CHAPTER 15

Incentives in the Modification and Cessation of Cigarette Smoking

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We review research on the effectiveness of incentives in general health promotion, and in interventions for smoking and other drug addictions in particular. Consistent with basic principles of learning and reinforcement, and from a behavioral economic perspective, we find that (1) incentives are effective in encouraging smoking cessation and other health behaviors; (2) incentives are effective while in place but not after they are terminated; and (3) nonsmoking may be encouraged by increasing the availability of reinforcing activities that substitute for the reinforcement from nicotine. Incentives may be especially effective when smoking cessation is a priority for a specific period of time, such as during pregnancy. Incentive programs appear to influence otherwise “hard-to-reach” groups. The impact of incentives is enhanced when implemented in the context of broader programs promoting smoking cessation, and incentives applied to populations may be cost efficient by achieving modest effects for large numbers of individuals. Basic principles of reinforcement and the use of incentives understood within a behavioral economic framework should continue to inform public-health interventions and may lead to new insights into effective approaches for influencing health behavior.

INTRODUCTION

The good news is that the prevalence of smoking among adults has declined from 42% in 1965 to 20.8% in 2008 (Centers for Disease Control [CDC], 2008). Of all adults in this country who have smoked, 49% have quit (CDC, 2002). The bad news is that despite these impressive strides, one-fifth of the adult population continues to smoke, and the percentage of teenagers who smoke was also 20% in 2007 (Centers for Disease Control Office on Smoking and Health, 2007). Thus, this widespread, severe public health problem will persist for at least another generation. Moreover, the prevalence of smoking remains especially high in several groups of special concern: low-income groups, minorities, those with smoking-related disease, and low-income women of childbearing age (Gilpin & Pierce, 2002). The need for focused and vigorous approaches to reducing smoking among these groups remains especially acute.

Early research on the effectiveness of smoking-cessation programs often considered the role of incentives. A review of worksite smoking programs by Orleans and Shipley (1982) included a number of case-study and anecdotal reports of successful incentive programs. They advocated controlled investigations of how incentives might enhance worksite programs. The investigation of incentives also was encouraged by a more general recognition of the role that positive reinforcement plays in smoking (Pomerleau, Collins, Shiffman, & Pomerleau, 1993), including how genetics may influence the effectiveness of nicotine metabolism as a reinforcer (Lerman et al., 1999). Additionally, the field of behavioral economics has increased our understanding of
how different incentives for drug use interact with each other and with the contexts in which they operate (e.g., Bickel & McLellan, 1996; Kagel, Battalio, & Green, 1995). These literatures raise the prospect of more rational and effective incentive programs to encourage nonsmoking and smoking cessation.

Since Orleans and Shipley’s review (1982), however, research on the use and impact of incentives in smoking cessation has been modest. We conducted a series of Medline searches of journal articles published between 1966 and 2009, using cognates of reinforcer, contingency, reward, incentive, lottery, and contest. The vast majority of papers identified that also dealt with smoking were not intervention studies. Despite this limited research on incentives in smoking cessation, there are substantial literatures on incentives in general health promotion and in treating other types of drug abuse. Accordingly, we include in this chapter a brief review of incentives in other areas of health promotion along with review of the use of incentives in treating addictions to other drugs as well as to nicotine.

There are two broad approaches in the use of incentives for promoting appropriate health behavior. The first approach includes incentives applied directly to the target behavior, for example, providing reinforcers for maintaining abstinence from smoking for several days. A second approach entails incentives for other behaviors that may compete with the target behavior, what in behavioral terms is referred to as “differential reinforcement of alternative behavior.” Consequently, the first part of this chapter addresses incentives applied directly to behaviors, and the second addresses incentives applied indirectly.

INCENTIVES APPLIED DIRECTLY TO BEHAVIOR

Following a brief presentation of the use of incentives in health promotion in general and in the treatment of drug use other than smoking, we discuss the use of incentives in smoking cessation.

Incentives in Health Promotion

For some time, reports have indicated that incentives may be successful in a wide variety of areas of health promotion: child immunizations (Achat, McIntyre, & Burgess, 1999) and vaccinations (LeBaron, Starnes, Dini, Chambless, & Chaney, 1998); adherence to antihypertensive medications (Feldman, Bacher, Campbell, Drover, & Chockalingnan, 1998); return for reading of tuberculosis (TB) skin tests among drug users (Fitzgerald et al., 1999; Malotte, Hollingshead, & Rhodes, 1999); compliance with TB drug regimens among homeless adults (Tulsky et al., 2004); adherence to the hepatitis B vaccine regimen among injection drug users (Seal et al., 2003); promoting mammography (Janz et al., 1997); maintenance of breast self-examination (Solomon et al., 1998); reducing loss to follow-up among women with abnormal Pap tests (Marcus et al., 1998); and, of pertinence to the present chapter, reducing carbon monoxide levels (levels of carbon monoxide correlate with tobacco smoking) among individuals with chronic obstructive pulmonary disease (Crowley, MacDonald, Zerbe, & Petty, 1991).

Based on results reported in individual studies and findings from other systematic reviews and meta-analyses, recent papers (Marteau, Ashcroft, & Oliver, 2009; Sutherland, Christianson, & Leatherman, 2008) have summarized the evidence for the effectiveness of incentives in health promotion. A comprehensive review of studies evaluating the role of incentives on risky behaviors, preventive care, and adherence to recommended treatment (Sutherland et al., 2008) concluded: “The findings of studies reviewed in this article suggest that financial incentives, even rather small ones, can influence health behaviors” (p. 745). This conclusion is probably an understatement. The review documents evidence for the effects of incentives in exercise promotion, improving lipid metabolism, having a mammogram (with the odds ratio for those given incentives being 2.7; that is, the likelihood of having a mammogram was 2.7 times greater among those offered incentives
than among those not offered incentives) (Stone et al., 2002), follow-up after positive PAP tests, screening for colon cancer, screening and treatment for tuberculosis, prenatal and postnatal care, as well as outpatient HIV testing and attendance at classes addressing HIV prevention (see pp. 635–78S). Providing incentives for immunizations has produced especially clear results: “In all reviews, patient-targeted incentives, used alone or in combination with other interventions, were found to be effective in increasing uptake of immunizations in both children and adults” (p. 665). In particular, a meta-analysis that included 81 studies of incentives for immunizations reported an odds ratio of 3.4 for incentives (Stone et al., 2002). The review evaluated price reductions and reductions in copays among incentives, including, for example, price reductions that increased choices of healthy foods (p. 43S) or reductions of out-of-pocket costs that increased the likelihood of getting vaccinated (p. 66S).

The use of incentives for producing weight loss has provided mixed results: “The evidence on the effect of incentives on weight loss, either in the community or at worksites, is less conclusive” than that for other health behaviors (Sutherland et al., 2008, p. 65S). As noted in reviews, methodological problems have contributed to this lack of conclusiveness, especially the use of designs in which incentives are combined with other interventions (e.g., behavioral counseling, health-promotion classes, or self-monitoring of weight), complicating the evaluation of the effect of the incentive itself.

Incentives do not preclude but rather may complement other program components. For example, either a personal trainer or monetary incentives were effective in increasing exercise in a weight-management program, and the combination was more effective than either alone (Jeffery, Wing, Thorson, & Burton, 1998). A similar pattern emerged from a review of programs designed to promote adherence to TB treatment. The odds ratios comparing program components to control conditions were 1.6 for monetary incentives, 1.2 for health education, and 2.4 for the combination of the two (Volmink & Garner, 1997).

Incentives for Drug-Use Problems Other Than Smoking

Various forms of treatment programs have used incentives in treating problems other than cigarette smoking. Some of these include contingency contracting, in which the patient and the treatment provider agree that specified consequences (i.e., incentives) will be contingent upon appropriate behaviors (Pendergast, Podus, Finney, Greenwell, & Roll, 2006; Silverman et al. 1996); vouchers retrievable for goods and services (Bigelow, Brooner, & Silverman, 1998; Jones, Haug, Silverman, Stitzer, & Svikis, 2001; Plebani et al., 2006; Robles et al., 2000); and the receipt of privileges, such as the freedom to take doses of methadone at home rather than at a clinic (contingent on drug-free urine tests) (Chutuape, Silverman, & Stitzer, 1999a). Additional research has demonstrated the benefits of using escalating schedules of reinforcement (e.g., Roll & Shoptaw, 2006; Silverman, Chutuape, Bigelow, & Stitzer, 1997). In escalating schedules, the criterion for earning the next reinforcer is higher than that for the previous reinforcer. Using this type of schedule to deliver reinforcers makes it more likely that individuals will make contact with the reinforcer early in treatment, a variable that has been shown to be related to treatment success (Kirby, Marlowe, Festinger, Lamb, & Platt, 1998). Moreover, because the number of reinforcers delivered decreases with time, an escalating schedule may also be cost efficient because it delivers more incentives early in the program, when they are likely to have a greater effect, and fewer later on.

A set of several incentives among which individuals can choose can also serve as an extra incentive. Choice between a take-home dose of methadone or a voucher worth $25.00 contingent on drug-free urine tests resulted in more drug-free urine samples, greater latencies to drug-positive urine samples, and longer sustained abstinence than did standard care, which lacked these features (Chutuape, Silverman, & Stitzer, 1999b).

As with health promotion in general, incentives do not preclude the effective use of other
interventions. Contingent delivery of vouchers significantly improved success when added to a drug-treatment program that already included a system of contingent privileges for such things as take-home medications and individual counseling (Iguchi, Belding, Morral, Lamb, & Husband, 1997).

The literature on incentives in the treatment of drug abuse reveals an important finding: Incentives may be especially effective for those who are resistant to treatment or otherwise hard to reach. In one study, for example, individuals who had achieved fewer than 4 out of 13 weeks of cocaine abstinence in a methadone maintenance program were considered treatment resistant and eligible for a study of voucher magnitude (Silverman, Chutuape, Bigelow, & Stitzer, 1999). In counterbalanced order, the individuals received three, 9-week programs that differed in the total dollar value of the vouchers earned: $0, $382, or $3480. The $3480 total incentive amount resulted in 10 of the 22 patients (45%) achieving abstinence in ≥ 4 out of a possible 9 weeks. Only one patient in the $382 phase and none in the $0 phase achieved more than 2 weeks of cocaine abstinence. The high reward magnitude condition also resulted in a significantly higher percentage of cocaine-negative urine samples (p < 0.01). In addition to showing how incentives may be effective in reaching otherwise treatment-resistant individuals, the study also demonstrated another important finding, namely the importance of amount of reinforcement.

Incentives for Smoking Cessation

Initial work by Stitzer, Bigelow, and their colleagues demonstrated that monetary incentives could reduce smoking (Stitzer & Bigelow, 1982). Importantly, incentive effects were specific to the contingencies imposed, such as with contingencies on carbon monoxide (CO) in expired air, an indicator of recent smoking. When the target CO level was 8 ppm or less, 45% of participants reduced their CO to that level, in comparison to 0% when the target CO was 16 ppm (Henningfield, Stitzer, & Griffiths, 1980; Stitzer & Bigelow, 1985). (It is to be noted that 8 ppm or lower is generally taken as indicative of abstinence.) Having shown that smoking could be brought under the control of incentives, Stitzer, Rand, Bigelow, and Mead (1986) secured short-term smoking abstinence with payments contingent on reduction and cessation in conjunction with worksite and home CO monitoring. Extending these findings, contingent payment ($42 twice weekly) led to greater abstinence over 3 months than noncontingent payment (Rand, Stitzer, Bigelow, & Mead, 1989). These results were obtained without any provision of cessation strategies, coping skills training, or programmed social reinforcers to the participants, thus underscoring the positive impact that incentives have on behavior change.

A critically important finding, one that will be emphasized in this chapter, is that incentives appear to be effective only while they remain in effect. Once the incentive is discontinued, the change in behavior typically ceases. A review of the literature conducted by the Cochrane Collaboration on smoking-cessation programs that use incentives and competitions found these programs to be effective, but only while they are in force (Cahill & Perera, 2008). Long-term maintenance of behavior change requires continuation of incentives, either through continuation of programs providing them or through generalizing program-specific reinforcers to those occurring naturally.

In addition to modifying smoking among users of other drugs, incentives also have been shown to reduce smoking among schizophrenics (Roll, Higgins, Steingard, & McGinley, 1998). This finding is important because of the heightened prevalence of and difficulty of treating smoking among patients with schizophrenia as well as depression (Covey, Glassman, & Stetner, 1997; El-Khorazaty et al., 2007) and other psychological problems (Hughes, Hatsukami, Mitchell, & Dahlgren, 1986).

Clinical Impact

The studies reviewed were designed to examine whether incentives would influence smoking, but they did not address the issue of whether clinically significant, sustained changes in smoking would be achieved. A study by Fortman and
Killen (1995) demonstrated the potential contributions of incentives in smoking cessation. Participants who had quit for at least 24 hours were recruited by random phone surveys for a study of self-help materials and nicotine gum. All participants were offered $100 if they were able to remain abstinent at 6 months follow-up. Remarkably, even a control group that received neither self-help materials nor nicotine gum, but did receive $100 if they remained abstinent for 6 months, achieved 20% and 16% abstinence at 6- and 12-month follow-up, respectively. Of course, the sample was a volunteer sample of those who had already quit (albeit for only a day). However, the proportion of smokers identified from the random phone surveys who qualified for and volunteered to participate in the study—14.6% (1,044 out of 7,135)—was still much higher than the percentage of smokers who volunteer for other, non-incentives-based treatment programs. This finding suggests that the $100 incentive was quite influential in promoting both enrollment as well as cessation among those who joined.

More recently, Volpp and colleagues studied the effect of incentives on smoking cessation in a population of lower-income smokers in a Veterans Administration hospital (Volpp et al., 2006) and middle-income employees in a worksite-based cessation program (Volpp et al., 2009). Results from these randomized, controlled trials showed a significantly lower rate of smoking at 1 and 12 months following program completion, respectively, for the groups that were given incentives contingent on smoking cessation.

Return of Deposit

A popular form of the use of incentives to change behavior has been requiring a deposit of money or valued possessions for entry into a program and then returning the deposit contingent on progress in the program. Paxton (1980) showed that return of monetary deposits increased the efficacy of a smoking-cessation program, and that, consistent with the literature on reinforcement effects, the amount of deposit returned (although not the frequency by which deposits were returned) increased the short-term impact on smoking abstinence (Paxton, 1981).

An obvious concern with this type of incentive implementation is whether requiring a deposit for entry into a program reduces participation. However, collecting a cash deposit in four, weekly installments rather than one initial payment increased participation rates with no lesser impact on abstinence from smoking (Paxton, 1983). In a study of the trade-off between increased efficacy and decreased participation (Jeffery, Hellerstedt, & Schmid, 1990), participants either paid $5 to enter a 6-month correspondence program or gave a $60 deposit, one-sixth of which was refunded for each month of smoking abstinence. In terms of participation, the version with the $5 entrance fee was far more popular (in terms of enrollment) than that with the $60 deposit by a ratio of about 5 to 1. However, abstinence at 6-month follow-up in the return-of-deposit condition was 20% versus 9% in the $5 condition. A similar pattern of results was found in a second group of individuals recruited for a weight-loss program in which the return of deposit was based on preset monthly weight-loss goals.

Contests and Lotteries

As would be expected from research on the effects of extinction on behavior, contests and lotteries have been shown to have appreciable impact on abstinence while those contingencies are in place, but lesser impact on long-term abstinence from smoking after the contingencies have been removed (Matson, Lee, & Hopp, 1993). For example, a “Quit-to-win” contest achieved abstinence rates of 56%, 27%, and 21% at 6-week, 6-month, and 12-month follow-up evaluations (Leinweber, Macdonald, & Campbell, 1994).

As with return-of-deposit programs, evaluation of lotteries and contests also must examine effects on both participation and efficacy (Matson et al., 1993). In one study, adding competitions to worksite smoking-cessation programs increased participation without reducing the cessation rate among those who participated. Thus, the competition worksites achieved cessation among an estimated 16% of all smoking employees, versus 7% in worksites that did not incorporate competitions (Klesges, Vasey, &
Glasgow, 1986). However, participation and cessation rates may diverge, as demonstrated in a community study that compared participation and cessation rates among those receiving smoking-cessation classes, self-help materials, or contests (Altman, Flora, Fortmann, & Farquhar, 1987). The smoking-cessation classes achieved the highest cessation rates but reached the fewest people and were the least cost efficient. The self-help materials had the lowest cessation rate, percentage-wise, but reached the largest number of people and were more cost efficient than the classes. Finally, the contests fell in between the other two approaches (i.e., the smoking-cessation classes and self-help materials) in cessation rate, numbers of participants, and cost efficiency.

A program for smokers with chronic obstructive pulmonary disease demonstrated the importance of the amount of incentive, the potential of combining several different types of incentives, and the utility of variation in procedures to enhance their salience (Crowley et al., 1991). When up to three public lottery tickets were contingent on CO levels below 10 ppm, there was no change in smoking behavior from baseline. When the incentive was increased to five lottery tickets combined with the use of nicotine gum, CO levels were initially reduced but recovered over time. The lottery tickets were eventually presented contingent on reduced CO levels but following random checks of CO levels (i.e., a variable ratio, VR, reinforcement schedule). This resulted in CO levels that were abruptly reduced and remained low as long as the contingencies remained in place. A VR schedule is one that produces high, constant rates of responding, in part because the organism cannot predict which response will produce reinforcement. The VR schedule may be beneficial in this type of program because participants need to maintain abstinence throughout the duration of the program in order to receive the lottery tickets when they are (unpredictably) made available.

Taxes

Increases in excise taxes and the use of those proceeds for smoking prevention programs have been associated with substantial statewide reductions in smoking in California and Massachusetts (CDC, 1996; Pierce et al., 1998). Because such an approach reaches entire populations, even a small impact can have substantial benefit. In California, reductions in consumption attributable to a $0.25 tax increase were greater than those attributable to an anti-smoking media campaign (Hu, Sung, & Keeler, 1995). (Such effects, of course, are dependent on the tax amount and the level of investment in media campaigns.) Uptake among youth appears especially price sensitive and therefore susceptible to the imposition of taxes. Results from surveys among adult and teen smokers in Massachusetts indicated reduced smoking following a $0.25 tax increase. Reductions were most pronounced among low-income smokers, especially low-income teens (Biener, Aseltine, Cohen, & Anderka, 1998). Analyses of changes in smoking rates among Canadian provinces that did and did not institute reductions in cigarette taxes indicated that the tax cuts were associated with greater uptake of smoking and lower rates of quitting (Hamilton, Levinton, St-Pierre, & Grimard, 1997).

The effects of taxes can be quite complex. For example, increasing taxes on cigarettes has been shown to increase use of smokeless tobacco. Presumably, the relative cost reduction for smokeless tobacco led to increased consumer choice. However, this effect was not reciprocal. Increasing taxes on smokeless tobacco did not increase consumption of cigarettes (Ohfeldt, Boyle, & Capilouto, 1997). This nonsymmetrical result mirrors an effect found in rats: When food was restricted, rats increased the amount of water they drank (above baseline, nonrestricted levels), but when water was restricted, the rats did not increase their food consumption (relative to baseline) (Rachlin & Krasnoff, 1983). Such a finding fits within a behavioral economics framework in which issues of substitutability and complementarity are addressed (see Green & Freed, 1993, 1998). These issues will be discussed in more detail in the following sections.

Combination of Social and Monetary Incentives

In their review, Orleans and Shipley (1982) called for research into how incentives might
potentiate the influence of other components of worksite programs, such as social support among employees. The possibility of incentives enhancing other treatment components is not limited to worksites, of course. Donatelle, Prows, Champeau, and Hudson (2000) reported impressive effects from the combination of interpersonal support and voucher incentives for smoking cessation among pregnant recipients of WIC services. Every participant initially received educational materials about quitting smoking and also identified a "social supporter, preferably a female non-smoker with whom the participant had a regular, close, positive association" (p. i167). Additionally, for those in the voucher condition, participants were eligible to earn department store vouchers worth $50 per month over 10 months, for a total of $500 in vouchers, contingent on monthly self-reports of abstinence confirmed by biological assessments (i.e., salivary cotinine and thiocyanate levels). The quit rate during the eighth month of gestation for those women who received vouchers plus interpersonal support and educational materials (voucher group) was 32%, as compared to 9% for those who received only the support and educational materials (control group). At 2 months postpartum, 21% of the voucher group had remained abstinent, whereas only 6% of the control group had done so.

As reviewed by Matson and colleagues (1993), several studies have demonstrated impacts of combining support groups, competitions, and incentives in worksite smoking programs. For example, one worksite-based study (Jason, Jayarat, Blitz, Michaels, & Klett, 1990) included the following:

- Direct incentives—$10 for each of 14 meetings attended (independent of smoking status), $1 per each day that the individual was abstinent for up to 6 months following completion of the program, $30 for each period of 30 consecutive days’ abstinence, and chances in a cash lottery
- Availability of support groups—participants could complete smoking-cessation procedures on their own or with a group
- Availability of team competition—participants could form teams of three smokers and compete for a cash prize of $300 to be given to the team with the most number of days abstinent

Relative to a control worksite that received no intervention, the combination of the support group, incentives, competition, and cash prize resulted in substantially greater numbers of participants who were abstinent at the end of the program (49% versus 9%), 6-month follow-up (42% versus 13%), and at 12-month follow-up (36% versus 16%). The success of this combination of intervention tactics raises interest in further research examining sequences and combinations of such approaches. For example, a program might begin with financial incentives and then phase them out while introducing social incentives that may be more sustainable and also may be more able to link individuals to naturally occurring reinforcers among friends and families.

INFLUENCING PROBLEM BEHAVIORS INDIRECTLY THROUGH INCENTIVES FOR OTHER BEHAVIORS

Behavioral economics identifies several ways in which incentives for one behavior may influence the likelihood of other behaviors. One is substitutability in which changes in the price or the availability of one good leads to opposite or compensating changes in consumption of another good. As mentioned earlier, an example would be an increase in the price of cigarettes leading to reduced consumption of cigarettes but increases in the consumption of smokeless tobacco. In this case, smokeless tobacco and cigarettes would be substitutable for each other. Another way in which consumption of two goods can be linked is complementarity, in which changes in the price or availability of one produces similar directional changes in the consumption of the other good. For example, an increase in the price of cigarettes may lead to reduced purchases of cigarettes as well as reduced purchases of coffee.

Drug taking has been shown to be substitutable with other reinforcing activities. This finding is
in contrast to the typical image of drugs as blinding the individual to other reinforcers, thereby keeping the addict from seeking other sources of reinforcement. The substitutability of drug taking was demonstrated in an experimental, controlled economy in which participants lived and had unconstrained access to marijuana. Participants received no money other than that earned by making belts while in the experiment. In this closed economy, increases in the wage for belt making reduced marijuana smoking during the experimental period (Kagel, Battalio, & Miles, 1980; Miles et al., 1974), consistent with the view that money is substitutable for marijuana.

Pleasant activities and social relationships also are substitutable for drug taking. High frequency of reinforcing activities unrelated to drug taking (Correa, Simons, Carey, & Borsari, 1998), pleasant events (Van Etten, Higgins, Budney, & Badger, 1998), and social engagement and activity (Audrain-McGovern et al., 2004; Vuchinich & Tucker, 1988) are related to lower levels of smoking, drug taking, and alcohol consumption. Similarly, a combined take-home methadone and voucher treatment showed greater cocaine abstinence as well as greater enjoyment of daily activities among methadone-maintained cocaine abusers (Rogers et al., 2008). Nondrug social reinforcers have the potential for enhancing the effectiveness of a treatment program. A review of cocaine treatment studies found that the availability of alternative, nondrug reinforcers enhanced the effects of pharmacological treatments for cocaine abuse (Higgins, 1997; LeSage, Stafford, & Glowa, 1999).

The demonstration of substitutability of other reinforcers for drug taking has important implications for the promotion of abstinence. From the perspective of behavioral economics, low prices of alternative reinforcers relative to the price of drugs should increase consumption of those alternatives and decrease consumption of the drugs. For example, cigarette puffs decreased as their price increased relative to either nicotine gum or money (Johnson & Bickel, 2003). In contrast, drug taking will be encouraged if drug reinforcers are more readily available than other reinforcers, such as a rewarding job and a supportive family and friends. For those under conditions of economic disadvantage, or when opportunities to obtain these reinforcers are blunted by prejudice, access to these non-drug-related reinforcers may be limited. This type of situation is more likely to be found among many of the subpopulations with high rates of drug use.

The effect of increasing alternative activities and goods in people’s lives as a way to reduce drug taking or to help sustain abstinence has received little attention in programs for smoking cessation or other addictions. The implications of this approach may be especially important in light of the greater prevalence of addiction problems among economically and educationally disadvantaged groups. Whatever the reasons for an individual becoming addicted, the limited access to goods and pleasurable activities associated with educational and economic disadvantage, as well as the erosion of other sources of reinforcement that follow multiple drug dependencies, may make abstinence especially difficult. Increasing other reinforcers may encourage steps toward abstinence.

Community Reinforcement Approach (CRA) programs have been found to reduce alcohol consumption (Smith, Meyers, & Delaney, 1998) and opiate use (Abbott, Weller, Delaney, & Moore, 1998) through a variety of structured behavioral skills sessions focused on problem solving, abstinence, and communication skills. CRA programs often include structured drug- and alcohol-free social events. These social events may be thought of as situations in which non-drug-related social reinforcers are made accessible. The emphasis on relationships and pleasurable activities does not preclude the use of tangible reinforcers. Indeed, voucher incentives in conjunction with a CRA program were shown to produce significantly greater abstinence than the CRA alone (Higgins et al., 1994). Vouchers for work and work-related training in a therapeutic workplace for pregnant women led to 59% abstinence relative to 33% among controls (Silverman, Svikis, Robles, Stitzer, & Bigelow, 2001). Monetary reinforcement for abstinence and for attendance at a prenatal care and drug counseling program for cocaine-dependent
pregnant women led to higher rates of attendance and, strikingly, 0% as opposed to 80% adverse perinatal outcomes (Elks, Mangus, Rhoades, Andres, & Grabowski, 1998).

Reinforcement of behaviors other than drug taking also can be approached through family and friends. A number of years ago, Azrin and colleagues (Hunt & Azrin, 1973) demonstrated the beneficial effects of educating spouses in providing reinforcement for behavior other than drinking and extinction for drinking and related behaviors. An intervention that trained concerned family members and significant others in reinforcing the drug user's entering treatment and ceasing drug use, as well as reinforcing behaviors inconsistent with drug taking, increased the likelihood of the drug user's entering treatment relative to an Alanon self-help program (Kirby, Marlowe, Festinger, Garvey, & La Monica, 1999).

THEORETICAL ISSUES AND KEY FACTORS IN INCENTIVE PROGRAMS

The results from the studies reviewed are consistent with the conclusion that, while they are in effect, incentives have reliable effects on health behaviors, including addictive behaviors and, in particular, cigarette smoking. In addition to demonstrating these effects in laboratory or experimental settings, they have been shown in a variety of clinical and prevention programs in diverse settings and with diverse populations. They also are consistent with an enormous literature on the effects of incentives/reinforcers on diverse human and animal behaviors (Rachlin, 1991). The answer to “Should we pay the patient?” (Giuffrida & Torgerson, 1997) is “Yes”—reinforcement works. That said, there still are issues to be considered in fully evaluating the effectiveness of incentives in reducing smoking.

Amount and Delay of Reinforcement

Increases in the amount of reinforcement have been associated with reductions in smoking and increases in the percentage of individuals achieving a criterion of 50% of baseline CO levels (Stitzer & Bigelow, 1983), increases in time since last cigarette smoked (Correia & Benson, 2006), and increases in consecutive abstinent CO readings (Roll, Higgins, & Badger, 1996). In programs for other problem behaviors, amount of reinforcement was associated with frequency of drug-free urine tests among cocaine abusers (Higgins et al., 2006; Petry et al., 2004), treatment attendance (Jones, Haug, Sitzter, & Svikis, 2000; Svikis, Lee, Haug, & Sitzter, 1997), reductions in heroin use in opioid-dependent individuals (Comer et al., 1998), and returning for reading of TB skin tests (Malotte, Rhodes, & Mais, 1998).

However, as noted earlier in the discussion of contests and lotteries and as confirmed by experimental studies, delay to reinforcement reduces the effectiveness of a reinforcer (see, e.g., Lattal, 1987) and has been shown to influence the choice to smoke cigarettes (Roll, Reilly, & Johanson, 2000). Of course, the relatively immediate reinforcement of smoking, 7-9 seconds from inhaling to the time that nicotine reaches the central nervous system, has long been implicated in the strength of addiction to nicotine (Henningfield & Keenan, 1993).

Greater Effectiveness of Cash Than Other Incentives

Ten dollars was more effective than the equivalent amount in grocery store coupons, bus tokens, or fast-food coupons in reinforcing return for reading of TB skin tests (Malotte et al., 1999). Similarly, cash was more effective than nonmonetary incentives in reinforcing attendance at a clinic for sexually transmitted diseases (Kamb et al., 1998) and was more effective than self-reward (i.e., a small reward that the individual administers, such as “enjoy some quiet time” or “buy yourself flowers”) in promoting breast self-examination (Solomon et al., 1998). Interestingly, the “urn” lottery, developed by Petry and colleagues (Petry, Martin, Cooney, & Kranzler, 2000) has been shown to be more effective in producing drug abstinence and more cost efficient than vouchers among opioid-dependent individuals (Petry, Alessi, Marx, Austin, & Tardif, 2005). In this lottery system,
abstinence results in an opportunity to draw a slip of paper from a bowl, where each slip states the prize to be received. Prizes often range in value from very small to large, and the probability of drawing a prize is inversely proportional to its value. Research should compare the efficacy of monetary and other rewards when applied to smoking cessation.

Effects of Context on Incentives

Tangible incentives operate within broader contexts of other program components. The importance of other program components was shown in analyses of contests within the COMMIT program, a major trial of community-based programs and activities to promote nonsmoking (The COMMIT Research Group, 1995a, 1995b). The best predictor of positive smoking outcomes for a community was the amount of money invested in the contest program (e.g., media, staff, and labor costs) that did not include the contest prizes themselves (Shipley, Hartwell, Austin, Clayton, & Stanley, 1995). This result underlines the importance of investing resources in planning and announcing programs, working with individuals, and employing appropriately trained staff, in addition to the money invested in the actual incentives, an aspect that is often overlooked in the literature.

A number of other studies have evaluated the impact of the context of lotteries or contests in promoting cessation. In the Minnesota Heart Disease Prevention Program, intensive promotion of a statewide contest in Bloomington resulted in participation by about 1.06% of eligible smokers, substantially higher than the 0.2% participation in other suburbs of the Twin Cities area. With the 37% long-term abstinence rate obtained in Bloomington, this translates to a total reduction of the smoking rate in the community of about 0.39% (1.06 × 0.37). Although the long-term abstinence rate among participants in the other Twin Cities suburbs was somewhat higher (45%) than the 37% in Bloomington, the difference in participation resulted in a net reduction in the overall percentage of smokers of 0.09% in those other suburbs (0.2 × 0.45), relative to the 0.39% in Bloomington (Lando, Loken, Howard-Pitney, & Pechacek, 1990). Despite the small percentage difference, notice that the intensively promoted program had a four-fold greater reduction in smoking, a not-inconsequential effect when considered at the population level. Combinations of contests and incentives with group smoking-cessation programs and promotional campaigns to encourage quitting have been reported to lead to 12-month abstinence rates of 36% (Jason et al., 1990) and 50% (Maheu, Gevirtz, Sallis, & Schneider, 1989).

The North Karelia project in Finland (Puska, Vartiainen, Tuomilehto, Salomaa, & Nissinen, 1998) also demonstrated the importance of broader community support and promotion in enhancing the benefits of a nationwide combination of a contest and an 8-installment television program promoting smoking cessation. Relative to the city of Turku, in which community support was less intensive, rates of viewing the program, participating in the contest, attempted quits among viewers, and abstinence rates 6 months after the program all favored the region of North Karelia (Korhonen et al., 1992).

Nicotine Replacement as Substitutability

In a sense, the demonstrated success of nicotine replacement (e.g., nicotine patch, nicotine gum) reflects the substitutability of one source of nicotine for another (e.g., Buchkremer, Minneker, & Block, 1991; Fiore, Smith, Jorenby, & Baker, 1994). This is joined with the finding of substitutability of cigarettes and smokeless tobacco (Ohsfeldt et al., 1997). Of course, the choice of nicotine replacement over smoking cigarettes will be influenced by their relative prices and the levels of inconvenience associated with obtaining them. A behavioral economic perspective on relatively safe sources of nicotine as a substitute for cigarettes that contain nicotine is congruent with current movements to make varied sources of nicotine readily available and competitively priced.

Social Support and Interactions as Incentives Substitutable for Nicotine

A key factor in the success of smoking cessation may be the presence of supportive people around
the smokers. For example, cessation rates were higher among the 60% of participants in a Minnesota community-based contest who designated a "support person" (e.g., a friend, spouse, or other family member) than among those who did not (Pirie, Rooney, Pechacek, Lando, & Schmid, 1997). This difference was especially pronounced among those who reported that their spouses (who were not designated as the "support person") were either smokers or nonsupportive.

More generally, substantial research indicates that smoking is more likely among socially isolated individuals and that social support from friends and family is associated with greater likelihood of successful quitting (Fisher, Brownson, Heath, Luke, & Sumner, 2004). Reflecting these findings, the 2008 guidelines on smoking cessation of the Department of Health and Human Services, *Treating Tobacco Use and Dependence* (Fiore et al., 2008), reported that the provision of social support along with the number of contacts and the total duration of smoking-cessation interventions are all predictive of greater success.

Nevertheless, there have been mixed findings regarding efforts to enhance smoking cessation with social support, such as reported in an influential review by Lichtenstein, Glasgow, and Abrams (1986). In his review of what may explain such mixed findings, Fisher (1997) emphasized a behavioral economic perspective in which social support is viewed as a reinforcer that may substitute for nicotine. From this perspective, several problems with social support interventions that were unsuccessful and several possible changes to these interventions based on behavioral economics were noted:

1. Social support was often terminated at the end of treatment. However, the ex-smokers may still need the reinforcement that social support provides as a substitute for nicotine. If support is to be an effective alternative to nicotine, then its availability needs to be sustained.

2. Some interventions focused on teaching individuals how to obtain support for quitting rather than providing social reinforcement to the quitter. Other interventions were too inflexible in the ways in which the social support could be provided to the individuals. It seems reasonable, then, that these social interactions may have been less enjoyable and, thus, less reinforcing.

3. Some supportive interventions emphasized teaching participants how to obtain support rather than simply providing them with sources of support. The latter is more effective if support is to serve as an incentive that substitutes for nicotine.

"Overjustification Effect" and Intrinsic Motivation

A recurrent concern about the use of incentives has centered on the possibility of "overjustification effects" in which salient, extrinsic incentives might undermine intrinsic motives for behavior. However, a critical review of the empirical literature demonstrated that such effects are, in fact, minimal in real-world settings in which manipulated incentives are not very large, in which extrinsic incentives are not administered in a manner so as to obscure the salience of other incentives for desirable behavior, or in which newly introduced reinforcers do not interfere with already existing reinforcers of established behavior (e.g., by introducing prizes for practicing the piano that impose a new requirement of keeping records that, in turn, interferes with already established reinforcers in the practice routine) (Cameron & Pierce, 1994; Fisher, 1979). In their analysis of over a quarter century of research, Cameron and Pierce (2002) found little evidence that reinforcement reduces intrinsic task interest. Reinforcement does not appear to reduce intrinsic motivation; on the contrary, Cameron, Banko, and Pierce (2001) observed that when reinforcement is linked to level of performance, intrinsic motivation increases or shows no change (see also Eisenberger & Cameron, 1996; Eisenberger, Pierce, & Cameron, 1999).

The same perspective that distinguishes intrinsic and extrinsic incentives and gives rise to the hypothesized overjustification effect also leads to hypotheses that programs aimed at bolstering enduring intrinsic motivation will be
more successful than those that address extrinsic rewards and incentives for desired behavior. There is remarkably limited evidence to support this claim. Seattle-area smokers were offered extrinsic rewards or individually tailored feedback (i.e., a personalized analysis of the participant's progress throughout the intervention) contingent on returning a baseline questionnaire and progress reports within a self-help program (Curry, Wagner, & Grotaus, 1991). Those given the feedback were more likely to use the self-help materials, report short-term abstinence (3 months), and be abstinent (validated by measuring cotinine levels, a salivary by-product of smoking tobacco) at 12-month follow-up. These findings might be interpreted as showing that increasing intrinsic motivation is better accomplished with personalized feedback rather than with extrinsic rewards. However, consideration of the details of the procedures suggests an alternative explanation. The extrinsic reward entailed a “secret gift” (a ceramic coffee cup) along with entries into drawings for three prizes, a 1-week vacation in Hawaii, a weekend at a resort on the San Juan Islands outside of Seattle, or a weekend at a deluxe hotel in Seattle. Thus, individually tailored feedback did produce better results than did receipt of a coffee cup and chances among 607 other participants to win one of three vacation prizes. Considering the evidence regarding the importance of amount and probability of reward, the results from this study may be seen as indicating the greater impact on smoking cessation of tailored feedback than of one small prize and low odds of winning, rather than a more general advantage of intrinsic rewards.

Although many might interpret such a conclusion as evidence for the ineffectiveness of incentives, the reader of this volume is well aware that extinction is an established phenomenon and that diminution of benefits of incentives following their termination—in the absence of other incentives to maintain the behavior—reflects the adaptability of behavior to its context, not a failure of incentives to change behavior. Therefore, the use of incentives might be highly recommended (a) for increasing key behaviors that need to occur only once or relatively few times, or (b) for increasing the likelihood of behaviors in particular settings or for particularly crucial periods. The first point is illustrated by the evidence for the use of incentives to increase immunizations mentioned earlier (Sutherland et al., 2008).

A noteworthy illustration of the second point (influencing behavior in certain contexts or during critical periods) would be nonsmoking during pregnancy, when the development of the fetus and newborn are crucially affected by smoking. For example, reduction of smoking among pregnant women can reduce the risk of a low birth-weight child by 45% (Ershoff, Quinn, Mullen, & Lairson, 1990). Thus, incentive programs may be especially appropriate for promoting nonsmoking during pregnancy. Little research has explored incentives for this group, but women taking part in an incentives-based smoking-cessation program during pregnancy and postpartum achieved a higher rate of abstinence up to 24 weeks after delivery (Higgins et al., 2004) and importantly, increased fetal weight during pregnancy (Heil et al., 2008). Incentives for nonsmoking among pregnant women could achieve substantial savings in costs such as those for caring for low birth-weight babies (Adams et al., 2002; Marks, Koplan, Hogue, & Dalmat, 1990).

It may be expected that extinction of the appropriate, desired behavior will occur when incentives are withdrawn. However, such an expectation is not reason to be discouraged nor is this the only way to terminate incentive-based smoking-cessation programs. In addition to providing extrinsic incentives contingent on cessation, interventions also must plan for the

The Use of Incentives for High-Priority Behaviors During Limited Time Periods

The reviews by Marteau et al. (2009) and Sutherland et al. (2008) make clear that incentives have only a modest long-term impact on behavior after the incentives are no longer in place. As Sutherland et al. noted: “. . . research evidence suggests that incentives can increase adoption of healthy behaviors but that positive effects may diminish over time” (p. 655).
generalization of program-based reinforcers to reinforcers that occur naturally contingent on smoking cessation (e.g., money savings, social approval, better health). Generalization must occur gradually, where the most effective, most easily controlled program-based reinforcers are delivered early in the intervention in order to achieve immediate cessation. Later, then, the programmed reinforcers can be faded out, and the naturally occurring reinforcers faded in. It is a failure of many incentives-based smoking-cessation programs to not plan for this needed generalization.

CONCLUSIONS

The literature reviewed above provides the basis for the following conclusions for intervention programs, research, and public health policies.

The Use of Incentives in Programs That Promote Smoking Cessation

Incentives do reduce drug taking, including cigarette smoking, at least while they are in effect. As with other reinforcers, amount, probability, and delay of incentives are important: Increasing amount and probability of incentives, and decreasing delay to their receipt, typically increases their effectiveness. Incentives are most promising when smoking cessation is an especially high priority for a defined period of time (e.g., among pregnant women, patients recovering from a heart attack, patients preparing for and recovering from cardiac or cancer surgery and treatment). The effects of incentive programs for cessation of substance use are not explained by other aspects of the intervention programs (e.g., educational components, interaction with intervention providers), although the benefits of incentives are often enhanced when combined with these other components.

Incentives alone may have little long-term or "carry-over" effects once they are terminated. This finding is consistent with most basic and applied research on reinforcement processes. Reinforcers must be continued as long as the target behavior is desired (that is, indefinitely, for substance-use cessation programs). More practically, interventions that incorporate naturally occurring reinforcers into the contingency are more likely to produce long-term behavior change. As Baer, Wolf, and Risley (1968) noted in a key paper on incentives in behavior modification over 40 years ago, "Generalization [or maintenance of behavior change] should be programmed, rather than expected or lamented" (p. 97). External reinforcers, such as incentives given in smoking-cessation programs, should be tapered toward the end of treatment and replaced with naturally occurring reinforcers before the intervention is terminated. This needs to be a planned component of the treatment program so that the appropriate behavior will be maintained and generalized, rather than a hoped-for result.

A variety of goods may function as incentives, including nicotine replacement, social interaction, and feedback of progress. Incentives could be used to increase participation in a program that already achieves acceptable rates of smoking cessation, or they could be made contingent upon the use of nicotine replacement. Other reinforcing activities can be substitutable for nicotine use, such as positive social interaction, physical activity, and other activities that generally support higher levels of health.

Based on research on other types of substance abuse, the use of incentives may be especially cost efficient. Cost efficiency will depend on program objectives. A program that reduces smoking during a limited period of time during which continued smoking would lead to appreciable health costs (e.g., during pregnancy or following surgery) may be quite cost efficient. Shifting from a tightly defined target group to a population perspective, modest incentives for smoking cessation deployed to large numbers of individuals can be quite cost efficient even if only a small percentage of the participants quit smoking.

Recommendations for Research

The aforementioned conclusions as well as comments and recommendations from several thoughtful reviews in the field (e.g.,
Bigelow et al., 1998) identify priorities for research in several areas, including refining the use of incentives in smoking cessation, and integrating incentives into broader programs for health promotion and quality of life. These are presented in the following sections.

Refining the Use of Incentives in Smoking Cessation

One important aspect of the use of incentives is to gain a greater understanding of the boundary conditions under which they are effective. What is the smallest amount or largest delay between the response and receipt of the incentive that can still produce satisfactory effects? If incentives are delivered intermittently, what is the most cost-efficient probability (as in a VR or escalating schedule) for delivering incentives contingent on abstinence? How effective is the use of money versus other incentive types? These parameters will be important in designing smoking-cessation programs that take into account a specific population, funding opportunities, and logistical constraints.

As already noted, there may be great cost efficiency in applying modest incentives to large populations of smokers, even if such interventions achieve only modest cessation rates. Dallery and colleagues have developed a very promising Web-based contingency management program for smoking cessation that could be very effective in reaching large numbers of smokers with minimal cost to both the agency and the individual (Dallery, Meredith, & Glenn, 2008; Reynolds, Dallery, Shroff, Patak, & Leraas, 2008). Large-scale studies should investigate the application to a wider population and to specific target groups.

Another aspect of incentive implementation that needs to be explored further is the application of shaping procedures for the acquisition and maintenance of behavior change. Although a central concept in the psychological tradition from which incentive programs emerged, the shaping of behavior is rarely emphasized in this literature. For example, one problem with the use of incentives contingent upon abstinence is that many individuals fail to achieve the minimal level drug-negative samples (e.g., in urine samples or CO breath levels) that are required to receive the incentive, and therefore never make contact with the reinforcement contingency. As a way to increase contact with the incentives, the use of percentile schedules of reinforcement may be especially helpful for those individuals who are more resistant to behavior change (Lamb, Morral, Kirby, Iguchi, & Galbicka, 2004).

In the study of percentile schedules by Lamb and colleagues (2004), smokers were randomly assigned to conditions in which reinforcement was contingent on breath CO levels being less than the lowest 1, 3, 5, or 7 out of their previous 10 samples. That is, the several different conditions made reinforcement contingent on the current sample being less than the 10th, 30th, 50th, or 70th percentile of the previous 10 samples. Thus, the conditions differed appreciably in their stringency requirement. In the 10th percentile condition, the participant received reward only if the most recent sample was lower than 9 of the previous 10 samples. In contrast, the 70th percentile condition was quite lenient in that reinforcement was provided for any sample lower than 3 of the previous 10. It is to be noted, however, that even in this lenient condition, meeting that contingency would gradually lower the 70th percentile, moving the contingency inexorably toward zero. Results showed that CO levels were significantly lower in the 70th percentile group as the 3-month study progressed. Furthermore, for those smokers classified as “hard to treat,” the 70th percentile schedule was more effective in producing immediate CO reductions and maintaining lower CO levels than any of the other schedules. This success among hard-to-treat individuals is especially noteworthy given that the prevalence of smoking continues to decline, leaving still smoking those who are often most challenged by cessation.

Fading procedures also must be explored more fully. As mentioned, incentives are effective when they are in effect. Therefore, interventions must include a procedure in which the programmed reinforceors (e.g., vouchers, lottery tickets) are faded out and replaced with reinforceors that occur naturally in an individual’s life (e.g., social approval, money savings,
better health). In order to use naturally occurring reinforcers most effectively, however, there must be a comprehensive conceptualization of the role of social influences as incentives. Several studies indicate that social support, social interaction, or feedback of progress may function as reinforcers for participation in programs as well as for not smoking. This view of social support as an incentive differs from the more traditional view in which social support has been conceptualized as an influence that enhances an individual’s skill or performance (Fisher, 1996). A fuller understanding of social influence will increase the ability to deploy it effectively.

**Integrating Incentives into Broader Programs for Health Promotion and Quality of Life**

If incentives for nonsmoking are integrated with other program components, then nonsmoking incentives might encourage participation in other health-promotion programs (e.g., preventive care, weight loss, disease management). For example, inclusion of incentives for not smoking may increase the overall attractiveness of the smoking-cessation programs in which they are included (Klesges et al., 1986) or for broader programs such as those for cardiovascular risk reduction or rehabilitation. This is especially important given the need to reduce the socioeconomic disparities in health surrounding smoking, obesity, physical activity, and the many diseases such as diabetes that are tied to lifestyle risks. Reaching disadvantaged groups is a high priority (Glasgow, Vogt, & Boles, 1999), and including incentives in health-promotion programs may assist in pursuing it.

Incentives also may provide incremental utility when added to programs with already documented benefits (e.g., smoking-cessation counseling for pregnant women). When added to otherwise successful interventions, the beneficial effect of incentives may be difficult to detect. This problem is statistical, not conceptual, in nature. It is not that the effect of incentives does not exist when other programs also are being implemented, but rather that the additional effect that is unique to the incentives may be too small to be detected statistically. A key proviso for such research is that it be designed with adequate power to detect what might often be subtle or modest additive effects.

**Implications for Public Policy**

Several aspects of the use of incentives to promote smoking cessation have implications for public policy. As already noted, these programs appear to be most appropriate for high-risk, high-priority, and hard-to-reach patients or for those for whom the importance of smoking cessation is heightened during a defined period of time. The application of incentive-based programs to these groups could be especially effective.

Few studies have employed incentive programs with large populations (Morris, Flores, Olinto, & Medina, 2004), but such programs could be especially effective in reaching large groups of people (e.g., all women of childbearing age) as opposed to smaller, more selected populations for whom behavior-change interventions are most often applied. For example, incentive programs might be incorporated within primary care or general health care or financing programs, such as Medicaid and Medicare.

Behavioral economic considerations of a broad range of incentives and disincentives for healthy behavior have gained increasing attention in discussion of national health care reform. Incorporating a reinforcement and behavioral economic framework in the design and implementation of health interventions offers the promise of bringing to bear the two major findings of this review: (1) for smoking cessation and other important health behaviors, incentives do work; and (2) consistent with perhaps the most reliable observations in all of psychology, for incentives to have sustained effects, the incentives themselves must be sustained.

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REFERENCES


follow-up protocol and economic incentives. Medicin Care, 36, 397–410.


The brief abstinence test: Voucher-based reinforcement of cocaine abstinence. Drug and Alcohol Dependence, 58, 205–212.


