Community Preventive Services Task Force

Nutrition and Physical Activity: Community-based Digital Health and Telephone Interventions to Increase Healthy Eating and Physical Activity

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Finding and Rationale Statement
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CPSTF Finding and Rationale Statement

Context

Poor diet and inadequate physical activity are well established risk behaviors for obesity, cardiovascular disease, cancer, and diabetes mellitus (Ford et al., 2012; Lloyd-Jones et al., 2010; U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2020; U.S. Department of Health and Human Services, 2018). These risk behaviors often cluster (Fine et al., 2004; Gillman et al., 2001), which creates an opportunity to intervene on multiple risk behaviors simultaneously (Spring et al., 2012).

Many behavioral interventions that address poor diet and physical inactivity use a combination of self-monitoring and goal setting, which are both based on behavioral theory (Burke et al., 2011). Participants record their dietary intake and physical activity to self-monitor and increase their awareness of these behaviors and set clear, measurable goals for themselves (Foster et al., 2005). Because self-monitoring and goal setting are intervention approaches that include recording information, they are often used in digital health interventions (Coons et al., 2012). Over the past decade, the use of digital devices such as computers, smartphones, and tablets to foster or support behavior change has steadily increased (Michie et al., 2018).

Digital health interventions have the potential to reach a large number of people (Beleigoli et al., 2019). In the United States, 93% of adults use the internet (Pew Research Center, 2021a), 85% have access to a smartphone (Pew Research Center, 2021b), and 77% have home broadband (Pew Research Center, 2021a).

Intervention Definition

Community-based digital health and telephone interventions to increase healthy eating and physical activity aim to support individuals who are interested in improving these behaviors. Interventions are delivered in community settings through websites, mobile apps, text messages, emails, or one-on-one telephone calls. They include one or more of the following:

- Coaching or counseling with trained professionals who provide personalized assistance related to eating and physical activity behaviors, or weight
- Self-monitoring to record eating or physical activity behaviors, or weight
- Goal setting related to eating or physical activity behaviors, or weight

Interventions also may include one or more of the following:

- Social support from peers through social media, internet forums, or discussion groups
- Educational tools and resources designed to support healthy eating or physical activity (e.g., newsletter, handbook)
- Motivational strategies that include incentives, rewards, prompts, and gaming techniques
- Computer-generated feedback that provides tailored information based on performance (i.e., prompts, meeting goals, and adherence)

CPSTF Finding (December 2020)

The Community Preventive Services Task Force (CPSTF) recommends digital health and telephone interventions that are implemented in community settings and focus on improving healthy eating and physical activity among adults interested in improving these behaviors. Sufficient evidence of effectiveness shows these interventions increase or maintain the amount of time adults engage in physical activity, with the greatest improvements seen among those who were less active before the intervention. Evidence also shows participants increase their consumption of fruit and vegetables and decrease their consumption of total energy and energy-dense, nutrient-poor foods. Sufficient evidence of effectiveness also shows these interventions lead to small reductions in weight-related outcomes and clinical outcomes (i.e., diastolic blood pressure, triglycerides, total cholesterol, and low-density lipoproteins).

CPSTF also recommends digital health and telephone interventions to increase healthy eating and physical activity among adults interested in improving these behaviors in worksite settings [https://www.thecommunityguide.org/findings/nutrition-and-physical-activity-worksite-digital-health-and-telephone-interventions-increase-healthy-eating-and-physical-activity] and among students interested in improving these behaviors attending institutions of higher education [https://www.thecommunityguide.org/findings/nutrition-and-physical-activity-digital-health-and-telephone-interventions-increase-healthy-eating-and-physical-activity-among-students-institutions-higher-education].

Rationale

Basis of Finding

The CPSTF recommendation is based on evidence from a review of 31 studies with 41 arms (search period: January 2009 - June 2020).

A team of specialists in systematic review methods and subject matter experts synthesized select physical activity (e.g., time spent in physical activity), dietary (e.g., fruit and vegetable intake), weight-related (e.g., Body Mass Index [BMI]), and clinical outcomes (e.g., cholesterol) to assess intervention effectiveness. Many of the included studies reported multiple physical activity, dietary, weight-related, and clinical outcomes.

Evidence from the 31 included studies showed interventions increased time spent in physical activity (with the greatest improvements seen among those who were less active before the intervention); increased intake of fruit and vegetables, decreased intake of total energy and energy dense, nutrient-poor foods; and led to small, but meaningful reductions in weight-related outcomes and several clinical outcomes (i.e., diastolic blood pressure, triglycerides, total cholesterol, and low-density lipoproteins). See results in the Table. Participants used instruments with demonstrated validity and reliability for to self-report their dietary and physical activity behaviors.

Twenty-one studies compared intervention groups with untreated or waitlisted control groups or groups that received another intervention of lower intensity (e.g., educational information only). The remaining ten studies compared intervention groups to groups that received an intervention of similar or greater intensity (e.g., goal setting plus in-person counseling without a digital health component). For the latter, the baseline and posttest timepoints were assessed for both the intervention groups and the comparison groups. Both the intervention groups and the comparison groups demonstrated improvements pre- to post-test.

Table. Intervention Effects on Physical Activity, Dietary, Weight-related, and Clinical Outcomes

Outcome	Studies (arms)	Effect	Direction of Effect
Physical Activity Behaviors			
Time Engaged in Physical Activity	12 studies (17 arms)	Median: +24.26 minutes/week (IQI: -10.25 to 81.50 minutes per week) Relative change Median: 6.35% (IQI -4.25% to 67.35%)	Favors the intervention
Dietary Behaviors			
Fruit and Vegetable Intake	12 studies (16 arms)	Median: +0.55 servings/day (IQI: 0.21 to 1.48 servings per day) Relative change Median: 14.79% (IQI: 4.07% to 28.81%)	Favors the intervention
Energy Intake	9 studies (13 arms)	Median: -133.84 kilocalories/day (IQI: -206.00 to 28.99 kilocalories/day) Relative change Median: -5.47% (IQI: -19.01% to -1.35%)	Favors the intervention
Energy Dense, Nutrient-Poor Food Intake	3 studies (4 arms)	3 of 4 study arms favorable	Favors the intervention
Weight-related			
Percent Weight Change	5 studies (6 arms)	Median: -1.12 percentage points (IQI: -2.00 to -0.62 percentage points)	Favors the intervention
Body Mass Index	12 studies (18 arms)	Median: -0.33 kilograms/meter squared (IQI: -0.46 to -0.20 kilograms/meter squared) Relative change Median: -1.03% (IQI -1.83% to -0.65%)	Favors the intervention
Weight Loss	6 studies (7 arms)	Median: -0.84 kilograms (IQI: -1.78 to -0.39 kilograms) Relative change Median: -1.12% (IQI -1.93% to -0.53%)	Favors the intervention
Clinical Outcomes			
Triglycerides	4 studies (6 arms)	Median: -10.25 milligrams/deciliter (IQI: -16.29 to 22.90 milligrams/deciliter)	Favors the intervention

Outcome	Studies (arms)	Effect	Direction of Effect
Total Cholesterol	3 studies (5 arms)	Median: -4.00 milligrams/deciliter (IQI: -14.74 to -2.93 milligrams/deciliter)	Favors the intervention
Low Density Lipoprotein	4 studies (6 arms)	Median: -1.40 milligrams/deciliter (IQI: -6.46, 8.20 milligrams/deciliter)	Favors the intervention
Diastolic Blood Pressure	6 studies (7 arms)	Median: -1.00 millimeter of mercury (IQI: -5.70 to -0.60 millimeter of mercury)	Favors the intervention

IQI: interquartile interval

Additional Physical Activity and Dietary Outcomes

In addition to reporting time engaged in physical activity, 15 studies (19 arms) assessed participants' physical activity using measures of prevalence, amount, or volume and reported inconsistent findings. Four studies (6 arms) reported a median increase of 0.06 minutes per day of sedentary time (IQI: -150.00 to 32.68 minutes/day).

Eighteen of the included studies reported participants' overall diet quality index scores and their intake of total fat, salt, fiber, and meat. Ten studies (13 arms) reported a median relative improvement in participants' dietary quality of 5.70% (IQI: -6.26% to 15.09%). Nine studies (13 arms) reported on saturated fat or total fat intake. Of these, four studies (6 arms) reported a median decrease in intake of 0.40 percentage points (IQI: -1.68 to 0.02), three reported favorable decreases, and two showed no change. Four studies reported inconsistent findings for both salt and fiber intake. Two studies reported meat intake; one reported a decrease in consumption, and the other reported no change.

Additional Outcomes of Interest

Some of the included studies reported additional outcomes of interest such as health-related quality of life and sleep. Seven studies that measured health-related quality of life reported inconsistent findings. Two studies used sleep quality indices to assess participants' self-reported sleep; one showed favorable increases in sleep quality, and the other reported no change.

Stratified Analyses

To understand the influence of selected factors on effectiveness, interventions were stratified by the presence or absence of coaching or counseling, intent of the intervention, and baseline physical activity.

Coaching or counseling

Effectiveness for behavioral outcomes was assessed by the presence or absence of coaching or counseling. Six studies (9 arms) with coaching or counseling reported a 45.50 minutes per week increase in time spent in physical activity (IQI: -0.35 to 118.25 minutes/week), and six studies (8 arms) without coaching or counseling reported a 10.88 minutes per week increase (IQI: -20.75 to 61.83 minutes per week).

Eight studies (11 arms) with coaching or counseling reported that fruit and vegetable intake increased by 0.80 servings/day (IQI: 0.51 to 3.80 servings/day), and four studies (5 arms) without coaching or counseling reported a median increase of 0.23 servings/day (IQI: 0.10 to 0.38 servings/day).

Intent of intervention

Effectiveness for weight-related outcomes was assessed by intent of the intervention. Intent was categorized into two groups: (1) improved dietary and physical activity behaviors for a healthier lifestyle (referred to as dietary and physical activity intent), or (2) weight gain prevention or loss that included dietary and physical activity behaviors but also focused on weight (referred to as weight intent).

Five studies (7 arms) with a dietary and physical activity intent reported energy intake decreased by 97.30 kilocalories per day (IQI: -181.65 to 84.10 kilocalories/day), while four studies (6 arms) with a weight intent reported a median decrease of 177.00 kilocalories/day, (IQI: -232.00 to -45.59 kilocalories/day). Four studies (6 arms) with a dietary and physical activity intent, reported participants' BMI decreased by 0.35 kilograms/meters squared (kg/m^2; IQI: -0.53 to -0.18 kg/m^2) compared to eight studies (12 arms) with a weight intent that found a median decrease of 0.33 kg/m^2 (IQI: -0.44 to -0.21 kg/m^2). Two studies (2 arms) with a dietary and physical activity intent reported percent weight change decreased by a media of 1.31 percentage points (range: -2.00 to -0.62 percentage points), while four studies (5 arms) with a weight intent reported a median decrease of 1.12 percentage points (IQI: -2.27 to -0.60 percentage points).

Baseline physical activity

Effectiveness for time spent in physical activity was assessed by baseline levels of physical activity reported by each study. Studies were categorized into two groups based on whether or not participants' median or mean baseline levels of physical activity met the recommended levels of physical activity outlined in the 2018 Physical Activity Guidelines for Americans (U.S. Department of Health and Human Services, 2018). Nine studies (13 arms) reported baseline levels of physical activity that met the Physical Activity Guidelines for Americans, and they reported a median increase of 7.20 minutes per week in time spent in physical activity (IQI: -16.30 to 51.96 minutes/week). Three studies (4 arms) reported baseline levels of physical activity that did not meet the Physical Activity Guidelines for Americans, and they reported a median increase of 89.25 minutes/week in time spent in physical activity (range: 45.50 to 128.00 minutes/week).

Applicability and Generalizability Issues

Included studies were conducted in the United States (15 studies), the Netherlands (6 studies), Australia (5 studies), Belgium (1 study), Canada (1 study), Israel (1 study), and the United Kingdom (1 study), and one study spanned multiple European countries. Participants were recruited online or through print media distributed through various community settings such as faith-based organizations, institutions of higher education, or worksites (16 studies). Of the 10 studies that reported information about population density, six were conducted in urban settings, three were conducted in rural areas, one was conducted in urban and rural areas, and none were conducted in suburban areas.

Across all 31 studies, participants had a mean age of 46.4 years (IQI: 39.6 to 55.9 years). Two studies that recruited older adults (60 years and over) reported inconsistent results for dietary, physical activity, and weight-related outcomes. Five studies only recruited females, while three studies only recruited males. The remaining 23 studies reported slightly higher proportions of females than males (on average, 62.9% were female). Studies were favorable for females and males for dietary, physical activity, and weight-related outcomes.

Fourteen studies reported socioeconomic status (SES) indicators and found similar effectiveness among low- and mixed-income populations.

The fifteen studies from the United States reported racial and ethnic distributions that demonstrated intervention effectiveness across groups. Studies included participants self-identified as White (median 90.0%; 13 studies), Black or African American (median 37.3%; 6 studies), Hispanic or Latino (median 6.3%; 7 studies), Asian (median: 5.7%; 6

studies), and other race/ethnicity (median 2.7%; 7 studies). Two studies only recruited participants who identified as Black or African American. Both studies reported favorable results for physical activity, dietary, and weight-related outcomes.

Included studies did not require participants to have overweight (BMI between 25 to <30 kg/m^2) or obesity (BMI 30 kg/m^2 or higher) as defined by the Centers for Disease Control and Prevention (2020), though most studies recruited participants who did. Of the 25 included studies that reported this information, all but one reported a mean or median baseline BMI of 25 kg/m^2 or higher. One study (Winett et al., 2011) stratified results by weight status, and reported participants with obesity demonstrated the greatest weight loss, followed by participants with overweight; participants who were of healthy weight maintained their weight. Intervention effectiveness on weight-related outcomes did not vary between samples with a baseline BMI consistent with overweight (25 to <30 kg/m^2) or obesity (30 kg/m^2 or higher).

Intervention duration ranged from two weeks to 12 months, with a median duration of 3.5 months. Most of the interventions were implemented for less than six months (22 studies) and reported similar effectiveness.

Data Quality Issues

Study designs included randomized controlled trials (22 studies, 32 arms), group randomized controlled trials (3 studies, 3 arms), group non-randomized controlled trials (2 studies, 2 arms), and other controlled trials (4 studies, 4 arms).

The most common study limitation, according to Community Guide quality scoring methods, was loss to follow-up. While studies did not report challenges to recruiting participants, 14 studies reported attrition of greater than 20%. Results did not differ by loss to follow-up.

The review team also identified self-reported weight as a study limitation. Of the 22 studies that reported weight-related outcomes, 12 used objectively measured weight and 10 used self-reported weight. Results did not differ between objectively measured and self-reported weight.

Other Benefits and Harms

Though seven studies measured health-related quality of life outcomes and showed inconsistent results, CPSTF identified improvements in health-related quality of life measures (e.g., perceived health status, stress levels, anxiety, depression) as potential benefits of the intervention and noted participants might develop healthy behaviors. CPSTF also cited the increased convenience of digital health as a channel for intervention delivery.

CPSTF identified increased risk of injury from increased physical activity as a potential harm. Programs may reduce this risk by helping participants select appropriate activity types. None of the included studies reported any musculoskeletal injuries.

Considerations for Implementation

The following considerations for implementation are drawn from studies included in the evidence review, the broader literature, and expert opinion, as noted below.

- Interventions that use technology are a convenient way to reach individuals. They have the potential for broad dissemination and scalability (Carter et al., 2013; Roess, 2017; Svetkey et al., 2015).
- Digital health interventions may increase access for people who live in rural areas or have transportation challenges that make it difficult to attend in-person classes or programs.

- The *digital divide* needs to be considered when using technology other than telephones to implement programs. Key issues include participants' access to affordable internet networks or mobile devices and digital readiness.
    - When compared with Americans living in urban and suburban areas, adults living in rural areas use the internet less often and are less likely to have home broadband (Pew Research Center, 2019a). Adults living in low income, urban areas also report having less access to broadband internet service (Reddick, 2020).
    - Among adults in the United States who earn less than $30,000 per year, about 44% do not have home broadband and about 33% do not have a smartphone (Pew Research Center, 2019a).
    - Approximately 10% of Americans do not use the internet (Pew Research Center, 2019a). Older adults are even more likely to say they do not go online, and approximately 30% of individuals with less than a high school education do not use the internet (Pew Research Center, 2019a).
- Implementers may want to consider the built environment around participants. It is important for participants to have access to healthier foods and safe places where they can be physically active.
- Studies in this review included primarily White and Black or African American populations, with smaller representations of Hispanic or Latino or Asian participants. Interventions that specifically recruited Black or African American participants were tailored to the population.
- Behavioral change theories were applied in all but one of the included studies. The most frequently cited theories were Social Cognitive Theory (Bandura, 1986), Self-Regulation Theory (Baumeister et al., 1994), and the Transtheoretical Model of Behavior Change (Prochaska et al., 1984). Implementers may consider incorporating these, or other theories, into the programs.
- Intervention intensity may vary. Some programs will aim for more frequent contact between participants and their coaches or counselors than others (e.g., daily vs. weekly). CPSTF notes populations may respond differently to varying levels of intensity. For example, younger adults may be more comfortable using their mobile devices to track daily behaviors than older adults would be.
- Data security and privacy issues need to be considered when individuals enter personal information electronically.
- Digital health is rapidly evolving. Newer digital health interventions, such as those that incorporate social media platforms, were not represented in this body of evidence.

Evidence Gaps

The CPSTF identified several areas that have limited information. Additional research and evaluation could help answer the following questions and to fill remaining gaps in the evidence base.

- What are the long-term effects of digital health interventions among adults? Studies with a follow-up period extending past six months would provide more evidence about the broader impact of these interventions on dietary and physical activity behaviors and clinical and weight-related outcomes.
- What are the effects of incorporating wearable devices or trackers in the intervention?
- What are the effects of adding social media to the intervention?

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