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Cost-effectiveness analysis of smoking-cessation counseling training for physicians and pharmacists

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Abstract

Background—Although smoking-cessation interventions typically focus directly on patients, this paper conducts an economic evaluation of a novel smoking-cessation intervention focused on training physicians and/or pharmacists to use counseling techniques that would decrease smoking rates at a reasonable cost.

Purpose—To evaluate the cost-effectiveness of interventions that train physicians and/or pharmacists to counsel their patients on smoking-cessation techniques.

Methods—Using decision-analytic modeling, we compared four strategies for smoking-cessation counseling education: training only physicians, training only pharmacists, training both physicians and pharmacists (synergy strategy), and training neither physicians nor pharmacists (i.e., no specialized training, which is the usual practice). Short-term outcomes were based on results from a clinical trial conducted in 16 communities across the Houston area; long-term outcomes were calculated from epidemiological data. Short-term outcomes were measured using the cost per quit,

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Contributors

SBC was the primary author of the manuscript. SBC, AVP, and NSL were responsible for data acquisition, study design and concept. AAD and GMN conducted statistical analyses, authored the results section of the manuscript, and contributed to the revision of the manuscript. NSL, TR, and AVP contributed to the preparation and critical revision of the manuscript.

Conflict of Interest

The authors declare no conflicts of interest.

and long-term outcomes were measured using the cost per quality-adjusted life-year (QALY). Cost data were taken from institutional sources; both costs and QALYs were discounted at 3%.

Results—Training both physicians and pharmacists added 0.09 QALY for 45-year-old men. However, for 45-year-old women, the discounted quality-adjusted life expectancy only increased by 0.01 QALY when comparing the synergy strategy to no intervention. The incremental cost-effectiveness ratio (ICER) of the synergy strategy with respect to the non-intervention strategy was US$868/QALY for 45-year-old men and US$8,953/QALY for 45-year-old women. The results were highly sensitive to the quit rates and community size.

Conclusion—Synergistic educational training for physicians and pharmacists could be a cost-effective method for smoking cessation in the community.

Keywords

medical decision making; costs and cost analysis; nicotine; smoking cessation

1. Introduction

Many smoking-cessation interventions have been successful and cost-effective. Typically, interventions focus directly on an individual patient through the use of pharmaceutical agents (e.g., bupropion (Bolin, Lindgren, & Willers, 2006) or nortriptyline (Hall, et al., 2005)), nicotine gum (Fagerstrom, 1982; Hjalmarson, 1984), and transdermal nicotine patch and nicotine nasal spray (Abelin, Buehler, Muller, Vesanen, & Imhof, 1989; Fiscella & Franks, 1996; Hurt, et al., 1994), or indirectly through physician counseling (Cromwell, Bartosch, Fiore, Hasselblad, & Baker, 1997; Cummings, Rubin, & Oster, 1989). Research on these interventions has shown that they can have significant health benefits.

Physicians are best positioned to play a crucial role in smoking cessation and prevention efforts (US PHS, 2000), and of all health care providers, pharmacists are possibly the most accessible to the public. Research shows that if trained, both physicians and pharmacists could have significant roles in helping patients quit smoking (Kottke, Brekke, Solberg, & Hughes, 1989; Richmond, Mendelsohn, & Kehoe, 1998). However, only one study (Pinget, Martin, Wasserfallen, Humair, & Cornuz, 2007) showed that such specialized training could be cost-effective.

On the basis of these previous studies, we hypothesized that an indirect physician and pharmacist training smoking-cessation intervention may also be cost-effective. The proposed study evaluates the cost-effectiveness of an intervention that trains physicians and/or pharmacists to counsel their patients on smoking-cessation techniques.

2. Methods

2.1. Intervention

Researchers at The University of Texas MD Anderson Cancer Center developed The Health Care Team Approach to Smoking Cessation: Enhanced Tobacco Outreach Education Program (eTOEP), known as the TEAM Tobacco intervention (Prokhorov, et al., 2010).

The intervention is a community-based health care provider continuing medical education (CME) training program designed to improve smoking-cessation counseling skills among physicians and pharmacists. The effectiveness of the eTOEP intervention was tested through a group-randomized trial with four treatment conditions—training both physicians and pharmacists (synergy condition), training neither physicians nor pharmacists (which is the usual practice), training only physicians, or training only pharmacists—in 16 communities around Houston, Texas.

2.2. Providers

Physicians and pharmacists (hereafter, providers) from the 16 communities were recruited to participate in the eTOEP. Each community was randomized into one of four training strategies for smokingcessation counseling. When smoking-cessation counseling training was not delivered (usual practice), an alternative duration of CME-accredited training on skin cancer prevention was delivered to counteract any potential bias or Hawthorne effect (McCarney, et al., 2007; Trudeau, 1982).

In each community, several clinicians and pharmacists were recruited for a total of 170 providers. The overarching “physicians” category included family practitioners, nurse practitioners, obstetrician/gynecologists, pediatricians, and physician’s assistants. Of 87 recruited physicians, 45 were trained for smoking-cessation counseling while 42 were trained about skin cancer prevention. Of 83 pharmacists, 45 were trained in smoking-cessation and 38 in skin-cancer prevention. The details of recruitment and retention of health care providers are presented elsewhere (Prokhorov, et al., 2010).

2.3. Participants

Participants eligible for the study were at least 18 years old, English or Spanish speaking adult smokers who consented to complete the baseline and follow-up surveys (Prokhorov, et al., 2010). The participants were surveyed four times by telephone or mail: at baseline and then 3, 6, and 12 months after entering the study. Each participant remained in the clinical trial for a 1-year period. A written informed consent was obtained from the participants during the initial contact.

Of the 888 eligible participants recruited, 240 were from a community where neither pharmacists nor physicians experienced tobacco-cessation training, 225 were from a community where only pharmacists received training, 177 were from a community where only physicians received training, and 246 were from a community where both pharmacists and physicians received training. The participants were compensated US$25 for a baseline assessment (at the time of recruitment) and for each subsequent assessment, for a total of US $100 at the end of the study.

The MD Anderson Cancer Center institutional review board approved the study protocol (BS01–129) on June 20, 2001. The study was conducted from February 2004 to May 2007.

2.4. Perspective for Economic Evaluation

A health care provider's perspective was adopted for this economic evaluation. This perspective necessitates inclusion of direct health care costs associated with the actual delivery of the program, and the economic evaluation was conducted to determine the cost-effectiveness of implementing the intervention (Honeycutt, et al., 2006).

2.5. Decision-Analytic Model

The study constructed two decision-analytic models (Cantor, 1995) to reflect the economic costs and potential clinical benefits produced by the four smoking-cessation counseling education training strategies for the providers at two time points. Short-term outcomes (at 1 year) were evaluated in terms of cost per successful quit. Long-term outcome were modeled using the quit rates from the trial, life expectancy data for smokers and non-smokers, and other parameters from the literature, and were presented in terms of cost per quality-adjusted life-year [QALY]. According to the Health and Human Services Commission guidelines, a longer study period better reflects ongoing costs because costs stabilize over the year as more participants enroll and staffs are fully trained (Honeycutt, et al., 2006). The guidelines also recommend a time frame long enough to cover the start-up and full implementation of the program (Honeycutt, et al., 2006). Thus, this analysis uses self-reported quit rates 1 year from the baseline to determine clinical outcomes.

The economic analysis, however, incorporated a lifetime analytic horizon to capture the long-term benefits of smoking cessation. This is consistent with guidelines for cost-effectiveness analysis established by the Panel for Cost-Effectiveness in Health and Medicine (Cantor & Miller, 2009; Lipscomb, Weinstein, & Torrance, 2005).

2.6. Model Parameters

Probability data for the decision-analytic models were based on the medical literature and on data collected for this study. The 1-year quit rates from the study formed a baseline model that used costs and probabilities of quitting to estimate the cost per quit for each training strategy. The analysis uses self-reported quit rates to determine how many participants quit smoking. This is a common practice in similar community-based studies on smoking cessation interventions (Velicer, Prochaska, Rossi, & Snow, 1992; Zhu, et al., 2002). The quit rates were assessed on the basis of response to the following two survey questions at the 12-month time-point since the participant's entry into the study:

1. How would you describe your smoking at this time, would you say that you have completely stopped smoking?
2. How would you describe your smoking at this time, would you say that you have not smoked at all since we last spoke?

Those who responded "yes" to one of the questions at the end of the one-year clinical trial period were considered quitters.

The second decision-analytic model (Sonnenberg & Beck, 1993) analyzed the long-term outcomes on the basis of data in the medical literature (Fiscella & Franks, 1996; Rogers, Hummer, Krueger, & Pampel, 2005), which enabled us to calculate the quality-adjusted life

expectancy for the hypothetical cohorts. Each of the four intervention arms branches into smokers and quitters. These branches ended in simple two-state ("alive" or "dead") Markov models that calculated life expectancies. Smokers were defined as patients who did not successfully quit smoking after the 1-year research period as discussed above. The mortality rates for smokers were based on life tables (Rogers, et al., 2005) and were adjusted by sex and age. Rogers et al categorizes mortality rates by the amount of cigarettes consumed: < 1 pack/day, 1–2 packs/day, or ≥ 2 packs/day (Rogers, et al., 2005). Accordingly, our decision-analytic model categorized hypothetical smokers using this method. Spontaneous quit rates after 1 year were assumed to be the same for all four interventions and were factored into the life expectancies from the Rogers model (Rogers, et al., 2005), as were the proportions and mortalities of former heavy, light, and very light smokers (Rogers, et al., 2005). See Table 1 for model parameters.

2.7. Utilities

Outcomes in the model were based on both life expectancy and quality-adjusted life expectancy, as measured in life-years and QALYs, respectively. Utility scores, representing a preference for quality of life for a particular health outcome, were derived from Fiscella and Franks (Fiscella & Franks, 1996) to adjust for quality of life in patients aged 25–69 years. The data are organized by smokers and quitters (those who have quit smoking for 15 years) and by men and women. The model assumed that the quality of life score would progressively improve in a linear fashion over the 15-year period (Fiscella & Franks, 1996). After age 70, utility values remained constant through the cohort lifetimes. The model also assumed that the quality of life did not vary depending on the amount of cigarettes consumed by current or former smokers.

2.8. Costs

Because the decision analysis was structured on a per patient basis, the costs of the intervention were allocated similarly. Costs were spread across the number of smokers who would be expected to receive each intervention and were measured alongside the clinical trial and were valued in terms of 2003 US dollars, since that was the starting year of the study and the year in which many of the initial costs were incurred.

Total costs were split into personnel, capital, supplies, and program delivery (Table 2). Following the guidelines of the US Panel on Cost-Effectiveness in Health and Medicine, the analysis did not include the research and development costs since the eTOEP program had already been created. This is because the money spent to create the program will be amortized over a long time frame and a much larger group of participants if the program is implemented in other communities. Thus, development costs will be negligible when conducting a cost-effectiveness analysis for future implementations (Luce, Manning, Siegel, & Lipscomb, 1996). The implementation costs, including project staff's time spent implementing the program, were measured to see how effective the program would be if applied in another community. The costs included in the analysis were based on 2003 average hourly wage rates. Table 2 contains a more comprehensive list of costs and their inclusion in our analysis.

At each site, the model assumed that a maximum of five physicians, or five pharmacists, or both (a mixed group of five) would participate in the training session. The study assumed that on average, physicians and pharmacists would see 750 unique smokers every year (Appendix). In each community the five clinicians would see 3,750 unique smokers every year. Therefore, total costs (implementation and provider training time) were allocated across 3,750 unique smokers.

2.9. Analysis

Strategies were evaluated using an incremental cost-effectiveness ratio (ICER), which determined the per unit economic and clinical value of an intervention with respect to alternative strategies. The model estimated the cost per quit, and dollars per QALY. For cost per QALY analysis, both costs and effectiveness were discounted at a rate of 3% as generally recommended by economic evaluation practice (Severens & Milne, 2004). The discount rate measures future costs and benefits in terms of net present value according to the societal preferences.

The cost-effectiveness analysis was conducted using TreeAge Pro 2013 software. The base case analysis was a 45-year-old smoker since that was the average age of participants in the clinical study (Prokhorov, et al., 2010). Sensitivity analysis determined how robust the conclusions of the base case analysis were to changes in the model parameters. One-way sensitivity analysis identified the relative effect of changes in the uncertain parameters on the ICER. With a willingness-to-pay threshold of US$50,000/QALY, two-way uncertainty analysis was conducted on the 95% confidence interval (CI) of quit rates on the non-dominated strategies (Weinstein, 2008). The two-way uncertainty analysis determines the effect of change in quit rates on the net benefits valued at the willingness-to-pay threshold.

3. Results

3.1. Provider and Participant Characteristics

The provider characteristics are presented elsewhere (Prokhorov, et al., 2010). The demographic characteristics of the participants are presented in Table 3. The average age of the participants targeted by each of the training strategies was between 43 and 47 years. The majority of the participants were white, had a high school or higher degree, were married, and were employed. There was no significant difference between demographic characteristics of the participants targeted by each of the training arms, except for race of the female participants.

3.2. Effectiveness Analysis

Table 4 presents the results of the effectiveness analysis in terms of survival, undiscounted QALYs, and QALYs discounted at a 3%. Training both physicians and pharmacists added 0.09 QALYs in 45-year-old men. However, in 45-year-old women, the synergy training only added 0.01 QALYs when compared to no intervention. The overall undiscounted, unadjusted survival duration was 5 years more in women than in men, which, when adjusted for quality of life and discounted, was almost an additional year.

3.3. Cost-Effectiveness Analysis

The cost per patient of the physician-only strategy and pharmacist-only strategy was $77.38 and $77.26, respectively, whereas the combined strategy cost approximately $78.39. Tables 5 and 6 present the results of the cost-effectiveness analysis in terms of cost/quit and cost/QALY analysis. Table 6 compares the no-training strategy to training both physicians and pharmacists, excluding the dominated strategies (training only physicians or training only pharmacists) from further analysis because these strategies cost more and provided fewer added life-years.

When compared to the no training group, training both physicians and pharmacists increased the quit rate by 7% in men, but only by 1% in women. The corresponding ICER in terms of cost per quit of the combination strategy was US$1,104/quit for men, US$13,065/quit for women, and US$3,105/quit for all. Among 45-year-old women, the combination therapy saved one discounted QALY at a cost of US$8,953. The same strategy saved one discounted QALY at a cost of US$868 in 45-year-old men. With every additional year in age, the ICER decreased in both men and women.

3.4. Uncertainty Analysis

One-way sensitivity analysis showed that the ICER was sensitive to the number of patients a provider would see in a given community in 1 year and to the discount rate (see Table 7). For a community with 500 unique smokers per provider, the ICER of the synergy strategy was US$1,302/QALY for men and US$13,430/QALY for women. When the number of smokers per provider was increased to 1,000, the ICER of the intervention was reduced to US$651/QALY for men and US$6,716/QALY for women. Similarly, the ICER was highly sensitive to the change in discount rate and was moderately sensitive to the change in provider salary. The x- and y-axis of Figure 1 represent a 95% CI of the undominated strategies (synergy intervention and usual care); the quadrant is partitioned into the regions corresponding to various incremental net benefits, and the boundaries represent the points at which the strategies have the same net benefits. The points falling in a particular zone indicate the strategy that will be most cost-effective with respect to the other strategies at the willingness-to-pay threshold of US$50,000/QALY. For example if the 12-month quit rates for the combination strategy and the no-training strategy are 17.5% and 6.5%, respectively, then the combination strategy would be the most cost-effective strategy for men. Similarly, if the 12-month quit rates for the combination strategy and no-training strategy are 7% and 6%, respectively, then the pharmacist-only training strategy would be the most cost-effective strategy for women.

4. Discussion

The analysis found that the combination strategy was highly cost-effective for men and moderately cost-effective for women. The other training interventions were dominated, as they were more costly and less effective. The increase in QALYs (0.09 QALYs for men and 0.0.1 QALYs for women) in the base case show the overall effectiveness of the program spread across all participants. This does not mean an increase of 0.09 for each of the program participants. If the intervention causes approximately 1 in 10 men to quit smoking,

the one quitter may gain 0.9 QALYs (about 329 additional discounted days in perfect health), but these gains have to be distributed among the other 9 participants who are still smokers. This leads to a 0.09 incremental effectiveness number. All QALY numbers should be interpreted through this framework. Thus, the higher the quit rates from the smoking cessation program, the greater the benefits and incremental QALYs gained.

Several other researchers have investigated educational smoking-cessation interventions (Cromwell, et al., 1997; Goldberg, et al., 1994; Ockene, et al., 1987; Ockene, et al., 1997; Richmond, et al., 1998; Stead, et al., 2013). The study by Pinget et al was the only one that assessed the cost-effectiveness of a physiciancentered cessation-training program (Pinget, et al., 2007). In that study, if residents received training, the ICERs were US$25 per life-year saved in men and US$35 per life-year saved in women. If physicians in private practice received training, the ICERs were US$88 per life-year saved in men and US$123 in women (currency reported in 2003 US dollars). The study was conducted in university hospitals in Switzerland and used parameters, such as hospital-specific wage rates, that are not easily generalizable. Additionally, the results were presented in terms of dollars per life-year saved rather than dollars per QALY. The present study uses a similar approach to Pinget et al with regards to the eTOEP intervention, but has a broader scope since its results may be generalized to other communities using a similar intervention program. Additionally, our study uses a dollar per QALY analysis that more accurately captures long term costs and benefits.

Other studies on smoking cessation have focused on educating patients directly. Cromwell et al compared 15 recommended smoking-cessation interventions (Cromwell, et al., 1997). The costs (measured in 1995 US dollars) per quit without nicotine replacement therapy for minimal counseling, brief counseling, and full counseling by primary care physicians were US$7,922, US$6,276, and US$2,989, respectively. The ICERs—US$2,186 cost/quit and US $1,108 cost/QALY—for the group intensive counseling intervention were less than the ICERs for the individual counseling intervention.

Our study found similar results that showed the eTOEP program to be fairly cost-effective. At a cost of $3,105 per quit, the program was effective in the short term. Moreover, among 45-year-old smokers, costs were $868/QALY and $8,953/QALY for men and women, respectively. Not only are these numbers on par with previous studies, but they also fall well under the willingness-to-pay threshold outlined above.

The combination strategy was far more cost-effective in men than in women, largely owing to the higher quit rate among men. As demonstrated in the two-way uncertainty analysis, the cost-effectiveness of the intervention depends heavily on the quit rates. Studies have shown greater challenges in helping women to quit smoking than in helping men, potentially owing to differences in confidence, although this hypothesis is controversial (Bauld, Judge, & Platt, 2007; Jarvis, Cohen, Delnevo, & Giovino, 2012). Pinget et al also observed that their intervention was more cost-effective in men than in women (Pinget, et al., 2007). This might be because in both studies more men were heavy smokers than women, which allowed men to receive more benefits in terms of QALYs saved.

The eTOEP study was subject to several limitations. Several assumptions were made regarding the number of smokers a physician or a pharmacist would see in a year. This study also does not consider relapse rates, which means that it may be overestimating the benefits of tobacco cessation. The results found here may not be generalizable to other communities in other areas, as the study was conducted in 16 communities in Texas. Another potential limitation of this study is that we did not use the biochemical validation for to determine smoking cessation. However, evidence from the literature suggests that self-reporting is actually highly accurate in low-intensive interventions that take place in settings outside of a controlled laboratory (Velicer, et al., 1992). In a community based study like this one, saliva testing is both unfeasible and unreliable. Thus, any false negatives due to misreporting should not greatly change the results of this study.

The study did not use probabilistic sensitivity analysis (PSA). The purpose of PSA is to evaluate the joint uncertainty in all model parameters, mainly costs and effectiveness. The costs associated with the interventions did not have any variation since they were point estimates calculated from the resources utilized in the clinical trial. Moreover, the major parameters, such as utilities and smoking intensity, were based on the literature and did not have variation associated with them. Therefore, we decided not to perform PSA and evaluated model uncertainty using one-way and two-way sensitivity analysis.

Since this study was conducted from the health care provider perspective, it did not account for costs that participants would face if they sought out other smoking-cessation counseling or pharmacotherapy to help them quit. Health care costs incurred owing to additional life-years gained by participants were also not considered because the topic is a controversial methodological issue that does not lie within the scope of the project.

We conclude that the eTOEP intervention yields favorable cost-effectiveness. The cost-effectiveness of the intervention depended on gender and quit rates. Implementing this program at a community level would increase the program cost marginally; however, similar success in other communities is possible.

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Research highlights

- We performed an economic evaluation of smoking-cessation counseling training.
- We compared training physicians or pharmacists, training both, and training none.
- Outcomes were measured using cost per quit and cost per quality-adjusted life-year.
- Training both physicians and pharmacists could be cost-effective.

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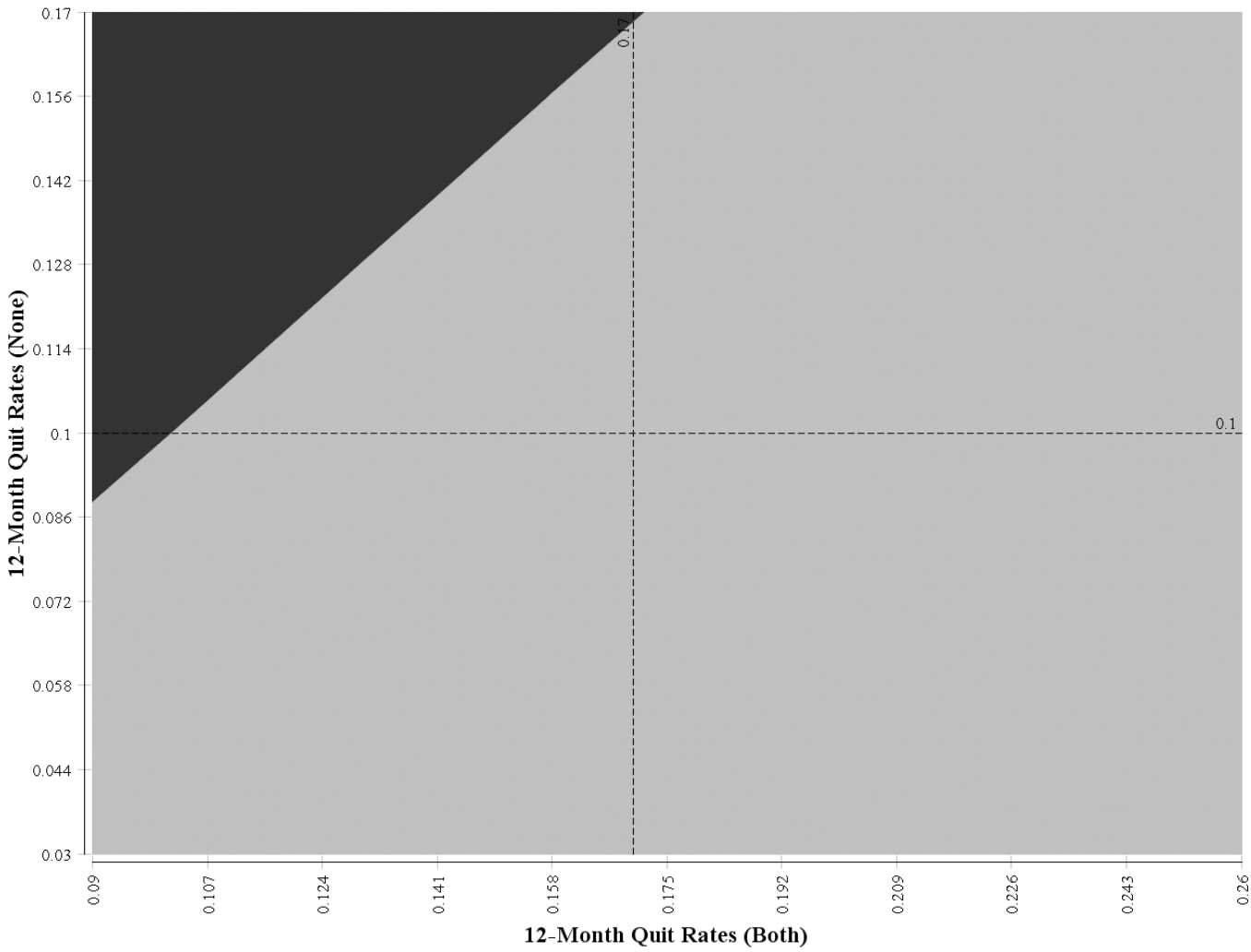

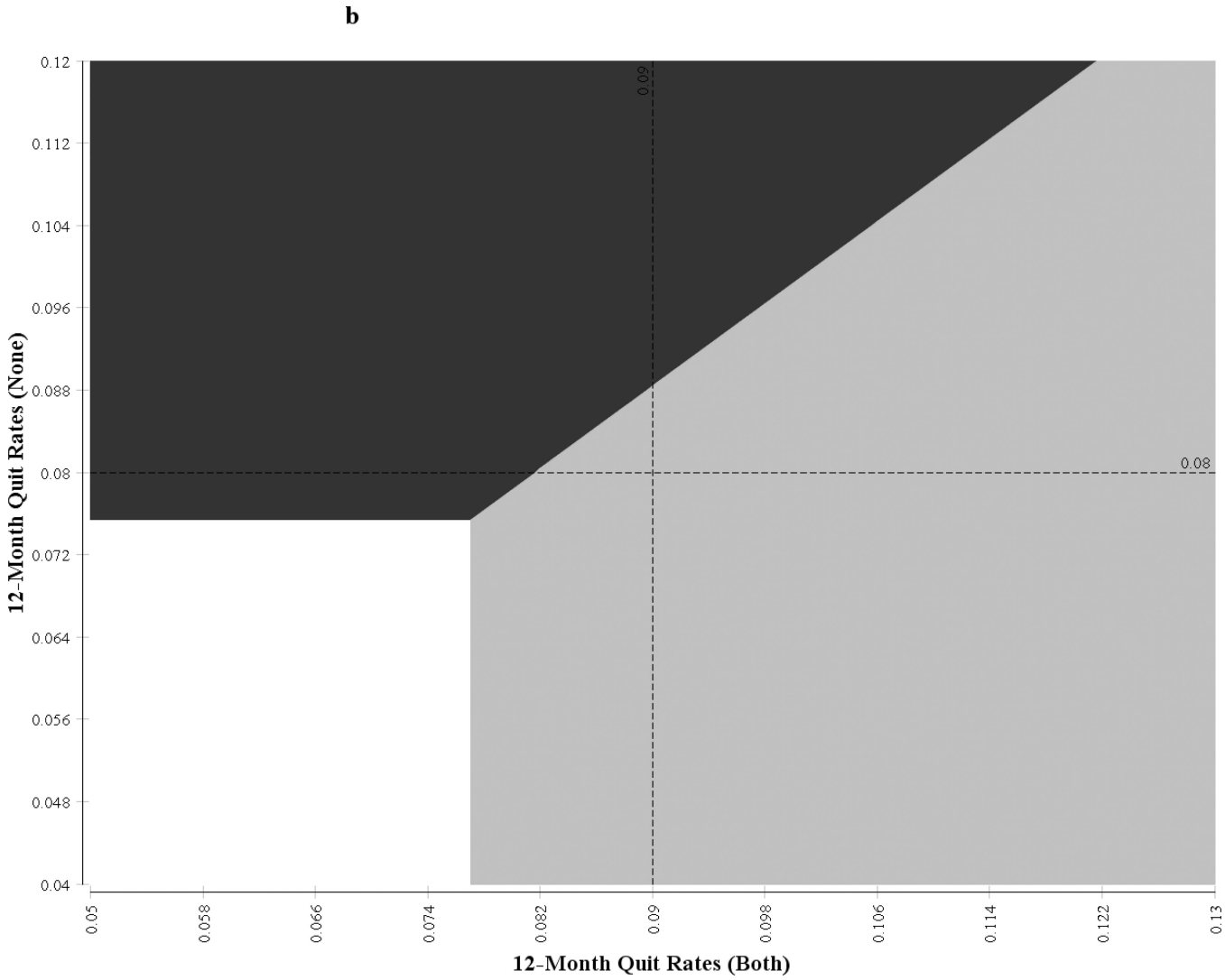

Figure 1.

Two-way uncertainty analysis of the effect of change in quit rates on net benefits at willingness-to-pay threshold of US$50 000 of eTOEP

* The dotted line represents the base case results.

Figure 1a Neither

Physician and Pharmacist

Figure 1b.

Neither

Physician and Pharmacist

Pharmacist only

Table 1

Model parameters of adult smokers participating in eTOEP (February 2004–May 2007)

Parameters	Base case			Source
Quit rates (strategies)	**Men % (95% CI)**	**Women % (95% CI)**	**All % (95% CI)**	**Clinical trial**
Physicians and pharmacists (both)	17% (9% to 26%)	9% (5% to 13%)	11% (7% to 15%)	
Physicians only	7% (0% to 14%)	3% (0% to 6%)	5% (1% to 8%)	
Pharmacists only	9% (2% to 15%)	8% (3% to 12%)	8% (4% to 12%)	
No training (none)	10% (3% to 17%)	8% (4% to 12%)	9% (5% to 12%)	
Prevalence of smoking intensity	Men		Women	Rogers et al., 2005
Heavy smokers (≥2 packs a day)	13%		6%	
Light smokers (1–2 packs a day)	56%		47%	
Very light smokers (<1 pack a day)	31%		47%	
Prevalence of former smoking intensity	Men		Women	Rogers et al., 2005
Former heavy smokers (≥2 packs a day)	25%		12%	
Former light smokers (1–2 packs a day)	57%		40%	
Former very light smokers (<1 pack a day)	18%		48%	
Life expectancy (for smokers and former smokers)		-		Rogers et al., 2005
Health-related quality-of-life weights		-		Fiscella and Franks, 1996
Discount rate		3%		Gold et al., 1996

Abbreviations: eTOEP, The Health Care Team Approach to Smoking Cessation: Enhanced Tobacco Outreach Education Program; CI, confidence interval.

Sources:

Fiscella K, Franks P. Cost-effectiveness of the transdermal nicotine patch as an adjunct to physicians' smoking cessation counseling. *JAMA* 1996;**275**(16):1247–1251.

Lipscomb J, Weinstein MC, Torrance GW. Time Preference. In: Gold MR, Siegel JE, Russel LB, *et al.*, eds. *Cost-Effectiveness in Health and Medicine*. New York: Oxford University Press 2005:214–235.

Rogers RG, Hummer RA, Krueger PM, *et al.* Mortality attributable to cigarette smoking in the United States. *Population and Development Review* 2005;**31**(2):259 – 292

Table 2

Summary of eTOEP implementation costs

Cost categories	Implementation costs
Personnel	**(2 years; US$)**
Lead Investigator	8,160
Manager	13,864
Project Director	69,000
Coordinator	96,750
Trainer	96,750
Capital	
Note-taking materials	231
CDC smoking books	4,899
Supplies	
Office posters	1,000
Personalized program	30,000
Pre-training costs	
Advertising	5,801
Room rental	65
Office supplies	4,034
Conference services	1,500
Actual training day costs	
Trainers (presenters)	22,203
Education materials	2,622
Auxillary, internet-based	19,746
Maintenance costs	
Gifts (e.g., calendars)	781
Providers' training time costs	
Physicians	1,009
Pharmacists	585
Physicians and pharmacists	1,594

Abbreviations: eTOEP, The Health Care Team Approach to Smoking Cessation: Enhanced Tobacco Outreach Education Program

Provider training time cost calculation
Mean hourly wage of a pharmacist, 2003 US dollars = $39.03
Mean hourly wage of a family and general practitioner, 2003 US dollars = $67.24 (Source: US Bureau of Labor statistics)
The tobacco intervention training was 3 hours long.
Overall, 16 communities participated in the trial.
Overall, there were 87 physicians and 83 pharmacists.
Therefore, let us assume that at one site there are 5 physicians and 5 pharmacists.

* Therefore, the total cost incurred to provide training to physicians at one site = 5 × 3 × 67.24 = US$1,008.60

** And the total cost incurred to train pharmacists at one site = 5 × 3 × 39.03 = US$585.45

*** The total costs incurred training physicians and pharmacists = US$1,594.05

Table 3

Demographic characteristics of the participants

	Men					Women				
	Neither N (%)	Pharmacist only N (%)	Physician only N (%)	Pharmacist & physician N (%)	*P*-value	Neither N (%)	Pharmacist only N (%)	Physician only N (%)	Pharmacist & physician N (%)	*P*-value
Age					0.237					0.735
N	70	69	55	76		170	156	122	170	
Mean	43.9 (13.7)	42.6 (13.3)	46.1 (12.4)	46.2 (10.7)		43.9 (12.7)	45.1 (11.8)	43.7 (12.4)	43.8 (11.4)	
Median	44	43	46	47		45	47	45.5	45.5	
Race					0.360					<0.001
American Indian	1 (1.4)	3 (4.3)	3 (5.5)	0 (0.0)		1 (0.6)	1 (0.6)	2 (1.6)	5 (2.9)	
Asian	0 (0.0)	1 (1.4)	0 (0.0)	1 (1.3)		0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Pacific Islanders	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	0 (0.0)	2 (1.2)	
Black	15 (21.4)	11 (15.9)	12 (21.8)	18 (23.7)		25 (14.7)	49 (31.4)	24 (19.7)	33 (19.4)	
White	47 (67.1)	52 (75.4)	34 (61.8)	55 (72.4)		140 (82.4)	100 (64.1)	81 (66.4)	124 (72.9)	
Hispanic	6 (8.7)	2 (2.9)	5 (9.1)	2 (2.6)		3 (1.8)	6 (3.8)	13 (10.7)	5 (2.9)	
No answer	1 (1.4)	0 (0.0)	1 (1.8)	0 (0.0)		1 (0.6)	0 (0.0)	2 (1.6)	1 (0.6)	
Marital status					0.753					0.458
Single	23 (32.9)	27 (39.1)	18 (32.7)	20 (26.3)		47 (27.6)	37 (23.7)	34 (27.9)	40 (23.5)	
Married	31 (44.3)	31 (44.9)	25 (45.5)	43 (56.6)		67 (39.4)	75 (48.1)	56 (45.9)	70 (41.2)	
Separated	4 (5.7)	4 (5.8)	6 (10.9)	3 (3.9)		11 (6.5)	14 (9.0)	7 (5.7)	13 (7.6)	
Divorced	10 (14.3)	5 (7.2)	5 (9.1)	9 (11.8)		38 (22.4)	20 (12.8)	22 (18.0)	36 (21.2)	
Widowed	2 (2.9)	2 (2.9)	1 (1.8)	1 (1.3)		7 (4.1)	10 (6.4)	3 (2.5)	11 (6.5)	
Education					0.459					0.113
< 12thgrade	11 (15.7)	11 (15.9)	16 (29.1)	18 (23.7)		23 (13.5)	35 (22.4)	33 (27.0)	32 (18.8)	
High school	25 (35.7)	18 (26.1)	13 (23.6)	22 (28.9)		56 (32.9)	51 (32.7)	36 (29.5)	60 (35.3)	
Some college	19 (27.1	21 (30.4)	16 (29.1)	23 (30.3)		57 (33.5)	53 (34.0)	41 (33.6)	64 (37.6)	
College degree	13 (18.6)	12 (17.4)	7 (12.7)	12 (15.8)		28 (16.5)	15 (9.6)	12 (9.8)	12 (7.1)	
Master's degree	2 (2.9)	6 (8.7)	2 (3.6)	1 (1.3)		3 (1.8)	2 (1.3)	0 (0.0)	2 (1.2)	
Unknown	0 (0.0)	1 (1.4)	1 (1.8)	0 (0.0)		3 (1.8)	0 (0.0)	0 (0.0)	0 (0.0)	
Employment					0.185					0.231

	Men									Women								
	Neither N (%)		Pharmacist only N (%)		Physician only N (%)		Pharmacist & physician N (%)		*P*-value	Neither N (%)		Pharmacist only N (%)		Physician only N (%)		Pharmacist & physician N (%)		*P*-value
Employed	47	67.1	49	71.0	32	58.2	50	65.8		88	51.8	80	51.3	61	50.0	91	53.5	
Student	1	1.4	3	4.3	0	0.0	0	0.0		8	4.7	7	4.5	5	4.1	6	3.5	
Retired	11	15.7	4	5.8	10	18.2	10	13.2		18	10.6	18	11.5	12	9.8	15	8.8	
Keep house/take care of family	8	11.4	6	8.7	4	7.3	6	7.9		40	23.5	44	28.2	35	28.7	48	28.2	
Income									0.774									0.992
< $25,000	17	24.3	20	29.0	19	34.5	23	30.3		68	40.0	59	37.8	46	37.7	60	35.3	
$25,001–$55,001	15	21.4	10	14.5	10	18.2	16	21.1		30	17.6	37	23.7	27	22.1	42	24.7	
$55,001–$75,000	5	7.1	11	15.9	7	12.7	10	13.2		13	7.6	11	7.1	8	6.6	10	5.9	
$75,001–$95,000	3	4.3	8	11.6	4	7.3	4	5.3		5	2.9	6	3.8	4	3.3	6	3.5	
> $95,000	4	5.7	4	5.8	1	1.8	3	3.9		7	4.1	8	5.1	6	4.9	9	5.3	
Unknown	26	37.1	16	23.2	14	25.5	20	26.3		47	27.6	35	22.4	31	25.4	43	25.3	

Table 4

Effectiveness results of eTOEP[a]

Strategy	Effectiveness (unadjusted for quality of life, undiscounted)	Effectiveness (adjusted for quality of life, undiscounted)	Effectiveness (adjusted for quality of life, discounted at 3%)
Men			
Training: none	31.15	19.79	13.71
Training: pharmacist only	31.08	19.77	13.70
Training: physician only	31.01	19.74	13.68
Training: physician and pharmacist (both)	31.51	19.92	13.80
Women			
Training: none	34.61	21.12	14.69
Training: pharmacist only	34.57	21.11	14.68
Training: physician only	34.28	21.02	14.62
Training: physician and pharmacist (Both)	34.65	21.13	14.70

[a]Base-case estimates based on a 45-year-old smoker

Abbreviations: eTOEP, The Health Care Team Approach to Smoking Cessation: Enhanced Tobacco Outreach Education Program

Table 5

Cost per quit analysis of eTOEP

Strategy	Cost/patient (US$)	Effectiveness (men)	Effectiveness (women)	Effectiveness (all)
None	0.00	10%	8%	9%
Training: pharmacists only[a]	77.27	9%	8%	8%
Training: physicians only[a]	77.38	7%	3%	5%
Training: physicians and pharmacists (both)	78.39	17%	9%	11%
ICER (both compared to none)		US$1,104	US$13,065	US$3,105

[a]The pharmacists-only and physicians-only strategies were dominated by the no intervention strategy.

[b]Measured in terms of cost/quit

Abbreviations: eTOEP, The Health Care Team Approach to Smoking Cessation: Enhanced Tobacco Outreach Education Program; ICER, incremental cost-effectiveness ratio.

Table 6

Incremental cost-effectiveness of the undominated strategies by sex and age at the time of intervention

Patient age at intervention, y	Incremental effectiveness (rounded to two decimals)	Incremental costs per QALY saved[a] (US$)
Men		
25–29	0.07	1,198
30–34	0.07	1,100
35–39	0.08	1,016
40–44	0.08	937
45–49	**0.09**	**868**
50–54	0.10	812
55–59	0.10	776
60–64	0.10	761
65–69	0.10	762
70–74	0.10	776
Women		
25–29	0.01	13,847
30–34	0.01	12,234
35–39	0.01	10,764
40–44	0.01	9,699
45–49	**0.01**	**8,953**
50–54	0.01	8,275
55–59	0.01	7,754
60–64	0.01	7,428
65–69	0.01	7,254
70–74	0.01	7,017

[a] Cost-effectiveness ratios based on 2003 US dollars with quality-adjusted life-years (QALYs) saved discounted at 3%.

Abbreviations: QALY, quality-adjusted life-year.

Table 7

Sensitivity analysis of eTOEP

Sensitivity analysis Base case (range)	Incremental costs per quality-adjusted life-year saved, US$*	
	Men	Women
Cost per hour of provider's (physician + pharmacist) training time, base case hourly wage: physician -US$67.24; pharmacist - US$39.03 (0.5 × hourly wage – 2 × hourly wage)	(866–873)	(8,929–9,002)
Discount rate, base case: 3% (1%–5%)	441–1,563	4,143–17,279
Number of patients a physician or a pharmacist would see in a year, base case: 750 (500–1,000)	1,302–651	13,430–6,716

* Base case estimates based on a 45-year-old smoker