



Smokers' risk perception, socioeconomic status and source of information on cancer



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HIGHLIGHTS

- A majority of smokers consider their own smoking behavior as relatively safe.
- Deprived smokers were more prone to deny the risk of smoking.
- Relying on information given by relatives/the internet was correlated to risk denial.

ARTICLE INFO

Available online 23 April 2014

Keywords:

Risk perception
Fear of cancer
Socio-economic status
Internet
France

ABSTRACT

Background: In many countries, the decline in smoking prevalence has coincided with a growing concentration of smoking among people with lower socioeconomic status (SES). This concentration may reflect the social differentiation of risk perceptions. We investigated the factors associated with risk perception and fear of cancer, paying particular attention to SES indicators and health information seeking.

Methodology: A cross-sectional telephone survey conducted in France in 2010 (including 826 current smokers aged 18–75) assessing how smokers perceive the risk of smoking-related cancer in terms of daily consumption and duration thresholds.

Results: Among current smokers, 38% considered that smoking can cause cancer only for a daily consumption higher than their own consumption, and an additional 22% stated that tobacco-related cancer risk only becomes high for a longer smoking duration than their personal one. Predictors of such risk perceptions included low SES, material deprivation and mentioning either the internet or their relatives as one's main source of information on cancer. The same characteristics were also predictive of personal fear of tobacco-related cancer.

Conclusion: Our results illustrate the challenges faced by prevention campaigns in the internet society, as information found on the web may fuel smokers' risk denial. Anti-tobacco policies should tailor interventions to people with low SES, who may be especially impervious to standard prevention campaigns because of material deprivation, and they should also address and challenge smokers' risk denial beliefs.

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1. Introduction

During the last decades, in most developed countries tobacco control policies have contributed to achieve a substantial decrease in smoking prevalence (Shafey, Eriksen, Ross, et al., 2010). Nevertheless, this

decline in smoking prevalence has coincided with an increased 'social differentiation': in other words, the smoking prevalence varies increasingly across the socio-economic spectrum, as cigarette smoking is becoming concentrated in underprivileged populations (Barbeau, Krieger, & Soobadern, 2004; Cavelaars, Kunst, Geurts, et al., 2000; Giskes, Kunst, Benach, et al., 2005; Kotz & West, 2009; Legleye, Khat, Beck, et al., 2011; Peretti-Watel, Constance, Seror, et al., 2009). Such phenomenon is consistent with the descriptive model of the 'cigarette epidemic': cigarette smoking was first adopted by the upper classes

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before percolating down the social hierarchy, and the upper classes are also supposed to be the first to quit (Lopez, Collishaw, & Piha, 1994). However, this descriptive model does not explain why the poorest smokers persist more in smoking. Among other explanations, the social differentiation of smoking behaviors may reflect the social differentiation of risk perceptions.

Indeed, low socioeconomic status (SES) has been found to be positively correlated with underestimation of the health hazards of smoking (Ma, Fang, Tan, et al., 2003; Shiffman, Pillitteri, Burton, et al., 2004), and smokers with low SES are also more prone to endorse beliefs that enable them to minimize the risk of smoking (Oakes, Chapman, Borland, et al., 2004; Peretti-Watel, Constance, Guilbert, et al., 2007; Peretti-Watel, Halfen, & Grémy, 2007). For example, in an Australian survey the less well educated smokers were more likely to think they have some personal immunity to the health effects of smoking, to distrust medical evidence about smoking and disease, and to endorse beliefs normalizing the risks of smoking because of the ubiquity of risks in contemporary societies (Oakes et al., 2004). More generally, it has been argued that SES-related differences in beliefs and expectations are one important pathway to SES-related differences in health behaviors (von Wagner, Good, Whitaker, et al., 2011; Wardle, McCaffery, Nadel, et al., 2004; Wardle & Steptoe, 2003).

Another important aspect regarding smokers' risk perception is the kind of information they use, especially in the internet society. People are increasingly engaging in health information seeking via the internet, including in France (Fahy, Hardikar, Fox, & Mackay, 2014; Renahy, Parizot, & Chauvin, 2008), but the quality of online health information has been found to be highly variable and often inaccurate for various health topics (e.g. colorectal cancer, vascular surgery, and healthy diet) (Grewal & Alagaratnam, 2013; Grewal, Williams, Alagaratnam, et al., 2012; Hirasawa, Yachi, Yoshizawa, et al., 2013). Moreover, people's eHealth literacy (i.e. the ability to seek, find, understand, and appraise health information from electronic resources, see Stollefson, Hanik, Chaney, et al., 2011) is generally poor, especially among people with low-income (Knapp, Madden, Wang, et al., 2011). A previous study found that the content of smoking-related websites was very heterogeneous, from smoking cessation counseling to pro-smoking ads (Morgan & Montagne, 2013). More generally, the internet can be a source of inaccurate, misleading and dangerous information promoting risky behaviors (Cline & Haynes, 2001; Fahy et al., 2014).

In this article, we replicated a previous study designed to assess how smokers perceive the risk of tobacco-related cancer in terms of daily consumption and duration thresholds, and how such perceptions were linked to fear of cancer (Peretti-Watel et al., 2007). We investigated the factors associated with risk perception and fear of cancer, paying particular attention to SES indicators (occupation, income, education, material deprivation: i.e. food insufficiency in the household and forgoing health care due to costs) and health information seeking (main source of information on cancer). We also included smoking so-called 'light' cigarettes in the analysis, as many smokers choose them because they think that such cigarettes are safer (Etter, Kozlowski, & Perneger, 2003; Kropp & Halpern-Felsher, 2004).

In this study we tested the following three hypotheses: 1) most smokers endorse risk denial beliefs that help them to consider their own personal smoking behavior as relatively safe; 2) such beliefs are fuelled by some sources of information on cancer, especially the internet; and 3) risk denial beliefs are more prevalent among smokers with a low SES.

2. Methods

2.1. Sampling design & data collection

We used data from the second Cancer KABP survey, a telephone survey on cancer-related knowledge, attitudes, beliefs and practices conducted by the French National Institute for Prevention and Health

Education (INPES). This second survey was carried out between April and August 2010 on a representative random sample of the general population aged 15–85, living in France and speaking French.

We used a two-stage random sampling design. Residents of collective dwellings, hospitals and other institutions were excluded from the survey. Private households with landline telephones, whether in the telephone directory or not, were included in the sample, as well as people owning only mobile phones. The first sampling step was household selection (by phone number). Within each selected household, one French speaking person aged 15–85 was randomly selected using the "next birthday" method (that is, the investigator asked which person had his birthday closest in the future). No incentive was proposed to participants.

The interviews were conducted using a computer-assisted telephone interview (CATI) system. All collected data were anonymous and self-reported. Interviews lasted on average for 36 min, and 3% of them were excluded from the sample as they were incomplete (interviewed people gave up before the end). The overall refusal rate was 43%, resulting in a sample of 3727 respondents. Questions dealing with smoking were not asked to individuals with a history of cancer (because they already answered to an additional questionnaire) and those aged over 75 years (the questionnaire was shorter for them, as hearing problems frequently complicate interviews within this age range). Among the remaining participants ($n = 3301$), 838 reported current smoking.

2.2. Questionnaire

Several questions dealt with smoking behaviors and beliefs: daily cigarette consumption, smoking duration, smoking 'light' cigarettes, perceived level of information on health consequences of smoking (from "very well" to "very poorly" informed), personal fear of smoking-related cancer ("yes"/"no"), and perception of smoking as a cancer risk factor ("cigarette smoking causes cancer: certainly, probably, probably not, certainly not"). More specifically, current smokers were asked the following questions: "According to you, smoking how many cigarettes per day is a smoker at risk of cancer because of smoking?"; and for a given response N they were asked: "And according to you, after how many years is someone who smokes N cigarettes per day at high risk of cancer?".

Other data collected included respondents' main information source on cancer (TV/radio/newspapers, internet, relatives, health professionals...) and socio-demographic background: gender, age, educational level, occupation, and 'equivalized' household income (EHI). EHI enables analysis of the relative wellbeing of households of different sizes and compositions. We first compute the number of consumption units (CUs) in a household: the first adult in the household counts for 1, each additional person aged 15 years or over counts for 0.5, and each younger person counts for 0.3. EHI is derived by dividing total household income by the number of CU within the household. Respondents were also asked about food sufficiency in their households (is there sometimes not enough food in their household) and health care deprivation (during the previous 12 months, did they forgo health care due to costs).

2.3. Analysis

The sample was weighted in order to take into account the sampling design and to approximate the distribution of French population by age, gender, geographic area and size of town. Analyses were performed with weighted data.

Regarding the two questions related to thresholds for cancer risk perception, instead of analyzing the collected responses as continuous variables, we compared these responses to smokers' self-reported daily consumption and smoking duration in order to detect patterns of risk denial. We used these questions to build three categories of smokers (see Fig. 1). Firstly, those who stated that smoking can cause

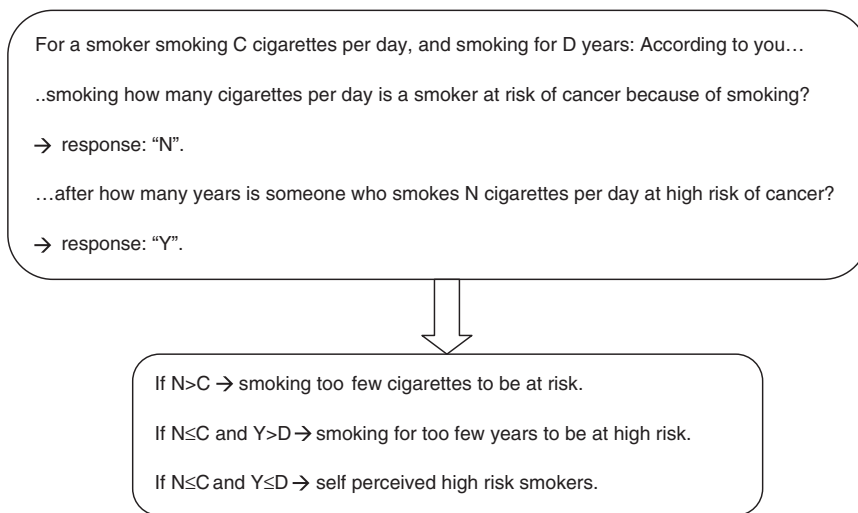


Fig. 1. Measurement of smokers' risk denial in three categories.

cancer only for a daily consumption larger than their own reported consumption were labeled "smoking too few cigarettes to be at risk." Secondly, among smokers who indicated a threshold equal to or lower than their own daily cigarette consumption, those who considered that the risk of cancer becomes high only for a smoking duration higher than their own reported one were labeled "smoking for too few years to be at high risk." Finally, remaining smokers were labeled "self perceived high risk smokers," since they stated that smoking can cause cancer for a daily consumption equal to or lower than their own consumption, and that such risk is high for a smoking duration equal to or lower than their own smoking duration.

Pearson's χ^2 , Student's t-test and logistic regressions (with a stepwise selection method, at a $p < 0.1$ threshold) were used to compare these three categories with each other. Candidate covariates in the logistic models included SES and deprivation indicators, smoking light cigarettes and main source of information on cancer. The same procedure was used to investigate the factors associated with personal fear of smoking-related cancer, adding the three categories of smokers as a potential covariate.

3. Results

3.1. Perceptions of tobacco-related risk of cancer among smokers

Among current smokers, 38% perceived themselves as "smoking too few cigarettes to be at risk" (see Table 1). On average, these smokers considered that smoking can cause cancer only if one smokes at least 23.9 cigarettes per day, which was far more than their own reported consumption (8.6 cigarettes per day on average). They also considered that cancer risk becomes high for a smoking duration of 18.5 years or more (for a reported average duration of 17.3 years). The category "smoking for too few years to be at high risk" gathered 22% of current smokers, with an average consumption threshold for cancer risk of 5.6 cigarettes per day (versus 13.7 for reported consumption) and an average duration threshold for high risk of 27.6 years (twice as much as their average reported duration: 13.5 years). Finally, 40% of current smokers perceived themselves as being at high risk for cancer because of smoking: their average reported consumption was three times higher than their perceived threshold for cancer risk (15.5 versus 5.4 cigarettes

Table 1
Smoking behaviors and beliefs according to perceptions of smoking-related risk of cancer (France, 2010, Cancer KABP survey, $n = 838$).

	Smoking too few cigarettes to be at risk (38%)	Smoking for too few years to be at high risk (22%)	Perceived high risk smoking (40%)
<i>Mean (SD)</i>			
Threshold for daily cigarette consumption associated with risk of cancer	23.9 (18.5)	5.6 (5.4)	5.4 (5.3)
Threshold for smoking duration (in years) associated with high risk of cancer	18.5 (12.5)	27.6 (14.0)	9.6 (7.6)
Daily cigarette consumption	8.6 (6.1)	13.7 (6.8)	15.5 (8.1) ***
Duration of daily smoking (in years) (daily smokers only)	17.3 (12.9)	13.5 (9.2)	22.6 (6.9) ***
<i>Column percentage</i>			
Perceived level of information on health consequences of smoking			
Very well informed (N = 404)	45%	51%	50%
Rather well informed (N = 363)	47%	40%	42%
Poorly/very poorly informed (N = 71)	8%	9%	8% ns
Cigarette smoking may cause cancer			
Certainly (N = 649)	71%	80%	83%
Probably (N = 179)	28%	18%	17%
Probably/certainly not (N = 11)	1%	2%	0% **

SD: standard deviation.

***, **, *, and ns: respectively statistically significant at $p < 0.001$, $p < 0.01$, $p < 0.05$, and non-significant.

Test used: Pearson's χ^2 for categorical variables, Student's t-test for continuous variables.

Table 2

Factors associated with perceptions of smoking-related risk of cancer among French smokers, bivariate analyses (France, 2010, Cancer KABP survey, n = 838).

	Smoking too few cigarettes to be at risk (38%)	Smoking for too few years to be at high risk (22%)	Perceived high risk smoking (40%)
	Column percentage		
Smoking light cigarettes			
Yes (N = 298)	42%	28%	34%
No (N = 540)	58%	72%	66% **
Main information source on cancer			
TV/radio/newspapers (N = 399)	46%	40%	54%
Internet (N = 110)	16%	19%	8%
Relatives (N = 145)	23%	18%	12%
Health professionals, health magazines (N = 148)	13%	17%	22%
Other (N = 36)	2%	6%	4% ***
Gender			
Male (N = 466)	54%	53%	58%
Female (N = 374)	46%	47%	42% ns
Age ^a			
15–25 (N = 178)	28%	29%	10%
26–34 (N = 198)	20%	30%	23%
35–44 (N = 213)	21%	25%	30%
45–54 (N = 169)	17%	12%	28%
55–75 (N = 80)	14%	4%	9% ***
Educational level			
<Baccalaureate (N = 541)	71%	60%	61%
Baccalaureate (N = 155)	17%	21%	19%
>Baccalaureate (N = 142)	12%	19%	20% *
Occupation			
Professional/manager/owner of a business (N = 111)	8%	13%	18%
Office worker/clerical (N = 343)	40%	40%	42%
Student/other (N = 140)	22%	19%	11%
Manual worker (N = 244)	30%	28%	29% ***
Equivalized household income ^b			
<900 €/CU (N = 286)	40%	32%	30%
[900; 1500] €/CU (N = 268)	32%	30%	33%
>1500 €/CU (N = 234)	20%	33%	32%
Unknown (N = 50)	8%	5%	5% **
Food sufficiency in the household			
Always enough food (N = 779)	90%	93%	96%
Sometimes there is not enough food (N = 59)	10%	7%	4% *
During the previous 12 months, did forgo health care due to costs			
No (N = 681)	84%	78%	81%
Yes (N = 157)	16%	22%	19% ns

***, **, *, and ns: respectively statistically significant at $p < 0.001$, $p < 0.01$, $p < 0.05$, and non-significant (Pearson's χ^2).^a Mean: 37.4; standard deviation: 13.0.^b Mean: 1289.6; standard deviation: 821.4.

per day), and their average reported smoking duration was also much longer than their average perceived threshold for high risk (22.6 versus 9.6 years).

These three categories had very similar perceived levels of information on health consequences of smoking: most of them (respectively 92%, 91% and 92%) stated that they were very well/rather well informed. However, they had distinct perceptions of the carcinogenic risk of smoking (from 71% to 83% stated that cigarette smoking certainly causes cancer, $p < 0.01$).

3.2. Factors associated with perceptions of smoking-related cancer risk

In bivariate analyses, those smokers who considered that they smoked too few cigarettes to be at risk were more prone to smoke 'light' cigarettes, and both youngest and oldest smokers were also over-represented in this category (see Table 2). Smokers gathered in the "perceived high risk smoking" category were more likely to report that their main information sources on cancer were either TV/radio/newspapers, health professionals or health magazines, instead of the internet or relatives. Regarding SES indicators, the "smoking too few cigarettes to be at risk" category was characterized by a higher proportion of low educational and low EHI levels, and a smaller proportion of professionals/managers/owners of a business. Reported food deprivation was also a bit more frequent in this category.

Results of the multivariate analyses are presented in Table 3. The first logistic model compared the categories "smoking too few cigarettes to be at risk" and "perceived high risk smoking".

Several results from the bivariate analysis remained statistically significant in this model. The youngest and oldest smokers were more prone to consider that they smoked too few cigarettes to be at risk, just as well as those who reported a lower EHI or food deprivation in their household, and those who were neither professionals, nor managers or owners of a business. Similarly, this risk perception remained positively correlated to smoking 'light' cigarettes (adjusted OR = 1.65, $p < 0.01$) and to mentioning either the internet or their relatives as one's main source of information on cancer: adjusted OR = 2.06 and 1.72 respectively, versus 1 (the reference) for TV/radio/newspapers and 0.70 for health professionals and health magazine. On the contrary, once controlled for other factors, the educational level was no longer a significant predictor.

The second logistic model compared the categories "smoking for too few years to be at high risk" and "perceived high risk smoking". Older smokers were less likely to consider that they smoked for too few years to be at high risk of cancer (as the adjusted ORs decreased as age increased), as well as those who reported food deprivation in their household (OR = 2.51, $p > 0.05$) and those whose main information source on cancer was the internet (OR = 2.69, $p < 0.001$) or relatives (OR = 1.72, $p < 0.1$) instead of TV, radio or newspapers.

Table 3
Factors associated with perceptions of smoking-related risk of cancer among French smokers, logistic regressions (France, 2010, Cancer KABP survey, n = 838).

	Smoking too few cigarettes to be at risk	Smoking for too few years to be at high risk
	Versus perceived high risk smoking	
	Adjusted odds ratios	
Gender		
Male (ref.)	NS	NS
Female		
Age		
15–25 (ref.)	– 1–	– 1–
26–34	0.39 **	0.44 **
35–44	0.35 ***	0.30 ***
45–54	0.24 ***	0.15 ***
55–75	0.79 ns	0.17 ***
Educational level		
<Baccalaureate (ref.)	NS	NS
Baccalaureate		
>Baccalaureate		
Occupation		
Professional/manager/owner of a business (ref.)	– 1–	NS
Office worker/clerical	2.08 **	
Student/other	2.55 **	
Manual worker	1.81 *	
Equivalized household income		
<900 €/CU (ref.)	– 1–	NS
[900; 1500] €/CU	0.73 ns	
>1500 €/CU	0.61 *	
Unknown	1.23 ns	
Food sufficiency in the household		
Always enough food (ref.)	– 1–	– 1–
Sometimes there is not enough food	1.93 #	2.51 *
During the previous 12 months, did forgo health care due to costs		
No (ref.)	NS	NS
Yes		
Smoking light cigarettes		
No (ref.)	– 1–	NS
Yes	1.65 **	
Main information source on cancer		
TV/radio/newspapers (ref.)	– 1–	– 1–
Internet	2.06 *	2.69 **
Relatives	1.72 *	1.72 #
Health professionals, health magazines	0.70 #	1.05 ns
Other	0.59 ns	1.68 ns

Ref.: reference category (corresponding odds ratio is put to 1).

NS: not selected by the forward stepwise selection procedure.

***, **, *, #, and ns: respectively statistically significant at $p < 0.001$, $p < 0.01$, $p < 0.05$, $p < 0.1$, and non-significant (Wald's χ^2).

3.3. Factors associated with personal fear of tobacco-related cancer

In bivariate analysis, only gender and food sufficiency were not significantly correlated to personal fear of cancer. Such fear was more prevalent among the most educated smokers (83%, versus 69% among the least educated, $p < 0.01$) and those aged 26–44 years old, but these relationships vanished in multivariate analysis. Regarding SES, students and manual workers and, to a lesser extent, office workers were less likely to fear cancer than professionals, managers and owners of a business. A low EHI and reported health care deprivation during the last 12 months were also associated with a lower propensity to fear tobacco-related cancer. After adjustment on other covariates, smoking 'light' cigarettes remained a strong predictor of reporting no fear of cancer (OR = 0.56, $p < 0.001$). Such fear was also significantly less prevalent among smokers whose main information source on cancer was relatives (OR = 0.60, $p < 0.01$). Finally, the three categories of risk perception were also strongly predictive of fear of cancer: among smokers who considered they smoked too few cigarettes to be at risk, only 57%

Table 4
Factors associated with personal fear of tobacco-related cancer among French smokers, bivariate analysis and logistic regression (France, 2010, Cancer KABP survey, n = 838).

	Personal fear of smoking related cancer	
	Column percentage	Adjusted odds ratio
Gender		
Male (N = 466)	70%	NS
Female (N = 374)	73% ns	
Age		
15–25 (N = 178)	65%	NS
26–34 (N = 198)	77%	
35–44 (N = 213)	75%	
45–54 (N = 169)	70%	
55–75 (N = 80)	65% *	
Educational level		
<Baccalaureate (N = 541)	69%	NS
Baccalaureate (N = 155)	72%	
>Baccalaureate (N = 142)	83% **	
Occupation		
Professional/manager/owner of a business (N = 111) (ref.)	85%	– 1–
Office worker/clerical (N = 343)	75%	0.59 *
Student/other (N = 140)	63%	0.42 **
Manual worker (N = 244)	66% ***	0.37 **
Equivalized household income		
<900 €/CU (N = 286) (ref.)	66%	– 1–
[900; 1500] €/CU (N = 268)	77%	1.60 *
>1500 €/CU (N = 234)	77%	1.17 ns
Unknown (N = 50)	52% ***	0.60 ns
Food sufficiency in the household		
Always enough food (N = 779)	72%	NS
Sometimes there is not enough food (N = 59)	66% ns	
During the previous 12 months, did forgo health care due to costs		
No (N = 681) (ref.)	70%	– 1–
Yes (N = 157)	79% *	1.58 *
Smoking light cigarettes		
Yes (N = 298) (ref.)	76%	– 1–
No (N = 540)	64% ***	0.56 ***
Main information source on cancer		
TV/radio/newspapers (N = 399) (ref.)	75%	– 1–
Internet (N = 110)	72%	0.85 ns
Relatives (N = 145)	60%	0.60 **
Health professionals, health magazines (N = 148)	71%	0.76 ns
Other (N = 36)	80% *	1.13 ns
Perception of one's risk of cancer		
Smoking too few cigarettes to be at risk (N = 315) (ref.)	57%	– 1–
Smoking for too few years to be at high risk (N = 188)	79%	2.50 ***
Perceived high risk smoking (N = 335)	81% ***	2.66 ***

Ref.: reference category (corresponding odds ratio is put to 1).

NS: not selected by the forward stepwise selection procedure.

***, **, *, #, and ns: respectively statistically significant at $p < 0.001$, $p < 0.01$, $p < 0.05$, $p < 0.1$, and non-significant (Pearson's χ^2 for bivariate analysis, Wald's χ^2 for adjusted odds ratios).

feared tobacco-related cancer, versus 79% and 81% in the two other categories (OR = 2.50 and 2.66 respectively, $p < 0.001$) (Table 4).

4. Discussion

4.1. Main results

Among a random national sample of 826 current smokers, 38% considered that smoking can cause cancer only for a daily consumption higher than their own consumption, an additional 22% stated that tobacco-related cancer risk only becomes high for a longer smoking duration than their personal one, while 40% perceived themselves as being at high risk for cancer because of smoking (supporting hypothesis 1).

Predictors of the “smoking too few cigarettes to be at risk” profile included low SES, smoking light cigarettes, and mentioning either the internet or their relatives as one's main source of information on cancer (supporting hypotheses 2 & 3). Similarly, personal fear of tobacco-related cancer was less frequent among smokers with low SES, those who smoked light cigarettes, those whose main information source on cancer was their relatives, as well as among those who considered they smoked too few cigarettes to be at risk.

4.2. Limitations of the study

The present study shares the usual shortcomings of quantitative telephone surveys. First, there is a potential selection bias, as residents of collective dwellings, hospitals and other institutions were excluded from the survey, while respondents who had only cellular phones were excluded from the analysis. Moreover, the overall refusal rate was quite high (43%). Nevertheless, it was very similar to those usually obtained in telephone surveys (McCarty, 2003), and we have no reason to suspect that smoking behaviors and beliefs were correlated with refusal, as the letter announcing the survey did not give any details about the topics to be investigated. Refusal was generally motivated by lack of time, or hostility toward any kind of phone survey. More specifically, the use of a retrospective question (for smoking duration) may have also introduced a recall bias; we focused on cancer risk, therefore neglecting the other tobacco-related risks (including the cardiovascular ones); and the measure of personal fear of smoking-related cancer was quite simplistic (with a yes/no answer). Finally, contrary to qualitative methods, a closed ended questionnaire prevents respondents from qualifying or justifying their responses: our questionnaire necessarily missed some aspects of smokers' beliefs and risk perceptions.

4.3. The persistence of risk denial among French smokers

It is possible to compare our results with those obtained in 2005 with the same questionnaire (Peretti-Watel et al., 2007). In 2010 as in 2005, approximately four smokers out of ten (38% in 2005, 44% in 2010) considered they smoked too few cigarettes to be at risk, with an average difference of 15 cigarettes per day between their own daily consumption and their perceived risk threshold (5.5 vs 19.4 in 2005, 8.6 vs 23.9 in 2010). Similarly, two out of ten (20% in 2005, 22% in 2010) considered they were smoking for too few years to be at high risk, and on average their own smoking duration was twice shorter than their perceived high risk threshold (12.5 years vs 23.5 in 2005; 13.5 years vs 27.6 in 2010). This comparison highlights the persistence of risk denial among smokers, despite the many anti-tobacco media campaigns conducted in France between 2005 and 2010 (INPES, 2013).

4.4. Risk denial and sources of information on cancer

Our results provide some insight to understand such persistence, as those smokers who minimized their personal risk were more likely to report that their main information source on cancer was either the internet or their relatives, instead of mainstream media or health professionals/magazines, which are the main channels of preventive information. In a previous study conducted in North America, heavier smokers reported a lower intention to quit and a lower trust in doctors as a source of health information, but they also reported more exposure to television (Rutten, Augustson, Doran, et al., 2009). In the present case, smokers were probably not passively ‘exposed’ to the internet. The abundance and diversity of information available on the web facilitate selective information seeking, and smokers may favor information that helps them to minimize their personal risks.

The role of relatives as the main source of information on cancer can also be interpreted as a kind of information selection bias. People who engage in risky behaviors usually learn to justify their behaviors, they elaborate rationalizations to minimize their personal risk, and these

rationalizations are built, shared and sustained among peers (Hughes, 2003; Peretti-Watel & Moatti, 2006). Of course, this interpretation would be better supported if we could identify smokers among relatives. Relatives may also play a key role in the persistence of smokers' attitudes toward ‘light’ cigarettes: 18% of interviewed smokers initiated smoking in 2003 or later, and a third of them reported smoking ‘light’ cigarettes, despite the prohibition of ‘light’ cigarette brand descriptors in 2003. Older relatives may play a key role in informing the younger ones about the existence of ‘light’ cigarettes and the belief that such cigarettes would be less hazardous than regular cigarettes. Finally, our results showed that relatives influenced smokers' risk perception, but also fear of cancer after adjustment on risk perception, suggesting that they influence smokers' attitudes in several ways.

4.5. SES and smokers' attitudes

Our results support the hypothesis that SES-related differences in beliefs and expectations are one pathway to SES-related differences in health behaviors (von Wagner et al., 2011; Wardle & Steptoe, 2003; Wardle et al., 2004), as several SES indicators were significantly correlated to smokers' risk perception and fear of smoking-related cancer. In more details, regarding both risk perception and personal fear of cancer, in multivariate analyses income and occupation remained significant predictors, but the effect of educational level became insignificant. On the contrary, food deprivation was predictive of risk denial, and health care deprivation was predictive of reporting no personal fear of smoking-related cancer. These last results can be interpreted in reference to temporal horizon. Material deprivation shrinks people's temporal outlook and makes them less sensitive to long-term risks: the risk of having cancer in several years may not weigh much for smokers who are currently enduring food and health care deprivation (Peretti-Watel et al., 2009). Previous studies found that time preferences were strong predictors of smoking status as well as smokers' attitudes, fears and risk perception, and may partly mediate the effects of SES (Jusot & Khat, 2013; Peretti-Watel, L'Haridon, & Seror, 2013; Van der Pol, 2011).

Moreover, deprived smokers are more likely to consider cigarette as a basic essential that helps them to cope with the hardships they face everyday (Hughes, 2003; Krueger & Chang, 2008; Peretti-Watel et al., 2009). Of course, if smokers were strictly rational, the perceived benefits and risks of smoking should not be correlated one with another, but such separation of utility and beliefs is rare in real-life: usually activities that are judged high in benefits tend to be judged low in risks (Siddiq Alhakami & Slovic, 1994).

5. Conclusions

Our results illustrate the challenges faced by prevention campaigns in the internet society, as they suggest that information found on the web may fuel smokers' risk denial. As many smokers build and share persistent risk denial beliefs that help them not to fear smoking-related cancer, such beliefs should be better understood, and prevention campaigns should address and challenge them, instead of conveying information translated from epidemiology and medicine. Anti-tobacco policies should also develop tailored tools to promote smoking cessation among people with low SES, as these people may be especially impervious to standard prevention campaigns, notably because material deprivation induces short-sightedness. Such tools could include messages that place emphasis on the financial gains to quitting. Indeed, behavioral economic studies suggest that consumers do not spontaneously consider opportunity costs when making a purchase decision (Frederick, Novemsky, Wang, Dhar, & Nowlis, 2009), and according to a recent study financial messages that make more salient the opportunity costs of smoking attracted more attention than health messages in low-income areas (Sindelar & O'Malley, 2014).

Role of funding sources

The French Institute for Public Health Research (IRESP, ACTAS project) and the French National Cancer Institute (INCa, grant #INCA_G950) supported this study financially. IRESP and INCa had no role in the study design, collection, analysis or interpretation of the data, writing the manuscript, or the decision to submit the paper for publication.

Contributors

Valérie Seror and Pierre Verger conducted literature searches and provided summaries of previous research studies. Stéphane Legleye and Patrick Peretti-Watel conducted the statistical analysis. Patrick Peretti-Watel wrote the first draft of the manuscript and all authors contributed to and have approved the final manuscript.

Conflict of interest

All authors declare that they have no conflicts of interest.

Acknowledgments

The authors thank all the people who agreed to participate in this survey. The French National Institute for Prevention and Health Education (INPES) provided access to the datasets.

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