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Randomized Trial on the *5 a Day, the Rio Grande Way* Website, A Web-based Program to Improve Fruit and Vegetable Consumption in Rural Communities

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Abstract

The Internet is a new technology for health communication in communities. The 5 a Day, the Rio Grande Way website intended to increase fruits and vegetables (FV) consumption was evaluated in a rural region enrolling 755 adults (65% Hispanic, 9% Native American, 88% female) in a randomized pretest–posttest controlled trial in 2002–2004. A total of 473 (63%) adults completed a 4-month follow-up. The change in daily intake on a food frequency questionnaire (control: mean = − 0.26 servings; intervention: mean = 0.38; estimated difference = 0.64, SD = 0.52, t(df = 416) = 1.22, p = 0.223) and single item (13.9% eating 5+ servings at pretest, 19.8% posttest for intervention; 17.4%, 13.8% for controls; odds ratio (OR) = 1.84, 95% CI = 1.07, 3.17) was in the expected direction but significant only for the single item. Website use was low and variable (logins: M = 3.3, range = 1 to 39.0; total time: M = 22.2 minutes, range = 0 to 322.7), but it was associated positively with fruit and vegetable intake (total time: Spearman r = 0.14, p = 0.004 for food frequency; Spearman r = 0.135, p = 0.004 for single item). A nutrition website may improve FV intake. The comparison on the food frequency measure may have been undermined by its high variability. Websites may be successful in community settings only when they are used enough by adults to influence them.

The Internet is a relatively new medium for health communication. It has several characteristics that might be used to improve health promotion: Its ability to span large distances at low cost with standardized information in multimedia formats that promote learning among populations with diverse ages, education, literacy levels, and social circumstances may help to address lower access to health care and transportation problems (Benton Foundation, 1998; U.S. Congress & Office of Technology Assessment, 1991; Walther, Pingree, Hawkins, & Buller, 2005). This article contains a report on diet changes produced by an Internet website among adults in a rural region in the southwestern United States. Rural communities present unique challenges to using this technology—lower Internet use, slower Internet connections, wide variations in computer and Internet skills, and limited training resources and technical support than in urban communities (Benton Foundation, 1998; Horrigan, 2005; Rainie & Horrigan, 2005; U.S. Department of Commerce & National Telecommunications and Information Administration, 2005).

Efficacy of Internet-based Nutrition Education for Rural Communities

Diet, nutrition, vitamins, and nutritional supplements rank as the third most popular Internet health topic (Fox, 2005), but there is little evidence that it is effective to deliver nutrition education over the Internet in community settings. Internet-based health communication has produced positive changes in diet and related behaviors (Celio et al., 2000; Oenema, Brug, & Lechner, 2001; Oenema, Tan, & Brug, 2005; Papadaki & Scott, 2005; Rothert et al., 2006; Tate, Wing, & Winett, 2001; White et al., 2004; Williamson et al., 2005; Williamson et al., 2006; Winzelberg et al., 2000), although not in all studies (Harvey-Berino et al., 2002; Womble et al., 2004; Zabinski et al., 2001). These results may not apply to rural communities, however, because most studies were conducted in colleges (Celio et al., 2000; Oenema et al., 2001; Papadaki & Scott, 2005; Zabinski et al., 2001), medical facilities (Tate et al., 2001), and workplaces (Oenema et al., 2001) with many computer and Internet resources, and in urban environments (Harvey-Berino et al., 2002; White et al., 2004; Womble et al., 2004). Nearly all evaluations enrolled predominately White populations.

Health Benefits of Fruit and Vegetable Intake

Maintaining a diet high in fruits and vegetables (FV) is associated with reduced risk of chronic diseases (Bazzano, Serdula, & Liu, 2003; Key et al., 2004; Knowler et al., 2002; Pietinen, Lahti-Koski, Vartiainen, & Puska, 2001; Rylander & Axelsson, 2006; Steffen et al., 2003; Zyriax, Boeing, & Windler, 2005). At the time of this program, the national 5 A Day for Better Health program sought to increase consumption of FV to five to nine servings daily (Heimendinger & Stables, 2001). Previous interventions have increased FV intake (Baranowski et al., 2000; Beresford et al., 2001; Buller et al., 1999; Campbell et al., 1999; Havas et al., 1998; Nicklas, Johnson, Myers, Farris, & Cunningham, 1998; Perry et al., 1998; Reynolds et al., 2000; Sorensen et al., 1999).

Study Purpose

This study evaluated a website promoting FV in the rural multicultural Upper Rio Grande Valley. Surveys before the trial showed that less than one-quarter of adults consumed five or more servings daily (U.S. Centers for Disease Control & Prevention & National Center for Chronic Disease Prevention and Health Promotion, 2005), and daily intake, particularly by Hispanics, lagged below five servings (Buller et al., 2001). It was predicted that adults who were provided the website would report more daily FV intake than adults who did not have access to it and that greater website use would produce more improvements in FV compared with lesser use.

Methods

Population and Sample

The Upper Rio Grande Valley encompasses 10,983 square miles along the Colorado–New Mexico border and contained 110,611 residents in 2000. Population densities ranged from 3.0 (Costilla) to 20.7 (Alamosa) persons per square mile. There were substantial proportions of minorities—63.8% White and 7.6% Native American. Also, 59.8% self-identified as Hispanic when asked separately from race. Females composed 50.6% of the population. Education levels (20.0% with bachelor’s degrees or higher) and per capita incomes (range = $10,748 [Costilla] to $16,103 [Taos]) were below statewide averages.

A sample of 762 adults participated. A sample size of 305 adults per group was estimated to achieve a power of 0.80 with two-sided $p < .05$ to detect difference of 0.5 (change = +0.6 intervention and +0.1 control; effect size = 0.23), assuming a common within-group and time standard deviation of 2.20. Adults had to live at least 6 months or more in the region, be at least 18 years of age, and be able to speak and read English to be eligible.

Trial Procedures

A randomized pretest–posttest controlled design was implemented. Participants were recruited and pretested in person by community outreach trainers (COTs) working for the project (see below) and randomly were assigned to receive immediate access to the website (intervention group) or delayed access after the post-test (control group). Use of the website was tracked, and participants who did not visit it within a month's time were contacted by a COT and encouraged to do so. Every 2 months, participants were sent a small gift reminding them to visit the website. Routine e-mail notifications were sent announcing new and updated information. Four months postrandomization, participants were contacted by telephone to complete the posttest, by professional telephone interviewers blind to condition. Telephone posttesting was used to control study costs and not delay COTs in recruiting additional participants. Secondary contacts and COTs attempted to help locate hard-to-reach participants.

Recruitment Procedures

Adults were recruited by 12 COTs (11 female, 1 male adults) working throughout the region from June 2002 to January 2004. They had prior experience working in community programs (e.g., nurse, health educator, Spanish translator/interpreter, day care or home health care provider) or local businesses (e.g., secretary, paralegal, radio disc jockey, small business owner), and represented the three ethnic groups. The COTs had a minimum of a high school education and several had completed college courses or degrees. Project staff conducted a 16-hour training program for COTs on trial objectives and procedures to locate participants, introduce the study and obtain consent, conduct the pretest, assign participants to condition, and introduce participants in the intervention group to the website.

The COTs identified participants through social networks and community organizations and at local events. They used a laptop computer linked to the project web server to record enrollment information using online forms and to conduct the pretest survey. The COTs were blind to condition during recruitment, enrollment, and pretesting, prior to randomization. This recruitment method was employed to increase the community nature of the sample.

At the end of the in-person meeting and after pretesting, COTs used a randomization program on the laptop computer to assign participants to experimental conditions. Intervention group participants were provided with a unique identification code (ID) to access the website, and this ID was used to track website usage. The COTs reviewed how to log on to the website but did not counsel them about FV. Participants were not blind to condition.

The COTs provided one-on-one training in computer skills to intervention group participants, if desired, usually in subsequent face-to-face meetings and using other websites. The COTs provided a list of local public computer access sites (Buller et al., 2001).

A project staff person (not the supervisors) accompanied COTs on 25 meetings with participants and verified that they followed the recruitment, enrollment, pretesting, and randomization protocols and maintained a pleasant, professional demeanor (all actions rated 4.12 to 5.00 out of 5). Minor deviations were rectified by retraining. A staff person accompanied COTs on 11 follow-up meetings and confirmed that they asked about use of the website, provided help to use it, and maintained a pleasant, professional demeanor (all actions rated 4.67 to 5.00 out of 5).

5 a Day, the Rio Grande Way *Website*

The *5 a Day, the Rio Grande Way* website was authored for this study. It contained content on health benefits of FV and instruction on skills for buying, storing, preparing FV, and for increasing FV in the family diet, particularly with children. Advice on gardening, recipes that included FV, information on FV in season, a community directory of organizations that sold FV or supplies for gardening in the region, and a listing of health resources on the Internet related to FV also were provided in the website. It was organized in a freely navigational node structure that balanced the need to engage users and encourage return visits with our desire to deliver specific information in predetermined doses to all users. All content was presented in English, the predominant language of the Internet and in the study region. It resembled most commercial websites in 2001.

The selection and organization of content areas were guided by expert advice and results from focus groups (Buller et al., 2001), evaluation of alternative message formats (Slater, Buller, Waters, Archibeque, & LeBlanc, 2003), and usability testing of website structure with local residents (Zimmerman, Akerelrea, Buller, Hau, & LeBlanc, 2003). Based on social cognitive theory (Bandura, 1986) and diffusion of innovations model (Rogers, 2003), content was intended to (a) provide necessary skills and knowledge on how to eat healthier; (b) convince users that FV were simple and compatible with current dietary behavior, easy to try, and advantageous; (c) create beliefs that users were capable of changing their diet; (d) create, activate, or alter beliefs and attitudes to support dietary change, particularly the perceived response efficacy of FV to prevent disease; (e) produce perceptions that dietary changes are supported by local people, normative within the communities, and beneficial to all; (f) motivate people to take action (convert intentions to actions); and (g) link dietary changes to existing dietary habits (e.g., drinking juice in the morning; taking FV in lunches; and adding a salad to a meal). Given the commonality of knowledge, concerns, and consumption in the ethnic groups, most of the information was geared to the general audience in the region. Pictures of White, Hispanic, and Native American adults and related food items, however, were displayed.

All website content was authored by the project investigators and staff, and professional multimedia programmers produced the website. Graphic design and the website logo were evaluated by local residents (Buller et al., 2001). All web pages and features were submitted to usability testing (Zimmerman et al., 2003); and photographs, testimonials, recipes, and other features from local residents were included to make the website locally relevant. Final production was completed in early 2002.

Participants in the website condition were instructed by COTs to log on to the website at least once a month over the 4-month study period. It was not known how frequently adults would use such a nutrition education website, and four visits was considered sufficient to receive the dietary information. To attract return visits, 13 updates to the *5 a Day, the Rio Grande Way* website were published during the study period (Woodall et al., 2007). The majority of content remained unchanged, however, so that participants would receive essentially the same website intervention regardless of when they enrolled.

Measures

Survey Measures—Two measures of FV intake were conducted in the pretest and posttest. The first was a validated food frequency assessment—the "All-day Screener" (Thompson et al., 2002). For this project, French fries and fried potatoes were eliminated from calculation of servings per day, as is customary. An additional question assessing consumption of red chile, green chile, and salsa was included because of their widespread presence in the regional diet. For each food item, participants estimated the frequency and amount of consumption over the past month. For the chile and salsa question, half a cup was counted as a serving. Responses were converted to servings per day following Thompson and colleagues (2002). Second, participants reported the number of servings of FV they ate, on average, each day on a single item, as used in numerous other studies (Heimendinger et al., 2005; Marcus, Heimendinger, et al., 1998; Marcus, Morra, et al., 1998; Marcus et al., 2001; Nicklas et al., 1998).

Several potential moderators were assessed: knowledge of health benefits of FV (pretest Cronbach alpha = 0.81, posttest Cronbach alpha = 0.82), support from others to eat FV (how much do family and friends encourage you to eat FV; 1 = not at all, 4 = a lot), involvement in purchasing and preparing foods (decide what foods are bought and prepared and served; 1 = not at all, 5 = a lot), experience using computers and the Internet (ever used a computer or Internet; number of times and hours in typical week used Internet), perceived self-efficacy for using the Internet (confidence in ability to use the Internet with no one to help; 5-point Likert scale), perceived self-efficacy for obtaining accurate and reliable health information (pretest Cronbach alpha = 0.77, posttest Cronbach alpha = 0.67), and social and demographic characteristics. Participants reported on their frequency of 13 meal preparation and eating practices (1 = never; 5 = always). Two composites with adequate reliability were identified using principal components analysis with vari-max rotation: eating habits (pretest Cronbach alpha = 0.75, posttest Cronbach alpha = 0.69) and access habits (pretest Cronbach alpha = 0.66, posttest Cronbach alpha = 0.58).

Website Use Measures—Website use was recorded using a custom-made program running on the web server. Each session was identified and linked to a unique participant with their ID to obtain number of logins, total time spent on the website, and visits to website features.

Statistical Analysis

Daily intake measured in number of servings on the All-Day Screener initially was analyzed using a mixed-effect analysis of variance, using PROC MIXED in SAS. The experimental condition was treated as a fixed factor between subjects. Pretest and posttest measures were treated as repeated measures within subjects by adding a random subject effect, which allowed the inclusion of participants with only pretest measurement (i.e., posttest values for participants without posttest measurement were estimated from those participants for which posttest measurement existed, assuming data were missing at random). All subjects were included regardless of whether they completed a posttest measurement. The model assumed reasonable normality and that completing a posttest was missing at random. It partially accommodated any differential dropout by using values at follow-up similar to those with the same baseline values should differential dropouts occur.

The robustness of the normality assumption was questionable, however, because of the large number of outliers. A nonparametric approach also was used to confirm the findings of the primary analysis by calculating the change in FV consumptions for all participants with valid data at pretest and posttest and using the rank of this change in a linear regression. This analysis was adjusted for covariates that demonstrated significant associations with the ranked change. The relationship between website use and ranked change in consumption was estimated using correlation techniques. A p value of 0.05 was considered significant for all analyses. No specific corrections were made for multiple testing, as the different approaches to analyses were aimed at confirming the results found.

Results

Profile of the Sample

A total of 755 adults were enrolled, pretested, randomized and had website use data (380 in intervention group, 375 in control group). Seven participants were excluded because they did not complete the pretest ($n = 7$). Nearly two-thirds self-identified as Hispanic and 9%, as American Indians/Alaska Natives. Despite intensive efforts to recruit men, 88% were female. This imbalance may reflect a prevailing gender difference in interest in dietary advice or the prevailing gender of the COTs, but it was surprising given that when this project began Internet users were more likely to be men. Nearly all (84%) participants had used a personal computer, and 66% had used the Internet more than 10 times in the past. Only one in five participants had never used the Internet. The randomization procedure successfully produced two groups with few differences at pretest (Table 1): The intervention group had slightly less education and more computer experience than the control group.

Of the 755 subjects who enrolled, 473 (63%) completed a posttest. Very few participants refused to be interviewed or did not complete the posttest when reached (Figure 1). Potential nonresponse biases due to loss to follow-up were examined (Table 2). Compared with nonresponders, responders were older, married, more educated, White, non-Hispanic participants born outside the region, living in smaller households and with children, and they had lived for a shorter time in the region. There was no differential nonresponse by treatment (62% control, 64% intervention; chi square = 0.35, $p = 0.554$). A receiver operating characteristic (ROC) curve analysis (Kraemer, 1992) showed that older, White participants were most likely to complete the posttest, while younger participants with no education beyond high school and older Native Americans who had used the Internet more frequently were most likely not to respond.

Intervention/Control Comparisons on Change in Fruit and Vegetable Intake

All-day Screener—The assignment of participants to the intervention group did not produce an increase in FV consumption as measured by the All-day Screener. At pretest, participants reported consuming seven servings of FV daily in both groups (control: mean = 7.2 [sd = 5.42]; intervention: mean = 7.3 [6.78]), which was much higher than expected based on a pilot survey. At posttest, consumption in the control group appeared to decline (mean = 6.8 [3.75]) and in the intervention, to increase (mean = 7.6 [5.62]). The analysis of the mean change using the mixed-model approach (control: mean change = −0.26 [se = 0.38]; intervention: mean change = 0.38 [0.37], correlation between pre/postmeasure = 0.52 [controls], 0.42 [intervention]), however, showed the difference between the groups was not statistically significant (estimated difference = 0.64, SD = 0.52, $t(\mathrm{df} = 416) = 1.23$, $p = 0.223$; effect size = 0.12). A Wilcoxon rank sum two-sample test comparing experimental groups on the rank-ordered FV intake was conducted to avoid problems with skewness and outliers but also it was nonsignificant, $p = 0.059$.

Potential covariates were examined to adjust the group comparison in the analysis of the ranked change in FV consumption using forward selection on participants that had valid dietary data at pretest and posttest. Ranked change was significantly correlated with worse FV eating and shopping habits, belief that one eats fewer FV than other people, and lack of family support. The adjusted group difference remained statistically nonsignificant when these variables were entered as covariates.

Intent-to-treat analyses were performed to estimate the potential effect of nonresponse on pre/postchange measured by the All-day Screener. The between-group difference was not statistically significant under any of assumptions about dropouts: casewise deletion ($p = 0.305$), multiple imputation using covariates of nonresponse ($p = 0.420$), multiple imputation using intervention group and pretest and posttest values of FV consumption only ($p = 0.389$), mean substitution by nonresponse group ($p = 0.390$) and mean substitution by nonresponse group and intervention group ($p = 0.069$).

Finally, the comparison was recomputed eliminating the item added to assess consumption of red and green chile and salsa (control: 6.52 [sd = 5.11] daily servings at pretest, 6.22 [3.44] at posttest; intervention: 6.55 [6.16], 6.94 [5.27]). The intervention/control difference in mean change remained nonsignificant (control − 0.16 [se = 0.34], intervention 0.49 [se = 0.33]; estimated difference = 0.65, SD = 0.48, $t(\mathrm{df} = 418) = 1.35$, $p = 0.177$).

Single-item Report—A larger proportion of adults in the intervention group reported that, on average, they ate five or more servings of FV each day at posttest than in the control group: In the intervention group 13.9% ate five or more servings daily at pretest (mean = 3.03 servings[sd = 1.75])and 19.8% ate five or more servings at posttest (mean = 2.98 servings [sd = 1.77]). By contrast, in the control group, 17.4% ate five or more servings daily at pretest (mean = 2.96 servings [sd = 1.67]) and 13.8% ate five or more servings at posttest (mean = 2.77 servings [sd = 1.60]). This difference was statistically significant (OR = 1.84, 95%CI = 1.07, 3.17, $p = 0.027$ adjusted for pretest value; OR = 2.00, 95% CI = 1.06, 3.79, $p = 0.033$ adjusted for pretest, education, age, length of residence, comparison with peers, and previous use of a personal computer).

Association of Website Use With Change in Fruit and Vegetable Intake

Website Use—Exposure to the website varied across participants. Only 192 out of 380 participants assigned to the intervention group visited the website after being registered on it by the COTs. Average visits and time on the website for those who logged on was low, with large variation (number of logins: mean = 3.3, range = 1 to 39, 25th percentile = 1, median = 2, 75th percentile = 4; total time on website in minutes: mean = 22.2 minutes, range = 0 to 322.7, 25th percentile = 1.3, median = 10.5, 75th percentile = 28.9). The two usage measures were highly correlated (Spearmean correlation = 0.893, p value < 0.0001). Thus, only analyses with total time are presented because it is more consistent with utilization. Time on the website was higher among adults who completed the posttest survey (mean = 26.5) than those who did not (mean = 4.34, $t = 8.55$, $p < 0.0001$). Usage of various sections varied widely, most popular being recipes, homepage, and information about the health benefits (Table 3).

Relationship to Change in Intake—A website exposure effect was evident in the change in FV intake. Time on the website was significantly and positively associated with ranked pre/postchange in FV consumption (Spearman $r = 0.14$, $p = 0.004$, assigning controls a value of zero). A multivariate model adjusting for purchasing habits ($t = -2.72$, $p = 0.007$) and posttest stage of change ($t = -2.42$, $p = 0.016$) showed that those who spent more time on the website reported more pre/postchange in intake on the All-day Screener (estimate = 0.74, SD = 0.19, $t(\text{df} = 414) = 3.87$, $p = 0.001$). The single item measure also was associated with time spent on the website (OR = 1.010 per minute of use, 95% CI = 1.003, 1.018). Participants who spent more time using recipes and sections on FV in season and health benefits reported greater increases in FV intake measured by the All-day Screener than participants who spent less time with these website features (Table 3).

Discussion

Assigning adults in the rural Upper Rio Grande Valley to use the *5 a Day, the Rio Grande Way* website may have motivated them to change their diet. A larger increase in FV intake was evident on both measures in the intervention group than in the control group, but this effect was statistically significant only for the single-item assessment. Other interventions have produced positive changes in FV intake on a single-item measure (Heimendinger et al., 2005; Marcus, Heimendinger et al., 1998; Marcus, Morra et al., 1998; Marcus et al., 2001; Nicklas et al., 1998). Another nutrition website increased intake of vegetables measured with a single item but not fruits (assessed on another single item; Oenema et al., 2001).

The lack of a treatment difference in the multi-item all-day screener tempers our conclusion about the website's effectiveness. The effect size produced was small and the study may be underpowered. The mean change in FV servings, however, was similar to previous studies (Buller et al., 1999; Campbell et al., 1999; Havas et al., 1998). There were concerns about how well the multi-item measure performed. It was validated on a sample of primarily highly educated White individuals (Thompson et al., 2002). This measure as used here produced much higher estimates of daily servings with larger variances in the present trial on a multiethnic community sample than in that validation study, and than our single-item measure. The addition of an item on ethnic foods such as red and green chile and salsa could be the source of this variability, and the average servings per day and variation was lowered slightly in both groups when eliminated. This barely altered the results, however. Estimated daily servings of FV have been observed to increase when measured with more individual items (Krebs-Smith, Cook, Subar, Cleveland, & Friday, 1995). With its very high variance, the multi-item scale may have been less sensitive to change produced by the website than the single item. Future studies should consider using instead 24-hour recalls or food records that may be less susceptible to measurement biases.

Still, a conservative conclusion from the inconsistent findings would be that the Internet is not as effective a channel for nutrition education in a rural community context as hoped. Some may say that indeed our expectations were too high and that with exposure being so limited the website could not induce change. Evaluations of other diet-related websites, however, found positive effects on intake of fruits, nuts, and legumes (Papadaki & Scott, 2005), weight loss (Tate et al., 2001; White et al., 2004), body weight (Celio et al., 2000), and eating disorders (Winzelberg et al., 2000). Also, the content in the 5 a Day, the Rio Grande Way website was based on theoretical models (Bandura, 1986; Rogers, 2003) that have guided interventions that improved dietary behavior.

An alternative explanation is that the 5 a Day, the Rio Grande Way website may have been used insufficiently by the adults in this rural sample to be broadly effective. Recently, a web-based weight loss program showed that body fat reduction was greater among adolescents who used certain program features more frequently (Williamson et al., 2005). Unfortunately, rural populations have lower Internet use (Rainie & Horrigan, 2005), slower Internet connection (Horrigan, 2005; U.S. Department of Commerce & National Telecommunications and Information Administration, 2005), and wider variations in computer and Internet skills, training resources, and technical support. The website was built to operate on a minimum modem speed of 28 K, so it was difficult to deliver the most engaging interactive multimedia features that might increase return visits (McMillian, Hwang, & Lee, 1990). And, despite following recommendations for making websites relevant (Benton Foundation, 1998; Koyani, Bailey, & Nall, 2003), usability studies showed that it was most attractive to the least experienced Internet users (Zimmerman et al., 2003).

If greater exposure did lead to website effectiveness, information on health benefits, the availability of fresh FV, and recipes may have been the most influential. Health benefits should create positive outcome expectations. Seasonal information and recipes may make dietary changes more feasible or make FV attractive. Recipes can help people develop and use food preparation skills and have more confidence in trying new dishes (Birmingham, Shultz, & Edlefsen, 2004; Newman et al., 2005).

Low website use is a major threat to the validity of medical and behavioral Internet research (Eysenbach, 2005). Audience exposure to a health communication program is necessary for it to be effective (Slater, 2004), and the association of web-site use with improvements in FV intake suggests that with exposure, it was effective. Website use was positively associated with diet-related outcomes in some past studies (Celio et al., 2000; Tate et al., 2001; Winzelberg et al., 2000; Womble et al., 2004) but not all experiments (White et al., 2004). Adherence to programs has correlated with improved FV consumption for non-Internet interventions, too (Campbell et al., 1999; Havas et al., 1998). Conclusions about website effectiveness based on degree of usage are weak, however, because use was self-selected.

Low use may be an unfortunate occurrence when websites are evaluated in community settings where participants are not required to use it. Low penetration of interventions into communities, especially rural ones, is not new. Surveys demonstrating high interest in Internet health information may be misleading. In most situations, some immediate need, most likely a real or potential health problem, drives use of this channel (Fox, 2005). By contrast, many evaluations of websites enroll participants without a real need for them, so they may not be motivated to use them. Trials on Internet programs that enroll and randomize adults regardless of interest may not represent the typical user experience. Self-selected website exposure may be the “normal” pattern to which results must be generalized. The reasons why individuals seek information on the Internet need to be better understood to promote their use. The higher use of recipes, tips on buying, storing, and preparing FV, and produce availability suggest that pragmatic utility will increase usage. Information about produce availability and recipes provided immediate benefits for immediate needs. Health websites directed to a wider public, not small, groups of users referred for specific needs and highly motivated to obtain the health information, might do well to provide content that satisfies as many such needs as possible.

Unfortunately, there is a paucity of research on strategies to stimulate exposure to any health program (Slater, 2004). Analyses identifying predictors of website use in this trial are reported elsewhere. Methodologically, researchers might consider screening participants for strong interest in the health topic or past use of the Internet (e.g., by advertising a trial on a search engine). Run-in techniques might be used that confirm that individuals will follow instructions to use a website before randomization.

In the end, it can be said that a website such as 5 a Day, the Rio Grande Way may provide some benefit to adults in rural communities. Many residents may not visit the website enough for it to be broadly effective, however, even with concerted promotional efforts. Internet interventions may function best when combined with more proactive means of reaching participants, such as with community health workers or where individuals can be accessed more readily to achieve higher usage such as at health care clinics or in worksite wellness programs.

Study Limitations and Strengths

There were limitations to the study, beyond the unexpected attrition, low use, and poor telecommunication infrastructure. There are strengths and weaknesses associated with the self-report measures, and most alternative methods—multiple daily food records, 24-hour recalls, and extensive food frequencies (Thompson & Byers, 1994)—rarely are feasible in community trials. The All-day Screener used here was similar to abbreviated FV food frequency measures used by others (Serdula et al., 1993) and demonstrated validity in line with most food frequencies (Thompson & Byers, 1994). It was open to social desirability biases, however, as are all self-reports. The personalized recruitment method may have produced an experimenter effect; we attempted to minimize this by keeping COTs blind to condition until after the pre-test, using telephone interviewers for posttesting, and instructing COTs not to discuss FV with participants. Finally, the study was conducted in the southwestern United States with some unique regional dietary patterns (e.g., large consumption of chiles and salsas) and food delivery system (e.g., sometimes presenting few FV options). Still, adults expressed dietary concerns in formative focus groups that seemed to be common elsewhere (Buller et al., 2001).

Conclusion

The Internet is revolutionizing profoundly the U.S. media environment (Rainie & Horrigan, 2005). Many health organizations have rushed to embrace it. It is not entirely clear from this study how websites with influential nutrition content can be positioned to reach large portions of the intended audiences in rural and community settings.

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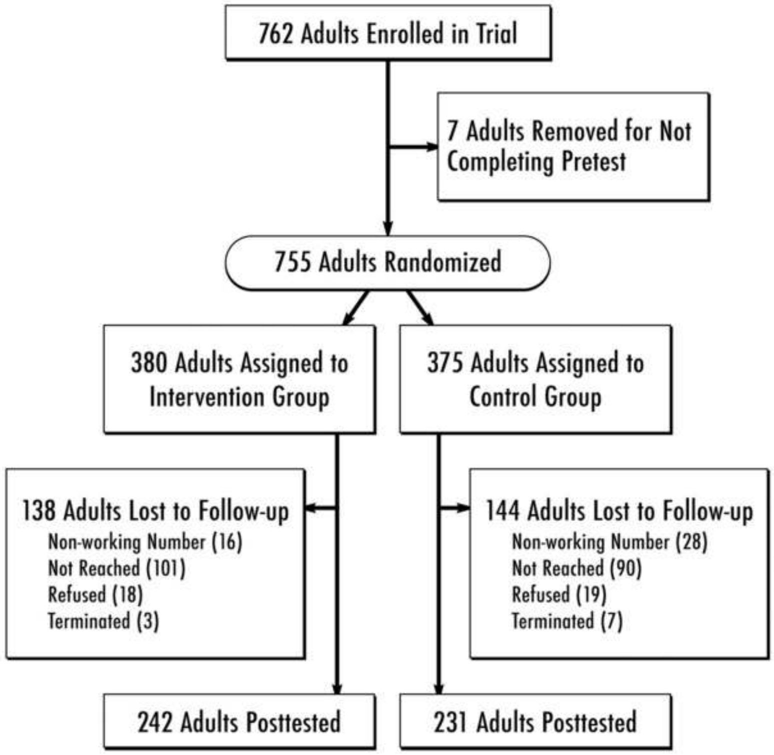

Figure 1.
Participant flow in randomized trial.

Table 1

Demographic characteristics and computer experience at pretest of adult participants from the Upper Rio Grande Valley enrolled in trial

	Control	Intervention
Demographics		
N	375	380
Gender		
Male	12%	12%
Female	88%	88%
Age (in years)		
29 or younger	32%	35%
30 to 39	17%	17%
40 to 49	19%	18%
50 to 59	15%	13%
60 or older	13%	14%
Refused/missing	4%	3%
Hispanic origin		
Of Hispanic origin	64%	65%
Not of Hispanic origin	34%	34%
Refused/missing	2%	1%
Race		
American Indian/Alaska Native	9%	9%
Asian	0%	1%
Black	0%	1%
Native Hawaiian/Pacific Islander	1%	0%
White	37%	35%
None of these	46%	46%
Refused/missing	8%	8%
Education*		
11th grade or less	12%	14%
High school/GED	27%	22%
Trade school or some college	29%	35%
2 yr college degree	9%	12%
4 yr college degree	10%	8%
Postgraduate	12%	10%
Refused/missing	1%	0%
Marital status		
Married or living with someone	59%	55%
Widowed, separated, or divorced	23%	20%
Never been married	17%	24%
Refused/missing	2%	1%
Place of birth		

	Control	Intervention
Upper Rio Grande Valley	57%	57%
Somewhere else in the United States	38%	39%
Outside the United States	4%	4%
Refused/missing	0%	0%
Number of people in household including participant		
1	16%	12%
2	24%	28%
3	20%	20%
4	21%	24%
5 or more	18%	17%
Refused/missing	0%	0%
Number of children in household		
0	41%	41%
1	19%	20%
2	25%	25%
3 or more	15%	13%
Refused/missing	0%	1%
Number of years participant resided in the Upper Rio Grande Valley		
5 or less	13%	11%
6 to 10	7%	6%
11 to 20	12%	16%
More than 20	44%	46%
Forever	24%	19%
Refused/missing	1%	1%
Computer Experience		
N	380	388
Ever used a personal computer[3]		
Yes	81%	87%
No	19%	13%
Number of times used Internet		
None	24%	18%
1–10 times	13%	13%
>10 times	63%	68%
Don't know	1%	1%
Currently use Internet		
Yes	62%	68%
No	13%	13%
Never used the Internet	24%	18%
Refused/missing	1%	1%
Total	100%	100%

*$p < .05$.

Table 2

Comparison of adult participants who did not complete and who completed the posttest survey on treatment group, demographic characteristics, and computer experience at pretest

	No posttest	Completed posttest
Treatment group		
N	282	473
Control	51%	49%
Intervention	49%	51%
Demographic characteristics		
Gender		
N	281	473
Male	10%	13%
Female	90%	87%
Age (in years)**		
N	266	460
Mean	35.3	43.6
Hispanic origin**		
N	278	465
Hispanic	77%	58%
Not Hispanic	23%	42%
Race**		
N	277	465
American Indian/Alaska Native	13%	8%
White	21%	46%
Refused	8%	7%
None of these	58%	40%
Education**		
N	279	473
High school graduate or less	51%	28%
Trade school or some college	41%	44%
College graduate	8%	28%
Marital status*		
N	276	467
Married	49%	63%
Not married	51%	37%
Place of birth**		
N	281	473
Upper Rio Grande Valley	71%	49%
Somewhere else in United States	25%	47%
Outside the United States	4%	4%
Number of people in household*		

	No posttest	Completed posttest
N	281	473
Mean	3.35	3.03
Number of children in household*		
N	279	473
Mean	1.33	1.07
Number of years participant lived in Upper Rio Grande Valley		
N	270	462
Mean	26.4	27.2
Computer Experience		
Ever used personal computer*		
N	282	473
Yes	78%	88%
No	22%	12%
Number of times used Internet*		
N	281	468
None	28%	16%
1–10 times	14%	12%
>10 times	58%	71%
Currently use Internet**		
N	281	468
Yes	56%	72%
No	44%	28%

* $p < .05$.

** $p < .0001$.

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Table 3

Average amount of time spent using features and sections on the website by participants in the intervention group who completed both a pretest and posttest including correlation of use to pre/postchange in fruit and vegetable intake for all participants (control group = 0 minutes)

				Pre/postchange in fruit and vegetable intake	
Site section	*N*	Mean	Std dev	Spearman correlation coefficient	*p*-value
About the site	216	0.102	0.396	0.126	0.0653
Administration	216	0.009	0.096	−0.076	0.2663
Buying, storing, and preparing fruits and vegetables	216	2.282	4.176	0.136	0.0463
Community directory	216	1.204	4.540	0.098	0.1503
Gardening	216	1.204	2.977	0.034	0.6217
Glossary	216	0.569	1.187	0.118	0.0827
Homepage	216	7.296	7.476	0.118	0.0831
Internet health resources	216	0.380	1.432	0.033	0.6316
Making sense of health information	216	1.884	2.935	0.083	0.2267
Previous updates	216	0.157	0.504	0.007	0.9189
Raising healthy children	216	1.532	3.536	0.011	0.8722
Recipes	216	13.745	21.203	0.157	0.0213
Site feedback	216	0.199	0.797	0.084	0.2215
Site map	216	0.481	0.722	0.021	0.7603
This season	216	1.194	2.329	0.145	0.0333
Tutorial	216	0.028	0.288	−0.007	0.9188
Vegetables and fruits for better health	216	3.243	6.662	0.185	0.0064