

Heart Disease and Stroke Prevention: Mobile Health (mHealth) Interventions for Treatment Adherence among Newly Diagnosed Patients

Community Preventive Services Task Force Finding and Rationale Statement Ratified December 2017

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CPSTF Finding and Rationale Statement

Intervention Definition

Mobile health (mHealth) interventions for treatment adherence use mobile devices to deliver self-management guidance to patients who have been recently diagnosed with cardiovascular disease.

Content must be accessible through mobile-phones, smartphones, or other hand-held devices, and interventions must include one or more of the following:

- Text-messages that provide information or encouragement for treatment adherence
- Text-message reminders for medications, appointments, or treatment goals
- Web-based content that can be viewed on mobile devices
- Applications (apps) developed or selected for the intervention with goal-setting, reminder functions, or both

Interventions also may include the following:

- An interactive component (i.e., patients enter personal data or make choices) that gives patients personally relevant, tailored information and feedback
- Mobile communication or direct contact with a healthcare provider
- Web-based content to supplement text-message interventions

CPSTF Finding (December 2017)

The Community Preventive Services Task Force (CPSTF) recommends mobile health interventions to improve treatment adherence among patients recently diagnosed with cardiovascular disease. Sufficient evidence of effectiveness from included studies showed improvements in medication adherence, outpatient follow-up, and adherence to self-management goals.

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 cardiovascular disease prevention.

Gandhi S, Chen S, Hong L, Sun K, Gong E, Li C, et al. Effect of mobile health interventions on the secondary prevention of cardiovascular disease: systematic review and meta-analysis. *Canadian Journal of Cardiology* 2017; 33:219-31.

The team examined a subset of 12 studies from the systematic review that were conducted in high-income countries and abstracted supplemental information about study, intervention, and population characteristics. The CPSTF finding is based on results from the published review, additional information from the subset of studies, and expert input from team members and the CPSTF.

The published systematic review and meta-analysis included 27 randomized controlled trials (search period through January, 2016). Included trials examined the impact of mobile health interventions on medication adherence or

adherence to one or more treatment recommendations. The CPSTF finding considered results from the full body of evidence in the Gandhi et al. publication. Results for adherence outcomes are summarized in Table 1 below.

Table 1: Summary of Adherence Outcomes in the Meta-Analysis

Adherence Outcomes	Number of Studies	Odds Ratio (95% Confidence Interval)
Adherence to Medications	9	4.51 (95% CI 2.38 to 8.57)
Adherence to Treatment (one or more medications, clinical care follow-up, or risk factor management recommendations)	15	3.86 (95% CI 2.62 to 5.70)

CI: Confidence interval

The Gandhi et al. systematic review and meta-analysis examined a number of additional outcomes related to changes for cardiovascular disease risk factors (i.e., blood pressure, lipids, smoking cessation), morbidity, and mortality. Conclusions were limited by the small numbers of studies and mixed, or inconsistent, results.

The CPSTF also examined results from a subset of trials conducted in high-income countries (12 studies). Results from this subset are summarized in Table 2.

Table 2: Adherence Outcomes from the Subset of Studies from High-Income Nations

Adherence Outcomes	Number of Studies	Median Odds Ratio (Range or Interquartile Interval)
Adherence to Medications	3	2.22 (Range 1.01 to 3.41)
Adherence to Treatment (one or more medications, clinical care follow-up, or risk factor management recommendations)	6	1.99 (IQI: 1.03 to 4.36)

IQI: Interquartile interval

Three studies from high-income nations provided measurements on adherence outcomes that were not included in the Gandhi et al. meta-analysis. One study compared medication adherence outcomes by measurement type and found meaningful improvements using an objective measure, but no significant differences for self-reported adherence (Park et al., 2014). Another study found significant improvements in self-reported medication adherence (Dale et al., 2015).

The final study reported significant improvements in treatment adherence with more participants completing their cardiac rehabilitation program (Lounsbury et al., 2015).

Studies in the subset also reported outcomes for cardiovascular disease risk factor change and morbidity. Although findings showed decreases in blood pressure (2 studies) and health care utilization (1 study), conclusions were limited by the small number of studies or inconsistent results.

Studies in the subset were of short duration (median 6 months; IQR: 1.5 to 12 months). Interventions used mobile phones (10 studies) or smartphones (2 studies). Studies provided web-based content that was accessible through smartphones (2 studies) or served as a supplement to text messages (2 studies). Studies used text messages for information or motivation (4 studies), as reminders (4 studies), or both (2 studies). Mobile content was tailored based on patient inputs (2 studies), or personalized without patient inputs (4 studies). Three studies offered contact or appropriate follow-up with a healthcare provider.

Applicability and Generalizability Issues

Studies in the subset were conducted in the United States (4 studies), Australia (2 studies), New Zealand (2 studies), Norway (1 study), Spain (1 study), France (1 study), and Canada (1 study).

All 12 of the subset studies (and 25 of the 27 studies in the full meta-analysis) were conducted among patients with a recent diagnosis of cardiovascular disease. Patients were recruited at the time of initial hospitalization (6 studies), or when they were referred to an outpatient cardiac rehabilitation program (6 studies). Given the range of adherence demands on patients at this time (new treatment regimens, appointments for follow-up and rehabilitation, and adoption of new lifestyle and self-management goals) mobile health interventions may be most useful and effective during the initial management period of patients with a new diagnosis. Longer term studies, and studies conducted in primary care settings would help to determine the effectiveness of mobile health interventions for the broader range of patients with cardiovascular disease.

Four U.S. studies provided limited information on patient demographic characteristics, and none provided stratified analyses of effectiveness by socioeconomic status, or race/ethnicity. None of the studies evaluated intervention effectiveness among older patients (>65 years). While additional research is warranted, the CPSTF finding is likely applicable to the use of these interventions in U.S. healthcare settings for adults recently diagnosed with cardiovascular disease.

Data Quality Issues

The published systematic review included only randomized controlled trials. Study quality was evaluated using the Cochrane risk of bias assessment tool (Higgins et al. 2011). Limitations in the subset of studies conducted in high-income nations included measurements of adherence based on, or including, self-reports (10 of 12 studies).

Other Benefits and Harms

The Gandhi et al. publication did not report information about additional benefits or potential harms. The CPSTF noted that adherence measures used in the included studies likely captured possible benefits associated with mobile health interventions such as treatment retention and cardiac rehabilitation program retention. Improved adherence might also reduce the number of in-person clinical care appointments needed to achieve control of cardiovascular disease risk factors. Text messages may be a source of distraction for patients involved in other activities.

Considerations for Implementation

While the review by Gandhi et al. did not summarize information on intervention implementation, some of the included studies provided information about the development and implementation of digital communications (Dale et al. 2014; Antypas et al., 2014).

The rapid evolution of mobile device technology is likely to provide newer studies with opportunities for substantially enhanced or personalized message content and interactivity. Neubeck et al. (2015) provides a useful review of smartphone apps used to prevent and manage cardiovascular disease. The review describes intervention characteristics associated with patient uptake including credible, sourced, clear, and concise messaging, and personalized content with feedback, rewards, and positive reinforcement.

The Million Hearts Initiative® includes [tools and resources](https://millionhearts.hhs.gov/tools-protocols/action-guides.html) [https://millionhearts.hhs.gov/tools-protocols/action-guides.html] to help organize health system and public health improvement strategies for prevention and management of cardiovascular disease risk factors. Broader strategies outlined in these resources identify potential opportunities to incorporate mobile health interventions.

Implementers should understand state policies regarding application of the [Health Insurance Portability and Accountability Act of 1996 \(HIPAA\)](https://www.hhs.gov/hipaa/for-professionals/privacy/laws-regulations/index.html) [https://www.hhs.gov/hipaa/for-professionals/privacy/laws-regulations/index.html] to electronic communications with patients.

Evidence Gaps

Gandhi et al. suggested a need for additional research to address the following questions.

- Are interventions based on smartphone apps more or less effective than interventions based on text messaging?
- Are mobile health interventions effective when used for older patients (>65 years), who may have less familiarity with mobile devices and content?
- Are mobile health interventions, especially smartphones, effective for patients of lower socioeconomic status, given potential limitations in access to data or current technologies?

The CPSTF further identified the following evidence gaps as areas for future research:

- Do studies that use objective measures report outcomes equal to or greater than studies that use self-reported data?
- Are interventions effective in helping patients adhere to medications and self-management goals over longer periods of time (1-2 years)?
- Are interventions effective in reducing morbidity, mortality, and healthcare use associated with cardiovascular disease?
- What factors influence intervention effectiveness?
 - Use with or without in-person counseling or contact?
 - Patients' gender, race, ethnicity, or socioeconomic status?
 - Length of time since cardiovascular disease diagnosis?
 - Use of current smartphone capabilities such as access to social support?

References

- Antypas K, Wangberg SC. An internet- and mobile-based tailored intervention to enhance maintenance of physical activity after cardiac rehabilitation: short-term results of a randomized controlled trial. *Journal of Medical Internet Research* 2014;16(3):e77.
- Dale LP, Whittaker R, Jiang Y, Stewart R, et al. Improving coronary heart disease self-management using mobile technologies (Text4Heart): a randomized controlled trial protocol. *Trials* 2014;15:71.
- Dale LP, Whittaker R, Jiang Y, Stewart R, et al. Text message and internet support for coronary heart disease self-management: results from the Text4Heart randomized controlled trial. *Journal of Medical Internet Research* 2015;17(10):e237.
- Gandhi S, Chen S, Hong L, Sun K, Gong E, Li C, et al. Effect of mobile health interventions on the secondary prevention of cardiovascular disease: systematic review and meta-analysis. *Canadian Journal of Cardiology* 2017;33:219-31.
- Higgins JP, Green S (editors). *Cochrane Handbook for Systematic Reviews of Interventions* Version 5.1.0. Updated March 2011: The Cochrane Collaboration, 2011. Available from URL: <http://handbook-5-1.cochrane.org/>.
- Lounsbury P, Elokda AS, Gylten D, Arena, R. Text-messaging program improves outcomes in outpatient cardiovascular rehabilitation. *IJC Heart and Vasculature* 2015;7:170-5.
- Neubeck L, Lowres N, et al. The mobile revolution—using smartphone apps to prevent cardiovascular disease. *Nature Reviews Cardiology*. 2015;12:350-60.
- Park LG, Howie-Esquivel J, Chung ML, Dracup K. A text messaging intervention to promote medication adherence for patients with coronary heart disease: A randomized controlled trial. *Patient Education and Counseling* 2014;94:261-8.

The data presented here are preliminary and are subject to change as the systematic review goes through the scientific peer review process.

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. CPSTF 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 other interventions best meet the needs, preferences, available resources, and constraints of their constituents.

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