

Research Article

Knowledge and Beliefs about Smoking and Cancer among Women in Five European Countries

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Abstract

Background: Lung cancer mortality in women is increasing across Europe, reflecting the alarming increase in smoking prevalence. Understanding women's perception of smoking may help to identify ways to reduce its prevalence and prevent uptake of smoking. The aim of this study was to examine factors associated with knowledge and beliefs about smoking and cancer among European women.

Methods: A cross-sectional landline telephone survey on health attitudes and knowledge was conducted in five European countries: France, Ireland, Italy, the Czech Republic, and Sweden. A general linear modeling was used to explore the factors related to knowledge and beliefs about smoking and cancer.

Results: A total of 5,000 women were interviewed (1,000 women from each country). The mean knowledge and belief scores about smoking and cancer were lower in current smokers than those of never and former smokers ($P < 0.05$). Women with above-the-median income ($P = 0.001$) and women who held skilled occupations seemed to be more knowledgeable about tobacco health risks ($P < 0.001$). The number of friends and family who smoked was inversely associated with knowledge on the harmful effects of tobacco ($P = 0.001$). Swedish women were the most knowledgeable about tobacco-related cancer risk, whereas in France and Italy, current smokers were less knowledgeable.

Conclusions: Knowledge and beliefs about cancer and smoking varied significantly by smoking status.

Impact: Results emphasize the need to develop health education programs that enhance cancer knowledge among women who currently smoke and are in low socioeconomic groups. *Cancer Epidemiol Biomarkers Prev*; 19(11); 2811–20. ©2010 AACR.

Introduction

It is currently estimated that ~1.1 billion people in the world are smokers, and this figure is expected to increase to more than 1.6 billion by 2025 (1). Traditionally, the smoking rate of males has exceeded that of females. In recent decades, smoking among men has declined in some European countries, but it is still increasing or has stabilized among women in most European countries (2–4). The gender gap is narrowing and in some countries, such as Sweden, the female smoking rate has even surpassed that of the male smoking rate.

In the last few years, there have been rapid successes within several European countries in increasing tobacco

control measures. The recent changes in European tobacco control policy have shown promising signs of slowing the epidemic. In a cross-sectional study of 18 European countries, countries with more developed tobacco control policies had higher levels of smoking cessation than in countries with less developed tobacco policies (5). Despite these advances, progress towards greater tobacco control across Europe is not homogenous and smoking prevalence among women remains disproportionately high in some countries such as Austria and Bosnia, relative to others, such as Armenia and Moldova. In Russia, smoking prevalence doubled among women between 1992 and 2003 (6). Therefore, the WHO Framework Convention on Tobacco Control has stressed the need to take

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measures to address gender-specific risks when developing tobacco control strategies (7).

Tobacco smoking is the single most preventable cause of disease and death among European women (8, 9), and research on the health hazards caused by tobacco is very extensive. The IARC concluded that tobacco smoking is associated with increasing the risk of 18 different types of cancer (10). In European women, close to 60% of lung cancer cases are attributed to smoking (11). Thus, with smoking rates in women increasing, it is not surprising that lung cancer rates in women have also increased in most European countries (12, 13).

Table 1. The statements and corresponding scores of seven questions on knowledge and beliefs about smoking and cancer

Questions	Options	Scores
Q1: Would you say light cigarettes are safer to smoke than regular cigarettes?	True	0
	False	1
	Don't know	0
Q2: What do you think is the most important cause of lung cancer in women?	Genetics/ heredity	0
	Radon	0
	Other chemicals or gases	0
	Tobacco smoking	1
	Stress	0
	Other specify	0
Q3: Would you say the medical evidence that smoking is harmful is exaggerated?	Totally agree	0
	Somewhat agree	1
	Somewhat disagree	2
	Totally disagree	3
Q4: Would you say exposure to secondhand smoke is dangerous to a pregnant woman and her child?	Totally agree	3
	Somewhat agree	2
	Somewhat disagree	1
	Totally disagree	0
Q5: Would you say smoking cigarettes has been shown to cause lung cancer in women?	Totally agree	3
	Somewhat agree	2
	Somewhat disagree	1
	Totally disagree	0
Q6: Would you say smoking cigarettes is as addictive as other drugs such as heroin or cocaine?	Totally agree	3
	Somewhat agree	2
	Somewhat disagree	1
	Totally disagree	0
Q7: Would you say quitting smoking decreases the risk of getting lung cancer?	Totally agree	3
	Somewhat agree	2
	Somewhat disagree	1
	Totally disagree	0

Europe has some of the highest levels of female smoking in the world, and to substantially reduce the prevalence of tobacco use and exposure to tobacco smoke, it is important that tobacco control measures targeted specifically to women are implemented in Europe. However, health interventions require an understanding of the context of the problem if they are to be appropriately targeted and effective (14). Therefore, understanding the knowledge and beliefs about smoking and cancer risks among European women is crucial for the development of appropriate preventive measures (15).

Five European countries were selected for the survey in this study to represent a range of smoking prevalence among women and tobacco control. Ireland can be considered at the forefront of tobacco control in Europe, since they implemented a 100% ban on smoking in bars and restaurants in 2004. Sweden and Italy are intermediate in tobacco control; they both implemented a ban on smoking in bars and restaurants with some exceptions in 2005. France implemented a ban with some exceptions in 2008. The Czech Republic does not have a ban, although nonsmoking areas are required in bars and restaurants. The smoking prevalence across countries ranged from 19.0% in Italy, 23.0% in Sweden, 27.0% in the Czech Republic, 27.0% in France, to 28.0% in Ireland, according to the WHO Global InfoBase 2006 (<https://apps.who.int/infobase>). The objective was to investigate the differences in the knowledge and beliefs about smoking and cancer among European women, and to determine if the knowledge and beliefs about smoking were associated with certain demographic characteristics.

Materials and Methods

Participants

As part of the Women in Europe against Lung Cancer and Smoking Project (grant agreement number 2006 319), supported by the European Commission, a cross-sectional landline telephone survey on health attitudes and knowledge was conducted from June to July 2008 in five European countries: France, Ireland, Italy, the Czech Republic, and Sweden. In brief, 5,000 women participated in this survey, with 1,000 women from each participating country. Of the women reached who were eligible for participation, the response rates were 64.8% in France, 54.6% in Ireland, 41.4% for Italy, 30.6% for The Czech Republic, and 59.0% for Sweden.

Sampling

A stratified sampling approach was used in the study. The goal was to have a sample of women from each country that was nationally representative with regards to age and smoking status. The sampling frame included all adult women 18 years of age and older who had a listed telephone number in the five participating countries. The household was selected through random digit dialing. When the interviewer reached a household, they asked about the number of eligible female adult household

Table 2. Characteristics of women who participated in the survey, by smoking status, weighted (numbers missing shown without weighting)

Characteristics	All (n = 5,000), %	Never smokers (n = 2,622), %	Former smokers (n = 957), %	Current smokers (n = 1,421), %	χ^2 P value
Age (y)					
18-24	8.5	8.7	5.1	11.8	<0.0001
25-34	18.8	18.4	15.7	23.1	
35-44	18.3	18.1	15.1	22.4	
45-54	17.7	16.8	17.4	20.7	
55+	36.7	38.0	46.7	22.1	
Education					
<Secondary school	12.7	12.9	13.8	11.2	<0.0001
Secondary school	41.9	39.3	43.7	47.6	
University/postgraduate	45.4	47.9	42.6	41.2	
(Missing)	(n = 270)	(n = 150)	(n = 36)	(n = 84)	
Marital status					
Married	41.1	43.0	42.5	33.7	<0.0001
Divorced/separated	14.2	12.2	16.5	17.5	
Widowed	12.8	14.5	14.0	6.8	
Never married	21.6	20.8	16.7	29.4	
Unmarried couple	10.4	9.6	10.3	12.7	
(Missing)	(n = 101)	(n = 60)	(n = 14)	(n = 27)	
Income					
Well below the median	9.2	8.6	10.9	9.2	0.0008
Below the median	23.5	22.8	23.2	26.0	
Around the median	27.6	28.1	25.7	28.3	
Above the median	19.3	18.4	22.0	19.2	
Refused to answer	20.4	22.2	18.2	17.2	
Occupation					
Highest skilled jobs	25.8	25.1	28.6	24.7	<0.0001
Technical position	4.5	4.1	4.2	6.1	
Skilled workers	40.3	39.8	40.0	42.1	
Unskilled workers	9.4	10.6	7.2	8.2	
Homemakers	14.6	14.8	16.4	12.3	
Full-time students	5.3	5.5	3.7	6.6	
Friends/family smoke					
None	19.9	25.5	19.9	9.6	<0.0001
Few	46.3	50.7	51.8	34.4	
Less than half	11.8	10.1	11.9	14.8	
About half or more	22.0	13.6	16.4	41.1	
(Missing)	(n = 24)	(n = 18)	(n = 0)	(n = 6)	
Parents smoke					
Yes	56.9	50.1	66.0	67.2	<0.0001
No	43.1	49.9	34.0	32.9	

members. In households containing only one eligible person, an interview was attempted with that person. In households containing two or more eligible women, an eligible woman was randomly selected by the interviewer. To ensure adequate power to examine subsamples of smokers and nonsmokers for each question, smokers were oversampled; analyses were weighted where appropriate to assure that the results were representative of each country's female population.

Specifically, a household sampling weight was calculated as its probability of selection. Sampling weight was adjusted for nonresponse with each sampling stratum. Next, each adjusted weight was multiplied by the number of eligible persons in the household to obtain a person sampling weight. Finally, the person sampling weights were poststratified to the most current country population estimates by region, income, and age category (18-24, 25-34, 35-64, 65+) to obtain the final analysis weights.

Measures

The questionnaire used in the survey was based on a previously developed and administered questionnaire by the American Legacy Foundation (2002-2003; ref. 16). The questionnaires were translated by native speakers from each participating country and the translations were checked by Women in Europe against Lung Cancer and Smoking investigators from each

country. All participants were asked questions about demographics, tobacco-related knowledge and beliefs, and tobacco use.

The primary outcome of interest was knowledge and beliefs about smoking and cancer. Women who reported currently smoking "every day" and "some days or occasionally" were combined to create a group of "current smokers." Former smokers were defined as not smoking

Table 3. Knowledge and beliefs about smoking and cancer by smoking status, weighted (numbers shown without weighting)

	All (n = 5,000), %	Never smokers (n = 2,622), %	Former smokers (n = 957), %	Current smokers (n = 1,421), %	χ^2 P value
Q1: Would you say light cigarettes are safer to smoke than regular cigarettes?					
True	9.6	8.2	8.7	14.7	<0.0001
False	71.8	67.5	78.9	76.6	
Don't know	18.6	24.3	12.4	8.7	
Q2: What do you think is the most important cause of lung cancer in women?					
Genetics/heredity	12.6	11.3	12.7	16.3	<0.0001
Radon	2.3	1.8	2.0	4.0	
Other chemicals or gases	8.1	6.7	8.1	12.0	
Tobacco smoking	62.8	67.8	61.9	49.1	
Stress	4.1	3.6	3.9	6.1	
Other	10.1	8.8	11.5	12.6	
Q3: Would you say the medical evidence that smoking is harmful is exaggerated?					
Totally agree	11.0	10.1	10.0	14.7	<0.0001
Somewhat agree	8.3	7.2	8.5	11.2	
Somewhat disagree	9.2	9.4	7.1	11.0	
Totally disagree	71.5	73.3	74.4	63.0	
(Missing)	(n = 185)	(n = 111)	(n = 25)	(n = 49)	
Q4: Would you say exposure to secondhand smoke is dangerous to a pregnant woman and her child?					
Totally agree	91.0	92.5	90.9	86.6	<0.0001
Somewhat agree	7.1	6.2	7.7	9.3	
Somewhat disagree	1.0	0.8	0.8	1.8	
Totally disagree	0.9	0.6	0.7	2.4	
(Missing)	(n = 111)	(n = 41)	(n = 25)	(n = 45)	
Q5: Would you say smoking cigarettes has been shown to cause lung cancer in women?					
Totally agree	74.7	74.7	80.3	68.3	<0.0001
Somewhat agree	20.7	22.0	15.3	23.0	
Somewhat disagree	2.7	2.1	2.3	4.7	
Totally disagree	1.9	1.2	2.2	4.0	
(Missing)	(n = 260)	(n = 135)	(n = 47)	(n = 78)	
Q6: Would you say smoking cigarettes is as addictive as other drugs such as heroin or cocaine?					
Totally agree	65.7	68.2	67.1	56.6	<0.0001
Somewhat agree	20.6	20.9	21.0	19.4	
Somewhat disagree	6.1	5.7	5.8	7.3	
Totally disagree	7.7	5.2	6.1	16.7	
(Missing)	(n = 383)	(n = 193)	(n = 78)	(n = 112)	
Q7: Would you say quitting smoking decreases the risk of getting lung cancer?					
Totally agree	64.9	65.7	68.6	58.7	<0.0001
Somewhat agree	26.0	27.4	23.8	23.8	
Somewhat disagree	3.9	3.2	3.1	7.0	
Totally disagree	5.2	3.7	4.5	10.5	
(Missing)	(n = 255)	(n = 135)	(n = 43)	(n = 77)	

Table 4. Percentage of respondents who correctly ranked the cancer types which European women die from, weighted

Rank of cancer	All (n = 5,000), %	Never smokers (n = 2,622), %	Former smokers (n = 957), %	Current smokers (n = 1,421), %	χ^2 P value
1st, breast cancer	50.8	49.8	51.1	52.8	0.0007
2nd, lung cancer	37.3	36.7	37.2	38.2	0.0703
3rd, cervical cancer	33.2	33.2	34.3	34.0	0.3065
4th, skin cancer	46.6	45.6	51.8	46.2	<0.0001

anymore but having previously smoked at least 100 cigarettes over the lifetime.

Demographic characteristics known to be associated with tobacco-related knowledge and beliefs, such as age, education, marital status, income, and occupation, were included in the analyses. Age at last year of education completed was categorized into <16, 16 to 19, 20 to 25, and >25 years old. These categories approximately reflect individuals who did not finish secondary school, finished secondary school, went to university, and had postgraduate education, respectively. Age at last education was collected because educational systems differ across countries. For marital status, subjects reporting being divorced or separated were combined into one category for analysis. Information on income was collected as "well below the median," "below the median," "around the median," "above the median," and "well above the median" to create comparable categories between countries. When asked about their personal household income, the participants were told the national median household disposable income for their country for 2005 to 2006. The actual question asked was "Given that the median annual household income in Ireland is ~43,000 euros, would you say that your household income is well below, below, around, above, or well above the median?" The medians used were 30,000 euros for France (2005; source INSEE), 230,000 krona for Sweden (2006; source Statistiska central-

byran), 32,000 euros for Italy (2006; source Bank of Italy), 110,000 koruna for The Czech Republic (2006; source Czech Statistical Office), and 43,000 euros for Ireland (2006; source Central Statistics Office Ireland).

Information on friends and family smoking was also collected for the analysis. Those who reported that "more than half" or "most or all" of their friends and family smoked were combined into one category for analysis. Women were also asked if any of their parents, step-parents, or guardians smoked.

For analysis, seven questions on knowledge and beliefs about smoking and cancer were used (Table 1). Each answer choice was given a score. For Q3 to Q7, the scores of "3," "2," "1," and "0" were given according to the degree of correct responses. For example, women totally agreeing to a false statement (Q3) were given a low score of "0," and women totally agreeing to a true statement (Q4-Q7) were given a high score of "3." For Q1, "would you say light cigarettes are safer to smoke than regular cigarette", a score of "1" was given to the response of "false," and other answers were given a score of "0." For Q2, a score of "1" was given for the response of "tobacco smoking," and others were given a score of "0." The individual scores were summed up to yield an overall score (seven items on a 17-point Likert scale), which is a well-established scoring methodology. Higher scores reflected more knowledge on cancer and tobacco use.

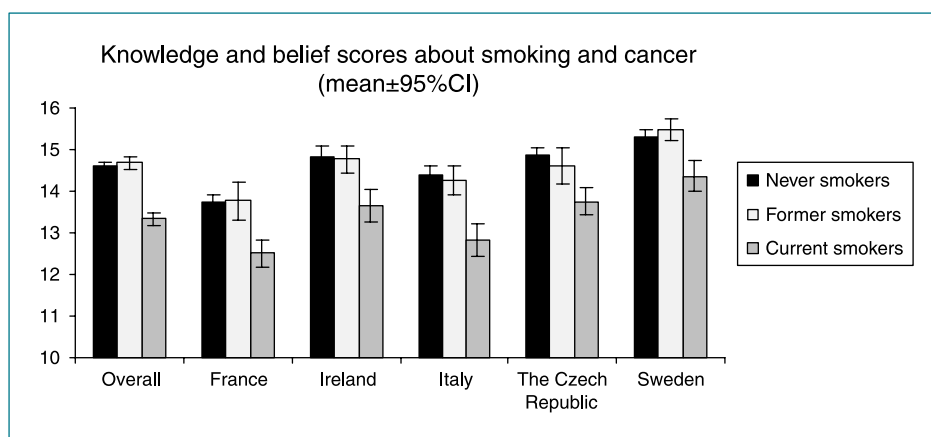
**Figure 1.** The knowledge and belief scores about smoking and cancer across smoking status by country.

Table 5. General linear analysis of the factors associated with the knowledge and belief scores about smoking and cancer by country, weighted

Variable	Overall (n = 3,788)		France (n = 846)		Ireland (n = 728)	
	Parameter estimate	P	Parameter estimate	P	Parameter estimate	P
Intercept	15.194	<0.0001	12.561	<0.0001	15.679	<0.0001
Age*	-0.005	0.112	0.019	0.023	-0.016	0.053
Smoke status						
Never smokers	0.000		0.000		0.000	
Former smokers	0.022	0.813	-0.216	0.351	0.079	0.726
Current smokers	-0.997	<0.0001	-0.972	<0.0001	-0.794	0.001
Education						
<Secondary school	0.000		0.000		0.000	
Secondary school	0.101	0.458	0.532	0.219	0.127	0.702
University/postgraduate	0.182	0.193	0.668	0.116	0.627	0.096
Marital status						
Married	0.000		0.000		0.000	
Divorced/separated	0.174	0.127	0.354	0.114	-0.118	0.740
Widowed	0.141	0.307	0.097	0.832	0.172	0.599
Never married	-0.095	0.381	0.132	0.680	-0.531	0.031
Unmarried couple	0.062	0.632	0.067	0.782	-0.508	0.319
Income						
Well below the median	-0.286	0.059	0.215	0.534	0.010	0.981
Below the median	-0.152	0.149	0.381	0.103	-0.076	0.779
Around the median	0.000		0.000		0.000	
Above the median	0.376	0.001	0.538	0.034	0.007	0.980
Refused to answer	-0.141	0.203	0.536	0.032	-0.075	0.814
Occupation†						
Highest skilled jobs	0.000		0.000		0.000	
Technical position	-0.161	0.396	0.263	0.612	-0.624	0.103
Skilled workers	-0.150	0.103	-0.385	0.134	-0.394	0.133
Unskilled workers	-1.011	<0.0001	-0.598	0.022	-0.428	0.407
Homemakers	-0.511	<0.0001	-0.425	0.169	-0.581	0.042
Friends/family smoke						
None	0.000		0.000		0.000	
Few	-0.088	0.372	-0.125	0.595	0.046	0.863
Less than half	-0.375	0.008	-0.344	0.262	-0.136	0.715
About half or more	-0.733	<0.0001	-0.629	0.021	-0.308	0.386
Parents smoke						
No	0.000		0.000		0.000	
Yes	-0.039	0.611	-0.030	0.864	0.053	0.792

(Continued on the following page)

Statistical analyses

χ^2 tests or Fisher's exact tests were conducted to test possible differences in demographic attributes among never, former, and current smokers in the data from the five countries pooled and across countries separately. One-way ANOVA was used to compare the mean scores of knowledge and beliefs on smoking and cancer by smoking status. The general linear model was used to explore the factors that might influence the knowledge and beliefs about smoking and cancer. SAS for

Windows, version 9.1, was used for all statistical analyses. All the analyses were carried out by country.

Results**Demographic characteristics**

A total of 5,000 women were interviewed for this study, including 1,000 women from each of the five countries. The results of the χ^2 tests showed that the demographic characteristics and smoking history of parents/friends of

Table 5. General linear analysis of the factors associated with the knowledge and belief scores about smoking and cancer by country, weighted (Cont'd)

Italy (n = 712)		Czech Republic (n = 738)		Sweden (n = 764)	
Parameter estimate	P	Parameter estimate	P	Parameter estimate	P
15.457	<0.0001	14.864	<0.0001	15.695	<0.0001
-0.010	0.127	-0.007	0.236	-0.006	0.297
0.000		0.000		0.000	
-0.152	0.482	-0.302	0.151	0.181	0.305
-1.565	<0.0001	-1.018	<0.0001	-0.639	0.004
0.000		0.000		0.000	
-0.037	0.888	0.670	0.045	0.228	0.419
-0.025	0.929	0.830	0.017	0.539	0.048
0.000		0.000		0.000	
0.003	0.993	-0.017	0.934	0.207	0.377
-0.206	0.546	0.182	0.427	-0.347	0.274
-0.262	0.244	-0.156	0.493	-0.464	0.051
0.502	0.324	-0.577	0.471	-0.077	0.697
-0.308	0.294	-0.258	0.402	-0.581	0.147
-0.188	0.426	-0.411	0.045	-0.166	0.490
0.000		0.000		0.000	
-0.123	0.725	-0.077	0.728	0.376	0.068
-0.286	0.269	-0.551	0.011	-0.090	0.681
0.000		0.000		0.000	
-0.436	0.579	-0.018	0.970	-0.255	0.416
0.042	0.843	0.030	0.853	-0.104	0.581
-0.691	0.289	-0.048	0.885	-0.766	0.040
-0.223	0.435	-0.258	0.437	-0.646	0.179
0.000		0.000		0.000	
0.044	0.854	0.209	0.328	-0.250	0.145
-0.316	0.342	-0.062	0.828	-0.306	0.303
-0.046	0.870	-0.566	0.032	-1.057	0.002
0.000		0.000		0.000	
-0.121	0.499	-0.071	0.639	-0.048	0.758

*Age was fixed in the model as a continuous variable.

†Occupation variable did not include full-time students group because of the small number.

responders were significantly different in never, former and current smokers (Table 2). The percentage of women who were over the age of 55 among the former smokers was much higher than those of never and current smokers. The majority of current smokers had more friends and family who smoked than never and former smokers.

Knowledge and beliefs about health risks of tobacco and cancer risks

Table 3 shows the results for the seven knowledge and beliefs questions about smoking and cancer among

never, former, and current smokers. Significant differences were found among never, former, and current smokers in their knowledge. The results showed that a larger percentage of never and former smokers believe that smoking is harmful to health. For example, more than 60% of never and former smokers stated that tobacco smoking was the most important cause of lung cancer, compared with 49.1% of current smokers ($P < 0.0001$). The percentage of never and former smokers who disagreed that the medical evidence stating that smoking is harmful is exaggerated were 82.7% and 81.5%, respectively, but that of current

smokers was only 74.0% ($P < 0.0001$). For the statement that quitting smoking decreased risk of lung cancer, current smokers were much more likely to disagree (17.5%), compared with never (6.9%) and former smokers (7.6%), although the actual percentage of current smokers was still rather low. Also, 24.0% of current smokers disagreed on the addictiveness of cigarette smoking, compared with 10.9% of never smokers and 11.9% of former smokers ($P < 0.0001$).

To examine knowledge of cancer risks, the participants were asked to rank cancers in the order in which European women die from cancer. As shown in Table 4, only 50% of subjects chose breast cancer as the first cancer among European women, and one third of subjects chose the correct rank of lung cancer as the second most common cause of cancer death in women. A great difference in the response to the rank of lung cancer by smoking status was not observed. However, difference across the countries was observed among current smokers (data not shown). A larger proportion of current smokers chose the correct rank of breast cancer in Ireland (55.4%), Italy (62.7%), Czech Republic (75.9%), and Sweden (50.6%) compared with only 21.6% in France. For the rank of lung cancer, the Czech Republic had a large proportion of current smokers (54.6%) who chose the correct answer, whereas France had a fairly low proportion of 24.5%.

Factors related to tobacco-related knowledge and beliefs

Figure 1 shows the mean of the knowledge and belief scores obtained about smoking and cancer across smoking status by country. There was no significant difference of scores between never and former smokers. However, the average score of current smokers (13.33) was significantly lower than those of never and former smokers (14.61 in never smokers and 14.68 in former smokers). To determine the main factors associated with the knowledge and belief scores about smoking and cancer, we present the results of the general linear model analysis in Table 5. Smoking status, income, occupation, and the number of friends and family who smoked were significantly correlated with the knowledge and belief scores in the total study population.

After adjustment for all demographic characteristics, smoking status was found, in parameter estimate sequence, to be associated with the level of knowledge on the health effects of smoking and seems to be the most crucial factor among European women overall and in each country. Compared with never smokers, current smokers were more likely to have lower knowledge and belief scores about smoking and cancer (parameter estimate = -0.997 , $P < 0.001$).

There was a positive association between higher income and knowledge and belief scores about smoking and cancer. Women with above-the-median income seemed to have higher knowledge and belief scores about smoking and cancer than those with a median income. Unskilled occupation was negatively associated with the scores of knowledge and beliefs. This associa-

tion was found in both unskilled workers and homemakers. After adjustment for other demographic factors, having more friends and family who smoked was also inversely associated with the scores of knowledge and beliefs about smoking and cancer. However, we found no evidence of the association between the knowledge and belief scores and parents' smoking, age, education, or marital status in the overall study population combining the data from five countries.

Discussion

Although the health consequences of smoking have been highly publicized and researched since the release of the First Surgeon General's Report in the United States on smoking and health in 1964 (17), research suggests that knowledge and perceptions of associated risks of tobacco use is not evenly distributed in the population (18, 19). This study provides an overview of factors associated with the knowledge and beliefs about smoking and cancer among European women during a time of significant changes in tobacco control policy.

We report that smoking status was associated with the knowledge and beliefs about smoking and cancer as expected. Never and former smokers were significantly more knowledgeable than current smokers about tobacco-related health hazards. These findings suggest that there is an opportunity for disseminating facts about the relationship between tobacco use and disease, cancer in particular, such as through health professionals, in health communications campaigns, and on cigarette packages. In our study of European women, more never and former smokers believed that smoking is harmful to health. Current smokers tend to minimize the health risks of cigarette smoking, and were much more likely to disagree that quitting smoking decreases the risk of lung cancer. Similar results have been reported from several studies in Europe and the United States, and the majority of current smokers underestimate the risk of smoking-related conditions, such as cancer and heart diseases (18-29). Therefore, it is important that women need to learn that quitting smoking lowers their lung cancer risk, as compared with women who continue to smoke.

Previous studies have shown that knowledge is a central component of effective health promotion that might affect an individual's engagement with health behavior change (15). Previous research also suggests that knowledge and beliefs about smoking are clinically relevant in that such factors may be associated with key behaviors such as cessation and intent to quit (27-31). It is therefore critical that current smokers should be accurately informed about the health risks from smoking. It would contribute to current efforts in developing and delivering effective prevention and treatment interventions to reduce population burden from tobacco-related cancers.

In our study, smoking by friends and family of the individual was also associated with the knowledge and beliefs about smoking and cancer among European women.

Women with more friends and family who smoked had lower knowledge scores for the risk of smoking. Prior studies based in Europe and several studies based in the United States, Iran, Thailand, and Mexico found that friends and family exert a strong influence on a woman's decision to start smoking (32-36). However, parent smoking was not associated with knowledge and beliefs about smoking in the present study. Our results suggest that friends who smoke may affect the knowledge and beliefs of women more than parents who smoke.

When asked to rank cancers in the order in which they cause death in women, only one-third of respondents chose the correct rank of lung cancer as second, and there was no significant difference among never, former, and current smokers. However, it was interesting and challenging that more women chose the correct ranks for breast cancer, but not lung cancer. The broad-based efforts of breast cancer awareness campaign among women may be one of the possible explanations. In recent years, screening for breast cancer with mammography is widely encouraged by governmental programs in the European Union (37). The pink ribbon has become a well-known symbol of breast cancer, along with a widespread corporate cause-marketing campaign (16). It has helped to increase public visibility of the disease. It further suggests that the anti-tobacco campaign for women, as currently being undertaken by the WHO, will be an effective strategy.

Several patterns emerged between the respondent sociodemographic characteristics and indices of smoking and cancer-relevant knowledge and beliefs. Low socioeconomic status was associated with lower knowledge scores (38-41). Rutten and colleagues found that respondents with lower levels of income and education lacked adequate knowledge and appropriate beliefs about smoking and cancer (20). Consistent with another study, knowledge about smoking increased with higher educational achievement and annual household income (39).

In our study, income and occupation, two important socioeconomic status indices, showed a strong association with knowledge and beliefs about smoking and cancer. Overall, those who had lower incomes and less skilled jobs were likely to have less adequate knowledge and beliefs about the health risks of smoking. However, no significant association was found in the multivariate analysis by country. The reasons may be explained by the fact that ~20% of respondents did not report their income because income is a sensitive topic. Although we included these persons in a separate category in our multivariable analyses, had their actual income data been obtained, the redistribution of these cases among the exact income categories could potentially alter risk estimates. With regards to occupation, the complexities of obtaining and coding occupational information could also lead to misclassification (41, 42).

Moreover, our results did not show a strong association between education status and tobacco-related knowledge and beliefs, except in the Czech Republic.

Concerning educational background, the results may partly have been due to the way the data were collected. Instead of asking what level of education had been achieved, participants were asked how old they were when they completed their education. As individuals can complete different levels of education at different ages, this may have made our education groups more similar in terms of actual educational level and biased the results toward the null. Also, age was not associated with knowledge score in European women. However, because the percentage of women over the age of 55 among former smokers was much higher than among never and current smokers, it suggests that current smokers below the age of 55 would be the key population to target through tobacco control strategies.

Finally, we observed differences across the five European countries in their knowledge and beliefs about smoking and cancer. Swedish women were the most knowledgeable about tobacco-related cancer risk, especially among former smokers. In France and Italy, current smokers seemed to be less knowledgeable about the risk of smoking. The result was consistent with our previous studies (43). Home smoking bans were more common in Sweden and the Czech Republic in comparison with other European countries.

In conclusion, we observed that knowledge and beliefs on cancer and smoking differed significantly by smoking status. As the rates of smoking are still increasing among women in Europe, there is much to be done to prevent smoking-attributable mortality rates from also increasing. The results from this study may serve as a helpful baseline for future studies on the long-term effectiveness of recent European tobacco control policies, which emphasize the need to develop health education programs that enhance cancer knowledge among current women smokers and in low socioeconomic women in particular. Our results also stress the importance of implementing gender-specific measures in the WHO Framework Convention on Tobacco Control when developing control strategies. Women within each European country have unique perspectives and beliefs for smoking and cancer, thus current efforts in Europe should consider targeting tobacco control approaches to women.

Disclosure of Potential Conflicts of Interest

No potential conflicts of interest were disclosed.

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