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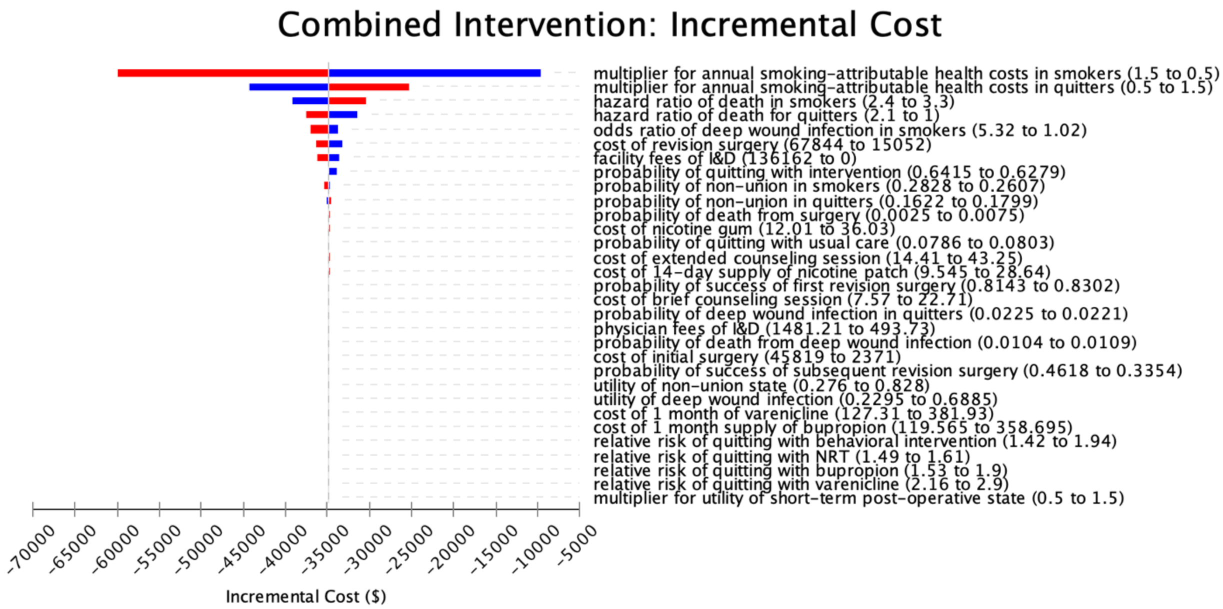

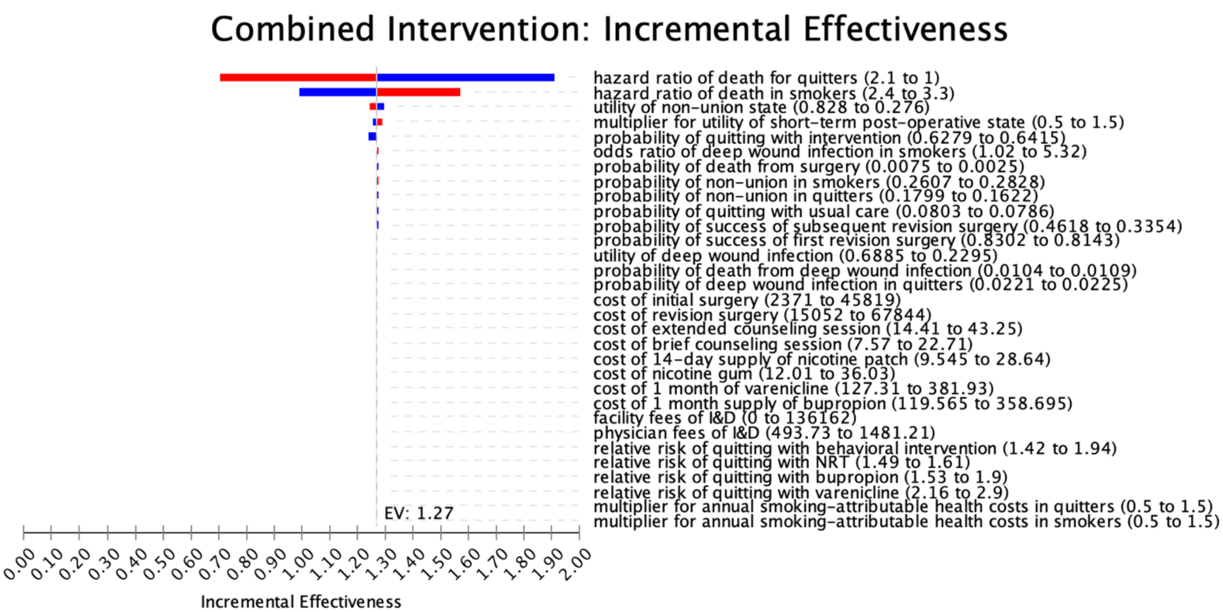

Figure S1. Tornado plots for (*top*) incremental costs and (*bottom*) incremental effectiveness of smoking cessation intervention versus usual care as each variable is varied across its range for the combined intervention on the lifetime horizon.

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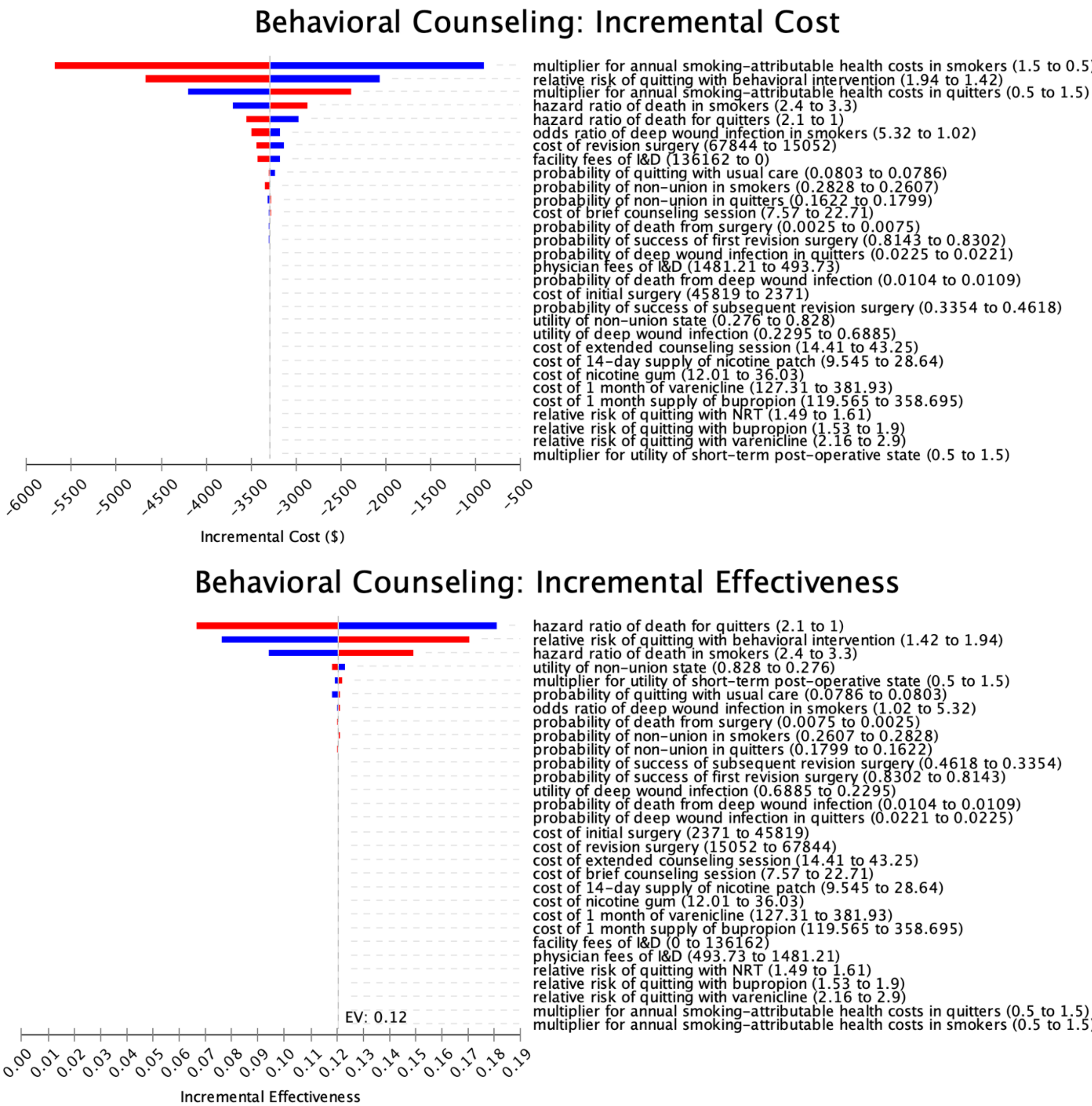

Figure S2. Tornado plots for (*top*) incremental costs and (*bottom*) incremental effectiveness of smoking cessation intervention versus usual care as each variable is varied across its range for behavioral counseling on the lifetime horizon.

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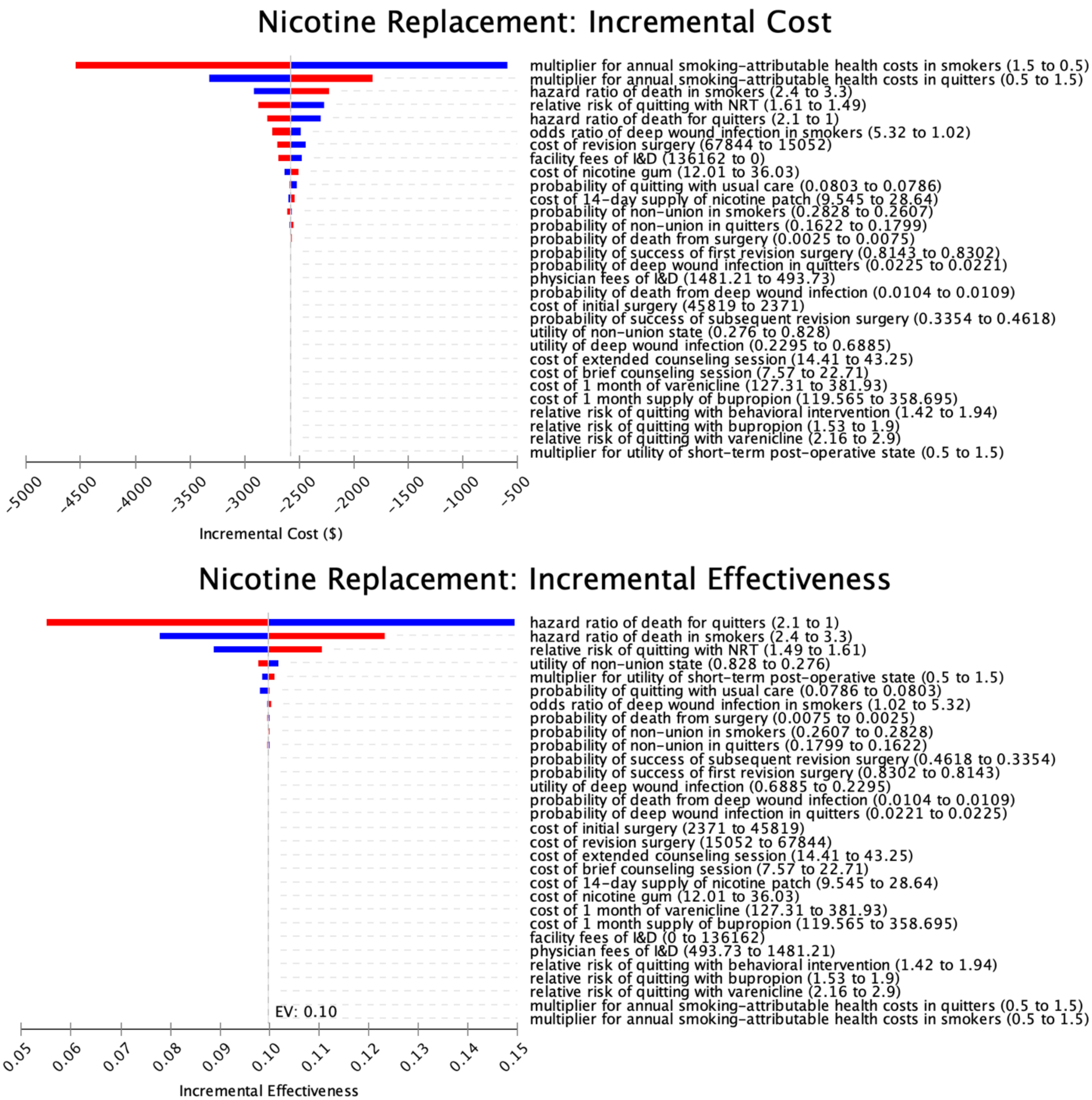

Figure S3. Tornado plots for (*top*) incremental costs and (*bottom*) incremental effectiveness of smoking cessation intervention versus usual care as each variable is varied across its range for nicotine replacement therapy on the lifetime horizon.

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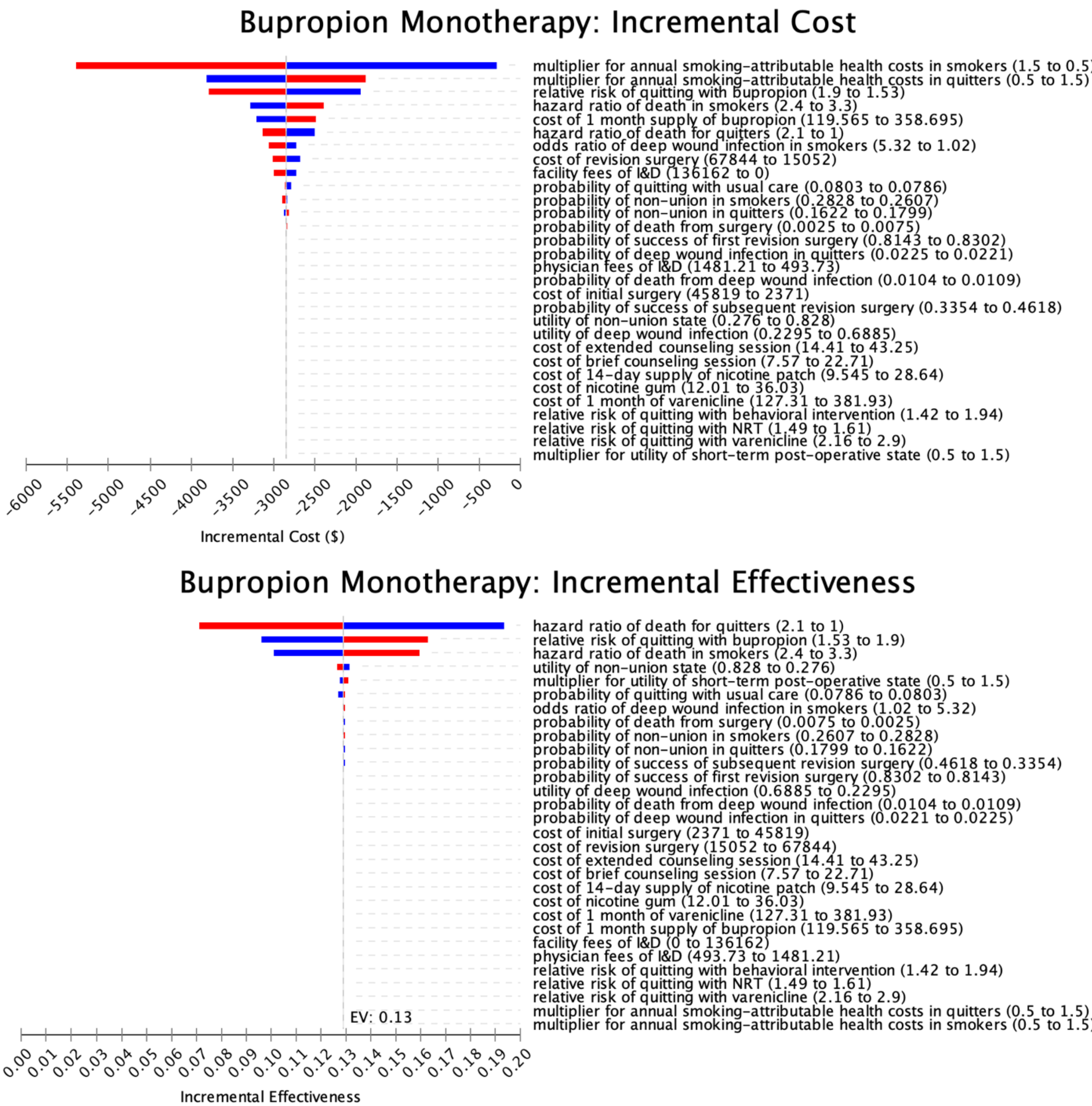

Figure S4. Tornado plots for (*top*) incremental costs and (*bottom*) incremental effectiveness of smoking cessation intervention versus usual care as each variable is varied across its range for bupropion monotherapy on the lifetime horizon.

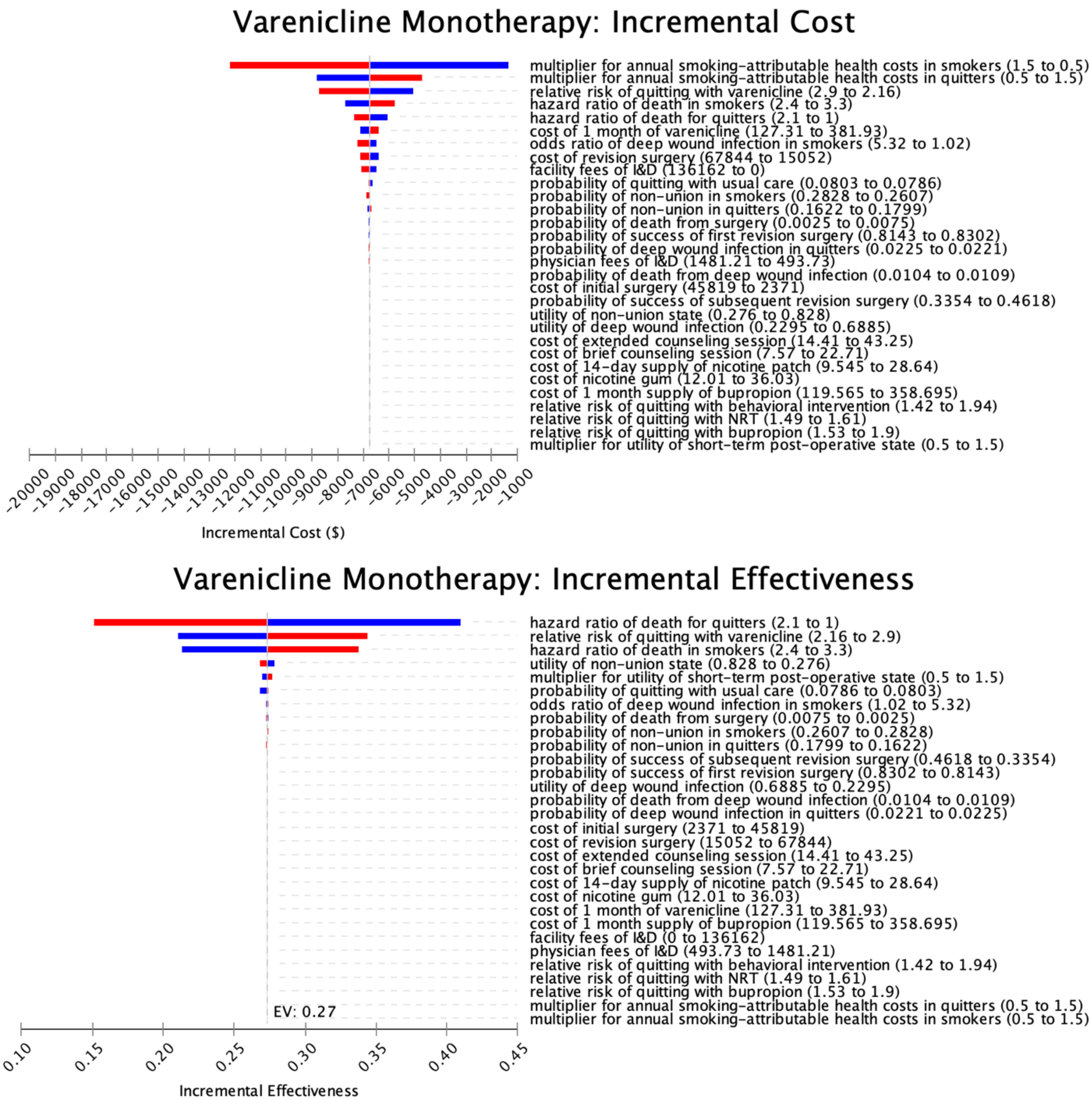

Figure S5. Tornado plots for (*top*) incremental costs and (*bottom*) incremental effectiveness of smoking cessation intervention versus usual care as each variable is varied across its range for varenicline monotherapy on the lifetime horizon.

Model Validation

Internal validity was tested by constructing two separate models. The first model utilized point estimates for all model parameters. The second model was constructed for the probabilistic sensitivity analysis and utilized probability distributions for all model parameters. The output of these two models were in agreement. Two analysts also independently verified these models.

To assess the external validity of our model, we first predicted 30-day mortality rates for smokers and quitters undergoing lumbar fusion using our model and compared them to those from an independent study that was not used to estimate our model parameters.[1] The 30-day mortality rates predicted by our model were as follows: in a cohort of smokers with a mean age of 49 years, 30-day mortality was 0.64% and in a cohort of quitters with a mean age of 62 years, 30-day mortality was 0.67%. These were qualitatively consistent with the 30-day mortality rates described in the independent study, i.e. 0.4% for current smokers and 0.3% for prior smokers.[1] By reducing the baseline probability of death with surgery to ~0.2%, we could bring our model into quantitative agreement with those described mortality rates. This resulted in a 0.3% change in cost savings, which falls well within one standard deviation of the estimate in our base model [Note: the standard deviation (across 10,000 Monte Carlo simulations) of our base-case estimate for cost-savings ranges from 12 – 29% of the mean estimate].

In addition, we compared the long-term difference in mortality for smokers versus quitters predicted by our model with actual differences in life expectancy that Taylor et al. has calculated from the Cancer Prevention II study.[2] The gain in life expectancy from smoking cessation predicted by our model for the base case (i.e. 45-year old patient) was in excellent agreement with those observed by Taylor et al. (Table S1). The gain in life expectancy predicted for a 55-year old in our model was also in good agreement with those observed. The gain in life expectancy predicted for a 35-year old in our model deviated from those observed. Two possibilities can account for this discrepancy. First, compared to the study we used to generate our model,[3] Taylor et al. may underestimate the permanent, deleterious effects of smoking in younger populations and thus overestimate the benefit of quitting at younger ages. This would result in an overestimation of the difference in mortality between a 35-year old quitter and a 45-year old quitter. In concrete terms, Taylor et al.'s calculations show that a 35-year old male quitter in 1990 could expect to live another 41.2 years.[2] According to U.S. life tables from 1990,[4] a 35-year old male in the general population could expect to live another 39.6 years. In other words, a 35-year old quitter could expect no excess mortality attributable to smoking. However, the study used in our model found a 10-30% increase in mortality in quitters aged 35-44 years, depending on sex.[3] Alternatively, our model may overestimate the potential mortality benefits of quitting at younger ages. Again, we can bring our model output into quantitative agreement with Taylor et al.'s values by adjusting the hazard ratio for death in 35-year old male quitters from 1.1 to 1.37 and in 35-year old female quitters from 1.3 to 1.59. Substituting these derived hazard ratios into our model results in a 4.8% change in cost savings for a 35-year old male and a 13.4% change for a 35-year old female. In comparison, the standard deviation of cost savings across 10,000 Monte Carlo simulations for a 35-year old male or 35-year old female ranges from 13 – 24% of the mean estimate in our base model (depending on intervention). In other words, the point estimate for cost savings obtained by using the derived hazard ratios lies within one standard deviation of the mean estimate produced using our base model. Therefore, our model produces predictions that appear to be externally valid in both the short- and long-term.

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Table S1. Comparison of Predicted and Observed Gain in Life Expectancy from Quitting

Age	**Gain in Life Expectancy (Relative to Continuing Smoker) in Years**			
	Taylor et al.[2]		**This study**	
	Male	**Female**	**Male**	**Female**
Quit at age 35	8.5	7.7	10.8	9.8
Quit at age 45	7.1	7.2	6.9	7.0
Quit at age 55	4.8	5.6	4.9	5.0

Gain in life expectancy in this study was calculated by subtracting the age at which 50% of the quitting cohort reached the death state in the Markov model from the age at which 50% of the smoking cohort reached the death state.

Table S2. Level of Evidence* Rating for Model Inputs

Variable	Authors (Year)	Level of Evidence*
Smoking cessation without intervention	Huges et al. (1992)	Prognostic Level II
Smoking cessation with behavioral intervention	Stead et al. (2013)	Therapeutic Level I
Smoking cessation with nicotine replacement therapy	Hartmann-Boyce et al. (2018)	Therapeutic Level I
Smoking cessation with bupropion or varenicline monotherapy	Cahill et al. (2013)	Therapeutic Level I
Smoking cessation with combined intervention	Møller, Kjellberg, and Pedersen (2006)	Therapeutic Level I
Probability of non-union in smoker or quitter	Glassman et al. (2000)	Prognostic Level III
Probability of deep infection in smoker or quitter	Schimmel et al. (2010)	Prognostic Level III
Successful correction of non-union	Carpenter et al. (1996)	Prognostic Level III
Mortality from deep infection and surgery	Veeravagu et al. (2009)	Prognostic Level III
Hazard ratios for mortality in smokers and quitters	Jha et al. (2013)	Prognostic Level II
Annual probability of smoking relapse	Hughes, Peters, and Naud (2008)	Therapeutic Level I

*Level of evidence was rated according to *JBJS* criteria, available here: https://journals.lww.com/jbjsjournal/Pages/Journals-Level-of-Evidence.aspx.

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Table S3. Ranges Used in Sensitivity Analyses and PSA Parameters

	Variable	Range for One-Way Sensitivity Analyses	Parameters for Probabilistic Sensitivity Analysis
Probabilities	Baseline, smoking cessation without intervention	0.0786 – 0.0803	α = 50, β = 580
	RR with behavioral intervention alone	1.42 – 1.94	μ = 0.5067, σ = 0.0780
	RR with nicotine replacement therapy[†]	1.49 – 1.61	μ = 0.4375, σ = 0.0194
	Corrected RR for bupropion monotherapy[†]	1.53 – 1.90	μ = 0.5336, σ = 0.0541
	Corrected RR for varenicline monotherapy[†]	2.16 – 2.90	μ = 0.9174, σ = 0.0737
	Smoking cessation with combined intervention	0.6279 – 0.6415	α = 77, β = 43
	Non-union		
	Smoker	0.2607 – 0.2828	α = 18, β = 50
	Quitter	0.1622 – 0.1799	α = 13, β = 63
	Deep infection in quitter	0.0221 – 0.0225	α = 36, β = 1,579
	OR of deep infection in smoker	1.02 – 5.32	μ = 0.8456, σ = 0.4129
	Successful correction of non-union		
	First attempt	0.8143 – 0.8302	α = 71, β = 15
	Subsequent attempt	0.3354 – 0.4618	α = 6, β = 9
	Mortality from deep infection	0.0104 – 0.0109	α = 8, β = 744
	Mortality from surgery	50-150% of base value	α = 120, β = 23,902
	Baseline mortality		
	HR for mortality in smoker, male	2.4 – 3.3	μ = 1.0034, σ = 0.0492
	HR for mortality in smoker, female	2.4 – 3.3	μ = 1.0936, σ = 0.0386
	HR for mortality in 35-year old quitter, male	1.0 – 2.1	μ = 0.1682, σ = 0.0647
	HR for mortality in 35-year old quitter, female	1.0 – 2.1	μ = 0.2827, σ = 0.0721
	HR for mortality in 45-year old quitter, male	1.0 – 2.1	μ = 0.3565, σ = 0.0670
	HR for mortality in 45-year old quitter, female	1.0 – 2.1	μ = 0.4521, σ = 0.0730
	HR for mortality in 55-year old quitter, male	1.0 – 2.1	μ = 0.5148, σ = 0.0686
	HR for mortality in 55-year old quitter, female	1.0 – 2.1	μ = 0.5737, σ = 0.0647
	Annual probability of smoking relapse*	N/A	α = 9.73, β = 85.55
Costs	Smoking cessation intervention		
	Extended counseling session (over 10 min)	50-150% of base value	μ = 28.83, σ = 14.415
	Abbreviated counseling session (3 – 10 min)	50-150% of base value	μ = 15.14, σ = 7.57
	Nicotine patch (14-day supply)	50-150% of base value	μ = 19.09, σ = 9.545
	Nicotine gum starter kit (110 pieces)	50-150% of base value	μ = 24.02, σ = 12.01
	Varenicline starter pack (0.5mg x 11, 1mg x 42)	50-150% of base value	μ = 254.62, σ = 127.31
	Varenicline continuing pack (1 mg x 56)	50-150% of base value	μ = 254.62, σ = 127.31
	Bupropion (150mg x 60)	50-150% of base value	μ = 239.13, σ = 119.565
	Single-level instrumented posterolateral fusion	$2,371 – 45,819	μ = 24,095, σ = 10,862
	Revision surgery	$15,052 – 67,844	μ = 41,448, σ = 13,198
	Deep infection treatment		
	Hospital	$0 – 136,162	μ = 61,866, σ = 37,148
	Physician	50-150% of base value	μ = 987.47, σ = 493.735
	Baseline annual smoking-attributable health costs		
	Smoker	50-150% of base value	N/A
	Quitter	50-150% of base value	N/A
Utilities	Deep infection	50-150% of base value	α = 1.7050, β = 2.0096
	Non-union	50-150% of base value	α = 1.2400, β = 1.0064

	Stable, post-operative	50-150% of base value	N/A

For the PSA, we modeled probabilities and utilities with beta distributions, relative risks with log-normal distributions, and costs with normal distributions. *The one-way sensitivity analyses shown were performed on the base model, which did not include smoking relapse; the beta distribution for this variable was estimated using its 95% confidence interval.

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4. *United States Life Tables, 1990*. U.S. Department of Health and Human Services https://www.cdc.gov/nchs/data/lifetables/life90_2acc.pdf. Accessed April 27, 2020.