1996—June 2015) The team calculated summary effect estimates as medians and interquartile intervals (IQI). Compared with usual care, mobile phone apps implemented in healthcare systems improved blood glucose levels (median decrease of 0.4% A1c, IQI: -1.0 to -0.2).

Included studies examined mobile phone apps that offered different feedback methods and required different types of self-monitoring tasks such as tracking blood glucose, blood pressure, body weight, food intake, diabetes medication, and physical activity.

Apps that provided feedback from healthcare professionals produced greater reductions in blood glucose levels when compared to apps that only offered automated feedback (mean reduction in A1c of 0.56% and 0.26%, respectively; p=0.16). Apps that allowed users to track more than three self-monitoring tasks produced greater reductions in blood glucose levels when compared to apps with three or less tasks (mean reduction in A1c of 0.58% and 0.44%, respectively; p=0.56).

Applicability and Generalizability Issues

Intervention settings

Only three of the included studies were conducted in the United States. The remaining studies were conducted in Finland (1 study), Japan (1 study), Korea (1 study), Norway (1 study), and the United Kingdom (2 studies). All mobile phone apps were implemented within a healthcare system (9 studies).

Demographic characteristics

Study participants had a mean age of 57.7 years (8 studies), were 43.7% female (8 studies), and had been diagnosed with diabetes for a mean of 8.8 years (6 studies).

Stratified analysis performed by Hou et al. showed that patients 55 years of age or younger experienced greater reductions in A1c levels than did patients over 55 years of age (mean reductions in A1c of 1.03% and 0.41%, respectively; p=0.10).

Intervention characteristics

Included studies examined eight unique mobile apps that offered a combination of the following functionalities: medication adjustment support (3 apps), graphical feedback (5 apps), automated feedback (6 apps), and healthcare professional feedback (6 apps). The apps tracked users' blood glucose levels (8 apps), blood pressure (2 apps), body weight (3 apps), food intake (3 apps), and diabetes medication adherence (5 apps).

Intervention implementers provided mobile phones (9 studies) and monitoring devices (7 studies) to study participants. One U.S. study provided patients with a 1-year unlimited data plan and services. Intervention duration ranged from 3 to 12 months, with a median of 6 months.

Data Quality Issues

Hou et al. performed quality assessment using the quality rating tool proposed by the U.S. Preventive Services Task Force (Harris et al., 2001). The tool contained seven criteria:

- Was there adequate randomization and concealment?
- Was there maintenance of comparable groups?
- Was there no important loss to follow-up?
- Was there equal, reliable, and valid measurement of outcomes?
- Was there clear definition of intervention?
- Were all important outcomes considered?
- Was intention-to-treat analysis used?

Studies were rated as having good, fair, or poor quality.

- Good: a study met all the criteria (1 study)
- Fair: a study met some but not all of the criteria (6 studies)
- Poor: one (or more) domain was assessed as having a serious flaw (2 studies)

Other Benefits and Harms

No additional benefits or harms were identified in the included studies or in the broader literature.

Economic Efficiency

An economic review is pending.

Considerations for Implementation

Evidence indicates that mobile phone apps for self-management of type 2 diabetes, when implemented within healthcare systems, can support existing diabetes care efforts and reduce patients' blood glucose levels. All included studies examined these apps within healthcare systems, limiting the review findings to interventions used in these settings. The CPSTF does not endorse any specific mobile applications or technology.

With the exception of three U.S. studies, most of the evidence came from countries with universal health coverage, where they have different processes for procuring and distributing effective mobile phone apps within the healthcare systems. For U.S. healthcare systems to implement effective mobile phone apps within their patient populations, certain issues need to be taken into consideration.

- Involvement of healthcare professionals. Review findings suggest that when healthcare professionals (including patients' primary care providers) delivered feedback, patients had greater reductions in A1c levels when compared to patients who only received automated feedback.
- Compliance with Health Insurance Portability and Accountability Act (HIPAA). All included studies used apps that required patients to enter their blood glucose measurements either manually or through an automated device. Patients' data were then transmitted, saved, and sometimes shared with healthcare professionals. In the United States, these apps needed to have measures to protect patients' privacy and be HIPAA-compliant. Two of the included studies were evaluating the same app in the United States, and study authors specified their app was HIPAA-compliant.
- Requirement of resources. Even though mobile phone ownership reached 95% in the United States in 2016, disparities still exist across population groups with different levels of income or educational attainment. People with lower incomes or educational attainment are less likely to have a mobile phone, and much less likely to have a smart phone (Pew Research Center, 2017)—the common platform for current mobile phone apps. People with lower incomes also are more likely to experience interruptions in data service due to past due monthly payments.

  The reviewed mobile phone apps transmitted patients' data and provided feedback with low data usage. And the U.S. phone market is moving towards more flexible ways for customers to obtain data plans, which could make it more affordable for people to use the apps. To use these apps in healthcare systems, however, implementers need to ensure all patients with diabetes have equal access to, and opportunity for, long-term use.
- Ease of using mobile phone apps. Older adults are much less likely to own a mobile phone (Pew Research Center, 2017). Among adults older than 65 years, 42% own a smart phone, 38% own a cell phone but not smart

phone, and 20% don't own a mobile phone (Pew Research Center, 2017). Findings from this review suggest that interventions were less effective with patients over 55 years of age when compared to patients 55 years or younger. Implementers need to be aware of this age divide and consider providing more training for older patients.

Older adults might be more comfortable using computers, either laptops or desktops, and mobile phone apps are often available for use with newer generations of computers. Older adults may feel more comfortable interacting with apps on these more traditional platforms. Findings from this review, however, only apply to apps used on mobile phones. People carry their mobile phones most of the time which allows for constant monitoring and rapid feedback. It's not clear if these apps will have the same effectiveness if they are accessed through computers.

None of the included studies examined apps available in mobile phone app stores, providing no further guidance on ways to determine their effectiveness. People with diabetes are more likely to have access to these apps than they are health system-based interventions. However, without evidence-based guidelines to help them identify effective apps, people can only rely on other users' reviews, which were found to be poor indicators of apps' clinical utility or usability in a survey of mobile health apps for chronic diseases (Singh et al., 2016).

Of the 25 diabetes apps Singh et al. surveyed, most apps had the ability to track, record, and display or summarize user-entered health information, and most provided educational information and reminders or alerts. Instead of communicating with users' primary care providers, apps tended to offer communication between users and their family members and provided support through social networks. Singh et al. entered data that would indicate a life-threatening situation into the apps and received inappropriate responses more than 80% of the time. Many apps also did not share users' health information in a secure way.

The fast-growing number of mobile health apps has drawn attention from healthcare professionals. The American Medical Association (AMA) issued guidelines in 2016 about the potential to incorporate these apps into daily care. AMA encouraged its members to follow evidence-based guidelines where available and use apps proven to support care delivery that is patient-centered, promotes care coordination, and facilitates team-based communication.

The Hou et al. review identified a subset of mobile phone apps used within healthcare systems that reduced users' A1c levels. For the majority of diabetes self-management apps on the market, however, additional research is needed to determine what characteristics make them effective.

Evidence Gaps

Additional research and evaluation are needed to answer the following questions and fill existing gaps in the evidence base.

- Are diabetes self-management apps available in app stores effective in reducing A1c levels for users with type 2 diabetes?
- What factors influence app effectiveness?
    - Number of functionalities offered?
    - Specific functionalities offered?
    - Type of feedback (i.e., none, automated, personalized from healthcare professional, or a combination of the latter two)?
    - Demographic characteristics such as race and ethnicity, income, and education?

- Users' health literacy?

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