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Improving Multiple Behaviors for Colorectal Cancer Prevention Among African American Church Members

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The WATCH (Wellness for African Americans Through Churches) Project was a randomized trial comparing the effectiveness of 2 strategies to promote colorectal cancer preventive behaviors among 587 African American members of 12 rural North Carolina churches. Using a 2 × 2 factorial research design, the authors compared a tailored print and video (TPV) intervention, consisting of 4 individually tailored newsletters and targeted videotapes, with a lay health advisor (LHA) intervention. Results showed that the TPV intervention significantly improved ($p < .05$) fruit and vegetable consumption (0.6 servings) and recreational physical activity (2.5 metabolic task equivalents per hour) and, among those 50 and older ($n = 287$), achieved a 15% increase in fecal occult blood testing screening ($p = .08$). The LHA intervention did not prove effective, possibly because of suboptimal reach and diffusion.

Key words: intervention studies, dietary habits, physical activity, colorectal cancer, African Americans, behavioral research

Colorectal cancer (CRC) is the second leading cause of cancer death in the United States and accounts for approximately 15% of all cancers diagnosed annually (Greenwald, 1992; Ries et al., 2000). In 2003, an estimated 57,100 people in the United States will have died from CRC and another 147,500 new cases will have been diagnosed (American Cancer Society, 2003). African Americans experience higher morbidity and mortality from CRC compared with other population groups in the United States. In the year 2001 the CRC mortality rate was 29.1 per 100,000 among African Americans compared with 21.9 per 100,000 for White Americans.

A growing body of research indicates that CRC risk can be reduced through primary prevention and early detection. Diets high in fruits, vegetables, and fiber and low in fat are associated with as much as a 50% decreased risk of CRC (Bingham et al., 2003; World Cancer Research Fund, 1997). In addition, moderate to vigorous physical activity has been shown to be protective (Rockhill et al., 1999; Slattery, Edwards, Boucher, Anderson, & Caan, 1999). Current national recommendations for cancer and chronic disease prevention include eating at least five daily servings of fruits and vegetables, consuming less than 30% of one's calories from fat, and engaging in moderate to vigorous physical activity for at least 30 min on most days of the week (U.S. Department of Health and Human Services, 2000).

Screening and early detection also have the potential to significantly reduce CRC morbidity and mortality. Several randomized controlled trials have demonstrated that routine screening is effective and cost-effective in decreasing CRC mortality (Mandel, Church, Ederer, & Bond, 1999; Pignone, Saha, Hoerger, & Mandelblatt, 2002; Ransohoff, Lang, & the American College of Physicians, 1997). For example, it is estimated that annual fecal occult blood testing (FOBT) starting at age 50 could lower mortality by 33% (Mandel et al., 1999). Although FOBT has limited sensitivity

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and specificity, it has the distinct advantage of ease of use and low cost and thus lends itself to mass screening. Current guidelines for average-risk individuals include yearly FOBT starting at age 50, annual FOBT plus flexible sigmoidoscopy every 5 years, double contrast barium enema every 5 years, or colonoscopy every 5 to 10 years (Pignone, Rich, Teutsch, Berg, & Lohr, 2002). Despite strong evidence, however, relatively few Americans follow these guidelines. Recent Behavioral Risk Factor Surveillance Study data showed that only 23.5% of respondents reported having FOBT in the past year, and 43.4% had a sigmoidoscopy in the past 10 years (Centers for Disease Control and Prevention, 2003). There are many barriers to initiation and maintenance of CRC screening behavior, especially among minority and lower income populations. These populations tend to have reduced access to preventive health services, and costs of both screening and follow-up can be prohibitive. For African Americans, awareness and knowledge of CRC may be lower in comparison with Whites' awareness and knowledge (Weinrich, Weinrich, Boyd, Johnson, & Frank-Stromborg, 1992). The lack of adequate screening leads to a later stage of diagnosis, which may contribute to the excess mortality among African Americans (Mayberry et al., 1995; Moorman, Jones, Millikan, Hall, & Newman, 2001).

Disparities in African American and White cancer-related morbidity and mortality argue for interventions that promote adoption of health behaviors linked to primary and secondary prevention of CRC and other cancers among African Americans. These interventions must be culturally sensitive and address the barriers to behavior change in communities of color. One promising approach is to work with faith communities. The African American church plays a vital role in the lives of most African American adults in the southern United States, and as such, it can serve as a powerful channel for health promotion efforts (Eng, Hatch, & Callan, 1985; Hatch & Derthick, 1992; Lasater, Carleton, & Wells, 1991). Churches serve many social, organizational, and religious functions and offer unique opportunities for promoting healthy behaviors among African Americans. Many African American churches include health of their members and the community in their mission. Pastors and church leaders can serve as credible role models and persuaders to encourage healthy behaviors through sermons, organized activities, and personal example (Eng et al., 1985).

Over the past 20 years numerous health promotion and disease prevention research programs have been conducted through African American churches. Many of these studies have shown positive impacts using a variety of strategies including educational sessions, awareness and screening programs, lay health advisors, and individual change strategies such as tailored messages and motivational counseling (Campbell et al., 1999; Resnicow et al., 2001). The Black Churches United for Better Health project, for example, demonstrated significant dietary impact (0.85 daily fruit and vegetable servings increase) from a multilevel intervention that included 11 different types of activities (Campbell et al., 1999). Process evaluation showed that the activities with the highest perceived impact were tailored newsletters, food events and church-wide activities, and social support from church members and the pastor (Campbell et al., 2000). Such complex interventions are expensive and demanding for both implementers and participants and may be difficult to replicate. There is a need for studies that dismantle the "kitchen sink" approach in order to compare theoretical frameworks and identify approaches that are effective yet are more parsimonious and practical to implement and maintain.

The WATCH (Wellness for African Americans Through Churches) Project was a church-based research study aimed at improving nutrition, physical activity, and CRC screening among rural African Americans. The aim was to measure the relative effectiveness of two different theory-based strategies: (a) individualized tailored print newsletters and targeted videotapes (TPV) and (b) a lay health advisor (LHA) intervention. Tailoring was based on stage of change, beliefs, knowledge, barriers and motivators, and cultural and spiritual factors. The LHA intervention used the same theoretical constructs to train lay advisors to diffuse health information while supporting behavior change among church members. We hypothesized that combining the strategies into a multicomponent intervention would be more effective than either intervention separately.

The primary prevention messages of the study encouraged increasing fruit and vegetable consumption, lowering dietary fat, and achieving moderate to vigorous physical activity on most days of the week (150 min or more per week). The main screening message was for participants to obtain FOBT annually starting at age 50, or earlier if an individual had risk factors. The study also educated participants about other tests, including sigmoidoscopy and colonoscopy, and encouraged discussion with health providers about appropriate testing and cost issues.

The study's 2 × 2 factorial research design evaluated the relative effect of these two intervention strategies independently and together as a multicomponent program, compared with a control condition. The primary research questions tested whether these interventions improved multiple health behaviors among rural African American church members and determined the most effective approach that should be disseminated to other churches and communities. This article reports the study design and framework, intervention, and primary study outcomes on the basis of participant surveys pre- and postintervention.

Method

Sample Recruitment and Randomization

The study population was composed of members of 12 African American churches in five rural eastern North Carolina counties. These counties, all of which had at least 30% minority populations, had higher rates of cancer morbidity and mortality than the state average. Average CRC screening was also generally lower (25.4%) than the 1998–1999 North Carolina average of 32.8% (Medical Review of North Carolina, 2002). Churches served as the units of randomization. All churches in each county (regardless of denomination) with a primarily African American membership were first inventoried using sources such as telephone directories, denominational lists, and personal contacts with key community members. The resultant initial master list of 221 churches was randomized and then geographically and denominationally sampled to minimize potential contamination that could occur if churches were in close proximity or shared activities or worship. To meet these criteria, the study statistician selected a random subset of 51 churches, which were at least 10 miles apart from each other and/or of different denominations. We did not exclude churches with racially "mixed" membership; however, it has remained typical that many churches in these rural, southern counties are segregated (Lincoln & Mamiya, 1990).

To recruit churches, we went down the list of 51 churches sequentially and contacted each church pastor or leader by telephone to determine

eligibility in terms of membership (80 or more active members), verify location, and assess interest in participation. Twenty-five of the 51 churches on the list did not meet the size criterion. Of the remaining 26 churches, those that expressed interest were sent a packet of study information and enrollment materials by Federal Express. The research team then met at the church with the pastor and interested church members to present the project and answer questions, after which the church leadership and members usually met or voted on whether to participate. Using these methods, we recruited 10 churches from the list of 26; random replacements were chosen from the master list to recruit the last 2 study churches. In general, it took 3 to 6 months to recruit each church. Follow-up telephone calls and certified letters were used to finalize enrollment versus refusal, and a signed letter of agreement to participate was obtained. A follow-up telephone survey with pastors of churches that declined to participate revealed that they most often cited reasons of time (competing priorities with other church activities) and concerns regarding separation of church and state as reasons for their refusal. In terms of denominations, the study included churches that were Baptist (8), United Church of Christ (1), African Methodist Episcopal (1), Church of God in Christ (1), and nondenominational (1).

The 12 churches were placed into the study in three waves of four to preserve the study timeline and minimize biases due to history or seasonality. After baseline surveys were completed, an independent statistician randomly assigned churches into four study conditions. All churches received a donation from the project of $300 on enrollment in the study and a second donation of $300 after the completion of the follow-up surveys.

Each church provided a membership list with names, addresses, and telephone numbers. All active members (i.e., those attending the study church at least once per month), aged 18 or older, were considered eligible to participate in the study. Early in the study, a health fair was conducted in each church to kick off the project and increase awareness of the upcoming baseline surveys. Health fairs also provided an opportunity to verify participant contact information and to collect measurements such as height and weight, which could be compared with self-reported survey information.

Intervention

The primary theories on which both interventions were based included social cognitive theory, the stages of change transtheoretical framework, the health belief model, and social support models (Bandura, 1989; Israel, 1985; Janz & Becker, 1984; Prochaska, DiClemente, & Norcross, 1992). From previous research, we hypothesized that tailoring health messages and feedback to individual factors such as current behaviors, stage of readiness to change, beliefs, barriers, and social support would enhance message attention, personal relevance, and information processing, therefore promoting behavior change (Kreuter, Bull, Clark, & Oswald, 1999; Kreuter, Farrell, Olevitch, & Brennan, 2000; Skinner, Campbell, Curry, Rimer, & Prochaska, 1999). In addition, we hypothesized that enhancing social support by using existing networks would help participants meet their informational, emotional, and instrumental needs related to initiating and sustaining changes (Israel, 1985). The TPV intervention was designed to deliver theory-based materials to individuals at home and hence did not depend on participation in church activities. The LHA intervention was designed to provide theory-based training for lay advisors to disseminate information and promote interactions and activities aimed at the interpersonal, social network, and church levels of influence and support. We further hypothesized that the combined intervention would prove most effective because it would intervene at two levels of the socioecological model (individual and social network), thereby enhancing motivation and supporting use of multiple influences relevant to health behavior change (MacLeroy & Bibeau, 1998). Early in the project, we conducted focus groups in two pilot churches to identify concerns, barriers, beliefs, and motivators relevant to adopting the recommended health behaviors (James, Campbell, & Hudson, 2002; James, Hudson, & Campbell, 2003). Qualitative findings revealed that participants lacked knowledge about the gastrointestinal tract and CRC and that their health providers had not recommended CRC screening (James et al., 2002). Participants also were interested in improving diet and physical activity but cited barriers such as lack of time, lack of exercise facilities, and need for support (e.g., someone to exercise with; James et al., 2003). The qualitative findings informed the study intervention and measures, described below:

TPV intervention. Individual computerized tailoring for health promotion is a technique that combines health behavior change theory, communication theory, social marketing principles, and computer-based programs and algorithms to produce personally relevant health messages for each project participant. Assessment information obtained from each individual's survey data are accessed and assembled using specially created software to generate customized messages designed to promote healthy behavior changes for each person (Campbell et al., 1994; Kreuter et al., 2000). Providing individualized messages means the information can be tailored so that it is particularly relevant, interesting, culturally appropriate, and credible to the message recipient (Skinner et al., 1999). The tailoring framework for WATCH incorporated demographic, psychosocial, behavioral, and church- and community-specific resource information in a newsletter format.

The TPV intervention included four personalized computer-tailored newsletters and four targeted videotapes corresponding to the same behaviors mailed to participants' homes bimonthly for the first 6 months after baseline data collection (Months 2, 4, and 6); the fourth mailing occurred 9 months postbaseline. Newsletters all were tailored using the baseline survey data and addressed each behavior in this order: fruit and vegetable consumption, physical activity, CRC screening, and dietary fat intake. Preintervention focus groups were used in combination with pertinent literature and project team expertise to develop appropriate tailoring variables, message content, language, literacy level (approximately 6th grade), and graphic design. Each eight-page newsletter, sized 8.5 in. × 11 in., was created from two 11-in. × 17-in. sheets preprinted in four colors. Tailored content was laser printed onto both sides of the paper, which was then folded in half.

An extensive message library of approximately 400 text files, graphics, and photographs was developed to correspond with each survey question selected for tailoring and its possible response options and/or combinations. The message libraries, layout and format, and the number of messages and graphics per newsletter were consistent across the health behaviors. The newsletters were targeted to appeal to an African American audience through choices of graphic design, photographs, stories, and recipes. Computer-based tailoring algorithms were used to link individual survey data to the appropriate messages and graphics. Pretesting was conducted with a convenience sample of African American church members not included in the study, and revisions were made based on this feedback.

Newsletters were personalized with names of the participant, pastor, and church and provided tailored elements, including behavioral feedback on dietary fat intake, fruit and vegetable consumption, physical activity, screening, CRC risk factors, stages of change, social support, barriers to change, beliefs, and demographics (age and gender). Additional message elements were targeted to cultural, spiritual, and community factors, including church-specific pastor messages, community-specific resources, testimonials written by community members, and scriptural passages deemed relevant to the study behaviors and motivation for change. Scriptural and religious content was reviewed and approved by several pastors.

Four targeted videotapes were created to complement the tailored newsletters. Community members and pastors who provided testimonials in the newsletters also were featured in the videotapes, which focused on reinforcing motivation and modeling skills to perform each behavior. For example, the fruit and vegetable videotape showed how to prepare healthy fruit and vegetable dishes, provided information about serving sizes and the

five-a-day goal, included testimonials, and showed a pastor delivering a sermon devoted to healthy eating and CRC risk. The videotapes were produced by a professional videographer and were targeted to an African American church audience.

LHA intervention. The LHA intervention was designed to provide education and promote social support for behavioral change through the "natural" social networks of individuals in a given community (Israel, 1985). LHAs are indigenous members of the community to whom others turn for help, advice, and support and who have empathy with and responsibility toward a community and its health needs (Giblin, 1991).

The LHA intervention began immediately after baseline data collection, with identification of lay advisors in the churches through an elicitation process with members. Church members were asked over a 4-Sunday period to submit names of people in the church to whom they turned for help and advice. Individuals who were named by multiple church members were identified as potential LHAs. These individuals were then invited to a reception and orientation designed to honor them for their role in the church, explain WATCH, and invite them to volunteer to participate in the LHA training program. We recruited and trained a total of 62 (47 women and 15 men) people from the six churches randomized to the LHA intervention.

A total of seven monthly or bimonthly group training sessions (approximately 16 hr of training) were scheduled at respective churches at times chosen by the LHAs. Project staff with extensive experience in implementing LHA interventions conducted the sessions. During the first 6–8 months of intervention, six training sessions were completed: LHA role orientation, strengths, and responsibilities; social support and lay helping; fruits and vegetables; physical activity; CRC screening; and dietary fat. A 4-hr integrative wrap-up training session was held approximately 1–2 months after the other trainings were completed. A detailed training manual developed to guide each training session was pilot tested and revised on the basis of participant feedback prior to program implementation. Similar to the newsletters, the LHA manual was targeted to the study population in terms of cultural and spiritual beliefs and graphic design and layout and included information based on the same theories underpinning the TPV intervention (Bandura, 1989; Israel, 1985; Janz & Becker, 1984; Prochaska et al., 1992). All LHAs completed a self-administered pretest that assessed knowledge related to the health behavior content covered in the trainings, and they were asked to complete a posttest after each session. For each behavior, the training included these components: a behavioral self-assessment section, information designed to increase knowledge and awareness, identification of barriers to change and strategies to overcome them, identification of stages of change and facilitating stage progress, enhancement of social support for healthy changes, and identification of specific church-wide activities that would spread the information. Each session also included interactive activities (e.g., games and role-plays), group discussions, skills training, healthy refreshments, Biblical passages, and prayers. LHAs received small gifts, such as tote bags, and each LHA group was provided with funds to purchase refreshments and supplies; however, LHAs did not receive any monetary compensation.

In addition to providing information to church members through existing networks, LHAs were expected to organize and conduct at least three church-wide activities focused on spreading information and enhancing support for healthy eating, physical activity, and CRC screening. Examples of their activities included starting walking and/or exercise groups at church, holding taste tests and providing healthy food choices at church-wide events, and inviting local physicians to speak at Sunday services about CRC and the importance of screening.

Control churches. Control churches were offered health education sessions and speakers on topics of their choice not directly related to study objectives. Control churches chose to have, on average, two of these sessions and picked topics including HIV/AIDS, adolescent health, child care and health, prostate cancer awareness, and elderly health issues. After follow-up data collection was completed, control churches were provided with intervention materials including LHA training manuals and sessions, tailored newsletters, and targeted videos.

Data Collection and Measures

Baseline telephone interviews were conducted before randomization. Announcements were made at Sunday services and in church bulletins in an effort to increase participation rates. Prior to each telephone interview, participants received a mailed packet that contained survey instructions and a set of answer choices. Follow-up telephone interviews were conducted 1 year after baseline survey completion, which corresponded to approximately 3 months after all intervention components had been delivered. The telephone-administered surveys consisted of approximately 130 items and took an average of 40 min to complete.

Of the 2,480 names on the church rosters, 1,017 (41%) were found to be ineligible for the study (e.g., no longer a North Carolina resident or no longer a church member, invalid contact information, medically incapable of participation, deceased, or less than 18 years old). Of the 1,463 that remained, 850 (58%) completed the baseline interview, 239 (16%) either declined or did not complete the survey, and 374 (26%) could not be contacted after at least 12 call attempts. The overall baseline Council of American Survey Research Organizations (CASRO) response rate was 66%, defined as the number of respondents divided by the estimated number of those eligible in the sample (CASRO Task Force on Completion Rates, 1982). The final sample for this study comprised 587 individuals who completed both the baseline and follow-up surveys, yielding a 72% CASRO response rate. The percentage of follow-up respondents was higher in the combined group (77%) compared with 67% for TPV only, 62% for LHA only, and 69% for controls; however, this difference was not statistically significant in models that included adjustment for study design effects. A total of 25 baseline respondents were ineligible for the follow-up survey because of factors such as leaving the church, illness, or death. Of nonrespondents to the follow-up survey, 48 (6%) refused to be surveyed, and the remainder could not be contacted within the study period. We collected the measures that follow.

Demographic and anthropometric information. Demographic information included age (continuous variable), race/ethnicity categorized as White, African American, or other (Hispanic, Asian, Native American, or other), educational level (six categories that were collapsed to three: less than a high school degree, a high school degree, and education beyond high school), marital status, and income (six categories that ranged from under $10,000 to $75,000 per year or higher). Respondents self-reported their most recent height in inches and their weight in pounds. The Quetelet Index (kg/m^2) was used to compute body mass index (BMI) as a continuous variable (Kuczmarski, Flegal, Campbell, & Johnson, 1994). A validation substudy among 62 study participants compared self-reported weight on the baseline survey with measured weight assessed using standardized scales at the health fairs; measured weight was highly correlated with self-reported weight ($r = .98$, $p < .01$).

Diet. Dietary fat and fruit and vegetable consumption were measured with the 60-item version of the National Cancer Institute Health Habits and History Food Frequency Questionnaire (Block et al., 1986). This instrument has been validated in an African American population (Block et al., 1986; Coates et al., 1991; McClelland, Demark-Wahnefried, Mustian, Cowan, & Campbell, 1998). The semiquantitative Food Frequency Questionnaire assesses frequency of consumption and portion size characterized as small, medium, or large. The Block database was used to determine total fat consumption, percentage of calories from fat, and number of daily servings of fruits and vegetables.

Physical activity. Items were drawn from existing instruments and modified for cultural appropriateness based on the presurvey focus groups (Jacobs, Hahn, Pirie, & Sidney, 1989; James et al., 2003; Lee, Paffenbarger & Hsieh, 1992). The 16-item checklist assessed frequency of different types of activity, with response options of "don't do," "1–3 times/month,"

"1–2/week," "3–4/week," or "5 or more/week." Total physical activity was the sum of all 16 items, and moderate–vigorous recreational exercise was calculated by summing responses for 11 of the items (walking, jogging, swimming, biking, sports like basketball or baseball, light sports like bowling or pool, fishing or hunting, weight lifting, dancing, aerobics, other exercise). The five activities not included in recreational activity were housework, child care, home repairs, yard work/gardening, and occupational exercise. For each activity in which participants engaged, they estimated duration as either < 20 min or 20 min or more per session.

Physical activity was then calculated in terms of metabolic equivalent task (MET) hours per week. One MET corresponds to the amount of oxygen (energy) the average person consumes while at rest (Lee et al., 1992). MET hours/week values for energy expenditure were assigned to each activity on the basis of validated instruments (Lee et al., 1992). For the purpose of creating a continuous MET variable, the duration response of < 20 min was estimated as 15 min and 20 min or more was estimated as 30 min. MET hours/week were computed by multiplying frequency times duration (converted to hours per week) by the MET value for each activity and summing across items (Jacobs et al., 1989). We assessed validity and reliability of the physical activity scores obtained by the WATCH physical activity instrument. Validity for MET hours/week scores and for duration measures was assessed by comparing the WATCH measure against the "gold-standard" Seven-Day Physical Activity Recall (Sallis, Haskell, & Wood, 1986), administered over the telephone in a demographically similar sample of 44 adults (for MET hours/week scores, $r = .60$, $p < .01$; duration of activity for those reporting < 20 min/day averaged 15 min and for those reporting ≥ 20 min/day averaged 31 min; unpublished data). Test–retest reliability of MET hours/week of exercise over the 1-year study time period was computed for the WATCH control group ($r = .65$, $p < .01$).

CRC screening. Participants were asked whether they had ever had any CRC screening tests and, if so, how long ago ($<$ 1 year, 1–2 years, 2–5 years, or $>$ 5 years). To increase comprehension, we included an explanation of each test in the question. Items were FOBT "which is stool slides;" sigmoidoscopy, "which is a tube inserted in rectum to look at colon and bowel;" colonoscopy, "which is a tube inserted to look at the entire intestine, usually given in a hospital or specialist's office;" double contrast barium enema, "which is an x-ray of the colon;" or digital rectal exam, "which is a rectal finger test." From these items, we computed two variables indicating compliance with recommendations: FOBT in the past year and any combination of tests indicating up-to-date adherence with recommendations (FOBT in the past year plus or minus sigmoidoscopy in the past 5 years, double contrast barium enema in the past 5 years, or colonoscopy in the past 5 years). Although colonoscopy is currently recommended every 5 to 10 years, we did not ask about colonoscopies carried out more than 5 years previously. Digital rectal exam was not counted as meeting CRC screening guidelines.

Process evaluation measures. Process measures were included on the participant follow-up surveys to assess exposure to and use of the intervention information. We also kept process notes and conducted postintervention focus groups approximately 3 months after follow-up to assess participant reactions to the TPV and LHA interventions and to determine whether any changes were being sustained. To assess LHA information dissemination, we asked LHAs to complete contact logs documenting what information was shared and with whom; however, despite monthly reminders, only about 20% of LHAs turned in completed logs. We therefore conducted postintervention telephone interviews to assess LHAs' information dissemination and to obtain feedback regarding their experiences with the WATCH project.

Statistical Analysis

Analyses were conducted using the Statistical Analysis System (SAS, 1997). Descriptive analyses included frequency distributions, analysis of variance, and cross-tabulations. Because the study design randomized churches rather than individuals to treatment conditions, potential errors in variance estimation can occur if observations are treated as completely independent (Murray & Wolfinger, 1994). Therefore, to account for the inherent correlation among church members and to avoid an inflated Type I error that could occur if observations were treated as completely independent, analyses comparing treatment groups were also conducted using SAS PROC MIXED with 12 church clusters. The study design and overall sample size were based on power calculations for the primary study outcomes (fruit and vegetable consumption, fat intake, recreational physical activity) with assumptions regarding intraclass correlations of individuals within churches based on previous research (Campbell et al., 1999). Actual intraclass correlations were low for all primary outcome variables (.01 or less). Statistical significance was based on an alpha level of .05 or less and power equal to 0.80. CRC screening was designated as a secondary outcome because the expected sample size aged 50 and older was marginally adequate to detect a change in FOBT screening. The 2×2 factorial design allowed for testing of main effects of each intervention implemented in six churches tested against those not receiving that intervention, plus a possible interaction effect of the combined intervention. Regression models were used to assess differences in continuous outcomes (diet, physical activity) at follow-up, adjusting for baseline levels and demographic covariates (age, gender, education). To test for independent and combined effects of the interventions, we created dummy variables to represent each intervention (TPV, yes–no and LHA, yes–no) and included an interaction term to assess possible combined effects. All demographic covariates and study group (main and interaction terms) were included in initial models; however, if nonsignificant, demographics and the interaction term were then dropped from reduced models. For recreational MET hours/week, because the interaction was significant, we also modeled differences in outcome variables by overall group (any intervention) versus control and compared each intervention condition (TPV, LHA, combined) versus the control group. For this post hoc analysis, we included the Bonferroni correction for multiple tests when comparing each intervention group to the control group. For categorical variables, Cochran–Mantel–Haenszel statistics were used to determine statistical significance and F tests were used to determine significance levels for continuous variables.

Results

Demographics

The final sample ($n = 587$) was 74% women and 99% African American, and the mean age was 52 years. Approximately 25% had some education beyond high school, and 58% were married or living with a partner. Annual household income was reported by only 52% of participants, therefore these data are not included. As shown in Table 1, sample demographics did not differ among study groups. Approximately 40% of the study sample was obese (BMI of 30 or greater). A total of 89% reported having at least some health insurance.

Nonrespondents to the follow-up survey were similar to respondents on all demographic factors except for younger age ($M = 48$ years vs. $M = 51$ years, $p < .01$). Nonrespondents and respondents had similar baseline health behaviors (dietary fat intake, physical activity, CRC screening) and BMI, but nonrespondents consumed fewer fruits and vegetables ($M = 3.1$ vs. $M = 3.4$ daily servings, $p = .04$).

Dietary Change

As shown in Table 2, fruit and vegetable intake at baseline was approximately 3.3 daily servings, with no differences among study

Table 1
Demographic Characteristics of WATCH Project Participants

Variable	Control $n = 129$	LHA only $n = 123$	TPV only $n = 159$	Combined $n = 176$	p
Gender (%)					
Male	22.7	27.6	26.4	26.0	.82
Female	77.3	72.4	73.6	74.0	
Age (years, %)					
<40	21.1	21.1	30.1	27.8	.82
40–49	26.6	37.5	22.7	23.1	
50 and older	52.3	41.4	47.2	49.1	
Marital status (%)					
Married	62.2	67.8	50.0	56.6	.08
Never married	14.2	8.3	18.6	17.3	
Divorced	7.1	11.6	14.7	9.8	
Separated	5.5	3.3	2.6	1.7	
Widowed	11.0	9.1	14.1	14.4	
Education (%)					
<High school	11.1	20.8	11.9	15.9	.42
High school/GED	40.3	32.5	32.1	28.0	
Trade/beauty/some college	24.8	26.0	27.0	29.3	
College graduate or higher	18.6	12.2	23.9	20.0	

Note. The *p*s are based on chi-square tests. WATCH = Wellness for African Americans Through Churches; LHA = lay health advisor intervention; TPV = tailored print and video intervention; GED = general equivalency diploma.

groups. At 1-year follow-up, regression analysis showed a main effect of the TPV intervention ($p = .02$) but no effect for the LHA intervention. Those in the TPV-only group demonstrated a 0.6 serving increase over baseline. The combined intervention group increased consumption by 0.3 daily servings, whereas in the LHA or control groups there was little change. Further analyses focused on the interventions' effect on meeting the recommendation of five daily servings of fruits and vegetables. Regression modeling showed a main effect of receiving the TPV intervention on meeting the five-a-day goal at follow-up ($p = .04$), whereas there was no added effect of LHA.

At baseline, participants consumed about 33% of kilocalories from fat, and there were no differences between study groups. At follow-up, the control group was consuming the most fat; however, differences between groups were not statistically significant (Table 2).

Physical Activity

At baseline, the groups did not differ in total physical activity or in the amount of recreational exercise (Table 3). At follow-up, analysis of covariance was used to compare the intervention groups, together and separately, to the control group. We found that being in any of the intervention groups resulted in significantly greater recreational exercise at follow-up compared with the control group ($p < .01$, data not shown). When each intervention was contrasted with the control group, however, the TPV-only group showed a significant improvement ($p = .04$) in recreational exercise, whereas the LHA-only versus control comparison was marginally significant ($p = .07$), and the combined versus control comparison was not significant. At follow-up, the TPV-only group's mean recreational exercise was 10.9 MET hours/week and the LHA-only group's was 10.6 MET hours/week compared with

Table 2
Dietary Intervention Outcomes of the WATCH Project

Variable	Control $n = 129$	LHA only $n = 123$	TPV only $n = 159$	Combined $n = 176$	p
Fruit and vegetable servings/day, *M* (*SE*)					
Baseline	3.3 (0.18)	3.5 (0.18)	3.3 (0.16)	3.4 (0.15)	.87
Follow-up	3.4 (0.18)	3.5 (0.18)	3.9 (0.16)	3.7 (0.15)	.02*
Percentage meeting five-a-day recommendation					
Baseline	13.4	16.0	18.9	19.5	.34
Follow-up	14.7	15.4	21.7	26.4	.04*
Calories from fat, *M* (*SE*)					
Baseline	31.8 (0.71)	31.5 (0.73)	33.1 (0.64)	31.9 (0.61)	.33
Follow-up	32.9 (0.72)	31.6 (0.74)	31.8 (0.65)	31.3 (0.61)	.07

Note. The *p*s are significant for tailored print and video (TPV) intervention main effect on the basis of PROC MIXED regression analysis controlling for baseline value, gender, age, and education. WATCH = Wellness for African Americans Through Churches; LHA = lay health advisor intervention.

Table 3
Physical Activity Outcomes of WATCH Project

Variable	Control $n = 129$	LHA only $n = 123$	TPV only $n = 159$	Combined $n = 176$	p
Recreational (moderate–vigorous) activity MET hours/week, M (SE)					
Baseline	9.3 (0.88)	10.5 (0.90)	9.5 (0.80)	9.7 (0.76)	.80
Follow-up	8.4 (0.69)	10.6 (0.70)	10.9 (0.61)	9.7 (0.60)	.04[a]
Percentage meeting physical activity recommendations (moderate–vigorous exercise ≥ 150 min/week)					
Baseline	38.0	45.5	41.1	40.9	.68
Follow-up	32.5	43.9	46.3	45.9	.04[b]

Note. WATCH = Wellness for African Americans Through Churches; LHA = lay health advisor intervention; TPV = tailored print and video intervention; MET = metabolic equivalent.
[a] Significant for the TPV versus control comparison on the basis of PROC MIXED analysis controlling for baseline value, gender, age, and education and using Bonferroni adjustment for multiple tests. [b] Significant for TPV main effect on the basis of PROC MIXED analysis controlling for baseline value, gender, age, and education.

the control group's 8.4 MET hours/week. Total physical activity showed a nonsignificant increase for all intervention groups compared with the control group.

CRC Screening

Analyses of the intervention effect on screening was limited to participants age 50 and over ($n = 287$). At baseline, 23% of participants 50 and over had had an FOBT in the past year; approximately one fourth of the participants reported having had other tests in the past year (flexible sigmoidoscopy, colonoscopy, and/or double contrast barium enema). The control group had a higher rate of baseline FOBT screening compared with the treatment groups, but this was not statistically significant (Table 4). At the 1-year follow-up, all of the intervention groups showed improvement in FOBT rates, however the TPV-only group demonstrated the greatest increase in the proportion (37%) of participants who had FOBT. This rate was 33% in the LHA-only group, and 31% in the combined group compared with 22% of the control group. Compared with their baseline FOBT levels, participants' adherence increased 87% in the TPV-only group, 59% in the combined group, and 42% in the LHA-only group and adherence decreased 29% in the control group. Regression modeling of FOBT at follow-up, adjusted for baseline level, showed that the effect of receiving the TPV intervention was marginally statistically significant ($p = .08$). Looking specifically at only those who had not had FOBT in the 12 months prior to baseline (data not shown), approximately one third of both the TPV-only and the combined groups obtained FOBT during the intervention year compared with 19% of the LHA-only and 17% of the control group. Rates of other screening tests did not differ among study groups at baseline or follow-up.

Process Measures

The majority of participants reported having heard something about CRC in the past year; however, this percentage was greatest in the TPV-only group (70%). As shown in Table 5, approximately three fourths of participants in the TPV-only and combined groups recalled receiving the personal health newsletters and close to half reported having read most or all of the information. Compared with the combined group, the TPV-only group reported greater perceived impact of the tailored newsletters. Over 85% of both groups recalled receiving the videotapes, and approximately one third reporting having watched most or all of the videos. Only about 10% of people in the LHA-only and combined groups

Table 4
Colorectal Cancer Screening Outcomes of WATCH Project (Participants Ages 50 and Older)

Variable	Control $n = 69$	LHA only $n = 51$	TPV only $n = 76$	Combined $n = 87$	p
FOBT test in the past year (%)					
Baseline	30.4	23.5	19.7	19.5	.36
Follow-up	21.7	33.3	36.8	31.0	.08[a]
Other CRC test in the past year (%)[b]					
Baseline	20.3	19.6	23.7	26.4	.75
Follow-up	27.5	25.5	21.1	14.9	*ns*

Note. WATCH = Wellness for African Americans Through Churches; LHA = lay health advisor; TPV = tailored print and video; FOBT = fecal occult blood testing; CRC = colorectal cancer.
[a] Determined on the basis of logistic regression models in PROC MIXED controlling for gender, age, and baseline values. [b] Other recommended tests include flexible sigmoidoscopy, colonoscopy, and double contrast barium enema. Digital rectal exam was not counted.

Table 5
Exposure to and Use of WATCH Interventions

Variable	Control % $n = 129$	LHA only % $n = 123$	TPV only % $n = 159$	Combined % $n = 176$
Exposure to CRC or WATCH activities (all churches)				
Heard information about CRC prevention in past year from any source	57.4	56.1	70.4	65.9
Participated in church health-related activities as part of WATCH	22.5	32.5	23.3	16.5
TPV exposure/use (TPV and combined groups)				
Recalled getting newsletters			80.5	75.6
Recalled amount of newsletters read (most or all)			48.4	41.5
Information in newsletters was personalized for reader (most or all)			32.7	31.2
Newsletters caused change in health behavior (a lot)			30.8	23.3
Newsletters shared with others			59.5	53.4
Recalled getting videotapes			87.0	96.9
Amount watched of videotapes (most or all)			39.0	36.9
Videotapes shared with others			32.6	26.1
LHA exposure/interaction (LHA and combined groups)				
Aware of an LHA program at church		71.5		67.6
Talked with an LHA about health issues		9.8		9.1
Shared LHA information with others		6.5		7.7

Note. Process evaluation data are from individual participant surveys. WATCH = Wellness for African Americans Through Churches; LHA = lay health advisor; TPV = tailored print and video.

reported having talked with an LHA, although 32% of the LHA-only group reported participating in WATCH-related activities at their church. There was evidence of dose–response relationships for at least some behaviors. Those who had read the tailored newsletters ate more fruits and vegetables at follow-up (*M*s = 3.8 vs. 3.3 servings) and were more likely to get FOBT testing (35% versus 12%, $p < .01$) compared with those who reported reading little or none. No relationships were found between the amount of videos watched and health behavior changes. Individuals who had spoken with an LHA about health were far more likely to have obtained an FOBT test (48% versus 26%, $p < .01$).

From church visits and process notes, we verified that all LHA churches had conducted at least three church-wide activities during the project. For telephone interviews, we selected 40 LHAs who had turned in at least 75% of the training session knowledge posttests. Of these, interviews were completed with 28 LHAs (70% response rate). Results indicated that all had shared health information from WATCH with family members, 96% with church members, and 65% with coworkers and other community members. The health topic that LHA's mentioned sharing most often was the section on fruits and vegetables (62%), which was followed by those on dietary fat (58%), CRC testing (38%), and physical activity (27%). Interview and focus group findings indicated that all of the churches that had the LHA program were continuing at least some WATCH-related activities, which included the following: exercise and walking groups, healthy meals and recipes, and cancer information and education dissemination.

Discussion

This randomized trial's results indicate that the WATCH project improved multiple behaviors related to lowering CRC risk. The findings show that the TPV intervention, consisting of four computer-tailored newsletters and four targeted videotapes, had statistically significant effects on participants' fruit and vegetable consumption and recreational exercise. The TPV intervention also demonstrated the most improvement in FOBT adherence (87% increase over baseline levels), although the result had marginal significance statistically. The TPV-only group achieved the amount of increase in proportion to those screened by FOBT (15%) that was hypothesized in the original study design and power calculations; however, we obtained a lower than projected sample size (287 vs. 400 projected) of those 50 and over at follow-up, which reduced our ability to detect change.

The study findings failed to confirm our original study hypothesis that a multicomponent approach combining a tailored and a targeted home-based intervention with a lay helping, church-based intervention would be more effective than either intervention alone. Indeed, the study did not demonstrate efficacy of the LHA intervention either alone or in combination with TPV. This finding is surprising for two main reasons. First, in our previous research in churches and blue-collar workplaces, dietary change promotion appeared to benefit from using a multicomponent strategy that included tailoring and social support and lay helping (Campbell et al., 2000, 2002). Second, other research has emphasized the importance of utilizing social support and social networks to promote health in the African American community through methods such as training lay advisors (Eng et al., 1985; Israel, 1985).

There are several possible reasons why the TPV intervention proved more effective than the LHA program. First, exposure to the intervention appeared to have differed markedly. Whereas the majority of individuals receiving the TPV intervention recalled and read the tailored materials, less than 10% of those in the LHA churches recalled talking with an LHA about health. This suggests that the LHA intervention may have had limited reach and, to the extent that some social networks were not represented among the chosen LHAs, some people may not have gotten the message. The fact that members of LHA churches participated more in church-wide health activities, however, suggests that exposure to and benefit from an LHA program may occur even though people may not identify the activities as coming from the LHAs. This finding

of less than optimal reach of LHA programs has been demonstrated in other studies (Earp et al., 2002).

Second, it may not be reasonable to expect the same level of behavior change from a more diffuse intervention delivered by nonprofessionals when compared with professionally developed tailored materials delivered to each person. The process evaluation indicated that among the 10% who did talk with an LHA, there was almost double the rate of FOBT testing. This finding is intriguing and warrants further research. A third explanation for the generally weak effect of the LHA program is that it may take time for a health message to diffuse through a community by LHAs. In our previous research, we found that it took many months for workplace natural helpers to start sharing information with coworkers, whereas initially they tended to use it for their own health and/or to share it with family members (Tessaro et al., 2000). The process evaluation suggests that this project's LHAs also shared information with others besides church members, including family, friends, and coworkers. The full impact of LHAs in terms of reaching social networks with health information, therefore, may be missed by assessing change in only one part of their network (e.g., churches). Our inability to obtain completed contact logs from the LHAs also prevented us from assessing more specific numbers and types of people with whom information was shared. In previous studies, we have had similar difficulty obtaining this type of paperwork from volunteer LHAs (Campbell et al., 2000). In addition, we followed participants for only 1 year and, therefore, were not able to document the natural history, longer term impact, or sustainability of information dissemination by each intervention strategy. Postintervention focus groups conducted with church members suggested that activities were continuing in the churches; therefore, it is possible that our 1-year follow-up survey did not capture all of the project's longer term effects.

The effectiveness of the TPV intervention across multiple behaviors is encouraging. Few studies have evaluated the impact of tailoring on multiple behavior changes (Emmons, 1997). The effect on fruit and vegetable intake (0.6 serving increase) is comparable to research studies that only focused on that one behavior (Buller et al., 1999; Havas et al., 1998; Marcus et al., 2001). The additional impact on recreational exercise suggests that tailoring to multiple lifestyle behaviors is both feasible and effective. Although the impact on activity was limited to recreational rather than total physical activity, it is likely that recreational activity is the component that is most volitional and, therefore, may be most responsive to interventions tailored to psychosocial determinants. A cross-sectional analysis of the WATCH baseline data showed that psychosocial mediators such as self-efficacy and barriers were associated only with recreational exercise and not with daily living or occupational activity (James et al., 2003).

The effect of the TPV intervention on FOBT screening rates also is encouraging but difficult to interpret because of the complexity of CRC screening recommendations and the relatively short-term (1-year) follow-up period. We chose to present FOBT testing as the primary CRC screening message of the study because of the demonstrated utility and low cost of FOBT and because during the study intervention period (1998–2000) colonoscopy was generally used as a diagnostic rather than a screening procedure for average risk individuals (James et al., 2002). Whereas FOBT testing is recommended annually, other tests such as sigmoidoscopy and colonoscopy are only recommended once every 5 to 10 years. Therefore, some study participants were not due for screening during the project year. In addition, we relied on self-reported screening information, which has shown good validity in other studies (Baier et al., 2000). Because the project occurred in a community rather than a health care setting, it would have been quite difficult to obtain access to patients' charts for verification of screening.

In this study it is not possible to separate the relative effects of the tailored newsletters versus the targeted videos. The process evaluation suggested that the newsletters may have had more impact; however, further research would be needed to disaggregate the effects of each method. The purpose of the videos was to provide additional motivating messages and modeling and skills demonstration to enhance and complement the information in the newsletters. The resultant mailed, home-based intervention cost approximately $20 per person (not including development costs) and could be feasible for widespread dissemination. Future research should study dissemination and impact of this intervention approach in other populations and settings.

This study had a number of limitations. Findings are based on self-report information that can be subject to a number of biases. We only followed participants for 1 year, thereby not assessing long-term maintenance of behavior change. The study response rates were adequate although not exceptionally high, and no information regarding nonrespondents to the baseline survey was collected. The small number of clusters (12) and factorial design in this study probably limited our ability to detect significant between-groups differences and argues for study replication with a larger number of churches. The limited number and geographic location (rural eastern North Carolina) of the churches in this study may not be generalizable to other types of churches, other population groups, or other geographic areas. In addition, the lack of impact on dietary fat consumption warrants further investigation to strengthen future interventions, especially considering the high rates of obesity observed in this population.

In this study we tested a specific "dose" of each intervention and did not explore the relative effect of alternative amounts of exposure or timing. One important avenue for future research would be to explore the optimal dose, delivery, and duration of tailored and lay helping programs. For example, postintervention focus group findings suggested that participants might have preferred more frequent mailings of tailored materials. A more intense LHA intervention consisting of more frequent training sessions and church-wide events might have increased the intervention's impact, but they also would have increased the burden on the LHAs and the church. Other training options should be explored for feasibility and effectiveness in future studies, such as delivering more intensive training in a "retreat" prior to starting the LHA intervention and then adding more booster sessions and contact. Alternative ways to conceptualize the role of LHAs, however, might provide effective avenues for change in future studies. For example, in another church-based study we have shown the efficacy of using lay church volunteers as telephone advisors to motivate and promote increased fruit and vegetable consumption (Campbell et al., 2003). Alternatively, LHA interventions could potentially be combined more efficiently and effectively with interventions providing expert-generated tailored advice (e.g., by training LHAs to facilitate computer access and skill development and/or to help participants interpret and use tailored information).

Further research is necessary to determine the optimal factors needed to enhance the capacity of individuals, social networks, and organizations such as churches and other community groups to achieve healthier behaviors.

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