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# Tobacco Evidence-Based Practice Implementation and Employee Tobacco-Related Outcomes at Small Low-Wage Worksites

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## Abstract

**Objective:** To assess whether tobacco policy, program, and communication evidence-based practice implementation is associated with employee tobacco outcomes (current smoking; quit attempt; smokeless tobacco (SLT) use; and perceived worksite support for cessation) at small low-wage worksites.

**Methods:** We analyzed data from a randomized controlled trial testing an intervention to increase implementation of evidence-based health promotion practices. We used generalized estimating equations to examine relationships between practice implementation and tobacco outcomes.

**Results:** Communication practice implementation was associated with better perceived worksite support for cessation ($p$=0.027). Policy and program implementation were associated with increased odds of being a current SLT user; these findings should be interpreted with caution given small sample sizes.

**Conclusions:** Tobacco communication evidence-based practice implementation was associated with favorable perceptions of worksite support for cessation; more may be needed to change tobacco use behavior.

### Keywords

cessation; prevention; policy; tobacco control; public health

## INTRODUCTION

Smoking increases the risk for developing several chronic diseases, including cancer, heart disease, and diabetes.[1] Currently the leading cause of preventable death,[2] active cigarette smoking caused almost 450,000 deaths in the U.S. in 2014, resulting in approximately 6.4 million years of life lost.[3] To reduce tobacco use, the Guide to Community Preventive

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Services recommends implementation of quitline programs, reducing out-of-pocket costs for cessation treatment, and smoke-free policies.[4]

Worksites have implemented these practices, with previous studies showing increases in cessation, quit attempts, and perceived support for quitting.[5–7] Small and low-wage worksites are understudied in this context, despite facing several barriers to health promotion.[8] Small worksites also tend to report paying low wages to a large proportion of their workers.[9] Workers earning lower wages not only have higher smoking rates,[1] but also smoke with greater intensity and are less likely to quit smoking.[1011] Further, while the current national smoking rate is 16%,[12] employees working for low-wage industries such as retail trade and accommodation and food services have higher smoking prevalence (22% and 29%, respectively).[13]

With noted exceptions,[14] most studies conducted at small and low-wage worksites have focused on cigarette smoking; an examination of smokeless tobacco (SLT) use within these settings warrants further attention. SLT is a form of tobacco that is chewed instead of smoked and includes chewing tobacco, snuff, and Snus. SLT use contributes to the development of chronic diseases such as oral, esophageal, and pancreatic cancers.[15] While the prevalence of SLT use among U.S. adults (3%) is lower than smoking, in contrast to the declines seen in smoking, SLT use has remained stable over time.[16] There is evidence that smoke-free policies reduce SLT use,[1718] although some studies have found these reductions to be non-significant.[19] Worksite tobacco-free policies may support stronger reductions in SLT use,[16] but additional research is needed to confirm this relationship.

The purpose of this study was to assess how tobacco evidence-based practice implementation is associated with tobacco outcomes among employees at small low-wage worksites. We examined three practice types: policy, program, and communication. Tobacco policies are rules that prohibit tobacco use and protect workers from its harmful effects. Tobacco programs are interventions designed to increase tobacco cessation among current users. Communication focuses on the promotion of tobacco cessation-related information, resources, and programs. Knowing how these practices influence tobacco behavior and perceptions can provide direction for efforts that seek to reduce tobacco-related disparities at the worksite. We proposed the following hypotheses:

| | |
|---|---|
| **H1:** | Higher tobacco policy evidence-based practice implementation will be associated with: (a) lower odds of being a current smoker; (b) lower odds of being a current SLT user; (c) higher odds of attempting to quit smoking; and (d) higher odds of agreeing that their worksite supports their cessation. |
| **H2:** | Higher tobacco program evidence-based practice implementation will be associated with (a), (b), (c), and (d). |
| **H3:** | Higher tobacco communication evidence-based practice implementation will be associated with (a), (b), (c), and (d). |

## METHODS

This study uses baseline and follow-up data from a three-arm randomized controlled trial (RCT) testing an intervention to increase implementation of evidence-based health promotion practices at small low-wage worksites.[20] The RCT was conducted in King

County, Washington. Worksites included in the trial employed between 20 and 200 employees and were classified as one of six industries with mean annual wages less than $40,000 in 2010: accommodation and food services; arts, entertainment, and recreation; educational services; health care and social assistance; other services except public administration; and retail trade. (Note: Three exceptions were made for companies close to the 20–200 employee inclusion criteria; these companies employed between 206–235 employees). Worksites were recruited from a purchased list of companies and through an existing partnership network. The University of Washington Institutional Review Board approved all study protocols.

Briefly, the two intervention groups (HealthLinks and HealthLinks+) were assessed on their current implementation of evidence-based practices at baseline. Worksites then received a tailored report with recommendations for practice improvement, a toolkit to help them through the implementation process, and support from a workplace health interventionist. The HealthLinks+ group also received recommendations and support for forming a worksite wellness committee. The delayed control group was eligible to receive the intervention after providing two-year follow-up data. For a more detailed description of the trial and study methods, refer to Hannon et al.[20]

## Data Collection and Measures

Trial data were collected between 2014 and 2017 from employers and employees at baseline, 15 months, and 24 months. In the trial, the period from baseline to 15 months represented the ‘active’ intervention phase, while the period between 15 months to 24 months represented the ‘maintenance’ phase of the intervention. For the current study, the independent variables are worksite implementation of tobacco policy, program, and communication evidence-based practices. The dependent variables are smoking status, quit attempt, SLT use, and perceived worksite support for cessation. We describe these and other measures relevant to the study below.

**Employer Survey—**We administered the employer surveys either in-person or by telephone; the respondent was a primary contact from each worksite. At 15 month and 24 month data collection, we offered a $20 incentive to respondents who completed the survey. To assess worksite implementation of tobacco evidence-based practices, employers responded to 16 questions about the three practice types: policy (five items), program (five items), and communication (six items). For policy, employers provided information about their current tobacco policy and enforcement rules. An example policy item: “Does [your company] have any written policy restricting employee tobacco use?”

For program, employers indicated whether their company provided a cessation program, and if so, were asked additional questions to elicit details about the program. An example program item: “Does [your company] provide an employee telephone tobacco cessation counseling program, or quitline? This does not include state-sponsored or other free quitline programs.” For communication, we asked employers about two practices: promotion of quitline and promotion of other tobacco cessation resources. An example communication item: “About how many times per year do you promote the quitline?”

We combined items using a weighted algorithm to create scores for each practice type. Scores ranged from 0–1, with higher scores indicating greater evidence-based practice implementation. We calculated scores for quitline and other tobacco cessation communication practices separately, and then averaged the two together to create a combined communication score. For descriptive purposes and to adjust for characteristics associated with employee tobacco outcomes, we also examined the following variables: annual turnover rate, company size (a continuous measure dichotomized into <50 employees vs. 50+ employees), percentage of full-time employees, trial arm (HealthLinks; HealthLinks +; delayed control), and whether the worksite offered health insurance (yes; no). We also included a variable for company industry, which was collapsed and recoded due to small cell sizes (health care & social assistance/education services; other).

**Employee Survey—**We offered the survey to all employees at each worksite who were eligible and interested in completing the survey. To be eligible, employees had to be able to read at least one of the four survey languages and 21 years of age or older. We worked with employers to identify the best date and time to administer the survey at the worksite. Research staff provided employees with survey packets containing a pencil-and-paper version of the survey, which they completed on their own. We did not collect personal identifiers (the survey was completely anonymous), thus were unable to determine if there were employees who completed surveys over all three time points. Due to high turnover and the fact that not all employees at each worksite elected to complete the survey, we believe only a small proportion of individuals completed surveys at each time point. We offered a $5 incentive to employees who completed the survey.

To assess smoking status, employees indicated whether they had smoked at least 100 cigarettes in their lifetime and whether they currently smoked cigarettes every day, some days, or not at all. Based on responses to these questions, we classified employees as being a smoker or non-smoker. To assess attempts to quit smoking, employees indicated whether they had stopped smoking for one day or longer during the past six months because they were trying to quit (yes; no). For SLT use, employees indicated whether they currently used chewing tobacco, snuff, or Snus. If they reported use of these products every day or some days, we classified the employee as being a SLT user.

To measure perceptions of worksite support for cessation, we asked employees to indicate the extent to which they felt their worksite supported them in trying to quit tobacco. Response options for this item ranged from strongly disagree (1) to strongly agree (5). Due to small cell sizes, this variable was dichotomized (strongly agree or agree; neutral, disagree, or strongly disagree). We included the following variables for descriptive purposes and as covariates in analysis: age (in years), gender (male; female), education (high school graduate or less; some college or more), ethnicity (Hispanic or Latino; non-Hispanic or Latino), race (white; black or African American; Asian; multiracial; other), and annual household income (less than $25,000; $25,000-$49,999; $50,000-$74,000; $75,000 or more).

### Data Analysis

We conducted data analysis in Stata 15.1.[21] We ran baseline descriptive statistics on all study variables. We calculated frequencies and percentages for categorical variables, and means and standard deviations for continuous variables. To account for correlations within worksites, we used generalized estimating equations (GEE) with an exchangeable correlation structure. (Note: The GEE models for the quit attempt tobacco outcome failed to converge when we specified an exchangeable correlation structure. For these models, we used an independent correlation structure. In all cases, we produced robust standard errors to ensure proper inference). We restricted the analysis for quit attempt to current smokers and the worksite support for cessation analysis to tobacco users (current smokers and SLT users). We adjusted all multivariable models for variables hypothesized or known to be associated with tobacco use: trial arm, company size, company industry, age, gender, education, ethnicity, race, and annual household income. Given low variability in health insurance (61 out of the 63 worksites included in this study offered insurance), this variable was excluded from multivariable analysis. While 78 worksites enrolled in the RCT, we limited our analysis to the 63 worksites with complete data for both employers and employees at all three time points.

## RESULTS

Table 1 describes the baseline characteristics for worksites and employees. More than half of the worksites were in healthcare & social assistance/educational services industries, and almost all worksites offered health insurance. Most employees were female, non-Hispanic or Latino, white, and had at least some college education. The mean age of employees was 40 years, and about a third of employees reported an annual household income of $75,000 or more. The median household income was $50,000-$74,000 (data not shown), which is lower than King County’s median household income of $78,800 in 2016.

Table 2 describes the change in worksite tobacco evidence-based practice implementation across the three time points (baseline, 15 months, and 24 months). From baseline to 15 months, mean implementation scores increased for all three practices (policy, program, and communication). Program evidence-based practice implementation showed the largest increase, from 0.39 (SD=0.45) to 0.61 (SD=0.46), a 0.22 absolute difference. We also observed increases, from 15 months to 24 months, in implementation of evidence-based policies and programs, although these increases were smaller than we observed from baseline to 15 months. Communication evidence-based practice implementation decreased slightly during this time, from 0.13 to 0.11. Change in implementation over time was significant for all practices ($p<0.001$). Tobacco policy and program scores increased from baseline in all three arms, while tobacco communication scores only increased in the two intervention arms (data not shown).

Table 3 describes the change in employee tobacco outcomes across the three time points. At baseline, approximately 12% (n=315) of employees were current smokers, and about half of these smokers had attempted to quit smoking within the past six months. The percentage of SLT users was smaller, around 2% (n=47). Only a third of current tobacco users (n=97)

strongly agreed or agreed that their worksite supported them in trying to quit using tobacco. For all four outcomes, there were no significant changes over time.

Table 4 describes the results from the multivariable GEE analyses. In support of H3(d), greater tobacco communication evidence-based practice implementation was associated with an increased odds of strongly agreeing or agreeing that their worksite provides support for cessation (OR=3.15; 95% CI: 1.14, 8.71; $p$=0.027). Communication evidence-based practice implementation was not significantly associated with smoking status, SLT use, or quit attempts, therefore H3(a), H3(b), and H3(c) were not supported.

Tobacco policy evidence-based practice implementation was not significantly associated with smoking status, quit attempt, or perceived worksite support for cessation, therefore we did not find support for H1(a), H1(c), and H1(d). Counter to H1(b), an increase in policy implementation was associated with an increased odds of being a current SLT user (OR=3.19; 95% CI: 1.12, 9.13, $p$=0.031). Similarly, and counter to H2(b), an increase in program implementation was associated with a nearly two-fold increase in the odds of being a current SLT user (OR=1.84; 95% CI: 1.10, 3.07; $p$=0.019). Program evidence-based practice implementation was not significantly associated with any other tobacco outcome, therefore we did not find support for H2.

## DISCUSSION

Greater tobacco communication implementation was associated with better perceived worksite support for cessation. However, in contrast to previous studies,[23–25] communication practice implementation was not associated with tobacco-related behavior. While implementation significantly increased from baseline to 15 months, communication scores remained fairly low across all three time points. Stronger implementation of these practices may therefore be needed to change behavior. More frequent promotion of tobacco cessation resources and use of multiple promotional methods (e.g., posters, newsletters, websites) are two examples of increased implementation.

Policy and program evidence-based practice implementation were associated with increased odds of being an SLT user, contrary to our hypotheses and previous studies.[17–19,26] It is possible that employees switched from cigarettes to SLT following greater practice implementation, although most studies have not found evidence to suggest that this switch in tobacco use behavior widely occurs.[17–19,27,28] A more probable explanation is that our findings are due to random variability. The sample size for current SLT users across the three time points was small (range: 47 to 59), and only three worksites had five or more SLT users at any given time. Since the data are cross-sectional and not linked across time, changes in the workforce composition could have also contributed to our findings. Future research efforts should seek to examine these relationships longitudinally and among a larger sample of SLT users.

Despite the fact that tobacco program evidence-based practices were not promoted in the RCT intervention, implementation of this practice increased significantly over time across both intervention and control groups. One possible reason for this increase is the enactment

of new Affordable Care Act (ACA) requirements, which coincided with the timing of data collection for the trial. Specifically, employers with 50 or more full-time employees were required to begin offering health insurance coverage that includes evidence-based preventive services such as tobacco cessation treatment.[29,30] The largest increase in implementation occurred between baseline and 15 months, when employer requirements for several worksites went into effect. At 15 months, all employers who offered a tobacco program indicated that their program was provided by an insurer. These points provide evidence in favor of the ACA driving increases in tobacco program evidence-based practice implementation.

However, program implementation was not significantly associated with positive changes in any of the tobacco outcomes we observed. Given the low communication implementation scores observed across all three time points, it is possible that some employees lacked knowledge and awareness of program changes. As noted by McAfee et al., "The Affordable Care Act has the potential to dramatically increase coverage of evidence-based cessation treatments and make these treatments available to millions of Americans. However, the potential benefits of this Act will only be realized if both smokers and physicians are aware of the opportunities it affords."[31] Employers must therefore promote awareness of cessation programs to ensure employees know what opportunities are available to them to help them quit.

There are several limitations to this study. Of the six industries eligible to participate in the trial, some were over-represented and others were under-represented, which could reduce generalizability of our findings. As mentioned earlier, we did not link employee data across the three time points, which limited our ability to assess change in behavior over time within individuals. We did not collect data on electronic cigarette (e-cigarette) use, a behavior that has attracted greater attention in recent years due to its potential for harm.[32] This study also has several strengths, among which include a strong research design, large sample size, and use of data from multiple time points that enabled us to assess trends in worksite tobacco control practices over time.

## CONCLUSIONS

This study highlights the potential benefit of increasing tobacco communication evidence-based practice implementation to increase perceptions of cessation support. Communication practices include promoting evidence-based interventions (e.g., quitline) and should be considered a complement to other tobacco control initiatives to improve employee health. This study also highlights the potential impact that federal laws such as the ACA may have made on tobacco program availability at small low-wage worksites. However, additional efforts may be needed to change employee tobacco use behavior, including stronger implementation of evidence-based practices and increased awareness of practice changes among employees.

Future research should explore the relationship between tobacco-free practice implementation and SLT use among a larger sample of users. Qualitative research could provide a better understanding of how SLT use may change with increased practice

implementation. Studies that assess the impact of the ACA on tobacco control at small low-wage worksites would provide clearer information on employee awareness and use of these programs, and could help to inform intervention efforts in tobacco control. The current study expands our knowledge of how tobacco evidence-based practice implementation can influence employee tobacco outcomes, and contributes to our understanding of how to reduce tobacco use within small low-wage worksites to improve employee health.

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**Table 1.**

Baseline descriptive statistics

| Variable | n | % | Mean | SD |
|---|---|---|---|---|
| **Worksite (n=63)** | | | | |
| Study arm | | | | |
| HealthLinks | 22 | 34.92% | — | — |
| HealthLinks+ | 21 | 33.33% | — | — |
| Delayed control | 20 | 31.75% | — | — |
| Company size | | | | |
| <50 employees | 24 | 38.10% | — | — |
| 50+ employees | 39 | 61.90% | — | — |
| Company industry | | | | |
| Healthcare & social assistance/educational services | 37 | 58.73% | — | — |
| Other | 26 | 41.27% | — | — |
| Annual turnover rate | — | — | 17.90 | 15.95 |
| Percent full-time employees | — | — | 75.13 | 23.19 |
| Offers health insurance | 61 | 96.83% | — | — |
| **Employee (n=2,679)** | | | | |
| Age (years) | — | — | 40.44 | 12.84 |
| Female (vs. male) | 1,789 | 67.92% | — | — |
| Some college or more (vs. high school graduate or less) | 2,284 | 86.94% | — | — |
| Hispanic or Latino | 258 | 10.20% | — | — |
| Race | | | | |
| White | 1,564 | 64.02% | — | — |
| Black or African American | 194 | 7.94% | — | — |
| Asian | 412 | 16.86% | — | — |
| Multiracial | 127 | 5.20% | — | — |
| Other | 146 | 5.98% | — | — |
| Annual household income | | | | |
| Less than $25,000 | 429 | 16.82% | — | — |
| $25,000–$49,999 | 780 | 30.58% | — | — |
| $50,000–$74,999 | 452 | 17.72% | — | — |
| $75,000 or more | 890 | 34.89% | — | — |

SD = Standard deviation.

**Table 2.**

Change in worksite tobacco evidence-based practice implementation over time (n=63)

| | Baseline | | 15 months | | 24 months | | |
|---|---|---|---|---|---|---|---|
| **Tobacco practice** | **Mean (SD)** | | | | | | ***P*-values** |
| Policy | 0.69 | (0.24) | 0.80 | (0.21) | 0.82 | (0.21) | <0.001*** |
| Program | 0.39 | (0.45) | 0.61 | (0.46) | 0.64 | (0.44) | <0.001*** |
| Communication | 0.04 | (0.11) | 0.13 | (0.22) | 0.11 | (0.21) | <0.001*** |

SD = Standard deviation.

We used generalized estimating equations (GEE) to calculate *P*-values.

* $p<0.05$.

*** $p<0.01$.

*** $p<0.001$.

**Table 3.**

Change in employee tobacco outcomes over time

| | Baseline n=2,679 | | 15 months n=2,613 | | 24 months n=2,328 | | |
|---|---|---|---|---|---|---|---|
| **Tobacco outcome** | n (%) | | | | | | ***P*-values** |
| Smoking status | | | | | | | |
| Current smoker | 315 | (11.98%) | 273 | (10.68%) | 250 | (10.92%) | 0.286 |
| Non-smoker | 2,314 | (88.02%) | 2,284 | (89.32%) | 2,040 | (89.08%) | |
| Made quit attempt in past six months[1] | | | | | | | |
| Yes | 176 | (55.87%) | 145 | (53.31%) | 142 | (57.03%) | 0.678 |
| No | 139 | (44.13%) | 127 | (46.69%) | 107 | (42.97%) | |
| SLT user | | | | | | | |
| Yes | 47 | (1.81%) | 59 | (2.33%) | 44 | (1.95%) | 0.392 |
| No | 2,548 | (98.19%) | 2,469 | (97.67%) | 2,216 | (98.05%) | |
| “My worksite supports me in trying to quit using tobacco.” | | | | | | | |
| Strongly agree or agree | 97 | (32.55%) | 102 | (38.35%) | 86 | (35.54%) | 0.355 |
| Neutral, disagree, strongly disagree | 201 | (67.45%) | 164 | (61.65%) | 156 | (64.46%) | |

[1] Reported for current smokers only.

We used chi-square tests to calculate *P*-values.

* $p<0.05$.

*** $p<0.01$.

*** $p<0.001$.

## Table 4.

Multivariable analysis: Worksite tobacco evidence-based practice implementation

| | Dependent variable | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Smoking status n=6,333 | | SLT use n=6,257 | | Quit attempt n=721 | | Cessation support n=689 | |
| **Best practice** | **OR** | **95% CI** | **OR** | **95% CI** | **OR** | **95% CI** | **OR** | **95% CI** |
| Policy | 0.79 | 0.41, 1.52 | **3.19** | 1.12, 9.13 | 1.60 | 0.74, 3.48 | 2.72 | 0.92, 8.03 |
| Program | 0.76 | 0.57, 1.01 | **1.84** | 1.10, 3.07 | 1.13 | 0.84, 1.52 | 1.41 | 0.90, 2.21 |
| Communication | 0.87 | 0.48, 1.55 | 1.59 | 0.87, 2.88 | 1.49 | 0.90, 2.45 | **3.15** | 1.14, 8.71 |

Table contains the results from 12 regression models (four models for each of the three evidence-based practices). All models adjusted for intervention arm, company size, company industry, age, gender, education, ethnicity, race, and annual household income.

Significant coefficients ($p<0.05$) are highlighted in bold.

SLT = Smokeless tobacco; OR = Odds ratio; CI = Confidence interval.