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## **Smoking or Not Smoking: Evidence from A Laboratory Experiment**

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**Abstract.** *Aims:* Determine the effect of information on health risk of smoking and current health status on individuals' decision to smoke.

*Design and participants:* The questionnaires followed by experimental laboratory to a sample of 214 subjects. They measure social demography, health habits, risk perceptions and assess details about individual smoking habit and peer effect.

*Measurements:* Individuals' smoking decisions were observed during 30-min break after two tasks, consisting of getting information on health risk of smoking and current health status.

*Findings:* Among smokers with information on current health status influenced by experimental condition. This implies that smokers more likely care about their health condition than information on health risk and cost related to smoking. The results suggest that the individuals' social demography, smoking habit, and risk perceptions were related to individuals' purchase decision on cigarettes in the experiment. Those are 1) age; 2) sex; 3) education; 4) marriage; 5) the number of cigarettes consumed per day; and 6) frequency of meeting with friends who smoke.

*Conclusion:* The information on risk of smoking may be less effective than information on current health status. These are potentially important to design the information policies.

**Keywords:** *experiment, health status, individual's decision, health risk*

## 1. Introduction

The Surgeon General's warnings include: 1) Smoking causes heart disease, lung cancer, emphysema, and may complicate pregnancy; 2) Quitting smoking now greatly reduces serious risks to health; 3) Smoking by pregnant women may result in fetal injury, premature birth, and low birth weight; 4) Cigarette smoke contain carbon monoxide (Tobacco BBS, tobacco timeline). If policy makers want to decrease the rate of cigarette smoking among adults with effective anti-cigarette policy and appropriate tobacco prevention and treatment programs, they must have an understanding of the many factors that contribute to smoking. What factors affect an individual's decision to smoke is one of the aims of this study.

The relation between cigarette addiction and education in current literature is quite controversial. Hu and Tsai (2000) and Yu and Abler (2007) find that education is positively associated with consumption of cigarettes in rural China studies for the UK (Jones 1989) and US (Decker and Schwartz 2000; Yen 2005) suggest that education is negatively correlated with the demand for cigarettes. How does the discrepancy come? It is very important to conform the discrepancy by conducting this study.

Viscusi (1991) assert that smoking risk perceptions follow the expected patterns given age differences in risk information acquired and differences in information associated with smoking status. Gender, often being considered together with age, may also differ risk perceptions and individual's decision to smoke.

Waldron and Lye (1989), Schone and Weinick (1998) and Umberson (1992) describe those who married are less likely to smoke cigarettes than who are unmarried, divorced and widowed. However, Homish and Leonard (2005) denote that smoking spouse, particularly, husband, can influence the nonsmoking spouse to smoke or relapse from cessation.

Blaylock and Blissard (1992) investigate the relationship between smoking behavior and self-evaluated health status from several different perspectives. Separate models are developed to study the simultaneous relationships between health status and whether a person currently smokes, has quit, and the number of cigarettes consumed. The models indicate that current smokers have lower odds of being in good health than non-smokers and the odds favoring good health are higher for those who have never smoked than for ex-smokers.

The study reports the laboratory experiment in which we elicit individual decisions for a sample of 214 subjects using real monetary payments. We combine these data with information about individual life style and health habits. The study aims at identifying whether the provision of information on health risk related to smoke and current health status affect individual's decision to smoke. Prior studies on the issue, to date, little is known in the various information sources<sup>1</sup>. A number of experimental studies (Holt and Laury, 2002; Tanaka et.al.,2010) have pointed out that, in order to truthfully reveal their preferences, subjects should be rewarded with real monetary payments according to their stated choices. Holt and Laury (2002) found that tests with real monetary payments

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<sup>1</sup> An exception is Lunborg and Lindgren (2002) where it was found that having received education about alcohol, narcotics, and drugs at school actually lowered risk perceptions regarding alcoholism.

provided better estimates of risk preferences than hypothetical payments. The price to be paid in order to guarantee truthful revelation of individual preferences is that, when using experimental tests with real monetary payments, risk preferences can only be elicited within a monetary domain, rather than within specific frames, such as the health-related domain.

Jones and Krigia (1999) conducted a study to understand individual smoking in South Africa using economic models. The paper attempts to identify which factors influence the choice by individual South African women to smoke cigarettes and their knowledge of the health risks of smoking. In order to identify those women who are most at risk of becoming smokers and those who are most likely to benefit from health education. The result show how probability of being an uninformed non-smoker or an uninformed smoker vary across different socio-economic groups.

Youth perceive cigarette consumption as an opportunity to rebel, to show that they belong to a group, or to simply look more mature. Their decision to smoke is likely to be influenced by their peers and will usually not be very costly because experimentation with cigarette smoking is often not related to the purchase of the product. Young individuals are likely to be less aware than adults concerning of health risks related to smoking, and even if they know some of the risk, they were prone to put little weight on those that are distant in time. This lack of awareness was also related to the addictive potential of the product, leading to over-optimism about future personal smoking status. Once an individual has smoked his first cigarette, he starts to accumulate “addictive capital” that will have a significant impact on his future decisions. This study also identified the influence of number

of cigarettes consumed per day to individual decision to consume cigarettes in the experiment.

## **2. Method**

### **2.1. Material**

To assess the impact of information on health risk and health cost of smoking in a naturalistic setting, a documentary film was made by a professional film maker. The full color audio visual film consisted of the pleasure of smoking, negative externality of smoking, health risk of smoking, and how much health cost related to smoking. Meanwhile, the provision of information on current health status was obtained from the spirometry test.

In the documentary film, information on the pleasure of smoking is presented by interviewing the smokers about background of their smoking habit. The negative externality of smoking can be identified by interviewing the people who feel uncomfortable when there is smoker nearby. The film was also present the explanation from physicians who were lung specialist and child specialist. They describe about the risks of smoking to smokers and non-smokers especially their family. The film was also presented the testimonial from people with lung cancer stage four. He described the background of his disease, the struggle to face his disease and how great his family's struggles to heal him. The final session of the film presented how much health cost related to smoking because of the inadequacy of health cost information of the smokers.

The spirometry test conducted by physicians from Lung Diseases Clinic. Besides the result of the test, the subjects were also measured their height and weight. By these

measurements, the physicians could describe to subjects about their current lung capacities. The subjects received information about their own current health status. When subjects experience smoking-related health shocks, these influence their decision on cigarettes consumption in the experiment that can be expressed by total reward earned in the experiment.

## **2.2. Design and participant**

The study design was 2 groups with different treatment between subjects of experimental design with random assignment to subjects. An experimental design divided into two groups i.e. Experiment I and Experiment II which consist of a treatment and control groups respectively. The treatment in Experiment I was a documentary film related to health risk and cost related to smoking, while the treatment in Experiment II is a spirometry test. Each experiment was followed by different subjects.

We conducted the experiments at the community center. The subjects were recruited through advertisement on the community center and from list of households who had expressed interest in participating in the experiments. Each subject was only allowed to participate in one experiment. The subjects earned between Rp10,000.00 and Rp50,000.00, and each session lasted for approximately 15 min.

The sample size in Experiment I and II were set at 96 and 118 subjects, respectively. A convenience sample was recruited via randomization in the rural area of Daerah Istimewa Yogyakarta. They participated in the experiment voluntarily. The experimenter set quotas



for equal numbers of subjects in treatment and control group within the age above 35 years old for each experimental condition.

### **2.3. Procedure**

This study used the subjects from the middle to lower income, because most of them are smokers and haven't understood about the health risk and cost related to smoking. And also they rarely to take medical check-up, so they might be don't know their current health status especially their lung capacities. Subjects whose age about 35 years old were asked if they were willing to participate in a study. No information was provided about the real aim of the study i.e. what the impacts of information about current health status on their decision of purchasing the cigarettes. Of the 120 subjects who participated, 118 were included in the analyses and 2 dropped-out from the analyses because they weren't completed the questionnaire.

For both experiments, before entering the room, subjects asked to fill in an attendance list and take a lottery for determining their seating. After they had entered the room, the experimenter explained the procedure of the study to the subjects.

Subjects were randomly divided into treatment group and control group. The subjects were asked to take a lottery to determine their group (treatment or control group). Based on the lottery, the participant entered each room. After they had entered the room, the experimenter explained the procedure of the study to the subjects. The subjects got vouchers for purchasing some cigarette that we sold during the experiment. They were asked to complete the questionnaire in the first step carefully. The questionnaire was about

social demography, health habit, smoking status, peer effect, and the knowledge related to smoking. This took approximately 15 minutes.

In the second step of Experiment I, the information on health risk and health cost of illness caused by smoking was shown on the LCD monitor for the treatment group. The free theme film was shown for control group. This took approximately 10 minutes. After the 10-min film, the second task began. Again, similar to the first task, the subjects had to fill in a questionnaire to evaluate the documentary film shown. The questionnaire was also concerning their respond of the film, perception of the health risk and cost related to smoking. This took approximately 15 minutes.

Meanwhile, in the second step of Experiment II, subjects of treatment group had to measure their height and weight, and then they had to test their lung capacities by spirometer. Afterward, they would be described by physicians about their current lung capacities conditions. Based on the physicians' information, the second task began. Similar activity was carried out as the first task, the subjects had to fill in a questionnaire to evaluate their spirometry test result. The questionnaire was also pertaining to their respond of the result. It is their perception of their current status health especially lung capacities. This took approximately 15 minutes.

After completing the second questionnaire, there was a break. During the break the subjects were informed that it was allowed to smoke (by exchanging their voucher to the cigarettes sold in the room) and they were offered free for lunch and drinks. After serving the lunch and drinks, the experimenter left the room (to avoid the participant starting a conversation with the experimenter). The subjects were allowed to exchange their voucher

with the cigarettes. If they didn't exchange their vouchers, they would get the cash money. This decision would depend on the subject's thought.

At the end of the session, both subjects (treatment and control group) were received the cash money. The amount of the money depends on the remaining vouchers. The research assistant had been recapitulated the amount of the subjects' received during the break. Twelve undergraduate research assistants were trained and served as observers in this study.

#### **2.4. Questionnaire**

The questionnaire was designed to measure the impact of information about health risk and health cost of smoking (i.e. a documentary film) on relevant smoking variables. The experimenter began with questions concerning subjects' social demography, health habit, smoking status, peer effect, and the knowledge related to smoking. In the second task of Experiment I, the participants were asked for their thoughts and feelings of the film, perception of the health risk and health cost of smoking. Meanwhile, in the second task of Experiment II, the participants were asked to their thoughts and feelings of the spirometry test result and perception of their current health status. Subjects' impressions were measured on five-point rating scales for: strongly disagree to strongly agree. For example "My productivity will decrease because of smoking?" The smokers were asked the different questions from non-smoker. In the smokers' questionnaires point out the smoking habit and risk perception. Meanwhile, the non-smokers' query on social demographic and health life style.

## **2.5. Randomization**

Randomization of experimental units to treatments is important, because there are often unknown sources of variation which could bias the results. This study randomized the units of experiment. In assign the position of chairs, randomization used by taking a lottery. For determining the units of treatment group, this study was also used a randomization. The randomized subjects had to take a piece of paper which determines his/her group. Furthermore, different groups (treatment or control group) were in the separate room because the environment was different between treatment and control group.

## **2.6. Blinding**

Where possible, experiments should be conducted blind with respect to the treatment, with samples coded so that their treatment group is unknown until the data are analyzed. This is a vital importance in any comparison between rooms.

## **2.7. Data Analysis**

We first checked the normal distribution of data. This study use two well-known tests of normality, are Kolmogorov-Smirnov Test and the Shapiro-Wilk Test (see Table I and II). Because of the data significantly deviate from a normal distribution, we investigated with non parametric analyses to compare between two groups, namely Mann-Whitney U test.

[ Table I and II here]

The Mann-Whitney U test used to investigate whether the groups (i.e. treatment or control group), and consumption status (i.e. consume cigarettes or not in the experiment). Further, we investigated whether health habit, socio-demographic, peer effect and smoking habit affect the number of cigarettes consumed in the experiment.

### **3. Results**

214 subjects – 115 smokers and 99 non-smokers – met the criteria for inclusion in our study. Table III presents summary statistics for subjects of both experiments. A total of 96 subjects of Experiment I, 32 females and 64 males participated; their age range 35-69 years (Mean = 43.41; S.D.= 8.343). The 56.3 percent of participant smoked daily; 19.8 smoked 1-5 cigarettes/day, 10.5 percent smoked 6-10 cigarettes/day, 8.3 smoked 11-20 cigarettes/day, and 4.1 percent smoked 21-30 cigarettes/day. Related to the educational background, 38.6 percent completed elementary school and senior high school, 19.3 percent completed Junior high school, and 3.6 percent completed university. 94 percent of subjects employed (full or part time). 38.5 percent of subjects didn't do exercise, 37.3 percent did exercise 1-3 hours/week, 8.4 percent did exercise 3-5 hours/week, 2.4 percent did exercise 5-7 percent hours/week, and 13.3 percent did exercise more than 7 hours/week. 4.9 percent of subjects no consumed vegetables, 23.2 percent consumed vegetables 1-2 days/week, 11 percent consumed vegetables 3-5 days/week, and 60 percent consumed vegetables more than 5 days/week. 33.7 percent of subjects have 1-4 friends who smoker, 28.9 percent have 5-10 friends, and 37.3 percent have more than 10 friends. 44.6 percent met them 1-3

times/week, 24.1 percent met 4-6 times/week, and 31.3 percent met more than 6 times/week.

The average number of cigarettes consumed in the experiment was 1 cigarette.

[ Table III here]

The sample size in Experiment II was set at 118 subjects. The total of 118 subjects, 16 females and 102 males participated; their age range 35-79 years (Mean = 45.42; S.D.= 12.357). Concerning to the smoking status, 63.6 percent of participant were smoked daily; 41.2 percent smoked 1-5 cigarettes/day; 15.1 percent smoked 6-10 cigarettes/day; 38.7 percent smoked 11-20 cigarettes/day, and 5 percent smoked 21-30 cigarettes/day. As the educational background, 27.1 percent sample were completed elementary school; 22 percent completed Junior high school, 41.5 percent senior high school, 1.7 percent completed bachelor degree; and 7.6 percent completed university. 87.3 percent of subjects employed (full or part time). 28.8 percent of subjects didn't do exercise, 44.1 percent did exercise 1-3 hours/week, 9.3 percent did exercise 3-5 hours/week, 8.5 percent did exercise 5-7 percent hours/week, and 9.3 percent did exercise more than 7 hours/week. 1.7 percent of subjects no consumed vegetables, 30.5 percent consumed vegetables 1-2 days/week, 30.5 percent consumed vegetables 3-5 days/week, and 37.3 consumed vegetables more than 5 days/week. 33.9 percent of subjects have 1-4 friends who smoker, 28.8 percent have 5-10 friends, and 37.3 percent have more than 10 friends. 32.2 percent met them 1-3 times/week, 28 percent met 4-6 times/week, and 39.8 percent met more than 6 times/week. The average number of cigarettes consumed in the experiment was 1 cigarette.

Table IV shows the result of Mann-Whitney U Test for testing treatment versus control group. The result shows that we accepted null hypothesis; means that no differences

for smoking or not in the Experiment I between treatment and control group ( $z=-0.620$ ;  $p=0.535$ ). Meanwhile, the significant differences that emerge was for smoking or not in the Experiment II between treatment and control group ( $z = -3.378$ ;  $p=0.001$ ).

[Table IV here]

Non parametric analysis (i.e. Mann Whitney-U) was used to test for differences in participant characteristics (i.e. age, education, health habits, number of cigarettes smoked daily, etc.), peer effect between treatment and control group. The only significant differences that emerge were for number friends who smoke between treatment and control group in Experiment I ( $z=-1.991$ ;  $p=0.046$ ) and healthcost ( $z=-2.649$ ;  $p=0.008$ ). Meanwhile, there was significant difference found in treatment and control group in Experiment II i.e. education level ( $z=-3.354$ ;  $p=0.001$ ), frequency of consuming vegetable per week ( $z=-2.305$ ;  $p=0.021$ ).

[ Table V here]

Table VI shows the results of our modeling, estimated on the individual of Experiment I and Experiment II. In the model for Experiment I, number of cigarettes consumed per day significantly influenced individual's smoking decision in the Experiment I. We also used the model to control for demographic differences between subjects. Among individuals, perception of individual that smoking cause illness and decreased productivity significantly influenced the individual's smoking decision in the experiment. The individual's smoking decision were not affected by experimental conditions in Experiment I.

[Table VI here]

The results also show that among individuals in Experiment II, marriage status significantly influenced individual's smoking decision in the experiment. In the model, we found that frequency of consuming vegetables per week affects individual's smoking decision. As the result of previous study that smokers with higher fruit and vegetable consumption smoked fewer cigarettes per day, waited longer to smoke their first cigarette of the day and scored lower on a common test of nicotine dependence (Goldbaum, 2012).

There were four other variables that influenced individual's smoking decision in the Experiment II: number of cigarettes consumed per day, individual's perception that smoking causes illness, treatment spirometry affects individual's smoking decision in the experiment.

#### **4. Discussion and Conclusion**

To some extent, the results from the experiment were surprising. First, when information both on current health status was exposed to subjects, smokers would make more future-oriented choices than they do in the absence of such manipulation. This suggests that individual with complete information may have been more likely than individual with information on health risk and cost related to smoking. This implies that smokers more likely care about their health condition than information on health risk and cost related to smoking. It was consistent with previous that smokers responded to personal experiences with diseases. The generalized information concerning the risk of smoking may be less effective than information on current health status. As the result of previous studies that smokers react more to information that smoking affects their ability to undertake common



physical activities later in their lives rather than information of the effects of continued cigarette smoking on the risk of premature death (Smith et.al.,2001).

The results of the study show that information on current health status influence to individual's smoking decision in the experiment. The result of our analysis are potentially important to design the information policies. Previous study raises the behavioral puzzle that found many smokers stating that they would like to quit but also continuing to smoke (Hanson &Logue, 1998). The key findings of this study are that individual are not affected by information on health risk and cost. The information on current health status seem to have a greater effect on individual's smoking decision than the information on health risk and cost . Prior to experiencing serious health shocks, smoker seem to be fatalistic. When smokers experience smoking-related health shocks, they interpret this information as reducing chance of living. In fact, our estimated models imply that current smokers update their health status more seriously than either non-smokers. These smoker didn't react comparably to general information on health risk, implying that specific information about their current health status is most likely to cause them not consuming cigarettes in the experiment. There was an essential notice to these current health status as information messages. Factual experiences of personal harm from smoking-related condition have to be considered the effective informational treatments designed to alter individual smoking habit.

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**APPENDIX.**

Tabel I. Normality Test of Experiment I

Group		Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Smoking or Not	Control group	0.350	44	0.000	0.636	44	0.000
	Treatment group	0.399	52	0.000	0.617	52	0.000

<sup>a</sup>Liliefors significance correction

Tabel II. Normality Test of Experiment II

Group		Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Smoking or Not	Control group	0.360	48	0.000	0.634	48	0.000
	Treatment group	0.442	70	0.000	0.576	70	0.000

<sup>a</sup>Liliefors significance correction

Table III. Demographic characteristics of subjects whose data were included in the present analysis. Values shown are either means (SD) or percent of subjects fitting each category

Characteristics	Mean	
	Experiment I	Experiment II
% Male	77.1	86,4
Age	43.41 (8.343)	45,42 (12,357)
% Married	85.5	83,9
Cigarettes per day	8.29 (6.743)	6,186 (7,085)
Education		
% Elementary school	38.6	27,1
% Junior High School	19.3	22
% Senior High School	38.6	41,5
% Bachelor degree	-	1,7
% University	3.6	7,6
% Employed (full or part-time)	94	87,3
Frequency of exercise		
% No exercise	38.5	28,8
% 1-3 hours a week	37.3	44,1
% 3-5 hours a week	8.4	9,3
% 5-7 hours a week	2.4	8,5
>7 hours a week	13.3	9,3
Vegetables consumption		
% No consumption	4.9	1,7
% 1-2 days/week	23.2	30,5
% 3-4 days/week	11	30,5
% > 5 days/week	60	37,3
Number friends smoker		
% 1-4 people	33.7	33,9
% 5-10 people	28.9	28,8
% > 10 people	37.3	37,3
Frequency of meeting		
% 1-3 times a week	44.6	32,2
% 4-6 times a week	24.1	28
% >6 times a week	31.3	39,8
Number of cigarettes consumed	0.9036 (2.676)	1,271 (3,164)

Table IV. Mann-Whitney U Test for Treatment vs Control Group

<b>Experiment I</b>				
		Smoking or Not Smoking		
Mann-Whitney U		1094,00		
Wilcoxon W		2472,00		
Z		-0,620		
Asymp. Sig.(2-tailed)		0,535		
		Group	N	Mean Rank
Smoking or Not Smoking	Control group		44	49,64
	Treatment group		52	47,54
		Total	96	
<b>Experiment II</b>				
		Smoking or Not Smoking		
Mann-Whitney U		1264,000		
Wilcoxon W		3749,000		
Z		-3,378		
Asymp. Sig.(2-tailed)		0,001		
		Group	N	Mean Rank
Smoking or Not Smoking	Control group		48	68,17
	Treatment group		70	53,56
		Total	118	

Table V. Mann-Whitney Test treatment vs control groups

Treatment vs Control Groups								
Variable	Experiment I				Experiment II			
	Mann-Whitney U	Wilcoxn	Z	Asymp . Sig	Mann-Whitney U	Wilcoxn	Z	Asymp . Sig
Age	971.50	2349.50	-1.273	0.203	1508.50	2684.50	-0.941	0.347
Educ.	1099.50	2089.50	-0.349	0.727	1100.00	3585.00	-3.354	0.001
Num_child	1046.00	2424.00	-0.741	0.459	1611.00	2787.00	-0.386	0.700
Marriage	1028.00	2406.00	-1.395	-0.163	1573.00	4058.00	-0.920	0.358
Vege	1138.00	2128.00	-0.046	0.963	1275.00	3760.00	-2.305	0.021
Sport	1016.00	2006.00	-0.993	0.321	1625.00	4110.00	-0.320	0.749
Numcig	1027.50	2405.50	-0.951	0.341	1419.50	2595.50	-1.471	0.141
Peersmoke	884.00	2262.00	-1.991	0.046	1543.50	2719.50	-0.781	0.435
Freqpeer	1134.00	2124.00	-0.079	0.937	1457.00	3942.00	-1.298	0.194
Risk_ill	980.50	2358.50	-1.301	0.193	1533.00	4018.00	-0.897	0.370
Risk_fam	1093.50	2083.50	-1.404	0.686	1593.500	2769.50	-0.526	0.599
Risk_prod	1125.00	2503.00	-0.151	0.880	1563.50	4048.50	-0.714	0.475
Healthcost	810.00	1800.00	-2.649	0.008	-	-	-	-

Table VI. Regression result

Variables	Experiment I		Experiment II	
	Coefficient	Stand.Error	Coefficient	Stand.Error
Constant	-2.1833	2.2069	-0.2234	1.7745
Age	0.0011	0.0268	-0.0188	0.0175
Educ	-0.1593	0.2555	-0.1976	0.1588
Num_child	0.1548	0.1855	0.0627	0.1075
Marriage	-0.8309	0.8914	1.7017**	0.7785
Vege	-0.1733	0.1885	-0.3164**	0.1680
Sport	-0.0561	0.2197	0.1821	0.1528
Numcig	0.0985***	0.0334	0.0593**	0.0249
Peersmoke	-0.1126	0.1964	0.0496	0.1324
Freqpeer	0.2201	0.3080	0.2065	0.2096
Risk_ill	0.6574**	0.3365	-0.4201*	0.2453
Risk_fam	0.4380	0.3024	0.3149	0.2418
Risk_prod	-0.6042**	0.2421	-0.1285	0.1976
Healthcost	-0.1199	0.2271	-	-
Group	-0.2776	0.5207	-1.3813***	0.4142
Log likelihood	-22.6666		-37.5562	
LR stat	30.8052***		35.0113***	

Dependent variable: Smoking or Not Smoking

\*significance at 10% level; \*\*significance at 5% level; \*\*\*significance at 1% level.