INFLUENCE OF PERCEIVED RISK OF SMOKING AND SECOND-HAND SMOKE ON SELF-REGULATORY BEHAVIOR AMONG PREGNANT TAIWANESE WOMEN

Ming-Cheng Lai[1], Feng-Sha Chou[2], Chih-Chien Wang[3] and Yann-Jy Yang[4]

[1]Graduate Institute of Business Administration, National Taipei University of Business, Taipei; [2]Department of Business Administration, [3]Graduate Institute of Information Management, National Taipei University, New Taipei City; [4]Tsing Hua College, National Tsing Hua University, Hsinchu, Taiwan

Abstract. Tobacco use is a global health problem, including in Taiwan. The present study evaluated the perceived risk of smoking and second-hand smoke among pregnant Taiwanese women using a questionnaire. Seven hundred twenty-four pregnant Taiwanese women were recruited from an online parenting community using convenience sampling in 2013. Pregnant smokers and non-smokers had significantly different perceptions regarding risk of smoking and second-hand smoke during pregnancy. Pregnant non-smokers adopted more behaviors to avoid second-hand smoke both at home and in public than pregnant smokers. We conclude that perceived fetal health risks from smoking and second-hand smoke influenced maternal behavior during pregnancy. Pregnant women's perceptions of the risk of tobacco smoke depended on whether their focus in the decision-making process was on prevention or promotion. Understanding the risk factors associated with smoking and exposure to second-hand smoke during pregnancy may help in developing strategies to reduce such exposure.

Keywords: pregnancy smoking, pregnancy passive smoking, risk behavior, self-regulatory focus, Taiwan

INTRODUCTION

Exposure to cigarette smoke during pregnancy has an effect on the pregnant women and the fetus (Hotham *et al*, 2002). Smoking during pregnancy increases the risk of intrauterine growth retardation (Nordentoft *et al*, 1996), low birth weight (Wang *et al*, 2002; Kaneita *et al*, 2007), stillbirth (Leonardi-Bee *et al*, 2011; Varner *et al*, 2014), early weaning (Horta *et al*, 2001; Erkkola *et al*, 2013), and sudden infant death syndrome (Kaneita *et al*, 2007; Zhang and Wang, 2013). Exposure to second-hand smoke also increases the risk of adverse fetal outcomes, including stillbirth and congenital malformations (Leonardi-Bee *et al*, 2011). Therefore, smoking behavior and second-hand smoke during pregnancy are important public health issues.

Perceived risk refers to a subjective opinion about the characteristics and se-

Correspondence: Ming-Cheng Lai, Graduate Institute of Business Administration, National Taipei University of Business, 321 Jinan Road, Section 1, Taipei 100, Taiwan.
Tel: +886 2 3322 2777 ext 6527; Fax: +886 2 2322 6465
E-mail: drlai511115@gmail.com

verity of a risk (Lopez-Quintero and Neumark, 2010). It is a rich and multifaceted construct that has a prominent influence on a variety of health-related decisions and behaviors (Lai *et al*, 2013; Waters *et al*, 2013). Previous studies found that when facing disease or negative situations, perceived risk is a reliable predictor of the adoption of preventive actions (Sibthorpe, 1992; Lopez-Quintero and Neumark, 2010; Rimal and Juon, 2010). A highly perceived risk motivates people to avoid the threat (Luszczynska and Schwarzer, 2003) and may be necessary to adopt preventive behavior (Gerrard *et al*, 1996).

Self-regulatory focus, proposed by Higgins (1997), is a state of goal pursuit in the decision making process and can differ among individuals and by situation. The Regulatory Focus Theory posits two separate, independent self-regulatory orientations: prevention and promotion (Higgins, 1997). Individuals use one of the two self-regulatory focus types to approach pleasure and avoid pain in goal directed behavior. Promotion focused individuals tend to pursue a positive outcome and are concerned with positive output and achievements. However, prevention focus self-regulatory individuals may care about the disappearance of the risk of smoking and avoid the presence of the negative result of smoking on health (Higgins, 1997). People with different self-regulatory focuses will adopt different behaviors to achieve their desired goal (Higgins, 1997; Scholer *et al*, 2010).

Self-regulatory focus theory can be viewed as a theoretical basis to explore an individual's intention to reduce risk behavior (Adam *et al*, 2011). The prevention focus emphasizes security and safety, and is concerned with the disappearance of negative results (Higgins, 1997). Thus, prevention focused self-regulatory individuals may care about eliminating the risk of smoking and avoiding the negative results of smoking on their health.

Higgins (1997) argued that people choose the approach to achieve their objectives based on their regulatory focus. Hamstra *et al* (2011) advocated the importance of self-regulatory focus on unique personal preference strategy and the strong effect of self-regulatory focus on daily behavior. Thus, we suggested that pregnant women with prevention self-regulatory focus are more willing than others to avoid tobacco smoke and second-hand smoke.

The present study aimed to explore the influence of pregnant Taiwanese women's risk perceptions and self-regulatory focus on smoking behaviors and avoidance of exposure to second-hand tobacco smoke. The present study aims to answer the following questions: do Taiwanese pregnant non-smokers have a higher perception compared to pregnant smokers that smoking is associated with fetal health risks? Do Taiwanese pregnant non-smokers adopt more avoidance behaviors toward second-hand smoke at home or in public compared to pregnant smokers? Does the self-regulatory focus influence pregnant Taiwanese women's risk perception of tobacco smoke?

MATERIALS AND METHODS

Participants

A convenience sample of pregnant women obtained from an online parenting community in Taiwan, (babyhome.com) was invited to participate in the study. Babyhome.com is the number one parenting community in Taiwan, with more than one million members at the end of 2014 (http://www.chinatimes.com/newspapers/20150414000127-260204). We

conducted an online survey during a two-week period. The participants joined the online survey voluntarily, and were informed of their right to decline. The questionnaire took about five minutes to complete.

Procedure and research ethics

To invite participants for the questionnaire survey, we posted an advertisment in the online community that illustrated the purpose and reward of the survey. We provided baby related products as incentives to participants who completed the online questionnaire.

All participants gave electronic informed consent prior to participation. The Research Ethics Committee at National Taiwan University approved this study.

Measures

The study questionnaire obtained demographic characteristics, and asked questions about gravidity, perceived health risks of cigarette smoke exposure, self-regulatory focus, smoking history and amount, if participant was a pregnant smoker, environmental tobacco smoke and any actions taken to avoid second-hand smoke. We used two questions to understand second-hand tobacco smoke exposure at home: "does your partner smoke near you at home?" and "does any other family member smoke near you at home?" We also asked about participants' second-hand smoke avoidance behaviors at home and in public places with the following two questions: "would you immediately leave when others smoke near you at home/in a public place?" and "would you ask others to stop smoking when they smoke near you at home/in a public place?"

Risk perception and self-regulatory focus were factors influencing pregnant women's willingness to avoid tobacco smoke. To measure risk perception, we used a six-item scale developed by Witte and Morrison (2000), composed of two aspects: susceptibility to threat of tobacco smoke of fetal health and severity of threat of tobacco smoke to fetal health. Each aspect was measured by three items. The risk perception of susceptibility to threat measured the level of possibility that the fetus would acquire a disease after exposure to tobacco smoke. The risk perception of severity of threat measured how serious the impact of tobacco smoke was to fetal health.

We used six items from a scale developed by Lockwood *et al* (2002) to measure self-regulatory focus of pregnant women. Self-regulatory focus was divided into two aspects: promotion and prevention. Each aspect was measured using three items. The three items for promotion focus were: "I frequently imagine how I will achieve my hopes and aspirations." "I often think about the person I would ideally like to be in the future" and "I typically focus on the success I hope to achieve in the future." The three items for prevention focus were, "in general, I am focused on preventing negative events in my life", "I frequently think about how I can prevent failures in my life" and "my major goal right now is to avoid becoming a failure". The items of perceived risk and self-regulatory focus were evaluated with a 7-point Likert scale, with 1 indicating "strongly disagree" and 7 indicating "strongly agree".

Higgins *et al* (2001) classified each subject in terms of whether the difference between promotion and prevention focus scores was greater or less than zero (Fitzsimons, 2008). Fitzsimons (2008) suggested that researchers not use median splitting to dichotomize a continuous independent variable. Instead, Fitzsimons (2008) advo-

cated that researchers should perform a "spotlight" analysis of the subjects with one (or more) standard deviations above and below the mean value. We followed the suggestion by Fitzsimons (2008) and divided subjects into two groups, prevention score focus and promotion score focus. Subjects were assigned to the prevention focus group when their prevention scores were one standard deviation above the mean. Subjects were assigned to the promotion focus group when their promotion scores were one standard deviation above the mean. Subjects were not included for analysis when the differences between promotion and prevention scores were less than one standard deviation.

Scale reliability and validity

We used multi-item scales to investigate the self-regulatory focus and risk perceptions of the participants. We calculated Cronbach's alpha and composite reliability coefficients to evaluate the reliability of the scales. The composite reliability of each construct ranged from 0.892 to 0.935, and Cronbach's alpha coefficients ranged from 0.819 to 0.973. The reliability of scales was acceptable, since all Cronbach's alpha and composite reliability coefficients were above 0.70.

We used confirmatory factor analysis and adopted Average Variance Extracted (AVE) for each scale to evaluate the convergent validity of measurement scales. Based on the confirmatory factor analysis results, the standardized factor loadings of all items loaded significantly on their respective factors, and were all above 0.75. The AVE values for each construct in the current study ranged from 0.726 to 0.949. Thus, they were all above the threshold value of 0.5, as suggested by Fornell and Larcker (1981). Therefore, the study confirmed the convergent validity of the measurement scales.

To explore the differences between the smoker and non-smoker groups in demographics and risk perceptions, we used the chi-square and *t*-tests for analysis. We used regression analysis to explore the association between self-regulatory focus and risk perception.

RESULTS

Sample

A total of 724 pregnant Taiwanese women were included in the study. The mean age (range) of participants was 33.3 (21-48) years (SD=4.4; 95% CI: 32.9-33.6). Of the 724 participants, 263 were smokers. Ninety-eight point six percent of subjects reported having a partner. Sixty-one percent of participants were primiparous.

The mean age of the non-smokers was 33.7 years (SD=4.2). This was significantly older than the mean age of the smokers (32.4 years) (SD=4.6; t=3.797; p<0.01; one-tailed). Younger participants were more likely to be smokers (chi-square=17.196, p<0.01). Fifty-six percent of participants aged 21-25 years were smokers and 18.8% of participants aged ≥41 years were smokers (Fig 1).

Smoking history and volume

The average length of time the 263 smokers had smoked was 6.61 years (SD=4.98; range 1-24; 95% CI:6.01-7.21). Ninety-three participants (35.8%) had smoked for fewer than 3 years and 75 (28.8%) had smoked for 10-15 years. The 263 smokers in the study smoked an average of 8.1 (SD=8.1) cigarettes per day. Forty-five point two percent of smokers smoked less than three cigarettes a day.

Exposure to second-hand smoke

Of the 461 non-smokers in this study, 154 (21.3% of the total participants) lived

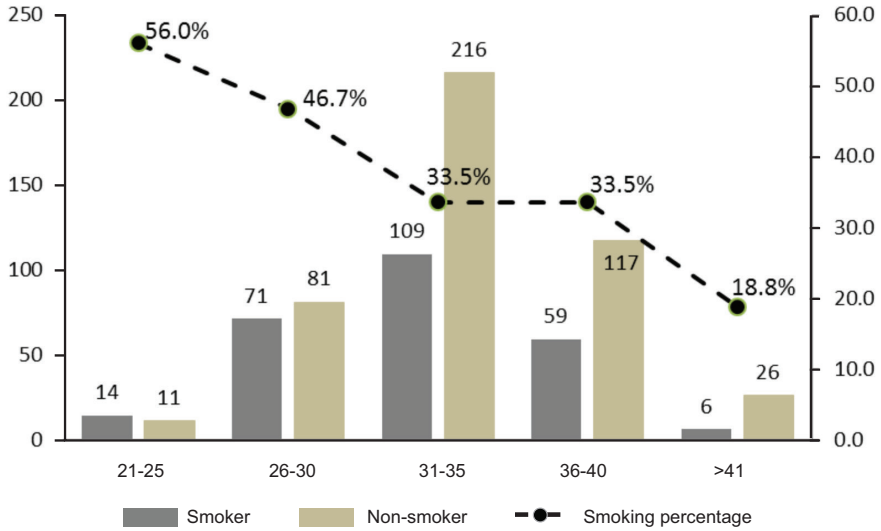

Fig 1–Smoking percentage by participant age.

in a smoke-free family and 307 (42.4% of the total participants) lived in a family where someone else smoked. When participants faced second-hand smoke at home, 88.3% (n=639) adopt actions to avoid the second-hand smoke, such as leaving or asking others to stop smoking. Ninety-one point one percent of participants adopted similar behavior when exposed to second-hand smoke in public. These results show regardless of whether the participant was smoker or non-smoker, they adopted behivior to reduce the risk of exposure to second-hand smoke.

Table 1 shows the exposure to second-hand smoke and efforts to avoid it by smoking and non-smoking respondents. Non-smoking participants were significantly less likely to be exposed to second-hand smoke at home than smoking participants (p<0.01). Non-smoking participants were significantly less likely to be exposed to second-hand smoke from their partners (p<0.01) or another family member (p<0.01) than smoking participants were. Non-smoking participants were significantly more likely to take actions to avoid second-hand smoke at home ($p < 0.01$) and in public ($p < 0.01$) than smoking participants were. Smoking participants were more likely to have a smoking partner than non-smoking participants were. The proportions of non-smoking participants who made an effort to avoid second-hand smoke at home (91.5%) and in public (94.6%) were higher than smoking participants (82.5% and 85.2%, respectively).

Risk perceptions about smoking

More non-smoking participants perceived a threat of exposure to tobacco smoke than smoking participants ($p < 0.05$). Non-smoking participants perceived the threat of exposure to tobacco smoke to be significantly more severe than smoking participants did ($p < 0.01$) (Table 2). Thus, non-smoking participants perceived exposure to tobacco smoke to be a greater risk than smoking participants did.

Table 1
Second-hand smoke exposure among participants.

	Smoker (n = 263)	Non-smoker (n = 461)	χ^2	p-value
Household smoking status				
Smoke-free family	0 (0%)	154 (33.4%)	57.494	$p < 0.01$
Smoking family	263 (100.0%)	307 (66.6%)		
Exposure to second-hand smoke from partner				
Yes	198 (75.3%)	307 (66.6%)	117.575	$p < 0.01$
No	65 (24.7%)	154 (33.4%)		
Exposure to second-hand smoke from another family member				
Yes	200 (76.1%)	267 (57.9%)	24.035	$p < 0.01$
No	63 (23.9%)	194 (42.1%)		
Effort made to avoid second-hand smoke at home				
Yes	217 (82.5%)	422 (91.5%)	13.180	$p < 0.01$
No	46 (17.5%)	39 (8.5%)		
Effort made to avoid second-hand smoke in public				
Yes	224 (85.2%)	436 (94.6%)	18.385	$p < 0.01$
No	39 (14.8%)	25 (5.4%)		

Table 2
Risk perceptions and self-regulatory focus of participants.

		Smoker (n = 263)	Non-smoker (n = 461)	t-value (p-value)
Perceived risk— susceptibility to threat	Mean	6.44	6.57	2.127
	SD	0.86	0.7	(p=0.03)
	95% CI	6.34 - 6.54	6.51 - 6.63	
Perceived risk— severity of threat	Mean	6.25	6.59	4.429
	SD	1.11	0.7	(p<0.01)
	95% CI	6.12 - 6.38	6.52 - 6.66	

Risk perceptions and behavior to avoid second-hand smoke

Participants who took action to avoid exposure to second-hand smoke at home and in public had a significantly greater perception of susceptibility to (p=0.03) and severity of (p<0.01) the threat of tobacco smoke to fetal health than those who did not take action (Table 3). When encountering environmental second-hand smoking, these participants would immediately move away from the source of smoke. Participants who perceived a lower risk from tobacco smoke tended to do nothing to avoid it.

Self-regulatory behavior and risk perception

Significant differences were found between participants in the promotion focus group and in the prevention focus group regarding their risk perception of susceptibility to the threat ($p < 0.01$) and

Table 3
Risk perceptions, self-regulatory focus and avoidance behaviors towards second-hand smoke.

		Made effort to avoid (n = 639)	Did nothing (n = 85)	t-value (p-value)
Effort to avoid second-hand smoke at home				
Perceived risk—susceptibility to threat	Mean	6.58	6.08	4.683
	SD	0.70	0.96	($p < 0.01$)
	95% CI	6.53-6.63	5.88-6.28	
Perceived risk—severity of threat	Mean	6.54	5.9	4.503
	SD	0.80	1.28	($p < 0.01$)
	95% CI	6.48-6.60	5.63-6.17	
		Made effort to avoid (n = 660)	Did nothing (n = 64)	t-value (p-value)
Effort to avoid second-hand smoke in public				
Perceived risk—susceptibility to threat	Mean	6.57	6.10	3.627
	SD	0.71	1.01	($p < 0.01$)
	95% CI	6.52-6.62	5.85-6.35	
Perceived risk—severity of threat	Mean	6.53	5.84	4.106
	SD	0.82	1.32	($p < 0.01$)
	95% CI	6.47-6.59	5.52-6.16	

Table 4
Risk perception of different self-regulatory focuses.

		Promotion focus subjects (n = 21)	Prevention focus subjects (n = 84)	t-value (p-value)
Perceived risk—susceptibility to threat	Mean	6.08	6.75	-2.495
	SD	0.94	0.44	($p < 0.01$)
	95% CI	5.68-6.48	6.66-6.84	
Perceived risk—severity of threat	Mean	5.97	6.7	-3.196
	SD	1.31	0.56	($p < 0.01$)
	95% CI	5.41-6.53	6.58-6.82	

their risk perception of the severity of the threat ($p < 0.01$) of exposure to tobacco smoke (Table 4).

Regression analysis (Table 5) showed promotion focus of participants was positively associated with their risk perception of the threat of tobacco smoke to fetal health. In addition, the prevention focus of participants was positively associted with their risk perception of the severity of the threat of tobacco smoke to fetal health. According to the definition of self-regulatory focus theory, a promotion focused individual tends to pursue

Table 5
Regression anlysis of self-regulatory focus and risk perception.

Regulatory focus	Dependent variables	
	Perceived risk—susceptibility to threat	Perceived risk—severity of threat
(Constant)	5.68 (0.00)[b]	5.84 (0.00)[b]
Promotion	0.15 (0.039)[a]	0.09 (0.093)
Prevention	0.03 (0.650)	0.11 (0.037)[a]

t-statistics are in parentheses under coefficient estimates. [a]$p<0.05$; [b]$p<0.01$.

a positive outcome, which will increase the sensitivity of the existence or lack of positive results. Thus, pregnant women with promotion focus pay more attention to evading the risk of tobacco smoke exposure. However, prevention focused individuals pursue security and protection-related goals to avoid the presence of negative outcomes. Thus, the prevention focus of self-regulatory behavior will be positively related to the severity of a risk.

DISCUSSION

Exposure to tobacco smoke is an important health issue for pregnant women and their fetuses. Anti-smoking advocates have tried to raise awareness of this risk to pregnant women. Understanding the factors associated with exposure to cigarette smoke during pregnancy can help develop strategies to prevent exposure.

The high percentage of pregnant women exposed to tobacco smoke in Taiwan is worrisome. Although the study design precludes application of these results to all pregnant Taiwanese women, the results suggest the scope of the problem and the need for interventions.

A previous study reported female smokers are more likely to have smoking partners, which makes it more difficult for the women to quit smoking (Dohnke *et al*, 2011). We found similar results; all smoking participants in our study lived with at least one smoking family member (their partner and/or other family members). More than half the partners or other family members of nonsmoking participants smoked in front of the participant. A previous study by Wang *et al* (2014) found pregnant women allowed their husbands to continue smoking to avoid conflict; thereby, exposing themselves to second-hand smoke. Therefore, it is not sufficient to persuade pregnant smokers to stay away from smokers. We also need to persuade smoking family members to quit or ask the pregnant women to stay away from second-hand smoke to avoid jeopardizing the health of the fetus.

Compared to smoking participants in our study, non-smoking participants were more likely to agree that smoking is associated with a higher risk to fetal health. Smoking participants perceived a lower risk of smoke exposure; therefore, they were less worried about the harmful effects of tobacco smoke on their fetus. Smoking particiants were used to being exposed to tobacco smoke and did not quit when they become pregnant.

In our study non-smoking perticipants adopted more avoidance behaviors

toward second-hand smoking at home and in public than smoking participants. However, all perticipants made an effort to avoid second-hand smoke. To explore the reasons why participants tried to avoid second-hand smoke, we investigated the risk perceptions of participants. Participants who kept their distance from second-hand smoke were more concerned about the harm of tobacco smoke exposure. Risk perception may be an important predictor of a pregnant women's willingness to avoid second-hand smoke.

The risk perception of study participants was associated with their self-regulatory focus. The self-regulatory promotion focus was associated with susceptibility risk perception, and the self-regulatory prevention focus was associated with severity risk perception. The self-regulatory focus theory states, individuals with promotion focus tend to pursue a positive outcome. They may pay much attention to the need to avoid risks, in this case, the need to avoid the harmful effects of tobacco smoke. Those with a greater promotion focus perceived a greater susceptibility to risk. Individuals with a prevention focus pursue security and protection-related goals to avoid negative outcomes and focus on the severity of the risk. Those with a greater prevention focus have an increased severity of risk perception.

We studied attitudes about exposure to active and passive smoke (second-hand smoke) among pregnant Taiwanese women. Many of our participants and their fetuses were exposed to tobacco smoke during pregnancy. It is important to promote smoking cessation at home and in public to protect both the mother and fetus.

We found risk perception predicted the participant's actions to avoid second-hand smoke. Lin *et al* (2010) found current pregnant smokers were less likely to try to avoid second-hand smoke. In our study, smoking participants had a lower perception of risk from tobacco smoke than non-smokers. This explains why smoking perticipants were less likely to try to avoid second-hand smoke. Pregnant smokers may continue to smoke, exposing themselves and their fetus to tobacco smoke due to a low risk perception. To reduce this risk anti-smoking programs for pregnant women and their families should educate them about the harmful effects of tobacco during pregnany. These programs need to especially target younger women.

Previous studies of smoking pregnant women have not evaluated the influence of self-regulatory focus on risk perception about tobacco smoke. The current study revealed self-regulatory thoughts increases risk perception regarding susceptibility while prevention self-regulatory focus increased perception of severity risk. Self-regulatory promotion and prevention focus have an influence on the persuasive effect of fear in advertising. Knowledge about the association between self-regulatory focus and perceptions about the risk of tobacco smoke exposure can be used to convince pregnant women to avoid it using a different self-regulatory focus by providing advertising with different appeals.

This study has limitations, one was the data were collected using a self-reported questionnaires. This information is usually reliable, but responses are affected by varias biasas.

Another limitation of this study is its generalizability to other populations is limited. Our study used a convenience sample of pregnant women from an online baby-parenting community by stating the study was about the affect of

tobacco smoke on the behavior of pregnant women. This may have resulted in subject bias, possibly resulting in a disproportionaltely large number of smokers. A survey conducted by Taiwan's National Health Research Institutes in 2000 found 3% of pregnant women smoked and 59% of husbands smoked during pregnancy (Shih *et al*, 2008). A survey conducted by Chen *et al* (2007) in 2004 found 6% of pregnant women smoked and 59% were exposed to second-hand smoke. Nearly 70% of our study participants admitted exposure to tobacco smoke. Thirty percent of our perticipants smoked and 42% were exposed to second-hand smoke. Future studies with larger sample sizes and random sampling are needed to obtain a representative group that can reflect the general population of pregnant Taiwanese women.

We studied the influence of risk perception on behavior related to tobacco smoke. The theory of reasoned action (TRA) proposed by Ajzen and Fishbein (1980) postulated that social norm is another factor influencing the adoption of risky behavior; this was supported by another study also (Kim *et al*, 2014). Future studies should consider the influence of social norms on behavior related to smoking among pregnant women. If social norms are an important influence on this issue, it may be used by smoking prevention programs.

To our knowledge, no previous studies have evaluated the association between risk perception of tobacco smoke exposure during pragnancy and self-regulatory focus. Further studies are needed to clarify this issue.

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