

Worksite-Based Incentives and Competitions to Reduce Tobacco Use

A Systematic Review

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Abstract: The *Guide to Community Preventive Service (Community Guide)* methods for systematic reviews were used to evaluate the evidence of effectiveness of worksite-based incentives and competitions to reduce tobacco use among workers. These interventions offer a reward to individuals or to teams of individuals on the basis of participation or success in a specified smoking behavior change (such as abstaining from tobacco use for a period of time). The review team identified a total of 26 published studies, 14 of which met study design and quality of execution criteria for inclusion in the final assessment. Only one study, which did not qualify for review, evaluated the use of incentives when implemented alone. All of the 14 qualifying studies evaluated incentives and competitions when implemented in combination with a variety of additional interventions, such as client education, smoking cessation groups, and telephone cessation support. Of the qualifying studies, 13 evaluated differences in tobacco-use cessation among intervention participants, with a median follow-up period of 12 months. The median change in self-reported tobacco-use cessation was an increase of 4.4 percentage points (a median relative percentage improvement of 67%). The present evidence is insufficient to determine the effectiveness of incentives or competitions, when implemented alone, to reduce tobacco use. However, the qualifying studies provide strong evidence, according to *Community Guide* rules, that worksite-based incentives and competitions in combination with additional interventions are effective in increasing the number of workers who quit using tobacco. In addition, these multicomponent interventions have the potential to generate positive economic returns over investment when the averted costs of tobacco-associated illnesses are considered. A concurrent systematic review identified four studies with economic evidence. Two of these studies provided evidence of net cost savings to employers when program costs are adjusted for averted healthcare expenses and productivity losses, based on referenced secondary estimates.

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Introduction

Tobacco use remains the leading preventable cause of death and illness in the U.S.¹ Helping tobacco users to quit is one important goal of a comprehensive prevention effort, along with preventing initiation and exposure to secondhand tobacco smoke, to reduce morbidity and mortality associated with tobacco use.² Approximately

70% of tobacco users want to quit,¹ and efforts to quit are frequent, even if frequently unsuccessful. Of the 36.3 million adults who remained current, daily smokers in the U.S. in 2006, 19.9 million (44.2%) had stopped smoking for at least 1 day in the previous year because they were trying to quit.³ In clinical settings, a number of evidence-based interventions and therapies have been demonstrated to motivate and support tobacco-using patients in their efforts to quit.⁴ Interventions designed to motivate and assist the cessation efforts of tobacco users are also important options for health promotion efforts in most community settings, including worksites.

Because employee populations use tobacco products in roughly the same proportions as the adult population as a whole and because many adults spend the majority of

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their day in a workplace environment, worksites are viable places to conduct health promotion activities. As noted by others,^{5–8} the worksite provides a number of advantages as a setting for health promotion interventions, including (1) accessibility to a large and rather stable population, which provides the potential for achieving intervention exposure; (2) the potential for adequate or enhanced promotion, recruitment, and participation in comparison to non-worksite environments; and (3) the potential for reinforcing social support networks and peer influences among co-workers.

The negative health effects and associated costs of tobacco use by employees are substantial, including both the direct costs (such as healthcare costs) as well as indirect costs (including lost productivity, absenteeism, and the recruitment and retraining of replacement workers).⁹ The health benefits of tobacco-use cessation include a rapid reduction in the additional risks for cardiovascular disease and a more gradual reduction in the additional risks for a variety of cancers.¹⁰ When the onset of disease and premature death can be prevented, it is generally accepted that some of the costs associated with treatment of the diseases can also be prevented or at least substantially reduced.⁵

Incentives and competitions to reduce tobacco use represent one intervention option for consideration by worksite health promotion programs. Alone or as part of a coordinated program, incentives and competitions can contribute to cessation efforts among workers by (1) increasing or improving motivations to quit; (2) increasing or improving action to quit; and (3) increasing or improving maintenance of an effort to quit. Incentives and competitions may be effective in increasing one or more of these pathways for an individual tobacco user. In addition, participation might prompt the individual to make use of new or existing cessation support resources offered within the workplace, through the workplace (such as a healthcare cessation benefit), or in the community. For a designated population (at a worksite or within a workforce), effectiveness of incentives or competitions within a cessation program would be demonstrated by a reduction in the number of baseline smokers who continue to use tobacco (i.e., fewer tobacco product users). The objective of this set of reviews is to examine the evidence on effectiveness of incentives and competitions, alone or when combined with additional interventions, in increasing the cessation of tobacco use among workers.

Guide to Community Preventive Services

The systematic reviews in this report present the findings of the independent, nonfederal Task Force on Community Preventive Services (Task Force). The Task Force is

developing the *Guide to Community Preventive Services (Community Guide)* with the support of the USDHHS in collaboration with public and private partners. The CDC provides staff support to the Task Force for development of the *Community Guide*. The book, *The Guide to Community Preventive Services. What Works to Promote Health?*¹¹ (also available at www.thecommunityguide.org) presents background and the methods used in developing the *Community Guide*.

Healthy People 2010 Goals and Objectives

The interventions reviewed here may be useful in reaching several objectives specified in *Healthy People 2010*.¹² These include objectives to:

- 27-1 Reduce cigarette smoking among adults (aged ≥ 18 years) from 24% (1998, age adjusted to Year 2000 standard population) to 12%
- 27-5 Increase the percentage of adult smokers (aged ≥ 18 years) stopping smoking for 1 day or longer because they were trying to quit from 43% (1998, age adjusted to Year 2000 standard population) to 75%

Methods

This review was conducted according to the methods developed for the *Community Guide*, which have been described in detail elsewhere.^{13,14} Inclusion criteria for this review were: (1) primary research published in a peer-reviewed journal; (2) published in English in the period 1980 to February 2009; (3) met the minimum research quality criteria for study design and execution;¹³ and (4) evaluated the effects of worksite-based incentives and competitions, alone or in combination with other interventions, on tobacco-use outcomes of interest to this review.

Conceptual Approach

Figure 1 shows the conceptual approach (analytic framework) that guided the review process for the selected interventions. Incentives and competitions, which provide a team or individual reward, are usually coordinated with additional interventions to increase or improve individual efforts to abstain from tobacco use. Incentives and competitions may reduce the number of tobacco product users by (1) increasing the number of tobacco users who participate in an effective cessation program; (2) increasing the number of tobacco product users who initiate a quit attempt; or (3) increasing the number of tobacco users who maintain a quit effort. Health promotion techniques often incorporate incentives to stimulate individuals who otherwise would not consider doing so to participate in a positive behavior change, to promote the initial adoption of the change, or to reinforce the sustainability of the positive behavior change.¹⁵ Researchers have previously noted that incorporating incentives in worksite health promotion programs

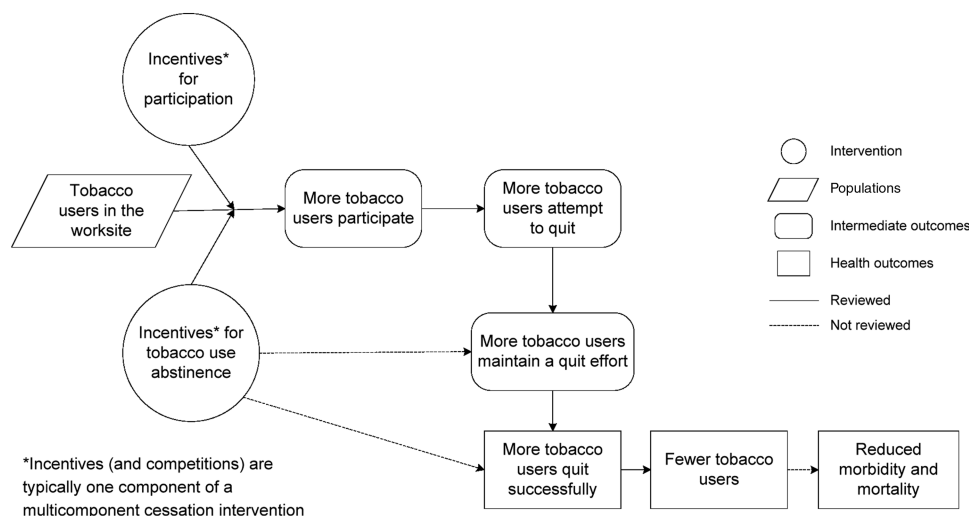


Figure 1. Analytic framework indicating the hypothesized effect of incentives and competitions on reducing tobacco use among workers. These interventions are postulated to work through one or more of the following pathways: (1) increasing the number of tobacco users who participate in cessation efforts; (2) increasing the number of tobacco users who initiate an attempt to quit; and (3) increasing the number of tobacco users who sustain a successful quit effort. Workers who quit using tobacco will contribute to reductions in tobacco-related morbidity and mortality.

can increase program participation, health behavior change, program visibility, and employee productivity while decreasing health risk factors and healthcare costs.¹⁵

Search Strategy

The articles to be reviewed were obtained from systematic searches of multiple databases, reviews of bibliographic reference lists, and consultations with experts in the field. The following databases were searched for the period between January 1980 and February 2009: MEDLINE, PsycINFO, EMBASE, and the database of the CDC's Office on Smoking and Health. The keywords used for the search were health behavior, health education, primary prevention, work, workplace, occupational health, smoke, tobacco, air pollution, indoor, tobacco smoke pollution, smoking cessation, insurance coverage, nicotine dependence treatment, motivation, incentives, compete, competition, and contest. Other relevant sources were identified from the bibliographies of pertinent articles.

Evaluating and Summarizing the Studies

Each study that met the inclusion criteria was evaluated for the suitability of the study design and study execution using the standardized *Community Guide* abstraction form.¹⁴ The suitability of each study design was rated as greatest, moderate, or least, depending on the degree to which the design protected against threats to validity. The execution of each study was rated as good, fair, or limited based on several factors, predetermined by the systematic review team (the team), that could potentially limit a study's utility for assess-

ing effectiveness. All studies were reviewed by at least two trained researchers. Any disagreements about quality of study design and execution were discussed and resolved by team consensus. The team decided to include only studies rated greatest or moderate in design suitability and good or fair in execution. For these qualifying studies, the effect sizes were calculated for the study outcomes wherever sufficient information was available to do so.

Outcomes Evaluated

The primary outcomes examined in this review were: (1) self-reported abstinence (and duration of abstinence) from tobacco use; (2) self-reported ab-

stinence from tobacco use, with biochemical verification; (3) self-reported prevalence of tobacco use within the worksite population or study sample; and (4) calculations of change in the total number of tobacco users. The team also collected information on worksite participation rates.

Calculation of Effect Sizes

The qualifying studies in this review all included a concurrent comparison group not exposed or less exposed to the intervention. If the results were not reported in absolute or relative percentage change, the review team calculated them as:

absolute percentage change (difference is described as "percentage point change"),

$$(I_{\text{post}} - I_{\text{pre}}) - (C_{\text{post}} - C_{\text{pre}});$$

and relative percentage change (result is described as "percentage change")

$$\left(\left[\frac{I_{\text{post}}/I_{\text{pre}}}{C_{\text{post}}/C_{\text{pre}}} \right] - 1 \right) \times 100\%.$$

For all calculations, I=intervention group; C=comparison group; and "pre" and "post" subscripts indicate measurements taken before and after intervention implementation, respectively. The post measurements used were the last measurements after the intervention. In addition to the calculation of differences for each study, an overall median study difference and interquartile interval were calculated for both absolute and relative percentage change.

Methods for Conducting Economic Evaluations

Economic evaluations are conducted only when the effectiveness of the interventions has been established. Methods used in assessing economic evaluations are described elsewhere.¹⁶ For comparability, all costs and benefits are reported in 2008 U.S. dollars using the Consumer Price Index (available at www.bls.gov). World Bank development indicators on purchasing power parity rates were used to convert foreign currency to U.S. dollars. Referenced estimates on the cost-of-illness-averted per smoker were used in two studies to calculate cost-effectiveness ratios by dividing the net cost (intervention cost minus cost of illness averted) by the number of quitters following the intervention, resulting in the net cost per quitter.^{17,18} In accordance with the accepted practice found in the literature,¹⁹ actual numeric values of negative cost-effectiveness ratios are not reported.

The search for economic evidence for interventions involving incentives and competitions for worksite smoking cessation was conducted using Medical Subject Headings (MeSH) terms for program effectiveness combined with economic key terms such as cost analysis, cost-effectiveness analysis, cost-benefit analysis, and cost-utility analysis. Relevant databases that were used in the search included the following: EconLit, MEDLINE, EMBASE, CDC's Office on Smoking and Health database, PsycINFO, and the Social Science Citation Index. In addition, references suggested by national experts from the consultation team were also considered. The team's search was open to all available peer reviewed economic studies published in English in the period January 1980–February 2009, and located in countries designated by the World Bank as having a high-income economy.^{a,20}

Results

Review of Evidence: Worksite-Based Incentives and Competitions When Implemented Alone to Reduce Tobacco Use

Worksite-based incentives and competitions to reduce tobacco use among workers offer rewards to individual workers and to teams as a motivation to participate in a cessation program or effort. Rewards can be provided for participation, for success in achieving a specified behavior change

(such as abstaining from tobacco use for a period of time), or for both. In this review, the types of rewards evaluated included guaranteed financial payments, lottery chances for monetary or other prizes, and self-imposed payroll withholdings.

Effectiveness. The team identified one study²¹ evaluating the impact of a worksite-based incentive program when implemented alone to reduce tobacco use among workers. This study, which did not qualify for inclusion in this review, was evaluated as fair in quality of execution and with a least suitable (single group, before-and-after) design (www.thecommunityguide.org/tobacco/worksite/incentives.html). The intervention consisted of a worksite-based tobacco cessation contest with a precontest promotion, an enrollment period, biochemical verification of self-reported abstinence at each assessment, and three lottery drawings over a 12-month intervention period (at 1, 6, and 12 months). The lottery-chance prize at 12 months was worth 15,000 Swedish crowns (US\$2355). There was no follow-up after the end of the intervention. The lottery-qualifying assessments were used as verified cessation among participants. Over the 12-month intervention period, continuous abstinence was determined for 24 of 73 (32.8%) of the baseline participants. Verified cessation rates were, respectively, 49% and 36% at 6 and 12 months into the contest period. The authors reported that 10% of tobacco-using workers participated in the intervention.

Conclusion

According to *Community Guide* rules,¹³ there is insufficient evidence to determine whether or not worksite-based incentives and competitions alone are effective in reducing tobacco use among workers. Evidence was considered insufficient because no studies qualified for consideration in this review, and only one study of least suitable design was identified.

Review of Evidence: Worksite-Based Incentives and Competitions When Combined with Additional Interventions to Reduce Tobacco Use Among Workers

Worksite-based incentives and competitions to reduce tobacco use among workers offer rewards to individuals or to teams of individuals based on participation in a cessation effort or success in behavior change (such as abstaining from tobacco use for a period of time). In this review, incentives and competitions were offered in conjunction with additional interventions to support an individual's efforts to quit using tobacco products. The rewards offered in the studies identified in this review

^aWorld Bank High-Income Economies (as of May 5, 2009): Andorra, Antigua and Barbuda, Aruba, Australia, Austria, The Bahamas, Bahrain, Barbados, Belgium, Bermuda, Brunei Darussalam, Canada, Cayman Islands, Channel Islands, Cyprus, Czech Republic, Denmark, Equatorial Guinea, Estonia, Faeroe Islands, Finland, France, French Polynesia, Germany, Greece, Greenland, Guam, Hong Kong (China), Hungary, Iceland, Ireland, Isle of Man, Israel, Italy, Japan, Republic of Korea, Kuwait, Liechtenstein, Luxembourg, Macao (China), Malta, Monaco, Netherlands, Netherlands Antilles, New Caledonia, New Zealand, Northern Mariana Islands, Norway, Oman, Portugal, Puerto Rico, Qatar, San Marino, Saudi Arabia, Singapore, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Trinidad and Tobago, United Arab Emirates, United Kingdom, U. S., Virgin Islands (U.S.).

included guaranteed financial rewards, lottery chances for financial rewards, and self-imposed payroll withholdings. Additional interventions used in conjunction with incentives and competitions to promote smoking cessation among participants included smoking cessation groups, self-help cessation materials, telephone cessation support, workplace smoke-free policies, and social support networks.

Effectiveness. The team identified a total of 26 studies^{22–47} evaluating worksite-based incentives and competitions when combined with additional interventions to reduce tobacco use among workers. Nine studies with limited quality of execution^{22,24,32,35,38,40,42–44} and three studies with least suitable study designs^{27,28,33} were excluded from the final body of evidence. Seven papers^{17,18,34,48–51} provided additional information from studies already included in the review. Details of the 14 qualifying studies^{23,25,26,29–31,34,36,37,39,41,45–47} (with 17 study arms) are available at www.thecommunityguide.org/tobacco/worksite/index.html.

Study design and implementation characteristics. Of those qualifying for the team's final assessment, 13 studies^{23,25,26,29–31,34,35,37,41,45–47} evaluated the effect of these interventions compared with a concurrent comparison group not exposed or less exposed to the intervention, and one study³⁹ compared outcomes among program participants and nonparticipants in a subset of employees over a 5-year study period. One study²³ examined two intervention approaches, in which all of the participants in the intervention and comparison groups received the same incentive (entrance in a lottery as reward for a 10-day abstinence). In the remaining 12 studies, the comparison group individuals were not offered a reward for either participation or behavior change.

The 14 qualifying studies implemented the rewards in several ways. One study³⁶ provided rewards through team competitions, and four studies^{26,30,37,41} provided rewards to both individual participants and to competing teams of participants. Incentives were offered to individual participants in the remaining nine studies.^{23,25,29,31,34,39,45–47}

The qualifying studies evaluated a variety of different rewards as a tool to promote participation^{29,30,46} and change in tobacco-use behavior (such as abstinence).^{23,25,26,29–31,34,36,37,39,41,45–47} Several studies provided additional rewards, such as incentives for completing follow-up^{23,31,46} or lottery-chance rewards for people providing support to smokers attempting to quit.^{30,39,41} The most common reward in the qualifying studies was entrance into a lottery,^{23,25,26,29,30,37,39,41,45} followed by financial reward.^{29–31,36,37,46,47} In one study, participants selected an amount to be withheld from their own pay-

check, as an incentive to meet their personal tobacco-use cessation goals.³⁴ Individual rewards ranged in magnitude from \$10 for participation in one study²⁹ to a maximum of more than \$750 for participation and extended tobacco-use abstinence in another study.⁴⁶ Lottery-chance rewards ranged in size from \$40²⁶ to \$500,²⁹ and one study³⁷ offered entrance in a \$2500 lottery as part of the team reward.

The qualifying studies evaluated the use of rewards as part of a multicomponent worksite-based tobacco cessation program. In eight studies (ten study arms),^{29–31,34,36,37,39,41} rewards were offered in conjunction with worksite-based tobacco cessation support groups with or without additional interventions. In 12 studies (13 study arms),^{23,26,29–31,34,37,39,41,45–47} rewards were coordinated with client education, such as lectures, instructional classes, and self-help cessation guides, with or without additional interventions. Other interventions evaluated include buddy participation (social support networks),^{30,39,47} telephone cessation support,^{23,29,37} smoke-free worksite policies,³⁷ counseling,^{26,45,47} and access to nicotine replacement therapy.^{39,45,46} In two studies, the worksite program was coordinated with a televised news series on smoking cessation.^{31,41} Finally, in five studies (six study arms),^{23,25,30,31,34} devices to measure carbon monoxide in exhaled breath were used for frequent and regular testing of participants for recent tobacco use (smoking).

Outcomes related to self-reported changes in tobacco use. The 14 qualifying studies^{23,25,26,29–31,34,36,37,39,41,45–47} provided 17 study arms and 18 measurements of differences in tobacco use. One study³⁴ evaluated change in tobacco-use prevalence; the remaining 13 studies compared tobacco cessation rates among study participants.

One group-randomized trial³⁴ compared changes in self-reported tobacco-use prevalence among 32 study worksites (400–900 employees each) assigned to a multicomponent smoking cessation effort (personal payroll withholding plus smoking cessation groups, with frequent assessment of smoking status using carbon monoxide measurements) or to a nontreatment comparison group. Self-reported tobacco use was measured using surveys, and results were analyzed using both cohort and cross-sectional survey samples. At the end of 2 years (four intervention cycles), among responding workers in the intervention companies compared to responding workers in the comparison companies, the prevalence of self-reported tobacco use decreased by 2.1 percentage points ($p=0.03$). In the cross-sectional comparison, self-reported tobacco use decreased by 4.0 percentage points ($p=0.058$).

Thirteen studies^{23,25,26,29–31,36,37,39,41,45–47} with 16 study arms evaluated differences in tobacco-use abstinence

among workers (tobacco users at baseline) recruited to participate in the study. Figure 2 presents the results from these study arm comparisons arranged in order of the duration of follow-up (following the end of the intervention). Overall, the median absolute difference in rates of tobacco-use abstinence was an increase of 4.4 percentage points (interquartile interval: 2.7–9.4 percentage points) in favor of participants exposed to incentives or competition. The median abstinence rate observed in the 16 intervention arms was 13.7% (interquartile interval: 8%–20.5%). The median duration of follow-up was 12 months (range from 0–48 months). Two study arm comparisons^{41,45} were based exclusively on self-reported abstinence; the remaining comparisons included biochemical verification of self-reported abstinence. Six of 16 study arm comparisons^{30,37,41,45–47} were reported as significant. The median relative percentage change in tobacco-use abstinence for 15 of the 16 study arm comparisons where data were available was 67% (interquartile interval: 24%–161%).

The team also examined tobacco-use abstinence in the subset of nine studies (11 study arms)^{25,26,29,31,39,41,45–47} with a minimum of 12 months of follow-up. The median difference in tobacco-use cessation was an absolute increase of 3.5 percentage points (interquartile interval: 2.7–5.8 percentage points), and a median relative improvement in cessation of 42% (interquartile interval: 19.5%–98%).

The team stratified results by the number of participants in the intervention arms of the qualifying studies. Most studies counted recruits lost to follow-up as current tobacco users. The median number of recruited tobacco users in the intervention study arms was 227 (range from 29 to 1344 users). In the six studies (seven study arms)^{25,29,31,39,45,46} with sample sizes ≥ 227 recruits, the median absolute difference in tobacco-use cessation was an increase of 2.9 percentage points (interquartile interval: 2.7–5.8 percentage points).

A subset of five studies^{30,31,37,39,41} evaluated a similar combination of interventions including an incentive, a worksite-based tobacco cessation group, and additional

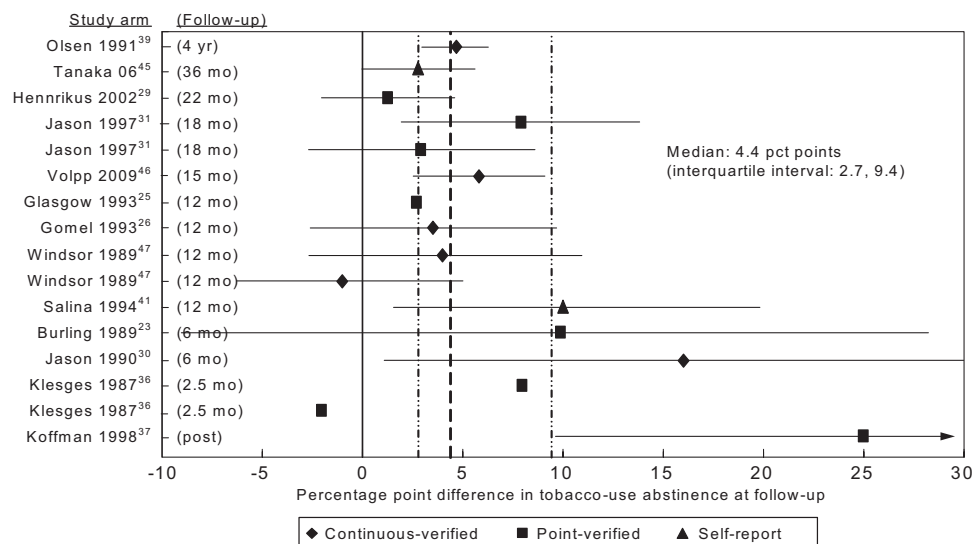


Figure 2. Scatterplot of absolute effect sizes for interventions using incentives to increase abstinence from tobacco use

client educational activities or materials, with or without additional interventions (such as social support, recurrent biochemical verification testing, or access to a telephone cessation support line). In this subset, the median cessation rate was 21%, the median absolute difference in tobacco-use abstinence was an increase of 10 percentage points, and the median relative percentage improvement in cessation was 168% (range of improvement from 62%–300%).

Participation in worksite-based tobacco cessation efforts. Eleven qualifying studies^{25,26,29–31,34,37,39,41,45,46} provided information on participation in one or more activities of the overall cessation program. One additional study²⁷ not eligible for inclusion in the outcome analysis also evaluated differences in participation across study arms. Two studies^{26,37} reported participation rates within the overall study workforce; the remaining ten studies^{25,27,29–31,34,39,41,45,46} examined participation in terms of the proportion of eligible tobacco users recruited. Workforce participation rates were reported as 2.0% in one study³⁷ and 88% in the other study.²⁶ Participation rates among eligible tobacco users in study worksites ranged from 12%^{39,45} to 84%³⁰ with a median participation rate of 28% (interquartile interval: 15%–59%).

Only eight study arms in seven studies^{27,29–31,37,41,46} compared participation rates across intervention and comparison study arms. In one study,³⁷ workforce participation rates were 2.0% of workers in the intervention companies and 1.3% of workers in companies that did not implement an additional tobacco cessation program. In the seven study arms from six studies^{27,29–31,41,46} that evaluated participation among eligible tobacco users, the

median absolute difference in participation was 3.0 percentage points (interquartile interval: –3.0 to +10.5 percentage points). However, participation rates in both the intervention (median: 55%) and comparison (median: 58%) arms were relatively high.

Applicability

The interventions evaluated in this review were conducted in a variety of worksites including manufacturing plants,^{29,31,34,36,37,46} healthcare facilities,^{23,29,31} government offices,^{25,29,34,36} a university,⁴⁷ chemical plants,³⁹ and an ambulance service.²⁶ Most studies were conducted in companies or worksites with more than 100 employees, and in urban or suburban settings. In seven studies,^{29–31,34,36,37,39,41,45–47} authors specifically attempted to recruit a range of different companies and worksites, although stratified results were not reported. Of the 14 qualifying studies,^{23,25,26,29–31,34,36,37,39,41,45–47} all but two^{26,45} were conducted in the U.S.

Other Positive or Negative Effects

The qualifying studies did not describe or evaluate any additional benefits of these interventions. One study described, but did not specifically evaluate the potential for synergy with the implementation of worksite smoke-free policies and worksite cessation programs.³⁷ The difficulties involved in conducting and evaluating smoking cessation contests have been described in the community setting (for example, attracting people who recently quit smoking on their own) and are potentially applicable to the worksite setting.⁵² Almost all of the studies identified in this review included biochemical verification of tobacco-use abstinence as part of the process for determination of lottery entrants and incentive awards. Verification creates an additional burden to conducting these interventions; without the use of these tools to verify self-reported abstinence, however, the potential for deception by contest participants exists.⁷

Economic efficiency. The economics review team identified four qualifying studies^{17,18,42,45} that provided economic evaluations of multicomponent worksite cessation programs including incentives. According to *Community Guide* quality assessment criteria for economic papers, two studies were rated as good^{18,45} and two as satisfactory.^{17,42} Due to the intricacies of intervention designs used in each of the qualifying studies, it might be difficult to precisely realize the economic gains reported. All four studies reported intermediate outcomes in terms of the number of quitters, and all costs and benefits were estimated from the employer perspective.

Costs. Total costs of the multicomponent interventions reported in five arms from four studies were \$2086⁴²;

\$39,800¹⁷; \$9878¹⁸; and \$37,956.¹⁸ Costs varied due to the type and size of the intervention but were based on direct intervention costs only. One study⁴⁵ provided complete details of intervention costs including opportunity costs for providers, participants, and researchers involved in the interventions plus costs of all materials. None of the studies provided information on intervention start-up costs and maintenance expenditures.

Benefits. Three studies in this review presented economic benefits in the form of costs averted. One study¹⁸ assessed benefits of \$454,333 and \$1.5 million for two different intervention groups, based on participants maintaining smoking abstinence for 20 years after their respective incentive interventions. A different study by the same researcher¹⁷ reported a \$2.9 million benefit for an entire group that maintained smoking abstinence for 19 years after receiving an incentive-based intervention. Two studies also approximated employer savings in healthcare expenditures at \$521 per year for each employee who quit smoking⁴² and at \$55,038¹⁷ for members of an intervention group that quit smoking. When providing economic benefits it is necessary to integrate core economic evaluation principles such as stating the perspective, conducting sensitivity analyses, and discounting costs and benefits. Some studies in this review referenced economic information to derive an estimate of the benefits, but they did not report if these techniques were incorporated into either the referenced study or their own analysis.

Economic summary measure. One study⁴⁵ provided a cost-effectiveness (CE) ratio defined as “cost per additional quitter.” This cost, \$596, was described as less expensive than available estimates of “high-intensity” interventions administered by primary care clinicians and cessation specialists and similar to estimates of cost per quitter in companies with smoke-free workplace policies.⁴⁵ For two studies^{17,18} with referenced sources, net cost per quitter CE ratios were calculated from secondary cost-of-illness averted data. These calculated economic summary measures were both negative, meaning the multicomponent interventions were not only cost effective, but also cost saving. One study⁴² found that the intervention would pay for itself in the first year with additional savings generated in later years.

Other caveats. Significant attrition rates, which may also affect costs and benefits, occurred in all the reviewed studies. Although one study⁴⁵ from Japan was published in 2006, the three studies^{17,18,42} conducted in the U.S. were published between 1989 and 1995, which may not reflect present worksite conditions or concerns.

Conclusions from economic evaluation. Costs and benefits were provided in all four studies, and cost-effectiveness ratios in terms of net cost per quitter were derived by *Community Guide* staff for two studies.^{17,18} These cost-effectiveness ratios indicate cost savings for employers that implemented programs combining incentives with additional interventions. One study,⁴² based on a small number of participants, reported that the program would break even the first year and continue to generate additional savings in later years. However, due to the paucity of studies providing primary evidence on costs averted from the intervention, a firm conclusion on cost savings cannot be determined at this time.

Barriers to intervention implementation. The Health Insurance Portability and Accountability Act of 1996 (HIPAA) (www.hhs.gov/ocr/privacy/index.html) includes statements specific to the use of incentives to improve employee health and wellness. The purpose of this law is to improve portability and continuity of health insurance coverage in the group and individual markets; to combat waste, fraud, and abuse in health insurance and health-care delivery; to promote the use of medical savings accounts; to improve access to long-term care services and coverage; to simplify the administration of health insurance; and for other purposes. Applying HIPAA and other laws to the use of economic incentives in the workplace is technical but should inform the implementation of this intervention.

Finally, the logistics of conducting verification of smoking cessation may present additional costs. Company size and resources may also limit the magnitude of the financial rewards offered, although the magnitude of the incentive has not been sufficiently demonstrated as a factor related to either participation or tobacco-use behavior change among workers.

Conclusion

According to *Community Guide* rules,¹³ there is strong evidence that worksite-based incentives and competitions, when combined with additional interventions to support individual cessation efforts, are effective in reducing tobacco use among workers. The qualifying studies included a variety of intervention combinations. For the subset of studies that consisted of multicomponent efforts that combined incentives with worksite-based cessation groups and additional educational activities or materials there is sufficient evidence on effectiveness. The presence of an incentive or competition was not associated with a consistent increase in participation in worksite tobacco programs in the studies considered in this

review; however, participation rates were high in most of the intervention and comparison study arms.

Discussion

The studies included in this review evaluated the impact of incentives and competitions when combined with additional interventions designed to motivate and support cessation efforts by tobacco-using workers. This review included evidence from worksite-based cessation programs only and did not include studies that evaluated the use of these interventions in other settings such as health-care systems (for patients) and communities (such as community-wide smoking cessation contests).

Additional Evidence from Outside Reviews

Other systematic reviews^{6–8,53} provide information on the effectiveness of worksite smoking cessation programs similar to and including the evidence presented here. A recent Cochrane review update by Cahill and Perera⁷ provides a different examination of the evidence on effectiveness of competitions and incentives for smoking cessation. That systematic review included papers through December 2007. The reviewers identified 17 studies meeting the Cochrane inclusion criteria that captured evaluations of incentives and competitions in workplace settings and in healthcare settings when directed at patients. Studies of community-based smoking cessation contests and studies evaluating healthcare workers were removed to companion reviews. The authors selected the most rigorous definition of tobacco-use abstinence in each trial. The authors conducted a meta-analysis on a subset of nine studies based on outcomes of smoking cessation for a minimum of 6 months. In this analysis, none of the included studies demonstrated significantly higher quit rates for the incentives group than for the control group beyond the 6-month assessment. The adjusted OR for smoking cessation of 6 months' duration was 1.44 (95% CI=1.01, 2.01) based on results from eleven study comparisons. The summary effect measurement for 12 months cessation was an adjusted OR of 1.07 (95% CI=0.78, 1.45) based on seven comparisons in five studies. The authors concluded that incentives and competitions did not help smokers to quit in the long-term. However, the authors held open the possibility that these interventions might still be effective by increasing participation in quit attempts, even if cessation rates were not significantly improved.

A second, updated Cochrane review by Cahill and Moher⁶ examined the evidence through April 2008 for a variety of workplace interventions for smoking cessation. Evidence from the 51 studies evaluated in this extensive set of reviews was organized into interventions aimed at

the individual (such as group cessation therapy) and interventions aimed at the workforce population (such as restrictive smoking policies or bans). Analyses were primarily qualitative and compared results from worksite-based studies with results from reviews of these interventions in other settings (especially healthcare settings). Overall, the authors found strong evidence of effectiveness for advice from a health professional, individual and group counseling, and pharmacologic treatment to increase smoking cessation. Only five of the included studies provided an evaluation of incentives, and the authors concluded that there was limited evidence that participation in worksite programs could be increased by competitions and incentives organized by the employer.

Two consecutive reviews, ten years apart, examined the overall evidence on effectiveness of a variety of smoking cessation interventions in the workplace including self-help manuals, physician advice, health education, cessation groups, and incentives and competitions.^{8,53} The 1990 review by Fisher et al.⁵³ included 20 controlled studies published through 1988 with 34 study comparisons. The average duration of follow-up was 12 months. Pooled effect estimates included an overall weighted mean effect size of 0.21 ± 0.07 (OR=1.66 at 12 months) and a weighted average quit rate from all interventions of 13%.

The second review, from 2004, by Smedslund et al.⁸ examined 19 controlled trials with 28 study comparisons published in the period 1989–2001. Pooled effect estimates were generated from study results based on 6-month, 12-month, and >12-month follow-up. Based on 12-month follow-up, the overall OR was 1.56 (95% CI=1.17, 2.07), and the unweighted mean quit rate from all intervention arms was 20.8%. For studies that provided cessation outcomes with >12 months of follow-up, the overall OR was 1.33 (95% CI=0.95, 1.87) and the unweighted mean quit rate was 17.2%.

The team's findings differ only slightly from the conclusions of these systematic reviews. Most of the identified studies evaluated overlapping combinations of interventions to support cessation efforts by workers, and the evidence, in general, was insufficient to identify the independent contribution of specific interventions. The team found evidence on effectiveness of incentives and competitions only when those components were combined with additional interventions such as group cessation and client education. It is possible that incentives and competitions do not add to the impact of the other interventions combined within a worksite-based effort. The team's conclusions reflect the current limitations in distinguishing the independent contributions of individual components within this multicomponent evidence.

As noted above, the recent Cochrane review by Cahill and Perera⁷ of incentives and competitions to reduce tobacco use concluded that the evidence of the impact of these interventions on increasing rates of successful smoking cessation was limited. Differences in the review focus and conduct may explain the differences in conclusions. The review by Cahill and Perera⁷ included studies conducted on patients in a healthcare setting, which was not a setting included in the team's worksite-based review. The team examined impact across the studies with differences in the duration of follow-up but did not attempt to draw conclusions on stratified subsets of the overall evidence. In the present review, studies with a duration of follow-up of ≥ 12 months had only a slightly smaller median difference in cessation, but the difference was more pronounced in the studies included in the Cochrane review.

Research Issues

Incentives and competitions when implemented alone. Only a single study of worksite-based incentives or competitions when implemented alone was identified; thus there was an insufficient number of studies to draw a conclusion on the evidence on effectiveness. Consequently, this intervention approach remains a potential area for future research. An earlier *Community Guide* review of community-based smoking cessation contests^{2,54} also found insufficient evidence to support a conclusion on effectiveness. In the community-based intervention studies, evidence was considered insufficient because most studies focused on contest participants only and did not include either a defined study population of eligible tobacco users or a concurrent comparison group. Worksite-based interventions, in contrast to community-based efforts, provide a study population that may be easier to quantify and define, and should provide an opportunity to evaluate participation and impact among eligible tobacco users. In addition, incentives might be offered in ways other than through tobacco cessation contests (such as rewards for setting and achieving personal health goals) and these intervention options remain an area for further research.

Incentives and competitions when combined with additional interventions. Although the evidence demonstrates that worksite-based smoking cessation interventions, when implemented in combination with incentives and competitions, are effective, the studies evaluated in this review do not provide sufficient evidence to distinguish the independent or synergistic contribution of rewards on participation or tobacco-use behavior change. Future studies, for example, could directly compare short- and long-term cessation rates for tobacco users

recruited to a worksite-based group cessation program based on the provision or absence of an incentive or competition.

Only three studies^{39,45,46} specifically included or evaluated access to nicotine replacement therapies as part of a worksite cessation program. Worksite-based interventions to increase access to nicotine replacement therapies (and other effective pharmacotherapies), as part of a combined cessation program, remain an area for further research.

The team observed, as also described in other reviews,^{6,8} recurring problems in the measurement and reporting of tobacco-use outcomes. Future research needs to address these problems. Analyses that include the entire workforce or an estimate of the proportion of tobacco users from a baseline survey of self-reported smoking status (i.e., those eligible for this intervention) would permit calculations of program participation and estimates of intervention impact (such as a change in workforce tobacco-use prevalence or in the total number of current tobacco users). In several studies, follow-up periods were calculated from the initiation of the intervention and not from the end of the intervention (e.g., from the last round of a smoking cessation contest).

Economic. The included studies provided limited economic information on multicomponent programs including incentives, and no evidence to determine the relative contribution of rewards to the impact of these programs. Furthermore, there were economic benefits not addressed in the research methods, including the averted costs from cigarette smoking–related fires in the workplace, increased worker productivity from not having to take tobacco breaks during working hours, and averted healthcare costs from decreased exposure to environmental tobacco smoke. Two qualifying studies indicated potential cost savings based on referenced estimates of averted healthcare costs and productivity losses outweighing the costs of intervention. Further intervention research using core methodologies for evaluating the economic evidence, and based on actual changes in healthcare costs and productivity are necessary to confirm such claims. In addition, due to established benchmarks for assessing cost effectiveness of an intervention, (e.g., \$50,000 per life-year gained),⁵⁵ future research agendas might consider converting intermediate outcome summary measures (such as the cost per quitter or additional quitter) to final outcome summary measures—the cost per life-year or quality-adjusted life-year gained, to allow for better interpretation of public health economic findings.

Summary

The Task Force on Community Preventive Services has reviewed the evidence on effectiveness of a number of interventions that practitioners can use to achieve the *Healthy People 2010* “Objectives for Tobacco Use.”¹² In this article, the team reported results from a systematic review of worksite-based incentives and competitions to reduce tobacco use. There was insufficient evidence to draw a conclusion regarding the effectiveness of worksite-based incentives and competitions when implemented alone to reduce tobacco use. Evidence was considered insufficient because no studies qualified for review, and only one study of least suitable design was identified. There was strong evidence that worksite-based incentives and competitions, when combined with additional interventions to support individual cessation efforts, are effective in reducing tobacco use among workers. By increasing the number of tobacco users who successfully quit, incentives and competitions can reduce both the short- and long-term morbidity and mortality associated with tobacco use.

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