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

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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.

INTRODUCTION

CARDIOVASCULAR DISEASE (CVD) IS THE LEADING CAUSE of death among women in the United States,[1] and mortality rates are particularly high among women of low socioeconomic status or from ethnic minority groups.[2–4] Lifestyle-related risk factors, such as an unhealthy diet and physical inactivity, are important causes of CVD[5–7] 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,[8–11] few result in long-lasting change.[12–14] Indeed, most people who succeed in making changes revert back to less healthy habits within 6–12 months.[13] Given that sustained changes can lead to substantial reductions in morbidity and mortality,[15,16] 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.[17–26] 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.[27] 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[28–30] and physical activity.[17–19,26,30–32] Moreover, some studies suggest that messages tailored to a person's specific needs and concerns are more effective in promoting changes in diet[33–35] and physical activity[36–39] 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 years, at local health departments.[40] 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*.[41] 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).[42] 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.[42] The pilot study results are described in more detail elsewhere.[42]

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,[41] the EI health departments gave at-risk par-

ticipants 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 enrolled in the intervention ($n = 1376$ in EI and $n = 685$ in MI).[43] At the 12-month follow-up, 37% ($n = 772$) of at-risk women returned to the health departments for rescreening.[43] Of the EI women ($n = 484$) seen at both baseline and 12-month follow-up, 65% ($n = 314$) attended at least two intervention sessions.[43]

The analyses on change in risk factors were completed on a subset of participants and restricted to women in the EI group who attended two or more intervention sessions ($n = 314$) or women in the MI group who were enrolled prior to April 1999 ($n = 276$). On the basis of brief single-item screeners, findings suggest that improvements in self-assessed diet and physical activity were greater in the EI group than in the MI group. From baseline to 12-month follow-up, the percentage of women who reported consuming a "very" or "pretty much" heart-healthy diet increased from 43% to 67% in the EI group vs. 50% to 57% in the MI group.[43] Similarly, the percentage of women reporting >30 minutes of moderate activity on most days increased from 60% to 68% in the EI group and 62% to 66% in the MI group.[43] Because of the significant loss to follow-up, however, no formal statistical tests or adjustments for clustering design were computed because the data were not considered valid. Accordingly, in Phase Three we chose to conservatively define "maintenance" as maintenance of behaviors that may have been present before the initial intervention (rather than maintenance of behaviors resulting from the intervention).

Phase Three: Maintenance study

After the initial intervention, the 22 EI health departments were randomly assigned to maintenance special intervention (MSI) or maintenance usual care (MUC) (Fig. 1). The eligible study population for the maintenance study consisted of 909 women who enrolled in the EI between January and December 1998. Of these, 511 completed the baseline maintenance survey and were enrolled 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 telephone calls from health department staff.

The follow-up contacts were based on the assumption 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 cognitive 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 perceived 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 behaviors, 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 specifically for each participant from a library of 141. A graphic design company produced the materials on a Mac OS computer using a program that matched participants' answers with specific messages and placed those messages in the final feedback form. The software used FileMaker Pro for data management, PageMaker for message and template management, and AppleScript for assembly and production functions.

Phase Three: Evaluation measures

Evaluation of health behaviors, beliefs, and attitudes was based on telephone surveys admin-
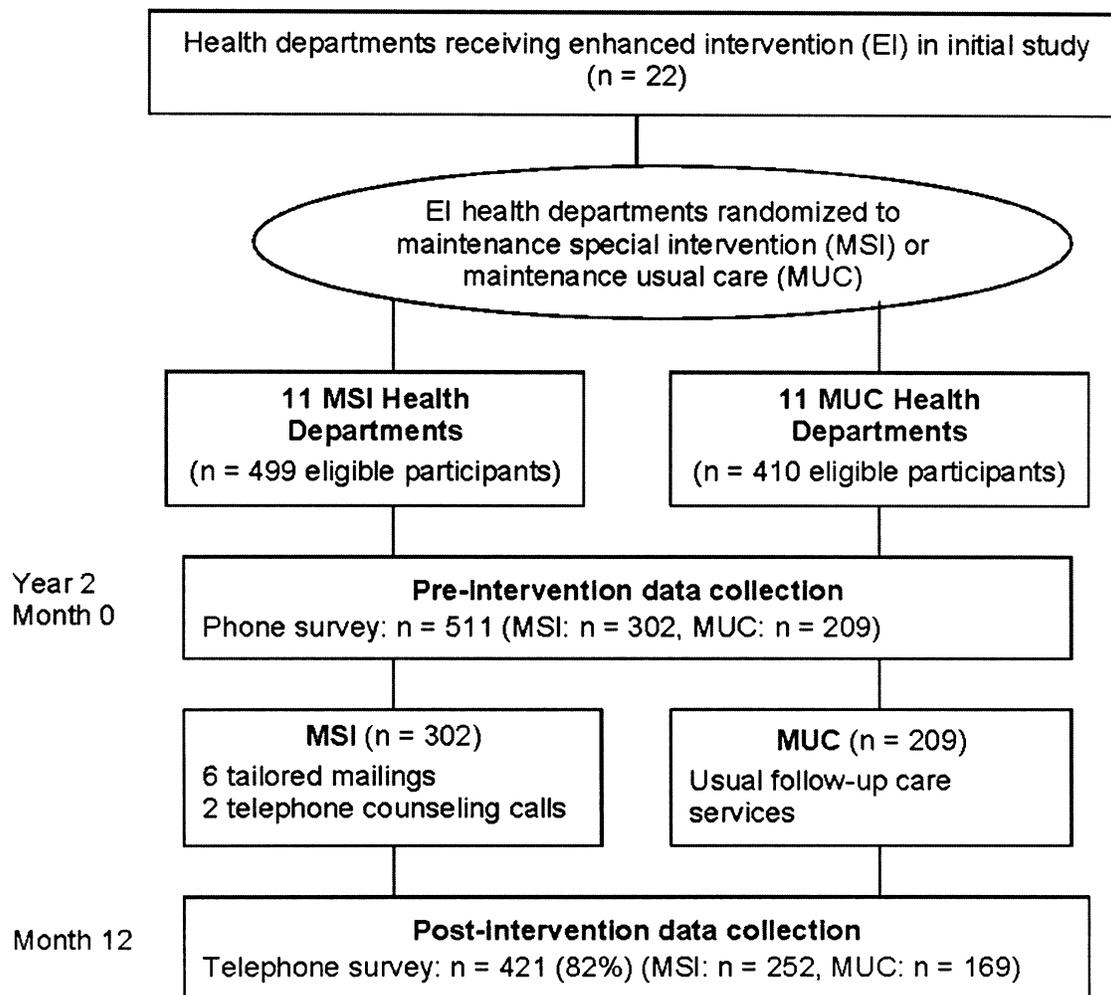
FIG. 1. Study design of the North Carolina WISEWOMAN maintenance program.

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),[48] 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.[48]

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,[47] participants were categorized into stages at baseline: precontemplation (not thinking about change), contemplation (thinking about change within next 6 months), preparation (planning to change within next 30 days), action (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.[49] as preaction (precontemplation,

contemplation, or preparation), action, and maintenance.

Psychosocial variables. Self-efficacy to consume low-fat foods and be physically active was measured using one item on a 5-point (1 = very unsure, 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 perceived 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' motivation 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). Perceived 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 randomization, and participants were the unit of observation. To account for clustering among individuals within health departments, mixed models and generalized estimating equations (GEEs) were used to analyze continuous and categorical outcomes, respectively. Because 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 covariates, which would have overtaxed the models, were not included.

GEEs were used to examine intervention effects on health beliefs and attitudes using SAS PROC GENMOD (SAS Institute, Cary, NC, 2001). Models were constructed using the ordered categorical outcome as the dependent variable and study group as the main exposure, controlling for baseline status of the response variable and accounting for the clustering variable. Mixed models were used to assess change in DRA and PAA scores using SAS PROC MIXED. Models were constructed using change score as the dependent 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 enrolled 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 survey and enrolled in the follow-up program (302 in MSI and 209 in MUC) (Fig. 1). Reasons for nonresponse were refusals (8%), no answer after 15 attempts (10%), no telephone number provided (2%), wrong number (3%), disconnected telephone or no number listed (9%), dropped from study (3%), and special cases (e.g., language barriers, Alzheimer's disease, completed half the survey 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 significant differences between posttest respondents and nonrespondents by study arm, race, education, or baseline CVD risk factors. However, more slightly older women and women taking blood pressure medication at baseline ($p \leq 0.05$) were in the follow-up group. Among the 90 women (18%) unavailable for posttest, no differences were observed between the study groups in baseline demographics or CVD risk factors.

The mean age of participants was 59 years (Table 1). Forty-four percent were from ethnic minority 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.

TABLE 1. BASELINE DEMOGRAPHICS AND CARDIOVASCULAR DISEASE
RISK STATUS OF MAINTENANCE INTERVENTION PARTICIPANTS

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

*Significant between-group differences at $p < 0.05$.
[a]Based on $n = 442$.
[b]Based on $n = 487$.
[c]Based on $n = 476$ (except where noted).
[d]Based on $n = 472$.
[e]Based on $n = 463$.

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

TABLE 2. EFFECTS OF MAINTENANCE INTERVENTION ON DIETARY RISK AND PHYSICAL ACTIVITY SCORES ($n = 421$)[a]

	n	Baseline	12-month follow-up
Dietary risk assessment[b]			
Maintenance special intervention ($\chi \pm$ SD)	198	28.42 ± 8.10	28.19 ± 7.12
Maintenance usual care ($\chi \pm$ SD)	136	29.52 ± 7.87	29.72 ± 7.85
Intervention effect[c] ($\beta \pm$ SE)			−0.39 ± 0.70
p value			0.60
Physical activity assessment[d]			
Maintenance special intervention ($\chi \pm$ SD)	251	12.84 ± 6.51	12.86 ± 6.69
Maintenance usual care ($\chi \pm$ SD)	165	12.68 ± 5.96	12.98 ± 6.96
Intervention effect[c] ($\beta \pm$ SE)			−0.25 ± 0.49
p value			0.62

[a]Participants completing pretest and posttest surveys.
[b]Score from 54-item scale, scored from 0 to 108 (not very to very atherogenic diet).
[c]Estimate for change score (posttest minus pretest score), adjusted for intrahealth department correlation (change scores calculated for participants with nonmissing scores at both pretest and posttest).
[d]Score from 31-item scale, scored from 0 to 42 (not very to very active).

and physical activity change (Tables 3 and 4). Forward movement was the next most common pattern (observed in 21% of participants) and occurred most 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 to preaction stages.

Adjusting for baseline levels and intrahealth department correlation, forward movement into later stages of dietary change did not differ significantly between study 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) = 1.48 (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[33–35,50–52] and physical activity[36,37,53] that can be reasonably well maintained for up to 6 months without further intervention.[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

Table 3.   Effects of Maintenance Intervention on Dietary Psychosocial Factors ($n = 421$)[a]

Variable[b]	MSI (n = 252)		MUC (n = 169)		β (SE)	OR (95% CI)
	Baseline n (%)[c]	Follow-up n (%)[c]	Baseline n (%)[c]	Follow-up n (%)[c]		
Diet stage of change						
Preaction	72 (30.4)	53 (22.4)	58 (36.7)	45 (28.5)		
Action	20 (8.4)	14 (5.9)	14 (8.9)	6 (3.8)		
Maintenance	145 (61.2)	170 (71.7)	86 (54.4)	107 (67.7)		
Change estimate[d]					0.16 (0.24)	1.17 (0.73, 1.88)
Diet social support						
Low	34 (14.7)	32 (13.9)	23 (14.9)	13 (8.4)		
Medium	37 (16.0)	41 (17.8)	29 (18.8)	27 (17.5)		
High	160 (69.3)	158 (68.4)	102 (66.2)	114 (74.0)		
Change estimate[d]					−0.47* (0.24)	0.63 (0.39, 1.01)
Diet self-efficacy						
Low	26 (10.4)	18 (7.2)	20 (11.9)	24 (14.3)		
Medium	68 (27.1)	52 (20.7)	41 (24.4)	33 (19.6)		
High	157 (62.5)	181 (72.1)	107 (63.7)	111 (66.1)		
Change estimate[d]					0.39** (0.22)	1.48 (0.97, 2.27)
Diet motivation						
Low	17 (6.8)	10 (4.0)	8 (4.8)	7 (4.2)		
High		234 (93.2)	241 (96.0)	160 (95.2)	161 (95.8)	
Change estimate[d]					0.12 (0.51)	1.12 (0.41, 3.06)
Diet barriers						
Low	32 (17.1)	31 (16.6)	12 (10.9)	19 (17.3)		
Medium	130 (69.5)	138 (73.8)	79 (71.8)	81 (73.6)		
High	25 (13.4)	18 (9.6)	19 (17.3)	10 (9.1)		
Change estimate[d]					−0.19 (0.27)	0.83 (0.48, 1.42)

[a]Participants completing pretest and posttest surveys.
[b]Totals do not add up to 421 because of nonresponses to some items.
[c]Percentages may not add up to 100 because of rounding to the nearest tenth.
[d]Change estimate (ratio of odds of moving from less to more favorable outcomes in MSI vs. MUC group), controlling for baseline level and intrahealth department correlation.
*Significant at the $p = 0.05$ level.
**Borderline significant at the $p = 0.07$ level.

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 ($r = 0.36$, $p < 0.0001$),[56] 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 4. EFFECTS OF MAINTENANCE INTERVENTION ON PHYSICAL ACTIVITY PSYCHOSOCIAL FACTORS ($n = 421$)[a]

Variable[b]	MSI (n = 252)		MUC (n = 169)		β (SE)	OR (95% CI)
	Baseline n (%)[c]	Follow-up n (%)[c]	Baseline n (%)[c]	Follow-up n (%)[c]		
Physical activity stage of change						
Preaction	63 (26.4)	56 (23.4)	35 (23.3)	47 (31.3)		
Action	30 (12.6)	23 (9.6)	20 (13.3)	17 (11.3)		
Maintenance	146 (61.1)	160 (67.0)	95 (63.3)	86 (57.3)		
Change estimate[d]					0.50* (0.22)	1.65 (1.07, 2.56)
Physical activity social support						
Low	31 (12.8)	23 (9.5)	21 (13.5)	19 (12.3)		
Medium	50 (20.7)	28 (11.6)	26 (16.8)	21 (13.6)		
High	161 (66.5)	191 (78.9)	108 (69.7)	115 (74.2)		
Change estimate[d]					0.32 (0.25)	1.38 (0.85, 2.25)
Physical activity self-efficacy						
Low	58 (23.2)	54 (21.6)	34 (20.7)	33 (20.1)		
Medium	84 (33.6)	77 (30.8)	59 (36.0)	51 (31.1)		
High	108 (43.2)	119 (47.6)	71 (43.3)	80 (48.8)		
Change estimate[d]					−0.05 (0.20)	0.95 (0.65, 1.40)
Physical activity motivation						
Low	20 (8.0)	17 (6.8)	11 (6.8)	8 (4.9)		
Medium	24 (9.6)	20 (8.0)	7 (4.3)	16 (9.9)		
High	207 (82.5)	214 (85.3)	144 (88.9)	138 (85.2)		
Change estimate[d]					0.15 (0.30)	1.16 (0.64, 2.10)
Physical activity barriers						
Low	118 (57.3)	128 (62.1)	69 (47.9)	81 (56.3)		
Medium	70 (34.0)	62 (30.1)	63 (43.8)	46 (31.9)		
High	18 (8.7)	16 (7.8)	12 (8.3)	17 (11.8)		
Change estimate[d]					0.15 (0.24)	1.16 (0.73, 1.86)

[a]Participants completing pretest and posttest surveys.
[b]Totals do not add up to 421 because of nonresponses to some items.
[c]Percentages may not add up to 100 because of rounding to the nearest tenth.
[d]Change estimate (ratio of odds of moving from less to more favorable outcomes in MSI vs. MUC group), controlling for baseline level and intrahealth department correlation.
*Significant at the $p = 0.02$ 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[41] prior to 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[28] and physical activity[18,19,23–25,31,32] that were reasonably well maintained with frequent contacts in person,[23,26] via mail or telephone,[18,28,32] or using a combination of these approaches.[17,19,24] However, most maintenance studies have recruited predominantly white, educated, middle-income adults,[17,18,31,32] often selecting people who may be more motivated than the general population.[19,23,26] 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.[28] Frequent mail and telephone contacts were effective in promot-

ing sustained dietary change following an intensive classroom-based intervention.[28]

Given the paucity of interventions targeting ethnically diverse, midlife, 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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