A Multicomponent Program for Nutrition and Physical Activity Change in Primary Care

PACE+ for Adolescents

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Background: Most adolescents do not meet national recommendations for nutrition and physical activity. However, no studies of physical activity and nutrition interventions for adolescents conducted in health care settings have been published. The present study was an initial evaluation of the PACE+ (Patient-centered Assessment and Counseling for Exercise plus Nutrition) program, delivered in primary care settings.

Participants: Adolescents aged 11 to 18 years (N=117) were recruited from 4 pediatric and adolescent medicine outpatient clinics. Participants' mean (SD) age was 14.1 (2.0) years, 37% were girls, and 43% were ethnic minorities.

Intervention: Behavioral targets were moderate physical activity, vigorous physical activity, fat intake, and fruit and vegetable intake. All patients completed a computerized assessment, created tailored action plans to change behavior, and discussed the plans with their health care provider. Patients were then randomly assigned to receive no further contact or 1 of 3 extended interventions: mail only, infrequent telephone and mail, or frequent telephone and mail.

Measures: Brief, validated, self-report measures of target behaviors were collected at baseline and 4 months later.

Results: All outcomes except vigorous physical activity improved over time, but adolescents who received the extended interventions did not have better 4-month outcomes than those who received only the computer and provider counseling components. Adolescents who targeted a behavior tended to improve more than those who did not target the behavior, except for those who targeted vigorous physical activity.

Conclusions: A primary care–based interactive health communication intervention to improve physical activity and dietary behaviors among adolescents is feasible. Controlled experimental research is needed to determine whether this intervention is efficacious in changing behaviors in the short- and long-term.


Because patterns of nutrition and physical activity can impact the current and future health of young people, the US Public Health Service has issued national guidelines. High rates of risk factors for cardiovascular disease among youth have brought new urgency to the need to improve health behaviors among young people.

Only about two thirds of adolescent boys and one half of adolescent girls in the United States meet the recommendation for vigorous physical activity. Most high school–age youth do not meet the recommendation that young people should accumulate 60 minutes per day of moderate to vigorous physical activity. Likewise, most young people do not meet dietary guidelines for fruits and vegetables and fat intake.

The Centers for Disease Control and Prevention estimated that only 15% of adolescents met the recommendation for total fat intake (<30% of energy) and only 24% reported eating 5 or more servings of fruits and vegetables per day. Because unhealthful eating and physical activity patterns are so common among young people, effective interventions are needed.

Although dietary and physical activity interventions have been evaluated in schools, such interventions have been neglected in primary health care. About 80% of children and adolescents visit a physician in any given year, with an estimated 76 million annual contacts. Thus, most young people could be impacted by prevention interventions in primary care.

At least 10 national and international agencies have recommended that
PARTICIPANTS AND METHODS

PARTICIPANTS

We recruited patients from 3 pediatric or adolescent medicine outpatient clinics in San Diego, Calif, and 1 in Pittsburgh, Pa. Each clinic served a diverse population and was staffed by 4 to 9 pediatricians. Recruitment was conducted by (1) contacting patients who were scheduled for an examination and their parents, asking them to complete consent forms prior to the appointment; and (2) approaching adolescents and parents when they arrived for a well-care visit. The inclusion criteria were that the adolescent be between the ages of 11 and 18 years, be well enough to complete the initial assessment, and agree to participate in the 4-month extended contact trial. Parents signed an informed consent agreement, and adolescents signed an assent form prior to the initial assessment. All participants who completed the 4-month follow-up assessment were paid $10.

We attempted to recruit 262 patients. Of these, 191 agreed to be in the study, yielding a 73% recruitment rate. However, 74 of these 191 could not be used in the final analyses: 33 did not complete the computer program (due to time constraints or technical problems), 5 were referred for further evaluation of disordered eating, 5 were siblings of current participants, and 31 did not complete the follow-up assessment. Based on the 148 who were assigned to an intervention group, the attrition rate was 21% (31/148) over the 4 months. Study dropouts were significantly more likely to be African American ($\chi^2=20.79, P<.001$) (Table 1) and from the Pittsburgh site, probably reflecting lower socioeconomic status and more frequent residential moves. Participants’ sex was not associated with dropout rates ($\chi^2=1.39, P=.24$). Other factors that contributed to dropping from the study included changing from school to summer schedules and summer jobs.

STUDY DESIGN

All participants completed a computerized assessment in the waiting room and received physical activity and nutrition counseling from their health care provider. Each participant was randomly assigned to receive 1 of 4 types of extended intervention: no contact control, frequent mail, infrequent mail and telephone, or frequent mail and telephone (Table 2). The duration of all extended contact was 4 months from the date of the initial assessment. Postintervention surveys were administered by telephone interviews.

INTERVENTION RATIONALE AND DEVELOPMENT

The multicomponent intervention called PACE+ (Patient-centered Assessment and Counseling for Exercise plus Nutrition) was designed to be practical for use in primary care and to support long-term behavioral change. Intervention design was based on literature review; consultation with experts in pediatrics, adolescent medicine, interactive health communications, and health behavioral change; our previous experience with behavioral change in primary care; and problem solving. Health care providers, believing to possess substantial credibility and authority, then gave their verbal and written endorsement of the action plan. Because of the consensus that long-term interventions are needed for long-term behavioral change in nutrition and physical activity, we used the Relapse Prevention Model to design the extended interventions. PACE+ helped patients anticipate barriers to change and make plans to overcome those barriers. Because previous physical activity and nutrition interventions conducted via mail and telephone have been effective, we adopted this low-cost strategy.

Because parents can influence adolescents’ health behaviors, all intervention components encouraged parental involvement. However, because developing autonomy is an important task for adolescents, each patient determined the extent of his/her parents’ involvement. The computer program encouraged the adolescent patients to allow their parents to participate in the assessment and action-planning process. Providers were encouraged to include parents in the clinical discussion if the adolescent agreed. During the extended intervention, adolescents were encouraged to share all materials with their parents. At the end of each counseling telephone call, adolescents were asked whether a counselor could give an update of their progress to a parent.

INTERVENTION COMPONENTS

PACE+ has 3 primary components: the interactive computer program, provider counseling, and extended follow-up by telephone and/or mail. We considered the computer-based assessment and action-planning program to be the only feasible method of conducting multiple behavioral assessments, interpreting the results, and developing a behavior change program within a busy clinic. After an introductory section, the computer assessed disordered eating to identify adolescents with a need for further evaluation and referral. Then the computer assessed all 4 behaviors, compared participants’ data with health recommendations, and fed this information back to the adolescent. On the basis of this feedback, adolescents were instructed to choose 1 physical activity and 1 dietary target behavior for which they developed a behavior change plan. These tailored action plans were printed out. Adolescents were encouraged to target a behavior that was not at the recommended level. If they were meeting goals for multiple behaviors, they were encouraged to have their action plan address behavior maintenance. These plans included the desired benefits of change; specific goals and strategies, including the time(s) and place of behavioral change; identification of a social supporter; and anticipated barriers. If the adolescent declined to target any behaviors for change, this information was reflected in their “provider summary” to initiate a discussion that would include brief motivational information. This provider summary, highlighting any areas in need of further evaluation (eg, disordered eating), was printed for the provider and placed in the medical chart prior to the clinical encounter.

Continued on next page
The provider counseling component centered around a discussion of the 2 printouts. Providers (physicians or nurse practitioners) reviewed action plans with their patients to assess whether they were appropriate and realistic. Providers also reviewed the provider summary for any special issues that needed attention. Providers received brief training in interpreting the printouts, making modifications as needed, and delivering motivational information related to the adolescents' personal health status.

The extended intervention by mail and telephone supported the adolescent in beginning behavioral change and maintaining gains. Except for the control group, extended intervention began 1 week after the clinical encounter. Telephone calls and mailings were handled by research staff who received training and frequent supervision. The same counselor was assigned to an adolescent for the entire 4-month intervention, and counselors identified themselves as their PACE+ counselor and not as doctor's office staff.

Mail intervention packets contained a cover letter, a postage-paid mail-back postcard, and age-appropriate tip sheets appropriate to the adolescents' goals. Tip sheets were divided into 4 categories: nutrition, physical activity, behavioral change, and parental support. Every mailing contained at least 1 physical activity and 1 nutrition tip sheet, and adolescents could request specific topics.

Telephone intervention counseling calls, about 10 minutes in length, were structured to assess participants' goal achievements since the last call, praise their progress, develop solutions to barriers, and revise goals if necessary. Participants were asked to name a person to support them (eg, a friend or parent) and specify how that person could help. Usually the focus of calls alternated between nutrition and physical activity targets. Mailings sent after each call related to topics covered during the telephone call.

Adolescents in the group receiving infrequent contact were scheduled for 3 calls at 6-week intervals. Those in the frequent contact group received 8 biweekly counseling calls alternated with 8 "prompt" calls to achieve the goal of some contact each week. Prompt calls lasted 1 to 3 minutes and were reminders to continue with the changes suggested the prior week. Prompt calls were considered completed if a message was left because of findings that the frequency of calls was more important than content.

MEASUREMENTS

We created or adapted physical activity and nutrition self-report measures for this study. We conducted assessments at baseline by computer program and at 4-month follow-up by trained telephone interviewers. The follow-up questions were identical to the ones used on the computer, but were asked over the telephone. Reliability and validity of all measures were assessed in separate psychometric studies.

We evaluated reliability in a diverse group of 250 adolescents with a 1-week interval between test and retest, using 1-way model intraclass correlations (ICCs). We based valid-
providers assess and counsel young people about dietary habits and physical activity behaviors. Even though 30% to 40% of primary care physicians indicate they provide counseling about physical activity and nutrition to young people during general medical examinations, the quality of this counseling is unknown. Critical barriers to counseling appear to be an expectation that it is not effective, limited time available during clinical encounters, and lack of reimbursement.

Two sets of guidelines exist to assist providers as they counsel young people about physical activity and nutrition: the American Medical Association’s “Guidelines for Adolescent Preventive Services” (GAPS), and “Bright Futures” produced by the National Center for Education in Maternal and Child Health under contract from the US Public Health Service Health Services and Resources Administration. However, neither of these programs has been evaluated. The growing literature on practice-based interventions to change adult physical activity and nutrition contrasts with the lack of studies targeting young people.

The purposes of the present study were to (1) develop and test a primary care–based intervention to improve young people’s physical activity and nutrition behaviors, (2) assess the feasibility and acceptability of program components among patients and providers, (3) assess the feasibility of conducting extended interventions after the clinical contact via telephone and mail, and (4) assess the effectiveness of those interventions in producing longer-term behavioral change. The design provides a randomized, controlled evaluation of 4 protocols for extended intervention. Continued intervention is believed to be essential for long-term changes in nutrition and physical activity, but the type and frequency of interventions rarely have been investigated. This pilot study was conceived as the first step in an effort to create effective programs that can be implemented in primary care settings to improve the nutrition and physical activity behaviors of young people.

### RESULTS

There were no significant differences between extended intervention conditions at baseline for moderate physical activity (F(3,113)=0.31, P=.82), vigorous physical activity (F(3,113)=1.60, P=.19), fruit and vegetable intake (F(3,113)=0.67, P=.57), or fat intake (F(3,113)=0.56, P=.65). At baseline, 39% of participants reported meeting the guidelines for moderate physical activity (30 minutes, ≥5 days a week), 74% for vigorous physical activity (20 minutes, ≥3 days a week), 17% for fat intake (≤3 servings a day of high-fat foods), and 42% for fruit and vegetable intake (≥5 servings per day).

**PRIMARY ANALYSES: BEHAVIORAL OUTCOMES AT 4 MONTHS**

We found no significant 3-way interactions (condition × time × sex), or any significant interaction effects between participants’ sex and their intervention group. This indicates that neither the sex of the participants nor their participation in an extended intervention was associated with measurable improvements in behavior beyond those provided by PACE+ computer and provider counseling alone. For all behaviors except vigorous physical activity, PACE+ participants generally improved over time: moderate physical activity (F(1)=6.35, P=.01), vigorous physical activity (F(1,113)=3.41, P=.07), fruit and vegetable intake (F(1,113)=9.81, P=.002), and fat intake (F(1,113)=5.20, P=.02). Put another way, following the PACE+ intervention, fat consumption decreased by 12%, fruit and vegetable consumption increased by 18%, vigorous activity increased by 10%, and moderate physical activity increased by 17%.

**EFFECTS OF TARGETING A BEHAVIOR**

No significant 3-way or 2-way interactions involving condition were discovered in the analyses of the effects of targeting a behavior on outcome. However, we found evidence that participants who targeted a behavior for change improved more over time than participants who did not target the behavior for change. Participants who targeted moderate physical activity showed significant improvement; those who targeted either fruit and vegetable intake or fat intake showed near-significant improvement. Improvement was not significant for those targeting vigorous physical activity (Table 3). Considering that effect sizes (d) can be interpreted as small (d=0.20) and medium (d=0.50), this represents a me-

### Table 1. Demographic Characteristics of Participants and Dropouts

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Participants (n = 117)</th>
<th>Dropouts (n = 31)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex, No. (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>74 (63)</td>
<td>16 (52)</td>
</tr>
<tr>
<td>Female</td>
<td>43 (37)</td>
<td>15 (48)</td>
</tr>
<tr>
<td>Ethnicity, No. (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>67 (57)</td>
<td>5 (16)</td>
</tr>
<tr>
<td>African American</td>
<td>25 (21)</td>
<td>18 (58)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>12 (10)</td>
<td>5 (16)</td>
</tr>
<tr>
<td>Asian</td>
<td>3 (3)</td>
<td>1 (3)</td>
</tr>
<tr>
<td>Other</td>
<td>10 (9)</td>
<td>2 (6)</td>
</tr>
<tr>
<td>Age, mean (SD), y</td>
<td>14.1 (2.0)</td>
<td>15.7 (2.0)</td>
</tr>
</tbody>
</table>

### Table 2. Study Design and Intervention Components in Each Condition

<table>
<thead>
<tr>
<th>Condition</th>
<th>Computer Assessment</th>
<th>Provider Counseling</th>
<th>Mail Contact</th>
<th>Telephone Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Mail only</td>
<td>Yes</td>
<td>Yes</td>
<td>Every 2 wk</td>
<td>No</td>
</tr>
<tr>
<td>Frequent</td>
<td>Yes</td>
<td>Yes</td>
<td>Every 6 wk</td>
<td>Counseling, every 6 wk</td>
</tr>
<tr>
<td>Infrequent</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Telephone and mail</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Infrequent</td>
<td>Yes</td>
<td>Yes</td>
<td>Every 6 wk</td>
<td>Weekly counseling and brief follow-up</td>
</tr>
<tr>
<td>Telephone and mail</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

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or family. Parents gave very high overall ratings of satisfaction, and 98% said that PACE+ should be offered at the clinic on an ongoing basis.

All mailings were sent as planned, regardless of whether telephone contact was made. Of the 3 planned telephone calls to those in the infrequent contact group, a mean of 2.04 (SD=0.9) or 68% were completed. Of the 8 planned counseling calls to those in the frequent contact group, a mean of 4.55 (SD=3.0) or 57% were completed.

**Satisfaction and Feasibility Data**

Adolescents expressed generally high satisfaction with all components of the intervention, between 3 and 4 on a 5-point scale (Table 4). They rated the computer program and provider counseling components as most helpful in making behavioral changes, and the mailed materials as least helpful. About 75% of the adolescents were satisfied with the frequency of both the mailed materials and telephone calls, and only 10% stated that contacts should be more frequent. Eighty percent of the adolescents stated they discussed some or all of the mailed materials with friends or family. Parents gave very high overall ratings of satisfaction, and 98% said that PACE+ should be offered at the clinic on an ongoing basis.

All mailings were sent as planned, regardless of whether telephone contact was made. Of the 3 planned telephone calls to those in the infrequent contact group, a mean of 2.04 (SD=0.9) or 68% were completed. Of the 8 planned counseling calls to those in the frequent contact group, a mean of 4.55 (SD=3.0) or 57% were completed.

**COMMENT**

The PACE+ intervention was successfully implemented in primary care settings and was associated with changes in dietary and moderate-intensity physical activity behaviors over a 4-month period. However, without a control group, it is impossible to determine whether these changes were due to the intervention, to other unmeasured factors, or to chance. Levels of vigorous physical activity did not appear to change, but this may have been due to the high levels of vigorous activity reported at baseline in this group.

Our results support the feasibility of PACE+, but they also identified areas in need of improvement. Some patients could not complete the computer program before they were called in for their provider encounter, suggesting a need to shorten the computer program or find another means of administering it before the office visit. Technical problems (eg, computer “crashes”) prevented others from completing the program or printing their action plans, but those difficulties mainly occurred early in the study. The mailings were reliably delivered, but it is not clear what percentage of the materials was read. Adolescents were generally pleased with the frequency of contact they received.

Although the moderate completion rates for telephone calls limited the comparison between the planned 3 and 8 calls, adolescents in the frequent contact group still received twice as many calls as those in the infrequent call group. The lack of differences in results be-

### Table 3. Comparison of Adolescents Targeting vs Not Targeting Each Behavior

<table>
<thead>
<tr>
<th>Variable</th>
<th>Those Targeting</th>
<th>Those Not Targeting</th>
<th>Statistics*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n Mean (SD)</td>
<td>n Mean (SD)</td>
<td>F   P   d</td>
</tr>
<tr>
<td>Moderate physical activity, d/wk†</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>59 3.10 (1.56)</td>
<td>58 4.40 (2.40)</td>
<td>12.13 .001 0.60</td>
</tr>
<tr>
<td>Follow-up</td>
<td>59 4.53 (1.88)</td>
<td>58 4.22 (2.01)</td>
<td></td>
</tr>
<tr>
<td>Vigorous physical activity, d/wk‡</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>35 4.17 (2.56)</td>
<td>82 3.94 (1.80)</td>
<td>0.001 .97 -0.01</td>
</tr>
<tr>
<td>Follow-up</td>
<td>35 4.57 (2.09)</td>
<td>82 4.35 (1.63)</td>
<td></td>
</tr>
<tr>
<td>Fruits and vegetables, servings/day</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>43 3.21 (1.88)</td>
<td>74 4.91 (2.37)</td>
<td>2.85 .09 0.32</td>
</tr>
<tr>
<td>Follow-up</td>
<td>43 4.47 (1.78)</td>
<td>74 5.36 (2.20)</td>
<td></td>
</tr>
<tr>
<td>Fat intake, servings/day high-fat foods</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>62 7.27 (3.13)</td>
<td>55 6.47 (5.28)</td>
<td>2.36 .13 -0.28</td>
</tr>
<tr>
<td>Follow-up</td>
<td>62 5.85 (3.26)</td>
<td>55 6.35 (4.00)</td>
<td></td>
</tr>
</tbody>
</table>

*F and P describe the targeted × time interaction. d = (Mean t − Mean nt)/SD pooled, where t indicates targeted and nt, nontargeted.†Number of days per week engaged in at least 30 minutes of moderate-intensity physical activity.‡Number of days per week engaged in at least 20 minutes of vigorous physical activity.

### Table 4. Adolescent and Parent Ratings of Intervention Components*

<table>
<thead>
<tr>
<th>Question (Respondents)</th>
<th>Mean (SD) Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>How helpful do you think the computer program and printouts will be in making changes to your eating and physical activity habits? (all subjects, 1 wk, N = 117)</td>
<td>3.84 (0.78)</td>
</tr>
<tr>
<td>How helpful do you think talking to your provider will in making changes to your eating and physical activity habits? (all subjects, 1 wk, N = 117)</td>
<td>3.82 (1.0)</td>
</tr>
<tr>
<td>To what extent did the mailed materials help you make changes in your activity level or eating habits? (intervention subjects, 4 mo, n = 93)</td>
<td>3.31 (1.1)</td>
</tr>
<tr>
<td>To what extent did the telephone counselor help you make changes in your activity level or eating habits? (subjects in telephone conditions, 4 mo, n = 64)</td>
<td>3.67 (0.93)</td>
</tr>
<tr>
<td>Parental satisfaction with the PACE+ program (parents of all adolescents, 4 mo, N = 117)</td>
<td>3.81 (1.0)</td>
</tr>
</tbody>
</table>

*All items were rated on a 5-point scale from 1 (not at all helpful) to 5 (very helpful). PACE+ indicates Patient-centered Assessment and Counseling for Exercise plus Nutrition.
tween these groups suggests that all the extended interventions may have had too low an intensity to be effective. However, we tend to believe that the content of the extended interventions was too limited. We targeted several empirically supported mediators for behaviors, including praise for successes, social support by telephone counselors, and problem solving to overcome barriers. It may, however, have been more efficacious to use the mail and telephone contacts to systematically teach behavior change strategies, as suggested by Social Cognitive Theory,55 and to tailor the teaching of strategies to the stage of change, as recommended by the Transtheoretical Model.24 Although others29 have found that frequency of contact was more important than content, present results suggest otherwise. Because creating long-term change may be the biggest challenge for those seeking to change health behaviors,26 more studies evaluating the mode, frequency, and content of behavior change communications are needed.

The lack of differences in outcomes associated with the various extended interventions suggests that the computer and provider intervention alone may be producing whatever effect we are seeing with this intervention. However, as is the case with our overall findings, because we did not conduct a separate experimental evaluation of the initial 2 components of PACE+ (computer program and provider counseling), we can draw no conclusion about their effectiveness. The possibility that the computer program and provider counseling per se were effective was partially supported by the analysis of targeting. Those who targeted moderate physical activity improved significantly more in this area than those who did not, and the effect size was medium. Targeting fat and fruit and vegetable consumption produced small effect sizes that were not statistically significant. If validated through further experimentation, these results support the utility of computer-based behavior change programs combined with provider counseling as a promising strategy for intervening with adolescents in primary care.

The apparent effects of “targeting” patient-selected behaviors must, however, be interpreted cautiously. The computer program encouraged patients who did not meet a particular behavioral guideline to choose that behavior for change. After the intervention, some of the targeted behavior means approached the recommended levels. However, some of this change could be due to regression to the mean. We interpreted the selection of a target behavior as an indication of the patient’s readiness to change, consistent with the Transtheoretical Model,24 so target selection was an integral part of the behavior change strategy. The efficacy of this approach needs to be compared with random assignment of target behaviors, selecting a standard sequence of target behaviors, and working on multiple targets simultaneously.

Another limitation of this study was the quality of the self-report measures of behavioral outcomes. The brief self-report measures were developed to be clinical assessments in the PACE+ computer program, but we applied them as measures of behavioral outcomes. A psychometric study provided support for the reliability and validity of most measures, but none performed as well as desired. Another concern in this study relates to the social desirability of responses in that measures of outcome were collected via telephone, while baseline measures were collected via computer. Although valid, we do not think this is a major concern because staff who collected final measures were different from intervention staff, and methods were the same for those who targeted behaviors and those who did not. Nonetheless, the difficulty of measuring physical activity and diet in young people is well known, and we encourage future researchers to use objective and previously validated measures.

To our knowledge, this is the first evaluation of a physical activity and dietary behavior change intervention for adolescents that combines (1) a computerized expert system based on behavior change theory, (2) health care provider counseling that is informed by the results of the expert system, and (3) postvisit telephone and mail counseling also tailored to an individual patient’s behavioral stage and goals. Results of this study indicated that this type of intervention is feasible in primary care settings. Participants were highly satisfied with all components of the intervention and there was relatively good participation in extended intervention by mail and telephone over a 4-month period. Even so, more effective approaches to long-term interventions need to be developed and evaluated. A randomized trial of the PACE+ intervention, currently under way, will help determine if this intervention is efficacious.

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What This Study Adds

Most adolescents engage in insufficient physical activity and have poor dietary habits. The increasing incidence of overweight and obesity in adolescents and young adults is a result of these behavioral patterns. Counseling by health care providers may help improve these behaviors but methods to enable brief, systematic, and tailored health behavior counseling have not been reported. This study evaluates the feasibility of a theory-based multicomponent intervention designed to improve the effectiveness of health care provider counseling for physical activity and dietary behaviors. It also explores the impact of different versions of this intervention on behavioral outcomes. Results of this study indicate that this intervention is feasible and provide background for its evaluation through controlled trials.
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REFERENCES


