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Effects of a Tailored Follow-Up Intervention on Health Behaviors, Beliefs, and Attitudes

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and WAYNE D. ROSAMOND, Ph.D. 4

ABSTRACT

Background: The high rates of relapse that tend to occur after short-term behavioral interventions indicate the need for maintenance programs that promote long-term adherence to new behavior patterns. Computer-tailored health messages that are mailed to participants or given in brief telephone calls offer an innovative and time-efficient alternative to ongoing face-to-face contact with healthcare providers.

Methods: Following a 1-year behavior change program, 22 North Carolina health departments were randomly assigned to a follow-up intervention or control condition. Data were collected from 1999 to 2001 by telephone-administered surveys at preintervention and postintervention for 511 low-income, midlife adult women enrolled in the Well-Integrated Screening and Evaluation for Women Across the Nation (WISEWOMAN) program at local North Carolina health departments. During the year after the behavior change program, intervention participants were mailed six sets of computer-tailored health messages and received two computer-tailored telephone counseling sessions. Main outcomes of dietary and physical activity behaviors, beliefs, and attitudes were measured.

Results: Intervention participants were more likely to move forward into more advanced stages of physical activity change (p = 0.02); control participants were more likely to increase their level of dietary social support at follow-up (p = 0.05). Both groups maintained low levels of reported saturated fat and cholesterol intake at follow-up. No changes were seen in physical activity in either group.

Conclusions: Mailed computer-tailored health messages and telephone counseling calls favorably modified forward physical activity stage movement but did not appreciably affect any other psychosocial or behavioral outcomes.

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INTRODUCTION

Cardiovascular Disease (CVD) is the leading cause of death among women in the United States, and mortality rates are particularly high among women of low socioeconomic status or from ethnic minority groups. Lifestyle-related risk factors, such as an unhealthy diet and physical inactivity, are important causes of CVD and are key targets for prevention. Although intervention programs have been successful in promoting short-term adherence to dietary and physical activity regimens for health promotion, few result in long-lasting change. Indeed, most people who succeed in making changes revert back to less healthy habits within 6-12 months. Given that sustained changes can lead to substantial reductions in morbidity and mortality, there is a crucial need for maintenance programs aimed at preventing relapse.

Of the studies reporting follow-up contact during the posttreatment period, promising results have been obtained from multifaceted maintenance programs that combine ongoing contact with other strategies, such as relapse prevention training. Few of these studies, however, have targeted low-income, middle-aged women from ethnic minority groups, and even fewer are feasible in public health settings.

A primary means by which states provide healthcare to low-income people is through health departments, but frequently health department staff lack the time and resources to provide preventive health services. Computer-tailored mail and telephone contacts are a promising means of providing ongoing personalized intervention to large numbers of people. Mail and telephone interventions have been effective in promoting sustained changes in dietary intake and physical activity. Moreover, some studies suggest that messages tailored to a person’s specific needs and concerns are more effective in promoting changes in diet than are standard, nontailored materials.

What had yet to be tested, but offered a promising approach to long-term behavior change, was whether computer-tailored, mailed health messages and brief telephone calls from healthcare providers could promote long-term adherence to positive dietary and physical activity behaviors among people who had participated in a behavior change program. We tested the hypothesis that providing ongoing personalized health information to midlife, low-income women after they had finished a CVD risk reduction program would promote greater improvements or maintenance of dietary and physical activity behaviors, beliefs, and attitudes relative to a usual care group.

MATERIALS AND METHODS

Study participants were 511 women who participated in the North Carolina Well-Integrated Screening and Evaluation for Women Across the Nation (WISEWOMAN) nutrition and physical activity program from January through December 1998. The NC WISEWOMAN project was a nonrandomized group-assigned intervention established to demonstrate the feasibility and effectiveness of offering CVD screening and patient education to low-income women, aged 50-64, at local health departments. NC WISEWOMAN consisted of a pilot phase (1995-1997), an initial intervention phase (1998-1999), and a maintenance intervention phase (1999-2001).

Phase One: Pilot study

In the pilot study, women in the enhanced intervention (EI) received three counseling sessions using a structured assessment and intervention program called New Leaf . . . Choices for Healthy Living. Results showed that EI participants experienced significant reductions in reported dietary fat and cholesterol intake (p = 0.001) compared with essentially no change in women in the minimum intervention (MI) (i.e., usual health department services). Improvements in total and high-density lipoprotein (HDL) cholesterol, diastolic blood pressure (DBP), body mass index (BMI), and physical activity also were observed but did not differ significantly between groups. The pilot study results are described in more detail elsewhere.

Phase Two: Initial intervention

Thirty-three health departments participated in the second phase of NC WISEWOMAN (1998-1999). Of these, 11 were assigned to MI and 22 to EI. Briefly, in MI health departments, participants at high risk for CVD were given the health department’s usual counseling and referred by staff members according to criteria provided by the state health department. Using the New Leaf program, the EI health departments gave at-risk par-
participants three 30-minute counseling sessions on diet and physical activity over 6 months.
At baseline, 88% (n = 2061) of women screened for CVD risk factors were at elevated risk and en-
rolled in the intervention (n = 1375 in EI and n = 685 in MI). At the 12-month follow-up, 37% (n = 772) of at-risk women returned to the health de-
partments for rescreening. Of the EI women (n = 484) seen at both baseline and 12-month fol-
low-up, 65% (n = 314) attended at least two in-
tervention sessions.

The analyses on change in risk factors were performed on a subset of participants and re-
stricted to women in the EI group who attended two or more intervention sessions (n = 314) or
gen in the MI group who were enrolled prior to April 1999 (n = 276). On the basis of brief single-
kle-item screeners, findings suggest that im-
provements in self-assessed diet and physical ac-
tivity were greater in the EI group than in the MI

Phase Three: Maintenance study
After the initial intervention, the 22 EI health

departments were randomly assigned to mainte-
nance special intervention (MSI) or maintenance
usual care (MUC) (Fig. 1). The eligible study pop-
ulation for the maintenance study consisted of
909 women who enrolled in the EI between Jan-
uary and December 1998. Of these, 511 completed
the baseline maintenance survey and were en-
rolled in the follow-up program. During the 1-
year maintenance program, MUC participants
(n = 209) received usual follow-up services at the
discretion of health departments. Basic nutrition
and physical activity counseling pamphlets, pro-
vided by the North Carolina Department of Health and Human Services, were available to
MUC health departments. Participants in MSI
(n = 302) were mailed six bimonthly computer-
tailored health messages and received two tele-
phone calls from health department staff.

The follow-up contacts were based on the as-
sumption of a prior counseling relationship and
were structured to efficiently reinforce the initial
New Leaf ... Choices for Healthy Living program.41

Intervention materials were based on social cog-
nitive theory,44,45 relapse prevention theory,46 and
the transtheoretical model (TTM).47 They were
computer-tailored to each participant’s behavioral
goals, stage of change, knowledge, social support
system, high-risk situations for relapse, and per-
ceived benefits and barriers to behavior change
and maintenance. The messages were designed
for a low-literate, low-income adult population
and featured testimonials and expert advice

columns, feedback on participants’ health behav-
iors, behavioral contracts and self-monitoring
forms, social support cards, and health tips and

quizzes. The intervention telephone calls were
conducted by trained health department staff who
assessed whether participants were meeting their
goals and also helped participants to identify and
negotiate barriers and set new goals. To facilitate
counseling, staff members received phone call

guides for each participant, which included such
information as the participant’s name, telephone
number, behavioral goals, and perceived barriers.

On the basis of individual responses to the
pretest survey, a separate set of materials was
computer-generated for each participant. The
material was mailed bimonthly and contained 32
messages selected specifically for each participant
from a library of 649 messages. Similarly for the
telephone calls, 10 messages were selected specif-
ically for each participant from a library of 141.

A graphic design company produced the materi-
als on a Mac OS computer using a program that
matched participants’ answers with specific mes-
ses and placed those messages in the final feed-
back form. The software used FileMaker Pro for
data management, PageMaker for message and

template management, and AppleScript for as-
sembly and production functions.

Phase Three: Evaluation measures

Evaluation of health behaviors, beliefs, and at-
titudes was based on telephone surveys admini-
istered immediately before and 12 months after the maintenance intervention. The evaluation covered dietary intake, physical activity, stage of change, and selected psychosocial variables. We assessed program implementation and participant acceptability of the maintenance program in terms of recall, use, and satisfaction with the computer-tailored contacts, using data from the follow-up telephone survey and call logs recorded by health department staff on each participant’s phone call guide.

**Dietary intake.** Dietary intake was assessed using the 54-item dietary risk assessment (DRA), a simplified, validated food frequency questionnaire that serves as a proxy measure for saturated fat and cholesterol intake. Validation of the DRA is described elsewhere.

**Physical activity.** Physical activity was assessed using the 31-item physical activity assessment (PAA) questionnaire developed for the initial behavior change program. The PAA focuses on lifestyle activities relevant to midlife, low-income women and is designed to assess elements of sedentary and active lifestyles.

**Stage of change.** Using three questions based on the TTM, participants were categorized into stages at baseline: precontemplation (not thinking about change), contemplation (thinking about change within next 6 months), preparation (currently trying to change), or maintenance (maintaining change for more than 6 months). The five categories were collapsed into three, defined by Kristal et al. as preaction (precontemplation,
contemplation, or preparation), action, and main-
tenance.

Psychosocial variables. Self-efficacy to consume
low-fat foods and be physically active was mea-
sured using one item on a 5-point (1 = very un-
sure, 5 = very sure) and 4-point scale (1 = not at
all sure, 4 = very sure), respectively. Beliefs about
perceived barriers to eating low-fat foods were
assessed using seven items on a 4-point scale (1 =
strongly agree, 4 = strongly disagree), and per-
ceived barriers to physical activity were assessed
using nine items on a 3-point scale (1 = a lot like
me, 3 = not at all like me). Participants’ motiva-
tion to eat well and be physically active were each
measured using one item on a 4-point scale (1 =
not at all important, 4 = very important). Per-
ceived supportiveness of family and friends for
eating healthy and being physically active was
measured using one item for each behavior on a
4-point scale (1 = disagree a lot, 4 = agree a lot).
Responses were grouped into categories of low,
medium, and high.

Analysis

Analyses are based on the 421 women who
completed both surveys. Health departments
were the unit of observation. To account for clus-
tering among individuals within health depart-
ments, mixed models and generalized estimating
equations (GEEs) were used to analyze continu-
ous and categorical outcomes, respectively. Be-
cause we had a limited number of clusters, a
modest number of observations per cluster, and several categories for each categorical variable,
only main variables of interest were included in
the models, while accounting for the clustering
variable (health departments). Additional covari-
ates, which would have overtaxed the models,
were not included.

GEEs were used to examine intervention ef-
fects on health beliefs and attitudes using SAS
PROC GENMOD (SAS Institute, Cary, NC, 2001).
Models were constructed using the ordered cat-
egorical outcome as the dependent variable and
study group as the main exposure variable, control-
ling for baseline status of the response variable and
accounting for the clustering variable. Mixed
models were used to assess change in PAA and
PAA scores using SAS PROC MIXED. Models
were constructed using change score as the de-
pendent variable and intervention group as the
main exposure variable, while incorporating a
random intercept term to account for clustering.

Using the standard of intent to treat, additional
analyses were completed on all participants en-
rrolled in the intervention (n = 511), assuming no
change from baseline in persons without follow-
up data (n = 90).

RESULTS

Sample characteristics

Of the 909 women eligible for the maintenance
intervention, 511 (56%) completed the pretest sur-
vey and enrolled in the follow-up program (302
in MSI and 209 in MUC) (Fig. 1). Reasons for non-
response were refusals (6%), no answer after 15
attempts (10%), no telephone number provided
(2%), wrong number (3%), disconnected tele-
phone or no number listed (9%), dropped from
study (3%), and special cases (e.g., language bar-
riers, Alzheimer’s disease, completed half the sur-
voy or less) (9%). Nonrespondents (n = 398) did
not differ significantly from respondents in age,
race, education, or CVD risk factors assessed at
baseline of NC WISEWOMAN, Phase Two.

Of the 511 participants who completed the
pretest, 421 (82%) were reinterviewed at the 12
month follow-up (Fig. 1). There were no signifi-
cant differences between posttest respondents
and nonrespondents by study arm, race, educa-
tion, or baseline CVD risk factors. However, more
slightly older women and women taking blood
pressure medication at baseline (p ≤ 0.05) were in
the follow-up group. Among the 90 women (18%)
unavailable for posttest, no differences were ob-
served between the study groups in baseline de-
mographics or CVD risk factors.

The mean age of participants was 59 years
(Table 1). Forty-four percent were from ethnic mi-
nority groups, and only 8% had more than a high
school education. Average total cholesterol and
HDL cholesterol were 231 mg/dl and 53 mg/dl,
respectively, and mean SBP and DBP were 135
mm Hg and 80 mm Hg, respectively. About half
the women were obese, 16% smoked, 12% had a
history of coronary heart disease (CHD), and 16%
had diabetes. Demographics and baseline risk
factors were generally similar for both groups.
However, more MUC than MSI participants were from ethnic minority groups and obese ($p < 0.05$).

### Intervention effects

**Process measures.** Ninety-six percent of MSI participants remembered receiving all six computer-tailored health mailings. Of these, 91% reported reading all or most of the materials. Most (89%) saved the mailings, but fewer (51%) shared them with others. Almost all (97%) were satisfied with the mailings, and most (76%) thought the information was written especially for them.

On average, it took health department staff two attempts to reach participants by telephone, and each call lasted an average of 8 minutes. Among participants who recalled receiving a telephone call (67%), almost all (94%) were satisfied with the calls. Ninety-six percent thought the calls provided support for their behavior change efforts, and 92% felt the nurses understood a lot, or quite a bit, about their behavioral goals and barriers.

**Dietary intake and physical activity level.** Both groups of participants maintained low reported intake levels of dietary saturated fat and cholesterol (i.e., low DRA scores) (Table 2). At 12 months postintervention, the intervention effect for diet atherogenicity (posttest minus pretest score), adjusted for intrahealth department correlation, was $-0.39$ ($p = 0.60$). No significant differences in PAA scores from preintervention to postintervention were found. Rather, both groups maintained somewhat low levels of physical activity (i.e., low PAA scores). At follow-up, the adjusted intervention effect for physical activity was $-0.25$ ($p = 0.62$).

Additional analyses were completed on all participants enrolled in the follow-up intervention ($n = 511$), assuming no change from baseline for participants without follow-up data ($n = 90$). Adjusted for intrahealth department correlation, intervention effects at 12 months remained virtually unchanged (i.e., $-0.32$ [$p = 0.59$] for diet atherogenicity and $-0.20$ [$p = 0.63$] for physical activity).

**Stage of change.** Sixty percent or more of the women in each group had no change in stage. Most participants started and ended the 1-year program in the maintenance stage for both dietary

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**Table 1. Baseline Demographics and Cardiovascular Disease Risk Status of Maintenance Intervention Participants**

<table>
<thead>
<tr>
<th>Demographics</th>
<th>MSI (n = 302)</th>
<th>MUC (n = 209)</th>
<th>Total sample (n = 511)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years (mean)</td>
<td>59</td>
<td>59</td>
<td>59</td>
</tr>
<tr>
<td>Education (%)a</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High school</td>
<td>48</td>
<td>54</td>
<td>51</td>
</tr>
<tr>
<td>High school</td>
<td>43</td>
<td>38</td>
<td>41</td>
</tr>
<tr>
<td>Race (%)b*</td>
<td>9</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Black</td>
<td>38</td>
<td>43</td>
<td>40</td>
</tr>
<tr>
<td>White</td>
<td>61</td>
<td>47</td>
<td>56</td>
</tr>
<tr>
<td>Native American or other</td>
<td>1</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>CVD risk statusc</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>History of coronary heart disease (%)</td>
<td>12</td>
<td>13</td>
<td>12</td>
</tr>
<tr>
<td>Smoker (%)</td>
<td>16</td>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td>Diabetic (%)</td>
<td>16</td>
<td>17</td>
<td>16</td>
</tr>
<tr>
<td>Obese (% BMI ≥30)</td>
<td>48</td>
<td>57</td>
<td>52</td>
</tr>
<tr>
<td>Total cholesterol (mg/dl)</td>
<td>234</td>
<td>228</td>
<td>231</td>
</tr>
<tr>
<td>HDL cholesterol (mg/dl)</td>
<td>53</td>
<td>52</td>
<td>53</td>
</tr>
<tr>
<td>Systolic blood pressure (mm Hg)</td>
<td>135</td>
<td>134</td>
<td>135</td>
</tr>
<tr>
<td>Diastolic blood pressure (mm Hg)</td>
<td>80</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>Taking BP medication (%)</td>
<td>44</td>
<td>50</td>
<td>47</td>
</tr>
</tbody>
</table>

*aSignificant between-group differences at $p < 0.05$.

*bBased on $n = 442$.

*cBased on $n = 487$.

*dBased on $n = 476$ (except where noted).

*eBased on $n = 472$.

*fBased on $n = 463$. 

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and physical activity change (Tables 3 and 4). Forward movement was the next most common pattern (observed in 21% of participants) and occurred more often between preaction and maintenance stages, followed by movement from action to maintenance. Backward movement was the least common pattern (observed in 14% of participants) and mainly involved relapse from maintenance stages, followed by movement from action to preaction stages.

Adjusting for baseline levels and intrahealth department correlation, forward movement into later stages of dietary change did not differ significantly between groups (OR [95% CI] = 1.17 (0.73, 1.88), \( p = 0.51 \)) (Table 3). However, intervention participants were significantly more likely than control participants to move forward into later stages of physical activity change [OR (95% CI) = 1.65 (1.07, 2.56), \( p = 0.02 \)] (Table 4).

**Psychosocial variables.** There were few changes in baseline levels over time in either group. Most participants began and ended the maintenance program with high levels of self-reported dietary and physical activity self-efficacy, social support, and motivation (Tables 3 and 4). Perceived barriers were low (physical activity) or moderate (low-fat eating). Some participants showed improvement in health beliefs and attitudes, but few regressed to lower than baseline levels.

Adjusting for baseline levels and intrahealth department correlation, shifts from less to more favorable levels of self-efficacy and social support for physical activity and motivation and perceived barriers to diet and physical activity did not differ significantly between groups (\( p > 0.10 \)) (Tables 3 and 4). Differences were borderline significant for dietary self-efficacy and social support. Intervention participants were more likely to report increases in dietary self-efficacy [OR (95% CI) = 1.88 (0.97, 2.27), \( p = 0.07 \)], whereas control participants were more likely to report increases in dietary social support [OR (95% CI) = 0.63 (0.39, 1.01), \( p = 0.05 \)].

**DISCUSSION**

To our knowledge, this project is the first one to use computer-tailored contacts as a posttreatment intervention strategy designed to sustain the effects of a more intensive intervention. Studies using computer-tailored communications have generally focused on adoption of health behaviors and suggest that tailored communications often, but not always, are associated with improvements in diet\textsuperscript{33-35,50-52} and physical activity\textsuperscript{36,37,53} that can be reasonably well maintained for up to 6 months without further intervention.\textsuperscript{39}

We tested the effectiveness of computer-tailored messages in promoting sustained adherence to health-promoting behaviors. Computer-tailored mailed messages and telephone calls showed an advantage over usual follow-up care for promoting forward physical activity stage movement but did not appreciably affect other psychosocial or behavioral outcomes. Both groups (MSI and MUC) were able to maintain
positive dietary behaviors, health beliefs, and attitudes for up to 1 year after the NC WISE-WOMAN project. Confidence in the validity of our findings is increased by the randomized study design and absence of differential attrition.

A limitation of this study is the use of self-report measures, which are susceptible to response set biases.54,55 In addition, although scores from the physical activity assessment compared favorably with Caltrac measures in a previous study ($r = 0.36, p < 0.0001$),36 the instrument has not been formally validated, which may result in errors in the measurement of physical activity. Another limitation is that participants who failed to complete the study may have had less favorable outcomes than those who completed it. This concern is mitigated to some extent by analyses of data on all participants who began the study; these analyses showed the same pattern of results. Another challenge to our interpretation of the study findings is the substantial loss to follow-up in the initial study (Phase Two), which limits the conclusions that can be drawn from the initial intervention. We conservatively defined “maintenance” as adherence to positive outcomes that may have already been present and not necessarily influenced by the initial intervention.

The failure of the intervention to demonstrate superior effects on many of the outcomes may be a result of insufficient strength of the maintenance intervention, a higher-than-expected effect of maintenance usual care (i.e., usual follow-up services at the discretion of health departments), a prolonged effect of the initial intervention, diminished power due to the group-assigned study design, measurement errors, or reduced precision caused by the small number of assignment units (health departments). Another explanation may relate to the observation that most participants began the maintenance program with low

<table>
<thead>
<tr>
<th>Variable</th>
<th>baseline n (%)</th>
<th>follow-up n (%)</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diet stage of change</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preaction</td>
<td>72 (30.4)</td>
<td>53 (22.4)</td>
<td>0.16 (0.24) 1.17 (0.73, 1.88)</td>
</tr>
<tr>
<td>Action</td>
<td>20 (8.4)</td>
<td>14 (5.9)</td>
<td>0.16 (0.24) 1.17 (0.73, 1.88)</td>
</tr>
<tr>
<td>Maintenance</td>
<td>145 (61.2)</td>
<td>170 (71.7)</td>
<td>0.16 (0.24) 1.17 (0.73, 1.88)</td>
</tr>
<tr>
<td>Change estimate</td>
<td>0.16 (0.24) 1.17 (0.73, 1.88)</td>
<td></td>
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<tr>
<td>Diet social support</td>
<td></td>
<td></td>
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<tr>
<td>Low</td>
<td>34 (14.7)</td>
<td>32 (13.9)</td>
<td>0.47 (0.24) 0.63 (0.39, 1.01)</td>
</tr>
<tr>
<td>Medium</td>
<td>37 (16.0)</td>
<td>41 (17.8)</td>
<td>0.47 (0.24) 0.63 (0.39, 1.01)</td>
</tr>
<tr>
<td>High</td>
<td>160 (69.3)</td>
<td>158 (68.4)</td>
<td>0.47 (0.24) 0.63 (0.39, 1.01)</td>
</tr>
<tr>
<td>Change estimate</td>
<td>0.47 (0.24) 0.63 (0.39, 1.01)</td>
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<tr>
<td>Diet self-efficacy</td>
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<tr>
<td>Low</td>
<td>26 (10.4)</td>
<td>18 (7.2)</td>
<td>0.39** (0.22) 1.48 (0.97, 2.27)</td>
</tr>
<tr>
<td>Medium</td>
<td>68 (27.1)</td>
<td>52 (20.7)</td>
<td>0.39** (0.22) 1.48 (0.97, 2.27)</td>
</tr>
<tr>
<td>High</td>
<td>157 (62.5)</td>
<td>181 (72.1)</td>
<td>0.39** (0.22) 1.48 (0.97, 2.27)</td>
</tr>
<tr>
<td>Change estimate</td>
<td>0.39** (0.22) 1.48 (0.97, 2.27)</td>
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<tr>
<td>Diet motivation</td>
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<tr>
<td>Low</td>
<td>17 (6.8)</td>
<td>10 (4.0)</td>
<td>0.12 (0.53) 1.12 (0.41, 3.06)</td>
</tr>
<tr>
<td>Medium</td>
<td>234 (93.2)</td>
<td>241 (96.0)</td>
<td>0.12 (0.53) 1.12 (0.41, 3.06)</td>
</tr>
<tr>
<td>High</td>
<td>25 (13.4)</td>
<td>18 (9.6)</td>
<td>0.12 (0.53) 1.12 (0.41, 3.06)</td>
</tr>
<tr>
<td>Change estimate</td>
<td>0.12 (0.53) 1.12 (0.41, 3.06)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

aParticipants completing pretest and posttest surveys.

bTotals do not add up to 421 because of nonresponses to some items.

cPercentages may not add up to 100 because of rounding to the nearest tenth.

dChange estimate (ratio of odds of moving from less to more favorable outcomes in MSI vs. MUC group), controlling for baseline level and intrahospital correlation.

*Significant at the $p /H110050.05$ level.

**Borderline significant at the $p /H110050.07$ level.
reported levels of dietary risk and positive health beliefs and attitudes. This observation is not surprising considering that participants completed an intensive dietary and physical activity behavior change program prior to enrolling in the maintenance program before enrolling in the maintenance program, which may have created a ceiling effect and limited the amount of possible further gains in participants' self-reported dietary behavior, health beliefs, and attitudes. It is also possible that participants learned the correct responses to the assessment surveys after taking part in the initial program and completing the surveys previously. This could further explain the fact that they began the maintenance program reporting low dietary risk and positive health beliefs.

The NC WISEWOMAN project provided three half-hour counseling sessions over 6 months (initial intervention), followed by six mailings and two telephone calls (maintenance intervention). These interventions may not have been potent enough to show significant effects over usual follow-up care in our sample of midlife, low-income women. Maintenance studies that have used more intensive behavior change programs (i.e., weekly, biweekly, or monthly contact) have produced significant improvements in diet and physical activity that were reasonably well maintained with frequent contacts in person, via mail or telephone, or using a combination of these approaches. However, most maintenance studies have recruited predominantly white, educated, middle-income adults often selecting people who may be more motivated than the general population. Only one other study that we know of evaluated the effect of posttreatment contacts on maintenance of dietary behaviors in low-income, low-literate, multiethnic women. Frequent mail and telephone contacts were effective in promot-

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**Table 4. Effects of Maintenance Intervention on Physical Activity Psychosocial Factors (n = 421)**

<table>
<thead>
<tr>
<th>Variable</th>
<th>MSI (n = 252)</th>
<th>MUC (n = 369)</th>
<th>Baseline n (%)</th>
<th>Follow-up n (%)</th>
<th>Baseline n (%)</th>
<th>Follow-up n (%)</th>
<th>p (SE) OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical activity stage of change</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Preaction</td>
<td>63 (26.4)</td>
<td>56 (23.4)</td>
<td>35 (23.3)</td>
<td>47 (31.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Action</td>
<td>30 (12.6)</td>
<td>23 (9.6)</td>
<td>20 (13.3)</td>
<td>17 (11.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintenance</td>
<td>146 (61.1)</td>
<td>160 (67.0)</td>
<td>95 (63.3)</td>
<td>86 (57.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change estimate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.50* (0.22) 1.65 (1.07, 2.56)</td>
</tr>
<tr>
<td>Physical activity social support</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Low</td>
<td>31 (12.8)</td>
<td>23 (9.5)</td>
<td>21 (13.5)</td>
<td>19 (12.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td>50 (20.7)</td>
<td>28 (11.6)</td>
<td>26 (16.8)</td>
<td>21 (13.6)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>161 (66.5)</td>
<td>191 (78.9)</td>
<td>108 (69.7)</td>
<td>113 (74.2)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Change estimate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.32 (0.25) 1.38 (0.85, 2.25)</td>
</tr>
<tr>
<td>Physical activity self-efficacy</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>58 (23.2)</td>
<td>54 (21.6)</td>
<td>34 (20.7)</td>
<td>33 (20.1)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Medium</td>
<td>84 (33.6)</td>
<td>77 (30.8)</td>
<td>59 (36.0)</td>
<td>51 (31.1)</td>
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<tr>
<td>High</td>
<td>108 (43.2)</td>
<td>119 (47.6)</td>
<td>71 (43.3)</td>
<td>80 (48.8)</td>
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<tr>
<td>Change estimate</td>
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<td></td>
<td></td>
<td></td>
<td>0.32 (0.25) 1.38 (0.85, 2.25)</td>
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<tr>
<td>Physical activity motivation</td>
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<tr>
<td>Low</td>
<td>20 (8.0)</td>
<td>17 (6.8)</td>
<td>11 (6.8)</td>
<td>8 (4.9)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Medium</td>
<td>24 (9.6)</td>
<td>20 (8.0)</td>
<td>7 (4.3)</td>
<td>16 (9.9)</td>
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<tr>
<td>High</td>
<td>207 (82.5)</td>
<td>214 (85.3)</td>
<td>144 (88.9)</td>
<td>138 (85.2)</td>
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<tr>
<td>Change estimate</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.15 (0.30) 1.16 (0.64, 2.10)</td>
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<tr>
<td>Physical activity barriers</td>
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</tr>
<tr>
<td>Low</td>
<td>118 (57.3)</td>
<td>128 (62.1)</td>
<td>69 (47.9)</td>
<td>81 (56.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td>70 (34.0)</td>
<td>62 (30.1)</td>
<td>63 (43.8)</td>
<td>46 (31.9)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>18 (8.7)</td>
<td>16 (7.8)</td>
<td>12 (8.3)</td>
<td>17 (11.8)</td>
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<td></td>
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<tr>
<td>Change estimate</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>0.15 (0.24) 1.16 (0.73, 1.96)</td>
</tr>
</tbody>
</table>

*Participants completing pretest and posttest surveys.
†Totals do not add up to 421 because of nonresponses to some items.
‡Change estimate (ratio of odds of moving from less to more favorable outcomes in MSI vs. MUC group), controlling for baseline level and intrahousehold correlation.
*Significant at the p = 0.02 level.
ing sustained dietary change following an intensive classroom-based intervention.28

Given the paucity of interventions targeting ethnically diverse, middle, low-income women, further work refining maintenance interventions applicable to these populations is warranted. Future studies should also examine the effect of posttreatment tailored mail and telephone contacts on maintenance of behavior change following initial interventions of varying intensity. Issues related to the amount of maintenance intervention needed to be effective should also be addressed.

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