

# Diabetes Management: Mobile Phone Applications Used Within Healthcare Systems for Type 1 Diabetes Self-Management

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## Community Preventive Services Task Force 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 United States reached 95% in 2016 (Pew Research Center). With the near saturation of mobile phone ownership, a 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 et al., 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 the effectiveness of these apps.

### 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) finds insufficient evidence to determine the effectiveness of diabetes self-management mobile phone apps implemented in healthcare systems to reduce blood glucose for patients with type 1 diabetes. Evidence is considered insufficient based on the small number of studies even though the included studies reported favorable results.

### 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, Francis 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 final CPSTF assessment considered results from the published review, additional information from the included studies, and expert input from team members and the CPSTF.

The CPSTF finding is based on evidence from 4 studies with patients who had type 1 diabetes (search period January 1996—June 2015).

Two studies compared the intervention with usual care and reported improvements in blood glucose levels (-0.9% and -1.4%, 2 studies). The other two studies evaluated an app designed to teach carbohydrate counting to patients with type 1 diabetes. Patients in the intervention and control groups received the same information to learn carbohydrate counting. Patients in the control group attended classes that met in-person for up to three months, and patients in the intervention group learned the same information through the app. Patients in both groups had similar reductions in A1c levels (apps: -0.4% and -0.5%, control group: -0.5% and -0.4%), but patients in the intervention group needed less time to learn the same material (apps: median of 6 hours of learning, control group: median of 12 hours of learning).

### Applicability and Generalizability Issues

#### *Intervention settings*

Included studies were conducted in Australia (1 study), France (1 study), Italy (1 study), and multiple European Union countries (1 study). All mobile phone apps were implemented within a healthcare system.

#### *Demographic characteristics*

Study participants had a mean age of 35.5 years (4 studies), were predominately female (median of 59.1%, 4 studies), and had been diagnosed with type 1 diabetes for a mean of 16.5 years (4 studies).

#### *Intervention characteristics*

Included studies examined three unique mobile apps that offered a combination of the following functionalities: carbohydrate and insulin bolus calculator (2 apps), medication adjustment support (3 apps), graphical feedback (1 app), automated feedback (3 apps), and healthcare professional feedback (3 apps). The evaluated mobile apps tracked users' blood glucose levels (3 apps), food and carbohydrate intake (2 apps), diabetes medication (2 apps), and physical activity (3 apps).

One of the included studies provided smartphones to study participants. Intervention duration ranged from 6 to 9 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 includes 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 (2 studies)
- Poor: one (or more) criteria was assessed as having a serious flaw (1 study)

### 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 of this intervention was not conducted because the Task Force did not have enough information to determine if the intervention works.

### Considerations for Implementation

The evidence indicates that mobile phone apps for self-management of type 1 diabetes, when implemented within healthcare systems, produced some favorable results. There were too few studies, however, to make a determination of effectiveness.

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 evaluated apps taught patients with type 1 diabetes to count carbohydrates. These apps allowed users to plan their meals by choosing food images, used in-app calculators to estimate the number of calories that would be consumed, and derived the best insulin dose to maintain appropriate blood glucose levels. When used on platforms with constantly improving displays and processing power, these apps provided an easier way for patients with type 1 diabetes to plan their carbohydrate intake and insulin doses and gain some independence from their long-term condition. More evaluation of these apps for type 1 diabetes is needed.

### Evidence Gaps

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

- Are self-management apps implemented in healthcare systems effective in reducing A1c levels among patients with type 1 diabetes?
- Are diabetes self-management apps available in app stores effective in reducing A1c levels for users with type 1 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 age, race and ethnicity, income, and education?
  - Users' health literacy?

### References

Fatehi F, Gary LC, Russell W. Mobile Health (mHealth) for diabetes care: opportunities and challenges. *Diabetes Technology & Therapeutics*. 2017;19(1):1-3

Harris RP, Helfand M, Woolf SH, Lohr KN, Mulrow CD, et al. Current methods of the U.S. Preventive Services Task Force: a review of the process. *Am J Prev Med* 2001;20(Suppl.):21–35.

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### Disclaimer

The findings and conclusions on this page are those of the Community Preventive Services Task Force and do not necessarily represent those of CDC. Task Force evidence-based recommendations are not mandates for compliance or spending. Instead, they provide information and options for decision makers and stakeholders to consider when determining which programs, services, and policies best meet the needs, preferences, available resources, and constraints of their constituents.

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