

The Cost-effectiveness of Three Smoking Cessation Programs

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Abstract: This study analyzed the cost-effectiveness and distribution of costs by program stage of three smoking cessation programs: 1) a smoking cessation class; 2) an incentive-based quit smoking contest; and 3) a self-help quit smoking kit. The self-help program had the lowest total cost, lowest per cent quit rate, lowest time requirement for participants, and was the most cost-effective. The most effective program, the smoking cessation class, required the most time from participants, had the highest total cost, and was

the least cost-effective. The smoking contest was in-between the other two programs in total costs, per cent quit rate, and cost-effectiveness; it required the same time commitment from participants as the self-help program. These findings are interpreted within the context of community-based intervention in which the argument is made that cost-effectiveness is only one of several factors that should determine the selection of smoking cessation programs. (*Am J Public Health* 1987; 77:162-165.)

Introduction

Cost-effectiveness analysis (CEA) and cost-benefit analysis (CBA) are used by some public health professionals as one aspect of evaluation.¹⁻³ Accordingly, one of the goals of the Stanford Five City Project (FCP) is to conduct cost-analysis of its health interventions. The FCP is a comprehensive, long-term, quasi-experimental community health education study designed to reduce heart disease risk, morbidity, and mortality in two intervention cities (total population of 117,000).⁴ The findings reported here examine the cost-effectiveness^{2,5} of three smoking cessation programs and are the results from experiences gained during the first five years of the FCP. The study does not attempt to quantify the monetary costs or benefits to society of a person who quits smoking.

Cost analysis has not been used equally to analyze different types of health interventions. For example, there are fewer studies examining the cost-effectiveness of prevention programs than of treatment-oriented programs.² In particular, the cost-effectiveness of smoking prevention/cessation programs has rarely been studied. In one of the few CEA studies of smoking cessation programs, a secondary analysis of 43 published studies, program costs were estimated on the basis of "... the dollars expended on contacts with smokers, based on the duration and number of contacts multiplied by the national average hourly salary or fees of workers of the kind used in the contact."⁶ This method of cost estimation probably underestimates the costs of these programs because only rough estimates of a single cost category (i.e., personnel) were made whereas the total costs include many other categories (e.g., overhead, benefits, volunteers, supplies, travel, data analysis).

This study examines in detail the cost-effectiveness of three smoking cessation programs while addressing some of the limitations of previous cost analyses. Specifically, a comprehensive analysis of program costs is included, the distribution of costs in program stages is analyzed, and cost-effectiveness is examined over the lifespan of a program and under different quit rate assumptions.

Methods

The three interventions selected for this study were community-based smoking cessation programs developed for use in the two education communities of the Stanford Five City Project.

Smoking Cessation Programs

Smoking Cessation Class—This program was designed by Stanford Five City Project staff and implemented by a county health department. The classes included eight one-hour sessions, the first five offered in consecutive weeks and the last three offered every other week; attendance ranged from 8-25 participants. Quitting techniques included behavioral problem solving, self-monitoring, tapering, deep muscle relaxation, goal setting, and group social support. Before leading a class, instructors received two to three hours of training and attended a class led by another instructor.

Incentive-based Smoking Cessation Contest—This program was a six-week community smoking cessation contest. Smokers enrolled in the contest provided verification of their smoking status and then attempted to quit by a predetermined day. Following a six-week period, a random drawing was held for the grand prize (a trip for two to Hawaii) and 21 other donated prizes. All winners had to verify their non-smoking status by submitting to a carbon monoxide assessment. One month following the drawings, a questionnaire was sent to all entrants assessing smoking status and habits. A large majority of the participants quit on their own even though self-help materials and smoking classes were available to them.* The contest was promoted through television, radio, newspapers, posters, schools, and word of mouth. Phone surveys indicated that 60 per cent of the community population was aware of the contest.

Self-help Quit Smoking Kit—The third program was a four-step self-help quit kit^{7,8} containing four "tip sheets" and an introductory page. Each tip sheet had two sides, one providing general information and the other providing tips on quitting and specific action steps to take. Tips include use of substitutes for smoking, social support, public commitment, planning, record keeping, and goal setting. A heart-shaped magnet is included in the kit for use in posting each of the tipsheets on a refrigerator or other prominent place. The kit can be distributed through a variety of channels, including libraries, health agencies, and physician offices.

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*King AC, Flora JA, Clark M, et al: Smokers' challenge: evaluation of a community smoking cessation contest. Paper presented at the annual meeting of the Society of Behavioral Medicine, New Orleans, 1985.

Cost Estimation

The seven major categories of costs are: 1) staff and staff benefits (Stanford, community, and volunteer staff, and consultants); 2) overhead; 3) rent; 4) supplies and materials (printing, advertisements, telephone, postage, prizes, supplies); 5) travel; 6) data analysis (keypunching, computer time); and 7) time required of smokers for participation in each program. In addition, program costs were divided into three project stages: 1) development (costs for program development and planning, leader training, formative research); 2) promotion/implementation (promotion of program, entry form distribution and collection, program implementation including the costs for prizes, and community organization); and 3) evaluation (pre- and post-test surveys, data entry and analysis, and feedback to participants). Developmental costs were limited to those directly related to the smoking cessation programs under study rather than to related resources required to develop the program (e.g., costs of theory development and intervention research by other investigators). To account for the fact that many health professionals use interventions developed by other people rather than developing their own, we also conducted analyses under the assumption that there were no developmental costs. In these analyses, only promotion, implementation, and evaluation costs were included.

Assumptions of the Cost Estimation—Each program was analyzed on the basis of one-year and five-year lifespans. The projection of a five-year lifespan is based on experiences from the FCP in which the smoking class has been conducted for five consecutive years, the smoking contest for three consecutive years, and the self-help quit kit has been used for five years in a variety of settings. All of these programs are still being implemented and it is conceivable that their lifespan would be greater than five years although such factors as program obsolescence, program saturation due to a finite number of interested smokers, and general degradation of intervention quality certainly limit the lifespan of community programs such as these. Quit rates were projected to remain the same over the life of the program and it was assumed that each program would attract equal numbers of people each year of implementation. These assumptions are also based on experiences from the FCP which indicate that quit rates remain the same or improve slightly each year a program is implemented and recruitment of participants decreases slightly until program saturation in the community is reached, at which point recruitment drops significantly.

The classes required about nine hours of participant time while the contest and self-help quit kit each required about 25 minutes. The value placed on each hour of participant time was assumed to be \$10.

After the first year of each program, we assumed that the developmental costs in each subsequent year is 15 per cent of first year costs. This estimated figure was based on previous experiences repeating these and other community programs, and it accounts for the minor changes that are made in the design of a program when it is implemented in different settings, with different people, and at different times. We assume, however, that the basic intervention remains unchanged throughout its lifespan. Evaluation costs in subsequent years are also assumed to be 15 per cent of first year costs since the programs were evaluated extensively in the first year.

The smoking class and self-help programs were implemented in 1981 while the smoking contest first occurred in

1983. By using present value analysis techniques,^{2,4} cost outlays were compared in 1981 dollars. A discount rate of 5 per cent was applied to cost outlays in each year of a program. The sum of these discounted values represents 1981 dollars needed to implement each program over its expected five-year lifespan.

Program Effects

The primary outcome variable was post-program smoking status (smoker or non-smoker) defined as complete abstinence from smoking at the time of assessment. Participants in the class quit, at the latest, by the fifth week of an 11-week class. Smoking status was assessed on average six weeks after the final date for cessation. Participants in the contest quit, at the latest, by the fourth week of a six-week contest. Smoking status was assessed four to six weeks after the final date for cessation. Participants in the self-help kit program quit, at the latest, by the third week of a four-week program. Smoking status was assessed on average five weeks after the final date for cessation. Thus, assessment of smoking status for all three programs occurred at a minimum from 4–6 weeks and at a maximum 8–11 weeks after cessation. In addition, it was assumed that participants who dropped out of a program (stopped attending classes, failed to return post-test questionnaire) between pre- and post-test measurement were still smoking at post-test. Because only the contest used biochemical validation of self-reported smoking status, comparisons of the three programs are based on self-report measures. It was assumed that smoking relapse rates would not differ between programs.

Quit Rates—The quit rate and number of participants on which the quit rate was based for each program is as follows: self-help (N = 101, quit rate = 21 per cent); contest (N = 498, quit rate = 22 per cent); class (N = 541, quit rate = 35 per cent). The quit rate for the self-help intervention is based on a sample of 101 people who contacted the Stanford community office for materials after they were described in a weekly newspaper column. Approximately 46 per cent of the households in the study area subscribed to the newspaper. During the period of program implementation, however, the self-help materials were actively distributed and widely used in many other settings. Thus, it is misleading to consider the costs for developing the self-help program materials to be limited to the particular community program that attracted 101 participants. Therefore, the cost-effectiveness ratios for the self-help program are based on a more realistic sample size of 500 in order to reflect the actual community-wide distribution of materials. It is reasonable to assume that in moderate-to-large sized communities, a self-help program would be of interest to even greater numbers of people.

Data Analysis

The cost per quitter was estimated by dividing the total cost of each program at one year and five years by the number of people who would be expected to quit. To examine the robustness of this CEA, a sensitivity analysis was conducted. The quit rate was changed to account for recidivism after the two-month quit date as well as for differences in quit rates obtained, either lower or higher, when the program is implemented in different settings. Nine quit rates were examined: 5, 10, 15, 21, 22, 25, 30, 35, and 40 per cent.

Results

Demographic Data

As Table 1 indicates, participants in the self-help program (mean age = 45) and class (mean age = 45) were older than those in the contest (mean age = 38). There was a greater

TABLE 1—Demographic Distribution of Participants in Smoking Cessation Programs

Program	Mean Age	Mean Education	% Males	% Females	Mean Cigarettes Smoked, Pretest
Class (N = 541)	44.6 (13.4)	13.5 (2.9)	33.7	66.3	26.8 (12.3)
Self-Help (N = 101)	47.0 (13.9)	not available	32.7	67.3	27.0 (15.2)
Contest (N = 498)	38.2 (12.6)	13.6 (2.8)	44.6	55.4	24.9 (12.6)

percentage of males in the contest (45 per cent) than in either the class (34 per cent) or the self-help kit program (33 per cent). Contest participants also smoked slightly fewer cigarettes per day at pre-test (mean=25) than did participants in the other two programs (both means=27). In addition, data on smoking rates in the FCP education communities indicate that 31.6 per cent of the population aged 25–74 smoked in 1981–82 while 26.6 per cent smoked in 1983–84. Likewise, the mean number of cigarettes smoked per day among smokers was 20.3 in 1981–82 and 19.1 in 1983–84.* These differences in the population and in the smoking rates at the time of the interventions should be noted in interpreting the findings from this study.

Total Costs by Program Stage

The total first year costs for each program are: self-help (\$15,144), contest (\$25,832), and class (\$75,632). If developmental costs are excluded and only the costs for implementing, promoting, and evaluating the programs are considered, first year total costs drop as follows: self-help (\$4,698), contest (\$17,671), and class (\$50,383). Development costs made up a higher proportion of total costs in the self-help program (69 per cent) than in either the class (33 per cent) or the contest (31 per cent), reflecting the substantial time needed to develop self-help materials but the limited time necessary to implement a self-help program, the reverse of the smoking class and contest.

Cost-effectiveness Analysis

The cost-effectiveness ratios (cost per quitter) for the three programs are presented in Table 2. The relative ranking of cost-effectiveness ratios across the three programs under the different conditions is consistent: the most cost-effective program is the self-help program, the least cost-effective program is the class. Depending on the assumptions made about program lifespan and costs included the following upper and lower range of costs per quitter by program were found: class (\$399 to \$235), contest (\$236 to \$129), and self-help (\$144 to \$22).

Sensitivity Analysis

Sensitivity analyses were conducted to examine the impact of different quit rates on the cost-effectiveness of each program in year one (see Figure 1). In all programs, the cost per quitter decreases as the per cent quit rate increases. Comparison of the ratios across the three programs is informative. The class, even at a 5 per cent higher quit rate than actually found (i.e., 40 per cent), is approximately as cost-effective as the smoking contest at a 7 per cent lower quit rate than actually found (i.e., 15 per cent) and is less cost-effective than the self-help program at a 16 per cent lower quit rate than actually found (i.e., 5 per cent). The point at which the contest and self-help programs become equally

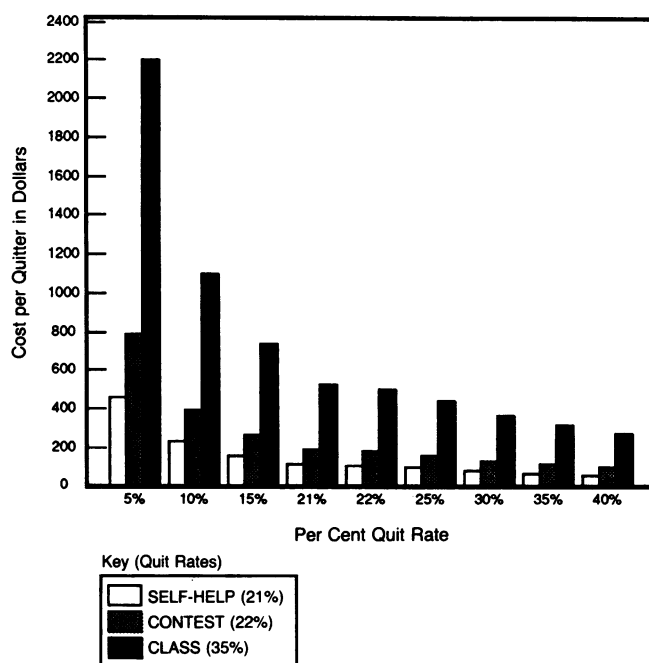


FIGURE 1—First Year Cost per Quitter under Different Quit Rate Assumptions (excluding developmental costs)

cost-effective occurs when the contest achieves a 35–40 per cent quit rate and the self-help program drops to approximately a 10 per cent quit rate.

Discussion

The total costs as well as the costs per quitter reported in the current study are generally higher than those reported by Green and Johnson.⁶ This is due, in part, to their incomplete estimation of program costs, which is understandable given that their study was an archival analysis of published smoking cessation studies.

Our findings are apparently robust within a number of varied assumptions. Moreover, if the number of participants recruited to smoking cessation programs, particularly self-help programs, is greater than the numbers assumed in the present analysis, the cost per quitter drops due to economies of scale.

Because it is unusual for health professionals or organizations to have resources available to develop all of their own programs, ratios with and without developmental costs were reported. In many, if not most, instances, previously developed programs or program components are adopted. Health professionals should carefully consider this issue since developmental costs can be substantial. Possible reasons for developing new programs include unavailability of interventions for a specific population, unacceptable effectiveness of

*Internal report, Stanford Five City Project, 1986.

TABLE 2—Cost-effectiveness Ratios in Three Smoking Cessation Programs

Smoking Cessation Programs	Total Costs		Total Costs Excluding Developmental Costs	
	One Year	Five Years	One Year	Five Years
Class				
Total cost	\$75,632	\$261,589	\$50,383	\$222,911
Number of participants	541	2,705	541	2,705
N of quitters (at 35% quit rate)	189	947	189	947
Cost-effectiveness ratio*	\$399	\$276	\$266	\$235
Contest				
Total cost	\$25,832	\$82,925	\$17,671	\$70,423
Number of participants	498	2,490	498	2,490
N of quitters (at 22% quit rate)	110	548	110	548
Cost-effectiveness ratio*	\$236	\$151	\$161	\$129
Self-Help				
Total cost	\$15,144	\$26,190	\$4,698	\$11,498
Number of participants	500	2,500	500	2,500
N of quitters (at 21% quit rate)	105	525	105	525
Cost-effectiveness Ratio*	\$144	\$50	\$45	\$22

*in 1981 dollars, $r = 5\%$.

previously developed interventions, or an interest in evaluating a new technology of intervention.

The findings from this study must be interpreted within a broad community context.^{3,9} In a given community, there are multiple demographic groups with different preferences for health services, and diverse smoking histories. Different smoking cessation programs may attract different types of people and preferences for cessation programs may shift over time. In this study, for example, the data indicate that the contest attracted a slightly younger population and a higher percentage of males than did either the self-help program or the class. Future research should collect more extensive data on the differential attraction of cessation programs for population subgroups. Moreover, the target population for community smoking cessation programs may vary over time due to changes in community social norms and health services utilization. For these reasons, the absolute cost-effectiveness should not be the only evaluative criterion employed. It may be important for a community to offer a range of integrated smoking cessation programs in order to meet the needs of diverse groups of citizens. In short, if the goal is to reduce smoking in the community-at-large, it makes little sense to limit the smoking programs offered to only the most effective or cost-effective if in fact they only attract a small fraction of the population in need. Moreover, if the cost of smoking cessation programs are below their value, the cost-effectiveness of a specific program may not be as important because a higher cost-effectiveness ratio implies only that the cost for achieving a given effect is higher in one program than in another. Thus, a higher cost-effectiveness ratio does not necessarily imply that a program is undesirable.

Similarly, there may be a need at the community level for sequencing or combining intervention strategies. Because of the unique nature of some cessation programs (e.g., a smoking contest), the community may not fully accept it until

other more visible and better understood programs (e.g., a smoking cessation class) are offered. Combining cessation strategies across programs (incorporating self-help materials into a smoking contest) may further increase the effectiveness. Findings from the current study may help professionals determine the most effective approaches to reducing cigarette smoking in free-living community populations.

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REFERENCES

- Banta HD, Luce BR: Assessing the cost-effectiveness of prevention. *J Community Health* 1983; 9:145-164.
- Warner KE, Luce BR: Cost-Benefit and Cost-Effectiveness Analyses in Health Care: Principles, Practice, and Potential. Ann Arbor: Health Administration Press, 1982.
- Altman DG: A framework for evaluating community-based heart disease prevention programs. *Soc Sci Med* 1986; 22:479-487.
- Farquhar JW, Fortmann SP, Maccoby N, et al: The Stanford Five City Project: design and methods. *Am J Epidemiol* 1985; 122:323-334.
- Levin HM: Cost-Effectiveness: A Primer. Beverly Hills: Sage Publications, 1983.
- Green LW, Johnson KW: Health education and health promotion. In: Mechanic D (ed): Handbook of Health, Health Care, and the Health Professions. New York: Free Press, 1983.
- Sallis JF, Flora JA, Fortmann SP, Taylor CB, Maccoby N: Mediated smoking cessation programs in the Stanford Five-City Project. *Addict Behav* 1985; 10:441-443.
- Sallis JF, Hill RD, Taylor CB, Flora JA, Killen JD, Telch MJ, Girard J, Maccoby N: A controlled evaluation of a self-help smoking cessation program. *Am J Prev Med*.
- Altman DG, King AC: Approaches to compliance in primary prevention. *J Compliance Health Care* 1986; 1:55-73.