Published in final edited form as:

Am J Health Behav. 2012 September ; 36(5): 681–692. doi:10.5993/AJHB.36.5.10.

Perceived Risk and Quitting Behaviors: Results From the ITC 4-Country Survey

Mary Jean Costello, MSc, Christine Logel, PhD, Geoffrey T. Fong, PhD, Mark P. Zanna, PhD, and Paul W. McDonald, PhD

Mary Jean Costello, School of Public Health and Health Systems; Christine Logel, Renison University College; Geoffrey T. Fong; Mark P. Zanna, Department of Psychology; Paul W. McDonald, School of Public Health and Health Systems, all from University of Waterloo, Waterloo, Ontario, Canada.

Abstract

Objective—To rigorously test the relation between perceived risk (ie, belief about the likelihood of harm) and quitting smoking.

Methods—Data from a longitudinal study with a nonrestrictive sample of smokers (N = 4307) from the United States, Canada, the United Kingdom, and Australia were examined to predict quitting behaviors at 8–12 months.

Results—Perceived risk predicted plans to quit, quit attempts, and, to some extent, sustained quitting. The relation was stronger for relatively simple (eg, plans to quit) than for complex behaviors (eg, sustained quitting).

Conclusion—Perceived risk plays a significant role in predicting quitting smoking, more so for relatively simple behaviors.

Keywords

perceived risk; health behavior change; smoking

Quitting smoking, practicing safer sex, and eating healthy foods can substantially reduce the risks of lung cancer, AIDS, and diabetes, respectively. However, in spite of efforts to inform the general public that their behavior puts them at risk of such diseases, rates of such healthy behaviors remain low. Thus, an important question remains: does the risk people perceive of a given health consequence actually play a role in their health behavior?

According to key health behavior models, perceived risk is hypothesized to play a major role in predicting health behavior (see the Health Belief Model;^{1–3} Protection Motivation Theory;^{4,5} protection adoption process;⁶ and the C-SHIP model^{7,8}). Although some empirical evidence supports this relation, there are alternative explanations and inconsistent findings that potentially diminish the value of perceived risk as a key determinant of health behavior. With respect to smoking, perceived health risk may play a particularly important

role in predicting quitting behavior. Given that most antismoking campaigns rely on conveying health risk to motivate people to quit, the extent to which perceived risk predicts quitting behavior warrants further investigation.

In this article, we investigated the relation between perceived risk and the process of quitting smoking. Although quitting behaviors are at least partially controlled by environmental and biological factors, findings from the present study may help underscore the important role perceived risk plays in health behavior change.

The Relation Between Perceived Risk and Quitting Smoking

The topic of perceived risk and smoking has received much research attention; however, relatively few studies investigate the role of perceived risk in quitting. Those that have are often plagued with methodological limitations resulting in inconsistent findings across studies. Typically, cross-sectional studies find a positive relation between perceived risk and concurrent plans to quit^{9–13} and quitting behaviors;¹⁴ however, they are unable to determine the direction of the relation and the role of third variables.^{15,16} Some longitudinal studies find a positive relation between perceived risk and subsequent quitting behaviors,^{17–19} but the associations are typically much weaker than what we would expect given the importance of perceived risk in health behavior models. Surprisingly, several longitudinal studies find no relation between perceived risk and subsequent plans to quit^{13,20} or quitting behaviors.^{13,20,21} These inconsistencies lead one to question the importance of perceived risk in predicting health behavior change.

Methodological limitations may help to explain these inconsistent findings. For example, measurement error and participant selection may hamper the detection of a true relation between perceived risk and quitting behaviors. Unconditional phrasing (eg, “What is the chance that you will get X disease?”) could add error variance if some participants assume the phrasing implies a condition (eg, if one continues smoking; if one quits smoking), whereas others do not. In contrast, phrasing such as “What is the chance that you will get X disease *if you continue to smoke*?” minimizes such random error by clarifying the conditions under which participants should judge their risk.^{15,22} Furthermore, some studies specify the type of risks people are asked to evaluate (eg, lung cancer or heart disease), whereas others refer to health in general. The use of a general health outcome may limit the precision of the measure, making it more difficult to capture an association with outcome measures.²³ Aggregating over multiple health outcomes may add even more value to the predictability of perceived risk as more than one risk is considered, but to the best of our knowledge this hypothesis has not been tested empirically. Participant selection can also impede detection of a true relation by restricting the range of intentions or attempts to change behavior (eg, by recruiting only participants who are highly motivated to quit). Other studies may find inconsistent results if the relation depends on the complexity of the behavior. Some have argued that the relation should be weaker for complex and difficult behaviors (eg, quitting smoking) than for simple and easy behaviors (eg, planning to quit).²⁴ Indeed, studies that show a strong positive relation between perceived risk and health behavior tend to measure relatively easy and low-complexity behaviors.^{25,26}

A rigorous test of the relation between perceived risk and quitting smoking is needed; one that uses a longitudinal design, a large nonrestrictive sample, and measures perceived risk in a way that minimizes random error. The present study used data from the International Tobacco Control Policy Evaluation Project Four Country Survey (ITC 4) to investigate how perceived risk of lung cancer and heart disease predicts plans to quit, attempts to quit, and sustained quitting in a longitudinal, representative sample of adult smokers in the United States, Canada, the United Kingdom, and Australia. We expected perceived risk to predict easy, simple behaviors (ie, plans to quit) and moderately difficult behaviors (ie, attempts to quit) more strongly than a difficult, complex behavior (ie, sustained quitting). We further test whether aggregating across multiple measures of perceived risk predicts quitting behaviors more strongly than a single measure does. We hypothesized that aggregating over multiple negative health outcomes may improve the measurement of perceived risk even more. Although not of primary interest to this paper, we also explore whether country of residence moderates the relation between perceived risk and quitting behaviors. To date, no study has investigated the potential moderating effects. We take advantage of our international sample to explore these effects.

METHOD

Study Design

We use data from the ITC 4-Country Survey, an annual cohort survey of adult smokers (aged 18 years or older) in 4 countries: United States, Canada, United Kingdom, and Australia.^{27,28} Participants reported smoking at least 100 cigarettes in their lifetime and had smoked at least once in the past 30 days.

The ITC 4-Country Survey is part of the ITC Project, a much larger international research project designed to evaluate the psychosocial and behavioral impact of tobacco control policies of the World Health Organization's Framework Convention on Tobacco Control (FCTC).^{27,29} Refer to the ITC Web site at (<http://www.itcproject.org/>) for additional information.

Wave 1 of the ITC 4-Country Survey was conducted from October to December 2002. Participants were recruited through a 10-minute telephone survey, followed a week later by a 45-minute main survey and follow-up surveys at approximately 8-to-12-month intervals. The cohort was constructed from probability sampling methods (random-digit-dialing methods from list-assisted phone numbers) with numbers selected at random from the population of each country within strata defined by geographic region and community size. Next-birthday method³⁰ was used to select the respondent in households with multiple smokers. Initial cooperation rates were high for a survey of this kind: United States = 77.0%, Canada = 78.5%, United Kingdom = 78.7%, and Australia = 78.8%.

Survey fieldwork was conducted by Environics Research Group, Toronto (Canada and United States), and Roy Morgan Research, Melbourne (Australia and United Kingdom). Study protocol was cleared for ethics by the institutional review boards or research ethics boards of the Roswell Park Cancer Institute (United States), University of Illinois-Chicago

(United States), University of Waterloo (Canada), University of Strathclyde (United Kingdom), and the Cancer Council Victoria (Australia).

Sample

The present analyses include participants who were recruited at wave 1 as smokers (Cohort 1) and completed wave 2 and wave 3 survey collection in April– August 2003 and August– December 2004, respectively ($n = 4706$). The overall retention rate among survey respondents from wave 1 to wave 3 was 52.0% (United States = 37.4%, Canada = 54.2%, United Kingdom = 55.3%, and Australia = 59.7%). Because perceived risk of lung cancer or heart disease was not measured at wave 1, wave 2 measures obtained from those still smoking were used to predict behavior at wave 3. For the purposes of this paper we will refer to wave 2 as Time 1 and wave 3 as Time 2.

In total, 4307 respondents who were smoking at Time 1 were re-interviewed at Time 2: United States ($n = 743$), Canada ($n = 1079$), United Kingdom ($n = 1216$), and Australia ($n = 1269$). Sample sizes for the reported analyses are lower due to missing responses for some items. See Thompson and colleagues³⁰ for technical details of the ITC Four Country Survey.

Measures

Perceived risk—At Time 1 and Time 2, respondents were asked “Let’s say you *continue to smoke* the amount that you do now. How would you compare your own chance of getting *lung cancer/heart disease* in the future to the chance of a nonsmoker?” The conditional nature of the question, the use of more than one item, the specification of disease, and the use of nonsmokers as a comparison group were meant to add clarity in order to minimize measurement error. Response options ranged from 1 to 4 representing: (1) just as likely to get [lung cancer/heart disease] compared to a nonsmoker; (2) a little more likely; (3) somewhat more likely; or (4) much more likely. Responses were recategorized to represent 3 levels of perceived risk for lung cancer and heart disease separately: (1) low (ie, 1), (2) moderate (ie, 2–3), and (3) high (ie, 4). Both measures were found to be significantly correlated at $P < 0.001$ (Kendall’s tau statistic = 0.55, $n = 4191$). The sum of the responses to the 2 perceived risk measures was calculated by adding the response values. Similar to the individual measures, the sum was transformed to represent 3 levels of perceived risk: (1) low (ie, 2–3), (2) moderate (ie, 4–6), and (3) high (ie, 7–8).

Dependent variables—Dependent variables were Time 1 and Time 2 plans to quit, Time 2 attempts to quit, and Time 2 sustained quitting. Respondents indicated if they were planning to quit smoking within the next month, within the next 6 months, sometime in the future beyond 6 months, or not planning to quit (dichotomized as 1 = planning to quit within the next 6 months, 2 = planning to quit beyond 6 months or not planning to quit). They next indicated if they had attempted to quit since the last survey date (1 = yes; 0 = no). Those who had stayed smoke-free for greater than 24 hours were considered to have made a legitimate quit attempt. Respondents who had attempted to quit were asked if they were (1) back to smoking or (2) still quit. Those who had made a legitimate quit attempt and indicated they were still quit were considered sustained quitters.

Covariates—At baseline, basic demographic variables were collected (ie, age, sex, ethnicity, income, and education). Respondents also reported whether they were (1) daily or (2) nondaily smokers. The Heaviness of Smoking Index (HSI),³¹ a commonly used composite measure of self-reported smoking dependence, was calculated for each respondent. HSI combines measures of cigarettes per day (CPD) and time to first cigarette after waking (TTFC). To calculate the HSI score, 4 categories of CPD were assigned values (0=10 or less, 1=11–20, 2=21–30, 3=31 or more) as were 4 categories of TTFC (0=after 60 minutes, 1=31–60 minutes, 2=6–30 minutes, 3=within 5 minutes). The values for both measures were summed resulting in a score ranging from 0 to 6. Scores were collapsed to represent low (< 2), moderate (2–4), and high (>4) smoking dependence. Those with high HSI scores are more highly dependent on smoking.

Survey Weights

Proportional survey weights were used to adjust the data to the populations of smokers in each country. Weights were constructed from basic sampling weights (reciprocals of estimated inclusions probabilities) by an adjustment for geographic stratum, nonresponse, and stratum attrition between recruitment and main surveys, followed by calibration in each country to national smoker prevalence estimates for groups defined by demographic categories in that country.²⁸ Weights for each stratum were combined into one weighting variable and applied to data for descriptive analysis. Although logistic regression models were conducted with unweighted data, key demographic variables used to calculate sample weights (ie, country, age, sex, and ethnicity) were included as covariates in regression models to adjust for potential sample differences, similar to weighted analyses.

Analytic Strategy

Data were aggregated across countries to ensure adequate sample size to conduct the following sets of logistic regression analyses. Cross-sectional logistic regression was conducted to determine whether perceived risk was associated with plans to quit at Time 1. A null model was created by including demographic variables necessary for constructing weights (ie, country, age, sex, ethnicity) along with covariates found to be significant predictors of planning to quit in bivariate analyses (ie, income, education, smoking status, HSI, Time 1 attempts to quit; bivariate results not presented here) using forced entry. Next, each measure of perceived risk (ie, perceived risk of lung cancer, perceived risk of heart disease, and the sum of the 2 measures) was added independently to the null model (Models 1, 2, and 3).

A similar approach was used for the longitudinal analyses. Null models were created for each dependent variable (ie, Time 2 plans to quit, attempts to quit, and sustained quitting) using the same approach described above; however, Time 1 plans to quit was also included. Doing so meant results represented a change score: the variance in Time 2 plans and attempts to quit not explained by Time 1 plans and attempts to quit. Next, each measure of perceived risk was added independently to the null model predicting plans to quit (Models 4, 5, and 6), attempts to quit (Models 7, 8, and 9), and sustained quitting (Models 10, 11, and 12).

For both the null and full models, we calculated the Akaike information criterion [(AIC); $AIC = -2\ln(L) + 2k$]³² and compared each set of models to determine (1) whether the full models were a better fit than the null model and (2) which of the full models contained the better measure of perceived risk. AIC is a measure of the relative goodness of fit of a model that includes a penalty to discourage overfitting. It provides a tool for model selection; the preferred model is the one with the minimum AIC value. To ensure a fair comparison between the models in a set, we limited the sample to include only participants who had data for both perceived risk measures.

Exploratory analyses were conducted to examine whether country of residence moderated the relation between perceived risk and quitting behaviors. Interaction terms (country X perceived risk) were added to each of the models. The AIC was calculated and compared to the previously tested models to determine whether adding the interaction term improved the model fit. SPSS Statistics GradPack 17.0 was used for all analysis.

RESULTS

Descriptive Statistics

Table 1 presents both the unweighted and weighted descriptive statistics for covariates, dependent variables, and risk perceptions. At Time 1, 70.9% ($n = 3005$) of respondents were planning to quit in the next 6 months, whereas 29.6% ($n = 1263$) had reported making a quit attempt during the 6 months prior to the survey. At Time 2, 68.1% ($n = 2556$) were planning to quit in the next 6 months, whereas 40.8% ($n = 1756$) had reported making a quit attempt during the 6 months prior to the survey, 11.7% ($n = 506$) of whom had remained quit at the time of the survey.

When respondents compared themselves to a nonsmoker, 35.6% ($n = 1551$) and 33.5% ($n = 1412$) reported being at high risk of developing lung cancer and heart disease, respectively. However, 19.3% ($n = 818$) and 20.6% ($n = 869$) perceived themselves at low risk of developing lung cancer or heart disease, respectively. Differences between countries are noted in Table 1.

Does Perceived Risk Predict Plans to Quit at Time 1?

Perceived risk of lung cancer, heart disease, and the sum of the 2 measures each significantly predicted plans to quit at Time 1 (Table 2). Compared to those who perceived themselves at low risk of developing lung cancer, the odds of smokers' planning to quit were 3.0 and 2.1 times more if they perceived themselves at high or moderate risk, respectively (Model 1). Based on the AIC values, Model 1 was preferred over the null model. Compared to those who perceived themselves at low risk of developing heart disease, the odds of smokers' planning to quit at Time 1 were 2.9 and 1.8 times more if they perceived themselves at high or moderate risk, respectively (Model 2). Model 2 was preferred over the null model but not over Model 1. However, Model 3, which contained the sum of both perceived risk measures, was preferred over both Models 1 and 2. Compared to those who perceived themselves at low risk of developing lung cancer or heart disease, the odds of smokers' planning to quit at Time 1 were 3.7 and 2.4 times more if they perceived

themselves at high or moderate risk, respectively (Model 3). Thus, the sum of both perceived risk measures appeared to be a better predictor of plans to quit at Time 1 than the individual measures.

Does Perceived Risk Predict Plans to Quit at Time 2?

Perceived risk of lung cancer, heart disease, and the sum of the 2 measures each significantly predicted plans to quit at Time 2 (Table 2). Compared to those who perceived themselves at low risk of developing lung cancer, the odds of smokers' planning to quit were 1.8 and 1.6 times more if they perceived themselves at high or moderate risk, respectively (Model 4). Model 4 was preferred over the null model. Meanwhile, compared to those who perceived themselves at low risk of developing heart disease, the odds of smokers' planning to quit were 2.0 and 1.9 times more if they perceived themselves at high or moderate risk, respectively (Model 5). Model 5 was preferred over both the null model and Model 4. The AIC value for Model 6, which contained the sum of the 2 perceived risk measures, was only marginally lower than it was in Model 5. Thus, both the sum of perceived risk and the heart disease measures appeared to be good predictors of plans to quit at Time 2.

Does Perceived Risk Predict Attempts to Quit at Time 2?

Perceived risk of lung cancer, heart disease, and the sum of the 2 measures each significantly predicted Time 2 attempts to quit (Table 3). Compared to those who perceived themselves at low risk of developing lung cancer, the odds of smokers' making a quit attempt was 1.2 times more if they perceived themselves at high risk (Model 7). Model 7 was preferred over the null model. Similarly, compared to those who perceived themselves at low risk of developing heart disease, the odds of smokers' making a quit attempt was 1.4 times more if they perceived themselves at high risk (Model 8). In both models, those with moderate risk were no more likely to make a quit attempt than were those who perceived low risk. Model 8 was preferred over both the null model and Model 7. When both perceived risk measures were summed and included in Model 9, the model no better fit the data than Model 8 did. Thus, the perceived risk of heart disease measure appeared to be the better predictor of attempts to quit at Time 2.

Does Perceived Risk Predict Sustained Quitting?

Perceived risk of lung cancer significantly predicted sustained quitting (Table 3). Compared to those who perceived themselves at low risk of developing lung cancer, the odds of a smoker's remaining quit were 1.6 and 1.5 times more if the smoker perceived him- or herself at high or moderate risk, respectively (Model 10). Model 10 was preferred over the null model. High risk perceptions of heart disease did not significantly predict sustained quitting (Model 11), nor did the sum of the 2 perceived risk measures (Model 12). Models 11 and 12 no better fit the data than Model 10 did. Thus, the perceived risk of lung cancer measure appeared to be the better predictor of sustained quitting at Time 2.

Exploratory Analysis – Does Country Moderate the Effects?

Perceived lung cancer risk interacted significantly with country to predict planning to quit at Time 2 ($P = 0.04$). Those in the United States with high or moderate risk perceptions were each 2.2 times less likely than those in Australia to intend to quit (CI: 1.1–4.7, $P = 0.03$ and CI: 1.1–4.5, $P = 0.03$, respectively). Similarly, those in the United States with high risk perceptions were 2.4 times less likely than those in Canada to intend to quit (CI: 1.1–5.1, $P = 0.03$). Meanwhile, those in Australia with moderate risk perceptions were 2.0 times more likely to intend to quit than those in the United Kingdom (CI: 1.1–3.6, $P = 0.03$). However, the model no better fit the data than Model 6 did (AIC = 3072.0).

Also, the sum of the perceived risk measures interacted significantly with country to predict sustained quitting at Time 2 ($P = 0.04$). Those in the United States and Australia with high risk perceptions were 3.3 and 4.2 times more likely to remain quit than those in the United Kingdom (CI: 1.1–9.9, $P = 0.03$ and CI: 1.6–10.8, $P = 0.003$, respectively), whereas those in Canada with high or moderate risk perceptions were 4.9 and 3.2 times more likely to remain quit than were those in the United Kingdom (CI: 1.6–14.8, $P = 0.005$ and CI: 1.1–9.4, $P = 0.04$, respectively). However, the model no better fit the data than Model 10 did (AIC = 1825.2).

Discussion

In this representative sample of smokers across 4 countries, perceived risk of smoking-related diseases predicted plans to quit, attempts to quit, and, to some extent, sustained quitting up to one year later. These findings provide strong support for the important role perceived risk plays in motivating quitting behavior. Unlike previous research in this area, the present study uses a longitudinal design, a large nonrestrictive sample, and measures perceived risk in a way that minimizes random error. Importantly, longitudinal analyses controlled for previous quitting plans and attempts, making the outcome a change score: perceived risk predicted increases in plans and attempts to quit since Time 1.

These findings support theoretical models that posit perceived risk is a key determinant of health behavior change.^{1–8} More specifically, they support the hypothesis that the greater people's perceived risk of a given health problem, the more likely they will attempt to change their behavior to reduce that risk. Considering the many biological and environmental factors that exert strong influences on smoking behavior (eg, physiological addiction, social relationships, and economics), these findings demonstrate that motivational factors predict quitting behavior and highlight the importance of psychological factors in health behavior change.

These findings also support arguments that the relation between perceived risk and health behavior is weaker for more difficult, complex behaviors than it is for simple, easy behaviors. The perceived risk measures predicted the comparatively easy, simple behavior of planning to quit more strongly than the more difficult, complex behaviors of making a quit attempt and remaining quit. Furthermore, perceived risk predicted respondents' immediate plans to quit (Time 1) more strongly than their plans to quit up to one year later (Time 2). These findings are consistent with Borland and colleagues,³³ who report

motivational factors, including concerns about health risks, may not be enough to sustain behavior change through intense physiological withdrawal and repeated situations of temptation. Instead, factors including emotional distress, outcome expectancy, nicotine dependence, previous quit attempt experience, use of alcohol, and home smoking bans, to name a few, may be more strongly related to quit attempts, and sustained quitting.^{34–37} Thus, perceptions of health risk may be necessary to motivate smokers to take initial action, but insufficient to expect sustained behavioral change. In fact, health behavior models such as relapse theory³⁸ and the reasons model incorporate this perspective.^{39,40}

Contrary to our hypothesis, the sum of perceived risk for multiple health outcomes was notably better than perceived risk for a single health outcome in only one instance (ie, when predicting plans to quit smoking at Time 1). This suggests people may be more apt to consider multiple risks when taking immediate actions. However, when making plans to quit in the future or when more complex behaviors are attempted, there appears to be little difference in the predictability of either perceived risk measures or their sum. In such cases, we suggest either measure of perceived risk or its sum as sufficient for use in future research. Future research should also investigate the predictive ability of perceived risk measures that specify other health outcomes.

One of the unique contributions this paper makes is the use of an international sample, and although not central to this paper, country differences were noted among the dependent variables, but largely absent for perceived risk. This suggests that perceptions of smoking-related health risk may be a relatively universal phenomenon among individuals residing in developed countries such as the United States, Canada, United Kingdom, and Australia. Furthermore, it suggests there may be something unique about the social, cultural, or policy contexts within each of these countries that may influence people's plans to quit smoking, their quit attempts, and quitting success. The interaction analysis further suggests that when it comes to predicting future plans to quit, both Canadians and Australians who perceive a high personal risk of developing lung cancer may be more likely to plan on quitting in the future compared to their American counterparts. Thus, factors beyond perceived risk may be more important at influencing Americans' plans to quit smoking. However, when it comes to sustained quitting, American, Canadian, and Australian respondents with high risk perceptions were more likely to remain quit up to one year later compared to their British counterparts. Likewise, it may be that factors beyond perceived risk are more important at influencing quitting success among British smokers. Further research is warranted to identify the factors that may contribute to the observed differences between countries.

Despite the robustness of the evidence provided, this study is subject to some limitations. The retention rate between survey waves may have biased our sample and subsequent results. Furthermore, the analysis did not control for perceived health or actual health, which may influence one's perceptions of risk. Future research should attempt to overcome these limitations and build on the strengths of this study.

So, can health communications that make the public aware of the risks of unhealthy behaviors actually promote behavior change? The present study did not manipulate perceived risk, so it cannot entirely rule out the possibility that some third variable, such as

policy change, changed respondents' perceived risk before Time 1 and additionally changed their quitting behaviors between Time 1 and Time 2. However, given that the present study controlled for Time 1 behavior change plans and attempts and used a large, nonrestrictive, international sample, we can be confident that as the public's perceptions of risk from their behaviors increases, their plans, attempts, and, perhaps less so, their success at behavior change increases. Thus, education efforts that aim to increase perceptions of health risk remain a justified public health intervention strategy.

Acknowledgments

The ITC 4-Country Survey was funded by grants from the Canadian Institutes of Health Research (CIHR; 57897, 79551, and 115016), the US National Cancer Institute (R01 CA100362 and P50 CA111236), Robert Wood Johnson Foundation (045734), Australia Commonwealth Department of Health and Ageing, National Health and Medical Research Council of Australia (254903), Cancer Research UK (C312/A3726 and C312/A6465), the Canadian Tobacco Control Research Initiative (014578). MJ Costello acknowledges support from a Banting & Best Canadian Graduate Scholarship provided by CIHR, Institute of Population and Public Health. C. Logel acknowledges support from a CIHR postdoctoral fellowship in Population Intervention for Chronic Disease Prevention. G. T. Fong was supported by a Senior Investigator Award from the Ontario Institute for Cancer Research and a Prevention Scientist Award from the Canadian Cancer Society Research Institute. We wish to thank Mary E. Thompson and Pete Driezen for guidance in the statistical analyses.

REFERENCES

1. Becker MH. The health belief model and personal health behavior. *Health Educ Monogr.* 1974; 2:324–508.
2. Rosenstock IM. Why people use health services. *Milbank Mem Fund Q.* 1966; 44:94. [PubMed: 5967464]
3. Rosenstock IM. Historical origins of the health belief model. *Health Educ Monogr.* 1974; 2:1–8.
4. Rogers RW. A protection motivation theory of fear appeals and attitude change. *J Psychol.* 1975; 91:93–114.
5. Rogers, RW. Cognitive and physiological processes in fear appeals and attitude change: a revised theory of protection motivation. In: Cacioppo, J.; Petty, R., editors. *Social Psychophysiology*. New York: Guilford; 1983.
6. Weinstein ND. The precaution adoption process. *Health Psychol.* 1988; 7:355–386. [PubMed: 3049068]
7. Miller SM, Shoda Y, Hurley K. Applying cognitive-social theory to health protective behavior: breast self-examination in cancer screening. *Psychol Bull.* 1996; 119:70–94. [PubMed: 8559860]
8. Miller, SM.; Diefenbach, MA. C-SHIP: A cognitive-social health information processing approach to cancer. In: Krantz, D., editor. *Perspectives in Behavioral Medicine*. New Jersey: Lawrence Erlbaum; 1998. p. 219–244.
9. Butler KM, Rayens MK, Zhang M, Hahn EJ. Motivation to quit smoking among relatives of lung cancer patients. *Public Health Nurs.* 2011; 28(1):43–50. [PubMed: 21198813]
10. Patterson F, Wileyto EP, Segal J, et al. Intention to quit smoking: role of personal and family member cancer diagnosis. *Health Educ Res.* 2010; 25(5):792–802. [PubMed: 20519265]
11. Klein WM, Zajac LE, Monin MM. Worry as a moderator of the association between risk perceptions and quitting intentions in young adult and adult smokers. *Ann Behav Med.* 2009; 38(3):256–261. [PubMed: 20049660]
12. Weinstein ND, Marcus SE, Moser RP. Smokers' unrealistic optimism about their risk. *Tob Control.* 2005; 14:55–59. [PubMed: 15735301]
13. Norman P, Conner M, Bell R. The theory of planned behavior and smoking cessation. *Health Psychol.* 1999; 18(1):89–94. [PubMed: 9925050]
14. Boney MS, Gibbons FX, Reis TJ, et al. Perceptions of smoking risk as a function of smoking status. *J Behav Med.* 1992; 15(5):469–489. [PubMed: 1447758]

15. Weinstein ND, Rothman AJ, Nicolich M. Use of correlational data to examine the effects of risk perceptions on precautionary behavior. *Psychol Health*. 1998; 13(3):479–501.
16. Weinstein ND, Nicolich M. Correct and incorrect interpretations of correlations between risk perception and risk behaviors. *Health Psychol*. 1993; 12:235–245. [PubMed: 8500454]
17. Borrelli B, Hayes RB, Dunsiger S, Fava JL. Risk perception and smoking behavior in medically ill smokers: a prospective study. *Addiction*. 2010; 150(6):1100–1108. [PubMed: 20331572]
18. Schnoll RA, James C, Malstrom M, et al. Longitudinal predictors of continued tobacco use among patients diagnosed with cancer. *Ann Behav Med*. 2003; 25(3):214–221. [PubMed: 12763716]
19. Kreuter MW, Strecher VJ. Changing inaccurate perceptions of health risk: results from a randomized trial. *Health Psychol*. 1995; 14(1):56–63. [PubMed: 7737074]
20. Clark MA, Kvitz FJ, Crittenden KS, Warnecke RB. Psychosocial factors and smoking cessation behaviors among smokers who have and have not ever tried to quit. *Health Educ Res*. 1998; 13(1): 145–153. [PubMed: 10178336]
21. Avis NE, Smith KW, McKinlay JB. Accuracy of perceptions of heart attack risk: what influences perceptions and can they be changed? *Am J Public Health*. 1989; 79:1608–1612. [PubMed: 2817187]
22. Ronis DL. Conditional health threats: health beliefs, decisions and behaviors among adults. *Health Psychol*. 1992; 11:127–134. [PubMed: 1582381]
23. Honda K, Neugut AI. Associations between perceived cancer risk and established risk factors in a national community sample. *Cancer Detect Prev*. 2004; 28(1):1–7. [PubMed: 15041071]
24. Montgomery SB, Joseph JG, Becker MH, et al. The Health Belief Model in understanding compliance with preventive recommendations for AIDS: how useful? *AIDS Educ Prev*. 1989; 1(4):303–323. [PubMed: 2701353]
25. Harrison JA, Mullen PD, Green LW. A meta-analysis of studies of the Health Belief Model with adults. *Health Educ Res*. 1992; 7(1):107–116. [PubMed: 10148735]
26. Janz NK, Becker MH. The Health Belief Model: a decade later. *Health Educ Q*. 1984; 11(1):1–47. [PubMed: 6392204]
27. Fong GT, Cummings KM, Borland R, et al. The conceptual framework of the International Tobacco Control (ITC) Policy Evaluation Project. *Tob Control*. 2006; 15(Suppl 3):3–11. [PubMed: 16436390]
28. Thompson ME, Fong GT, Hammond D, et al. Methods of the International Tobacco Control (ITC) Four Country Survey. *Tob Control*. 2006; 15(Suppl 3):12–18.
29. Fong GT, Cummings KM, Shopland DR. Building the evidence base for effective tobacco control policies: The International Tobacco Control Policy Evaluation Project (the ITC Project). *Tob Control*. 2006; 15(Suppl 3):1–2. [PubMed: 16436389]
30. Binson D, Canchola JA, Catania JA. Random selection in a national telephone survey: a comparison of the Kish, next-birthday, and last-birthday methods. *J Off Stat*. 2000; 16:53–60.
31. Heatherton TF, Kozlowski LT, Frecker RC, Fagerström K. The Fagerström Test for nicotine dependence: a revision of the Fagerström Tolerance Questionnaire. *Br J Addict*. 1991; 86(9): 1119–1127. [PubMed: 1932883]
32. Alaike H. A new look at the statistical model identification. *IEEE T Automat Contr*. 1974; 19:716–723.
33. Borland R, Yong HH, Balmford J, et al. Motivational factors predict quit attempts but not maintenance of smoking cessation: findings from the International Tobacco Control Four Countries Project. *Nicotine Tob Res*. 2010; 12(Suppl 1):S4–S11. [PubMed: 20889479]
34. Hyland A, Borland R, Yong HH, et al. Individual level predictors of cessation behaviors among participants in the International Tobacco Control (ITC) Four Country Survey. *Tob Control*. 2006; 15(Suppl 3):83–94. [PubMed: 16565454]
35. Hyland A, Li Q, Bauer JE, et al. Predictors of cessation in a cohort of current and former smokers followed over 13 years. *Nicotine Tob Res*. 2004; 6(Suppl 3):363–369.
36. Lee C, Kahende J. Factors associated with successful smoking cessation in the United States, 2000. *Am J Public Health*. 2007; 97(8):1503–1509. [PubMed: 17600268]

37. Shiffman S, Balabanis MH, Gwaltney CJ, et al. Prediction of lapse from associations between smoking and situational antecedents assessed by ecological momentary assessment. *Drug Alcohol Depen.* 2007; 91:159–168.
38. Marlatt, GA.; Witkiewitz, K. Relapse prevention for alcohol and drug problems. In: Marlatt, GA.; Donovan, DM., editors. *Relapse Prevention: Maintenance Strategies in the Treatment of Addictive Behaviors*. New York, NY: The Guilford Press; 2005. p. 1-44.
39. Meichenbaum, D.; Fong, GT. How individuals control their own minds: a constructive narrative perspective. In: Wegner, DM.; Pennebaker, JW., editors. *Handbook of Mental Control*. Englewood Cliffs, NJ: Prentice Hall; 1993. p. 473-490.
40. Rempel LA, Fong GT. Why breastfeed? A longitudinal test of the reasons model among first-time mothers. *Psychol Health.* 2005; 20(4):443–466.

Table 1
 Characteristics of a Sample of Adult Smokers (Unweighted and Weighted [Wt] Percentages)

	United States (n=743)			Canada (n=1079)			United Kingdom (n=1216)			Australia (n=1269)			Overall (N=4307)		
	n	%	Wt %	n	%	Wt %	n	%	Wt %	n	%	Wt %	n	%	Wt %
Gender															
Male	303	40.8 ^a	52.3	463	42.9 ^a	48.1	527	43.3 ^a	49.2	584	46.0 ^a	54.2	1877	43.6	51.7
Female	440	59.2	47.7	616	57.1	51.9	689	56.7	50.8	685	54.0	45.8	2430	56.4	48.3
Age															
18–24 years	56	7.5 ^a	10.2	115	10.7 ^b	12.2	58	4.8 ^c	11.0	149	11.7 ^d	13.4	378	8.8	10.7
25–39 years	171	23.0	27.2	318	29.5	32.0	325	26.7	30.4	433	34.1	34.5	1247	29.0	28.7
40–54 years	309	41.6	40.8	413	38.3	36.9	457	37.6	31.6	488	38.4	35.9	1667	38.7	38.4
55+ years	207	27.9	21.8	233	21.6	18.8	376	30.9	26.9	199	15.7	16.3	1015	23.6	22.2
Ethnicity															
White (English)	619	83.8 ^a	79.7	966	89.5 ^b	89.7	1164	95.9 ^c	95.9	1120	88.3 ^b	87.8	3869	90.0	84.3
Nonwhite (non-English)	120	16.2	20.3	113	10.5	10.3	50	4.1	4.1	148	11.7	12.2	431	10.0	15.7
Refused/DK	4			0			2			1			7		
Income															
Low	250	35.6 ^a	33.8	310	31.1 ^b	30.0	358	31.9 ^{a,b}	28.8	354	29.7 ^b	27.0	1272	31.7	32.1
Moderate	280	39.8	41.8	375	37.6	38.8	432	38.5	38.7	428	36.0	37.6	1515	37.8	40.7
High	173	24.6	24.4	313	31.4	31.3	332	29.6	32.6	408	34.3	35.4	1226	30.6	27.2
Refused/DK	40			81			94			79			294		
Education															
Low	289	38.9 ^a	39.1	479	44.5 ^b	45.7	773	64.0 ^c	62.5	843	66.5 ^c	67.3	2384	55.5	45.9
Moderate	355	47.8	48.3	452	42.0	41.9	282	23.4	25.4	259	20.4	20.8	1348	31.4	41.7
High	98	13.2	12.5	146	13.6	12.4	152	12.6	12.1	165	13.0	11.9	561	13.1	12.4
Refused/DK	1			2			9			2			14		
Smoking frequency															
Daily	685	92.2 ^a	91.5	990	91.8 ^a	91.9	1122	92.3 ^a	92.5	1144	90.1 ^a	90.0	3941	91.5	91.7
Nondaily	58	7.8	8.5	89	8.2	8.1	94	7.7	7.5	125	9.9	10.0	366	8.5	8.3

	United States (n=743)			Canada (n=1079)			United Kingdom (n=1216)			Australia (n=1269)			Overall (N=4307)		
	n	%	Wt %	n	%	Wt %	n	%	Wt %	n	%	Wt %	n	%	Wt %
HSI score ^e															
Low	186	25.5 ^a	26.6	298	27.8 ^a	27.2	319	26.4 ^b	27.8	370	29.4 ^a	29.1	1173	27.5	27.0
Moderate	452	61.9	59.6	653	60.9	61.3	790	65.3	64.1	726	57.6	57.8	2621	61.3	60.5
High	92	12.6	13.8	122	11.4	11.6	101	8.3	8.1	164	13.0	13.1	479	11.2	12.5
Refused/DK	13			6			6			9			34		
Perceived risk of lung cancer															
High risk	254	34.6 ^a	35.2	371	34.8 ^a	35.1	404	34.0 ^a	35.8	482	38.6 ^b	38.8	1511	35.6	35.5
Moderate risk	333	45.3	45.9	493	46.2	46.3	545	45.9	44.9	540	43.2	43.9	1911	45.1	45.6
Low risk	148	20.1	18.9	203	19.0	18.5	239	20.1	19.3	228	18.2	17.3	818	19.3	18.9
Refused/DK	8			12			28			19			67		
Perceived risk of heart disease															
High risk	233	32.0 ^a	32.2	356	33.4 ^a	33.9	372	31.5 ^a	32.8	451	36.3 ^b	35.9	1412	33.5	32.7
Moderate risk	327	44.9	44.5	496	46.6	47.6	564	47.8	46.9	549	44.2	45.2	1936	45.9	45.3
Low risk	169	23.2	23.3	213	20.0	18.6	245	20.7	20.4	242	19.5	18.9	869	20.6	22.0
Refused/DK	14			14			35			27			90		
Sum of perceived risk measures															
High risk	253	34.8 ^a	35.1	385	36.4 ^a	37.0	406	34.7 ^a	36.0	503	40.7 ^b	40.6	1547	36.9	35.8
Moderate risk	334	45.9	46.1	502	47.4	47.7	531	45.3	44.4	513	41.5	42.7	1880	44.9	45.7
Low risk	140	19.3	18.8	171	16.2	15.3	234	20.0	19.6	219	17.7	16.7	764	18.2	18.5
N/A	16			21			45			34			116		
Plans to quit (Time 1)															
Yes	518	71.0 ^a	71.7	856	80.4 ^b	81.3	725	60.4 ^c	63.0	906	72.8 ^a	72.3	3005	70.9	70.8
No	212	29.0	28.3	209	19.6	18.7	475	39.6	37.0	339	27.2	27.7	1235	29.1	29.2
Refused/DK	13			14			16			24			67		
Attempts to quit (Time 1)															
Yes	220	29.9 ^a	30.5	397	37.0 ^b	37.6	285	23.7 ^c	24.3	361	28.8 ^a	29.0	1263	29.6	29.8
No	517	70.1	69.5	676	63.0	62.4	919	76.3	75.7	894	71.2	71.0	3006	70.4	70.2

	United States (n=743)			Canada (n=1079)			United Kingdom (n=1216)			Australia (n=1269)			Overall (N=4307)		
	n	%	Wt %	n	%	Wt %	n	%	Wt %	n	%	Wt %	n	%	Wt %
Refused/DK	6			6			12			14			38		
Plans to quit (Time 2)															
Yes	442	67.7 ^a	69.4	719	74.6 ^b	76.0	619	58.5 ^c	61.2	776	71.9 ^{a,b}	72.4	2556	68.1	68.6
No	211	32.3	30.6	245	25.4	24.0	441	41.5	38.8	304	28.1	27.6	1200	31.9	31.4
Refused/DK	7			13			7			18			45		
N/A	83			102			150			171			506		
Attempts to quit (Time 2)															
Yes	301	40.5 ^a	40.7	469	43.5 ^a	44.7	437	35.9 ^b	36.1	549	43.4 ^a	43.2	1756	40.8	40.2
No	442	59.5	59.3	610	56.5	55.3	779	64.1	63.9	717	56.6	56.8	2548	59.2	59.8
Sustained quitting (Time 2)															
Still quit	83	11.2 ^{a,b}	11.2	102	9.5 ^a	9.7	150	12.3 ^b	11.9	171	13.5 ^b	13.6	506	11.7	11.3
Back smoking	660	88.8	88.8	977	90.5	90.3	1066	87.7	88.1	1098	86.5	86.4	3801	88.3	88.7

Note.

^{a-d} Superscripts indicate where differences in responses exist between countries for each variable. For countries with the same superscript, the responses are not statistically different at $P < 0.05$. Those with different superscripts are significant at $P < 0.05$ at least.

^e HSI=Heaviness of smoking index³¹

Table 2

Logistic Regression Examining Perceived Risk and Planning to Quit at Time 1 (N=3,798)^a and Time 2 (N=3,315)^b

Parameters	Time 1: Planning to quit vs not planning to quit				Time 2: Planning to quit vs not planning to quit			
	Model 1: Perceived risk of lung cancer	Model 2: Perceived risk of heart disease	Model 3: Sum of perceived risk measures		Model 4: Perceived risk of lung cancer	Model 5: Perceived risk of heart disease	Model 6: Sum of perceived risk measures	
	Adjusted odds ratio (95% CI)	P	Adjusted odds ratio (95% CI)	P	Adjusted odds ratio (95% CI)	P	Adjusted odds ratio (95% CI)	P
United States	Ref	<0.001	Ref	<0.001	Ref	0.007	Ref	0.007
Canada	1.5(1.2–2.0)	0.001	1.5(1.7–1.9)	0.002	1.1(0.8–1.4)	0.618	1.1(0.8–1.4)	0.673
United Kingdom	0.7(0.5–0.9)	0.001	0.7(0.5–0.8)	0.001	0.8(0.6–1.1)	0.176	0.8(0.6–1.1)	0.152
Australia	0.8(0.8–1.4)	0.520	1.1(0.8–1.4)	0.564	1.3(1.0–1.7)	0.101	1.2(0.9–1.6)	0.110
Male	0.8(0.7–0.9)	0.005	0.8(0.7–0.9)	0.009	—	<i>ns</i>	—	<i>ns</i>
Age^c	0.7(0.6–0.7)	<0.001	0.7(0.6–0.7)	<0.001	0.8(0.7–0.8)	<0.001	0.8(0.7–0.8)	<0.001
Nonwhite (non-English)	—	<i>ns</i>	—	<i>ns</i>	—	<i>ns</i>	—	<i>ns</i>
Income^c	—	<i>ns</i>	—	<i>ns</i>	—	<i>ns</i>	—	<i>ns</i>
Education^c	—	<i>ns</i>	1.1(1.0–1.3)	0.024	—	<i>ns</i>	—	<i>ns</i>
Daily smoker	1.5(1.1–2.1)	0.020	1.4(1.0–2.0)	0.045	—	<i>ns</i>	—	<i>ns</i>
HSI score^c	0.9(0.8–0.9)	<0.001	0.9(0.8–0.9)	<0.001	0.9(0.9–1.0)	0.004	0.9(0.8–1.0)	0.003
Attempted to quit	6.2(4.9–7.9)	<0.001	6.1(4.8–7.8)	<0.001	2.1(1.7–2.7)	<0.001	2.1(1.7–2.7)	<0.001
Planned to quit	<i>n/a</i>	<i>n/a</i>	<i>n/a</i>	<i>n/a</i>	8.9(7.4–10.7)	<0.001	8.6(7.2–10.4)	<0.001
Low risk	Ref	<0.001	Ref	<0.001	Ref	<0.001	Ref	<0.001
Moderate risk	2.1(1.7–2.5)	<0.001	1.8(1.5–2.1)	<0.001	1.6(1.3–2.1)	<0.001	1.8(1.4–2.3)	<0.001
High risk	3.0(2.4–3.8)	<0.001	2.9(2.3–3.6)	<0.001	1.8(1.4–2.3)	<0.001	2.2(1.7–2.8)	<0.001
AIC value^d	3824.1		3829.7		3073.1		3058.8	

Note.

^a 393 cases were excluded from models 1–3 due to missing data.

^b 876 cases were excluded from models 4–6 due to missing data.

^c Age, income, education, and HSI score were entered as continuous variables into the logistic regression models. Their corresponding odds ratios represent a 1 unit increase for each variable.

^dThe AIC values for the null models predicting Time 1 and Time 2 planning to quit were 3919.1 and 3092.3, respectively.

Table 3

Logistic Regression Examining Perceived Risk and Time 2 Attempting to Quit (N=3,798)^a and Sustained Quitting (N=1,558)^b

Parameters	Time 2: Attempted to quit vs no quit attempt				Time 2: Still quit vs back to smoking			
	Model 7: Perceived risk of lung cancer	Model 8: Perceived risk of heart disease	Model 9: Sum of perceived risk measures	P	Model 10: Perceived risk of lung cancer	Model 11: Perceived risk of heart disease	Model 12: Sum of perceived risk measures	P
	Adjusted odds ratio (95% CI)	Adjusted odds ratio (95% CI)	Adjusted odds ratio (95% CI)		Adjusted odds ratio (95% CI)	Adjusted odds ratio (95% CI)	Adjusted odds ratio (95% CI)	
United States	Ref	Ref	Ref	<i>ns</i>	Ref	Ref	Ref	0.025
Canada	—	—	—	<i>ns</i>	0.8(0.5–1.1)	0.8(0.5–1.1)	0.8(0.5–1.1)	0.181
United Kingdom	—	—	—	<i>ns</i>	1.3(0.9–1.8)	1.3(0.9–1.8)	1.3(0.9–1.8)	0.167
Australia	—	—	—	<i>ns</i>	1.1(0.8–1.5)	1.1(0.8–1.6)	1.1(0.8–1.6)	0.590
Male	—	—	—	<i>ns</i>	—	—	—	<i>ns</i>
Age ^c	—	—	—	<i>ns</i>	—	—	—	<i>ns</i>
Nonwhite (non-English)	—	—	—	<i>ns</i>	—	—	—	<i>ns</i>
Income ^c	—	—	—	<i>ns</i>	1.2(1.0–1.4)	1.2(1.0–1.4)	1.2(1.0–1.4)	0.011
Education ^c	—	—	—	<i>ns</i>	—	—	—	<i>ns</i>
Daily smoker	0.6(0.5–0.8)	0.6(0.5–0.8)	0.6(0.5–0.8)	0.001	—	—	—	<i>ns</i>
HSI score ^c	—	—	—	<i>ns</i>	0.8(0.7–0.9)	0.8(0.7–0.9)	0.8(0.7–0.9)	<0.001
Attempted to quit	4.0(3.4–4.7)	4.0(3.4–4.7)	4.0(3.4–4.7)	<0.001	0.7(0.5–0.8)	0.7(0.5–0.8)	0.7(0.5–0.8)	0.001
Planned to quit	2.3(1.9–2.8)	2.3(1.9–2.7)	2.3(1.9–2.7)	<0.001	—	—	—	<i>ns</i>
Low risk	Ref	Ref	Ref	0.003	Ref	Ref	Ref	<i>ns</i>
Moderate risk	1.0(0.8–1.2)	1.0(0.9–1.3)	1.1(0.9–1.3)	0.581	1.5(1.1–2.2)	—	—	<i>ns</i>
High risk	1.2(1.0–1.5)	1.4(1.1–1.7)	1.3(1.1–1.7)	0.007	1.6(1.1–2.3)	—	—	<i>ns</i>
AIC value ^d	4513.7	4512.0	4513.0		1823.0	1828.8	1826.4	

Note.

^a 876 cases were excluded from models 7–9 due to missing data.

^b 159 cases were excluded from models 10–12 due to missing data.

^c Age, income, education, and HSI score were entered as continuous variables into the logistic regression models. Their corresponding odds ratios represent a 1 unit increase for each variable.

^dThe AIC values for the null models predicting Time 2 attempting to quit and sustained quitting were 4520.3 and 1825.4, respectively.