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ORIGINAL PAPER

Tools for health: the efficacy of a tailored intervention targeted for construction laborers

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Abstract
Objectives Novel approaches to worksite health promotion are needed for high-risk workers who change job sites frequently, and thus may have limited access to worksite health promotion efforts. The objective of this study was to test a behavioral intervention among construction laborers.
Methods Using a randomized-controlled design, we tested the efficacy of a tailored telephone-delivered and mailed intervention to promote smoking cessation and increased fruit and vegetable consumption ($n = 582$).
Results At baseline, 40% of control group participants and 45% of intervention group participants reported using any tobacco in the last seven days. At final, 8% of baseline cigarette smokers in the control group had quit, compared to 19% in the intervention group ($p = 0.03$). In both groups, the mean consumption of fruits and vegetables at baseline was over five servings per day. At final, the intervention group had increased consumption by approximately one and one-half servings, compared to a slight decrease in consumption in the control group ($p < 0.001$).
Conclusions A tailored intervention can be efficacious in promoting tobacco use cessation and increased fruit and vegetable consumption among construction laborers, a high-risk, mobile workforce.

Keywords Smoking cessation · Nutrition · Blue-collar workers · Labor unions · Tailored intervention

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Introduction

Worksite health promotion programs have increasingly addressed disparities in risk by socio-economic position [1–4]. Evidence of growing disparities in disease risk by socio-economic position underscores the need for interventions that are effective with workers in working class occupations and/or who earn low wages. For example, blue-collar workers are more likely to be smokers than are those in white-collar jobs; in the year 2000, prevalence of current smoking was 35.4% among blue-collar workers, compared to 20.3% among white-collar workers [5]. Smoking prevalence also is declining more slowly among blue-collar workers than among white-collar workers [6]. In addition, evidence consistently indicates that persons with low incomes and less education are less likely to eat a healthy diet, as indicated by the consumption of the recommended number

of fruits and vegetables [7]. Workers who are nonprofessional, are black, or have lower education levels are less likely to be employed in worksites that offer health promotion programming [8] and are less likely to participate in programs when they are available [9–11].

For some, such as workers in the transportation or construction industries, access to health promotion programs is limited by the nature of their work. In the study described here, we focus on construction, one of the largest industries in the United States, employing over seven million persons representing 6% of the total labor force [12]. The nature of construction work poses particular challenges for worksite-based health promotion interventions, in that workers are often not situated in one location for long periods of time, but rather may move from one job site to another. We designed and tested an intervention for this work force to promote tobacco use cessation and increased fruit and vegetable consumption using motivational telephone interviewing and tailored and targeted written materials sent by mail. Tailored interventions aim to increase the relevance of health information by personalizing messages based on individual data such as age, gender, and readiness to change [13, 14], and have been shown to be effective in promoting health behavior change across a range of settings and with a variety of occupational categories [15–17], including among blue-collar workers [18]. Targeted interventions, by comparison, are designed to reach a particular population sub-group based on shared characteristics of group members [19]. This intervention was both *targeted* to the specific work experiences and perspectives of construction laborers, and also *tailored* to the specific concerns of individual workers.

This study was a collaboration between the Dana-Farber Cancer Institute (DFCI) and the Laborers' International Union of North America (LIUNA), along with the affiliated Laborers' Health and Safety Fund of North America (LHSFNA). LIUNA represents approximately 400,000 construction workers in the US and Canada. Unions offer well-established communication infrastructures for outreach to their members, a strong sense of unity and community identity, and an intimate knowledge of members' work conditions [20].

We jointly developed the intervention for LIUNA members based on the findings from our formative research [20]. We used a social contextual framework to structure the intervention strategies and materials to assure that messages were embedded within the social context of workers' lives and on-the-job experiences [13]. We evaluated the effectiveness of the intervention in a randomized-controlled trial. In this paper, we present results of the test of our primary study hypothesis: union members randomly assigned to a tailored, telephone-delivered intervention will be more likely to quit smoking and increase consumption of fruits and vegetables than those randomized to the control condition.

Methods

Study design

We identified eligible union members and assessed their knowledge, attitudes and behaviors in a baseline survey. Survey respondents agreeing to participate were randomly assigned to one of two conditions: (1) a delayed minimal intervention control group, or (2) a tailored intervention, which included telephone counseling, a tailored feedback report, and targeted educational materials. Six months following the baseline survey, we conducted the final efficacy survey to assess smoking cessation and increases in fruit and vegetable consumption. The study protocol was reviewed and approved by the Institutional Review Board of the Dana-Farber Cancer Institute, and at all points in the study all participants provided informed consent for their participation.

Sample and data collection

As part of formative research conducted with LIUNA members, we administered a background survey by telephone between May 2001 and November 2002 (n = 1,109, 44% response rate) [20]. (Additional formative research included a series of focus groups conducted to inform intervention development [20].) We invited the 1,108 respondents to the background survey to participate in the randomized trial. Of those, 194 (17%) were no longer eligible due to being retired or no longer a member of LIUNA. Of the remaining 915, 674 (74%) consented to participate in the randomized trial, completed the baseline survey and were randomly assigned to either the intervention or control condition. The baseline survey was conducted by telephone between November 2002 and December 2003. We contacted all participants six months post-baseline for the final efficacy survey. Of the 674 initially randomized participants, 582 (86%) completed the final survey (88% and 85% of those randomized to the control and intervention groups, respectively). The remaining 92 (13%) were lost to follow-up. Data collection was completed July 2004.

All study participants were members of LIUNA and were construction laborers. The most prevalent job categories included general laborer (29%), concrete worker (19%), heavy construction worker (19%), demolition worker (12%), and jackhammer (12%).

Intervention study conditions

Intervention condition

The intervention consisted of: (1) one-to-one motivational interviewing counseling sessions, delivered by telephone with a health advisor, (2) a mailed tailored feedback report, and (3) written educational materials, targeted to the specific needs and work experiences of construction laborers, mailed across the intervention period in six separate mailings. The intervention was delivered in either Spanish or English based on participant preference. Within approximately 2 weeks of the baseline survey administration, we mailed each participant a tailored feedback report that introduced the program and provided personalized health messages incorporating responses to the baseline survey. Our intervention protocol called for all participants to receive up to four telephone calls within a 3-month period. We gave tobacco users an option of two additional calls in case they determined that they needed additional time. With the motivational interviewing approach, participants choose their own behavior change goals and the sequence in which they address them so the content of each session was not predetermined by the protocol. We also mailed tip sheets to participants on topics related to nutrition, tobacco and the nature of laborers' work. These materials were targeted to this population of workers utilizing themes that emerged from the focus groups, as described below, but were not tailored to individual participants. All participants received at least 12 tip sheets, and smokers received up to three additional, based on their readiness to quit.; these tip sheets were designed for this population of workers, although they were not tailored to individual workers.

The intervention was also targeted to the specific needs and work experiences of construction laborers. We conducted formative research to identify elements of the social context of workers' lives on and off the job, following a social contextual framework for health behavior change [21, 22]. This formative research included the background survey and sixteen focus groups with a total of 88 participants, selected through purposive sampling methods, conducted in multiple regions across the country. Details of this formative research are reported elsewhere [20]. We used this formative research to target the intervention to construction laborers by identifying themes that we incorporated into our tailored feedback report, the protocol for telephone counseling, and written educational materials. The intervention was designed to reflect important job experiences shaping construction laborers' health behaviors and intentions to change. For example, materials addressed findings from the background survey, including a high prevalence of smoking (41%), and high interest in quitting among tobacco users (two-thirds of smokers were thinking about quitting in the next 6 months, and nearly half had attempted to quit smoking unsuccessfully over the past year) [20]. The intervention materials and telephone counseling addressed issues in the work environment, which focus group participants described as having high job demands and low control. They expressed concerns about exposures to hazardous substances and conditions, the perception that laborers were low-status workers, and a strong concern about being physically fit for work. Focus group participants also conveyed a strong sense of brotherhood within the local union, which provided them with a significant sense of solidarity. We specifically integrated concerns about hazardous exposures on the job into health behavior messages. For example, we provided information about the synergy between risks associated with tobacco use and exposures to some hazards on the job, such as asbestos or silica, and discussed the importance of diet in maintaining fitness for work and health in general.

The tailored feedback report and motivational counseling calls were tailored on individual health behaviors, intention to change, self-efficacy to change, risk perceptions, social support, and nicotine addiction, following principles from the Transtheoretical Stages of Change model [23] and Social Cognitive Theory [24]. The telephone counseling was based on a script that incorporated motivational interviewing techniques [25, 26], which focus the discussion on participants' choice, discrepancies between goals and behavior, personal responsibility for change, and enhancement of self-efficacy. Counselors worked with participants to set goals for those interested in making changes, or simply monitored participants' attitudes among those who were not ready to make changes. In the first call, the health advisors focused on establishing rapport, discussing participants' attitudes toward health behaviors and ways that health behavior changes might fit into their jobs and home lives, and aimed to set preliminary goals for health behavior changes. In subsequent calls, the health advisors monitored and encouraged progress with health behavior goals, and identified facilitators and barriers to meeting these goals. With the consent of their primary care physicians

(or laborer's own consent for those who had no physician), we mailed nicotine replacement therapy to participants interested in quitting tobacco.

The project director provided on-going training, supervision and quality assurance for the health advisors through weekly staff meetings and review of process tracking reports from the computerized process tracking system. In addition, the health advisors tape-recorded a random selection of 10% of study participants' calls. A staff member certified in motivational counseling reviewed the tapes and rated each counseling tape on key elements of motivational interviewing methods. The trainer reviewed each tape-recorded session with each health advisor to assure compliance with motivational interviewing style and adherence to the counseling protocols and to provide on-going feedback and training. The quality assurance process was adapted from prior motivational interviewing studies [27].

Control group

Upon completion of both the baseline and final efficacy surveys, participants in this condition received a packet of all the targeted written materials by mail. The control group did not receive any materials or other support during the intervention period.

Measures

Tobacco use

Current tobacco use was measured by self-report using standard measures from national samples to allow for comparability with other studies. Selection and measurement of our primary outcome were based on recommendations of a workgroup formed by the Society for Research on Nicotine and Tobacco [28]. For all types of tobacco, we assessed current use, and if using, whether the respondent was thinking of quitting. We measured cigarette smoking cessation by the prevalence of baseline smokers and recent quitters (within the last 6 months) who reported not smoking in the last 7 days; we used a similar approach to assess cessation of any tobacco use. We assessed 7-day abstinence (''Have you smoked a cigarette, even a puff, in the last 7 days?''), measured at 6 months post-baseline.

Fruit and vegetable consumption

Current fruit and vegetable consumption was measured with the revised screener used in the National Cancer Institute's 5-A-Day for Better Health research projects [29]. Seven groups of foods were included: 100% fruit juice, lettuce salad with or without vegetables, French fries or fried potatoes, other white potatoes, cooked dried beans, fruits, and other vegetables. For each set of foods the respondent was asked how often over the last month they usually ate the food and the usual amount. We based our scoring on procedures recommended by NCI [30]. The total number of servings of fruits and vegetables per day was computed by summing the servings per day of each food, excluding fried potatoes.

Sociodemographic variables

We included items on age, gender, race and ethnicity, living with a spouse/partner, the presence of children at home, income, and education. In addition, we assessed job characteristics (work hours, shift). We also combined responses to household income level and number of people supported by the income and the ages of household members to categorize respondents according to the federal poverty guidelines for food aid [31]. In 2001, the poverty threshold for a single person was $9,214, while the threshold for a family two adults and two children it was $17,960. The threshold for eligibility for food stamps and the Women Infant and Children's Supplemental Nutrition program (WIC) is 185% of the poverty threshold.

Data analysis

For the primary analysis of intervention effectiveness, we restricted the sample to the study participants who completed both the baseline and final efficacy surveys ($n = 582$). For servings of fruit and vegetables, we computed a participant-specific change in consumption as the difference between the follow-up and baseline servings per day. We then computed the Student's *t*-test on the difference in mean change between those randomized to the intervention and control conditions.

For cigarette use, we identified all participants in the baseline efficacy survey who reported smoking or having quit within the previous 6 months. Within each randomization group, we computed the percentage of those who reported not smoking in the previous 7 days on the follow-up survey. We compared the two percentages using the normal approximation to the Binomial distribution. For any tobacco use, we identified all participants who reported using any tobacco within the previous 7 days at baseline and compared percentages of those who reported not using any tobacco in the comparable period at follow-up.

We also computed an intention-to-treat analysis, using all 674 participants who responded to the baseline survey. For those who did not respond to the follow-up survey, we assumed that their fruit and vegetable consumption remained the same as that reported at baseline. We assumed that all smokers and recent quitters at baseline were smoking at final. We then repeated the analysis of intervention effectiveness using this larger data set.

Results

Characteristics of study participants

Table 1 presents the baseline characteristics of study participants who completed the final efficacy survey. There were no appreciable differences in participant characteristics by study condition. This predominantly male sample was approximately two-thirds white non-Hispanic. Over half (52%) of respondents were below the 185% of poverty threshold that permits eligibility for food stamps and the Women Infant and Children's Supplemental Nutrition program (WIC).

Tobacco use and cessation

As shown in Table 1, 40% of control group participants and 45% of intervention group participants reported at baseline using any tobacco in the last seven days. This baseline prevalence included cigarette smoking rates of 30% in the control and 33% in the intervention group; in addition, 12% of the control group used other forms of tobacco, compared to 15% in the intervention group. Because the intervention provided support to recent quitters (i.e., within 6 months) to continue to abstain from tobacco use, recent quitters were included in analyses of smoking cessation; there was only one recent quitter at baseline in each condition. By the final efficacy survey, 8% of baseline cigarette smokers in the control group had quit smoking for at least 7 days, compared to 19% in the intervention group ($p = .03$) (Table 2). We found similar results for cessation from any form of tobacco use (7% versus 19%, respectively, $p = .005$). We also examined between group differences in quit attempts, although data on quit attempts were missing for 29 of the 188 baseline smokers (data not shown). Of those who responded, 35% of control smokers (28 out of 79) compared to 53% of intervention smokers (42 out of 80) made at least one quit attempt ($p = 0.03$) (data not shown).

Table 1 Baseline characteristics of participants who completed the follow-up survey by randomization group ($n = 582$)

Characteristic	Control		Intervention	
	n	%	*n*	%
Race				
Latino	51	18	42	14
White	176	63	209	70
Black	29	10	32	11
All others	25	9	17	6
Education				
No high school	62	22	56	19
High school diploma	129	47	135	45
Some post-high school training	69	25	97	32
Baccalaureate or more	17	6	11	4
Income				
≤$15K	23	8	17	6
$15K–$50K	154	55	152	51
≥$50K	104	37	131	44
Poverty index				
Above 185% of poverty threshold	126	47	140	48
Between poverty threshold and 185% of poverty threshold	115	43	109	38
Below poverty threshold	26	10	42	14
Gender				
Male	261	95	279	94
Female	15	5	17	6
Shift				
Day	264	95	281	94
Night or evening	13	5	18	6
Live with spouse/partner				
No	65	24	68	23
Yes	209	76	229	77
Kids ≤ 18 years at home				
No	119	43	126	42
Yes	157	57	173	58
Work hours				
Part time (≤37 h)	15	5	14	5
Full time (38–42 h)	158	57	166	56
Over time (>42 h)	107	38	118	39
Any tobacco use				
Yes	113	40	134	45
No	168	60	166	55
	Mean	SD[a]	Mean	SD[a]
Age (years)	40.8	9.7	40.3	9.5
Servings of fruit + vegetables/day	5.19	3.7	5.39	3.5

[a] SD is standard deviation

Fruit and vegetable consumption

Consumption of fruit and vegetables ranged from zero to 27 servings per day at baseline. In both groups, the mean consumption was over five servings per day. Intervention group participants made significantly greater increases in their consumption of fruits and vegetables than those in the control group (Table 3). By the time of the final efficacy survey, participants in

Table 2 Seven-day quit status at final among smokers and recent quitters at baseline by intervention group (n = 188)

Smoking status at final	Control		Intervention		p-value
	n	%	n	%	
Smoker	80	92	82	81	0.03
Non-smoker (seven days or more)	7	8	19	19	

the intervention group had increased their consumption approximately one and one-half servings (range 0.9 servings decrease to 3.1 servings increase), compared to a slight decrease in consumption in the control group (range 1.4 servings decrease to 1.1 servings increase). This finding is similarly reflected in differences between baseline and final in the percent of participants reporting consuming five of more servings each day, which increased from 49% to 60% in the intervention group, and decreased from 46% to 40% in the control group.

In the intention to treat analysis, the differences between the intervention and control groups in both consumption of fruit and vegetables and smoking were smaller but they remained statistically significant ($p < 0.0001$ and $p = 0.04$, respectively).

Discussion

This study is among the first to demonstrate the efficacy of a tailored intervention targeted to the specific concerns of blue-collar workers [18]. Construction laborers are at elevated risk for hazardous exposures on the job [32, 33] as well as for risk-related behaviors, such as tobacco use [34]. We tested an intervention that was tailored to the needs of individual participants and additionally targeted to the specific occupational hazards and social context of the construction work setting. This study demonstrates that this intervention led to significant improvements in two key behavioral risk factors, compared to a non-intervention control. Smokers in the intervention group were more than twice as likely to quit smoking as those in the control group, and intervention participants increased their fruit and vegetable consumption by more than one and one-half servings relative to control group participants. The magnitude of these increases compares favorably with prior reports of interventions for blue-collar workers aimed at tobacco [4, 35, 36] and diet [1, 4, 37, 38]. Our collaboration with the union provided an important vehicle for engaging workers with restricted access to traditional worksite health promotion programs. By tapping into the union's infrastructure and the social context of workers' lives, shown to be important in our formative work [20], we were able deliver an intervention that led to significant improvement in the targeted health behaviors.

Tailored interventions are a powerful tool that increases the relevance and salience of health information by making it personally relevant [17]. These data illustrate both the feasibility and potential efficacy of a telephone-delivered intervention, supplemented by written materials, for this audience. The participation rate in this study, 74% of those invited, represents a high level of interest in participating in tailored interventions. The level of participation in the intervention was also high; 54% of smokers and 60% of non-smokers received four or more calls, and 84% of participants reported reading most or all of the intervention materials.

Findings from prior research have demonstrated the potential efficacy and impact of telephone-delivered interventions across a range of populations and risk factors. For example, quit lines have been shown to be efficacious and effective [39–42]. A distinction has been made between reactive approaches and proactive phone counseling, which has been shown in multiple trials to be efficacious in promoting both short- and long-term cessation [39, 43]. Zhu [44] reported that 87% of quit lines offered proactive services, in which counselors initiated scheduled calls to smokers, as we did in this study, and one-third offered pharmacological support for cessation. Studies in selected populations, such as women recently treated for early stage breast cancer [45] and members of a health maintenance organization [46, 47], have also found telephone counseling to be effective in promoting increased consumption of fruits and vegetables. The findings of the study reported here further suggest that telephone-delivered counseling, supported by tailored and targeted written materials, can be efficacious in promoting behavior change among high-risk groups, such as blue-collar workers with limited access to worksite-based programs.

Table 3 Mean and standard deviation (SD) of servings of fruits and vegetables[a] at each time point and mean change by intervention group (n = 578)

	Control (n = 280)		Intervention (n = 298)		p-value
	Mean	SD	Mean	SD	
Baseline	5.19	3.7	5.39	3.5	
Final	5.10	4.0	6.91	4.8	
Change	–0.09	3.31	+1.52	3.89	<0.0001

[a] Servings per day are computed incorporating serving size and excluding servings of French fries and other fried potatoes

This study builds on our prior research with blue-collar workers, in which we tested the impact of the integration of health promotion and occupational health and safety [48]. In the Well Works-2 study, we found that hourly workers participating in an intervention integrating health promotion and occupational health and safety were twice as likely to quit smoking as their counterparts receiving a traditional health promotion program [4]. The intervention described here built on these findings by addressing the specific work environment and job conditions of construction laborers.

This study had several strengths. This intervention was developed based on extensive formative research and in close collaboration with the LHSFNA, and accordingly reflects the day-to-day realities of workers' lives. The intervention addressed several health behaviors simultaneously, thereby increasing the relevance of the intervention to participants with different interests in and readiness for health behavior change, and also increasing the program's impact on potential health outcomes. The dose of intervention delivered was relatively high. As a result of the high response rate at the final efficacy survey, we were able to assess the impact of this intervention with little loss to follow-up over the duration of the intervention study.

This study has strong internal validity due to the randomization of the participants to intervention and control conditions and the high follow-up rate of those participating in the intervention study. Although the response rate to the background survey was somewhat low, respondents to this telephone survey are likely to be representative of constructions laborers who would consider participating in a telephone-delivered intervention, as tested here. This response rate indicates the challenges of conducting telephone surveys in an era of increased call screening and privacy blocks on incoming calls [49]. In focus groups conducted as part of our formative research, we heard from laborers that reaching LIUNA members by phone might be difficult, given work schedules, competing demands outside work, and the mobile nature of the lives of many of these workers; we opted to use this method for contacting workers because the alternative, an in-person design, was likely to provide even less representativeness and reach.

It is important to note as well limitations with the measures used. Our primary outcomes relied on self-report, and accordingly are subject to sources of reporting bias common with such measures; collection of biochemical measures would have not been feasible in this national survey conducted by telephone. In addition, according to the SRNT recommendations, biochemical verification is not typically used in large-scale public health oriented smoking interventions, in part because it has been found that the false reporting rates are generally quite low [50, 51]. To enhance the likelihood of valid self-reporting, survey administrators stressed that valid responses would assist us in developing effective programs for future programs, and survey administrators assured participants that all responses would remain anonymous and be reported in aggregate only. We also recognize the potential for differential reporting of health behaviors between the intervention and control conditions at the final survey, given the greater involvement of intervention participants. We sought to protect against this source of bias by employing different staff members to conduct the intervention versus administer the survey. We recognize the potential limitations of the 7-day abstinence smoking outcome measure; this measure does not capture smokers who quit and relapsed prior to the survey, and does not capture long-term sustained cessation. Nonetheless, this measure provides an important estimate of cessation. There are limitations to the instrument we used to measure fruit and vegetable consumption. At the time the study was planned the 5-A-Day screener had been used widely in other intervention trials [2, 37, 38, 52, 53]. Subsequent to the implementation of our study, Thompson et al. compared the 5-A-Day seven-item screener with a 19-item instrument that added portion sizes to the 5-A-Day screener [54]. They found that both instruments underestimated median daily servings of fruits and vegetables relative to two 24-h dietary recalls, although the estimated agreement between true intake and the screener was higher for the 19-item screener. The investigators concluded that both screeners might be useful in estimating median intakes of fruit and vegetable servings, as done in Tools for Health [55]. Specialized instruments for multiethnic, working class males were not available at the time this study was implemented.

Respondents reported relatively high levels of fruit and vegetable consumption at baseline. These values are not surprising in light of the high caloric demands of this work; fruit and vegetable consumption is likely to increase caloric intake. Although our measure may overestimate intake, the relative change between the two groups is still a valid measure of intervention efficacy.

Finally, although the smoking cessation rates observed in this study could have large implications if generalized to the entire union membership, we recognize this finding is based on a small number of quitters. It is therefore important to interpret this finding with some caution.

In conclusion, this study provides evidence that a telephone-delivered, tailored intervention that incorporates the social contextual framework for health behavior change can be efficacious in promoting tobacco use cessation and increased fruit and vegetable consumption among construction laborers. This intervention provides a strategy for reaching workers who are at a high risk but may be unable to participate in traditional worksite health promotion. It also demonstrates the critical role that collaborative partnerships can play in improving the public's health. A logical next step in this research is to test the effectiveness of this intervention in a real world scenario that would even more directly involve the union in reaching its members through a sustainable and cost-effective approach. Unionized laborers and most construction workers typically receive their health insurance through labor-management health and welfare funds, which on a national basis insure ten million union workers plus their dependents [35]. Future research might assess the effectiveness of tailored, telephone counseling delivered by health and welfare funds as a fully paid benefit for members and their dependents.

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