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The Effect of Smoking on Health Service Utilization

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This study involved direct observation of the differences in prevalence of disease and utilization of medical care by smokers, non-smokers, and ex-smokers. The data was collected from the 1989 Korean National Health Survey (1989 KNHS). A total of 5,201 individuals ages 20 to 59 were randomly selected from the whole Korean population using the three-stage stratified random sampling. Based on the logistic regression, the following results were obtained. Compared with the non-smokers, the relative risks for an acute disease were 1.9 and 1.7 for male ex-smokers and female current smokers, respectively. Smoking behavior significantly increased utilization of health services such as admissions (RR=2.5 for current smokers) among females, outpatient visits (RR= 2.1 for ex-smokers, RR=2.3 for age began to smoke was less than 18 years) among males and (RR=1.5 for current smokers) among females. Furthermore, the utilization of outpatient services for ex-smokers who were self-concerned about their health was 3.4 times higher than the non-smokers. Based on the weighted least square regression model the days of medication for male current smokers and ex-smokers were significantly longer than non-smokers. These effects persisted after controlling for major identified confounding factors. Thus, the results of this study confirmed that smoking is an important cause of diseases and a major contributing factor to the use of health services.

Key Words: Smoking, prevalence of disease, health service utilization

Cigarette smoking has been identified as the single most significant cause of preventable morbidity and premature death since 1964 in the U.S. Surgeon General's reports (US DHHS, 1989). Despite many epidemiologic studies showing that cigarette smoking increases the risk of disease incidence (Doll and Peto, 1976; Hammond, 1964; Allen, 1988), it has been debated among researchers whether cigarette smoking increases health service utilization. There are two arguments on this point. The first argues that cigarette smoking increases the risk of disease incidence, and as a result, it contributes to the increase of health service utilization (Ashford, 1973; Oakes *et al.* 1974; Weinkam *et al.* 1987; Gutzwiller *et al.* 1989; Freeborn *et al.* 1990). On the contrary, the second claims that cigarette smoking does not increase health service utilization at all. There are two reasons for supporting the latter. First, the smokers, in general, are not very concerned about their health and therefore fail to seek medical services even though they become ill (Vogt and Schweizer, 1985). The smoker's average life expectancy is shorter than that of the non-smoker and this reduces the smoker's opportunity to use health services (Leu and Schaub, 1983).

This study demonstrates how cigarette smoking can cause acute or chronic diseases and investigates the relationship between the

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smoking-induced disease prevalence and the utilization of health services. The detailed purposes of this study are; 1) to demonstrate a difference in disease prevalence between smokers and non-smokers; and 2) to demonstrate a difference in inpatient and outpatient utilization between smokers and non-smokers.

METHODS

Data

Data was collected from the National Health Survey conducted by the Korean Institute for Health and Social Affairs (Song and Kim, 1990). After stratifying the nation into city/district or residential areas, 11,501 families from 178 cluster sampling areas were selected using the cluster sampling method. From the sample of 11,501 families, 40,414 people were questioned about their basic family condition and 5,201 people were questioned about their health and behavioral characteristics. The questions concerning basic family conditions included symptomatic occurrence and subsequent medical treatment over the period of 15 days, and any record of chronic manifestation of disease and inpatient utilization. Data used in this study involves history of cigarette smoking among the 5,201 interviewees, medical record on illness and the subsequent health service utilization.

Variables used in the study

The independent variables for males were: smoking status, the amount of smoking and the age they began to smoke. For females only the smoking status was used as the independent variable since few had developed a smoking habit.

There are two types of dependent variables: The disease prevalence was divided into chronic and acute diseases; and the health service utilization was divided into inpatient and outpatient services.

Acute diseases were defined as the prevalence of illness manifested within the period of 15 days; whereas chronic diseases were defined as illness which lasted over 3 months during the period of a year. Utilization of Outpatient service refers to an experience of visiting a doctor's office within the past 15 days; whereas utilization of inpatient service refers to an experience of hospital admission during the period of one year. The possible confounders include gender, age, educational level, marital status, residential district, health insurance status, living condition, amount of exercise, average consumption of alcohol, and so on.

Study model

This study uses two types of models. The first model observes the relationship between the smoking status and disease prevalence using the smoking related disease data according to International Classification Disease Code 9 (140-238, 390-459, 460-519, 520-579, 710-739). The second model observes the relationship between the smoking status and utilization of inpatient and outpatient health service excluding non-smoking related diseases. Here the control variables include predisposing factors (e.g. age, educational level, marital status, drinking habit, self-concern on health, residency) and enabling factors (e.g. living standards, medical insurance status). Also, in order to determine whether the inpatient or outpatient utilization depended on the degree of the smoker's concern for health, the interaction term from the smoking status and self-concern on health service utilization was included. In the case of inpatient utilization, only a univariate analysis was carried out since the sampling number of the subjects was small.

Analytical method

In this study, to determine which smoking related variables affect the days of medication, the weighted least square (WLS) regression analysis was used instead of the ordinary least square (OLS) regression because the probabilities of being selected in the sample not equal in the three-stage stratified random sampling (Lee, *et al.* 1989).

The analysis was carried out in two steps using individuals as the unit of analysis. In the first step, the univariate analysis was conducted to observe the prevalence of smoking related diseases and the change in

the health service utilization. In the second steps, multivariate analysis was conducted to evaluate the effects of smoking using controlling for the confounding variables. The data were processed by SPSS, EGRET (Statistics and Epidemology Research Corporation, 1985) and PC-CARP (Statistical Laboratory, Iowa State University, 1986).

RESULTS

The prevalence rates of acute diseases among males by age and smoking status are shown in Table 1. The prevalence rate of acute diseases for the ex-smokers was 1.9 times higher than the non-smoker. The prevalence rate of acute diseases for male ex-smokers was 2.4 times higher than non-smokers. The prevalence rate of chronic diseases showed similar results.

Among females, the prevalence rate of acute diseases for current smokers was 1.6 times higher than the non-smokers (Table 2). The prevalence rate of chronic diseases showed similar results.

For males, inpatient utilization for ex-smokers was 1.4 times higher than the non-smoker; and 1.1 times higher than the current smoker (Table 3). Outpatient utilization for ex-smokers was 2.0 times higher than the non-smokers. The outpatient utilization between the ages of 20 and 39 was 2.1 times higher among the ex-smoker as compared with the non-smoker. In case of females, inpatient utilization for the current smokers was 2.3 times higher than the non-smoker. Also, the outpatient utilization was 1.6 times higher for the current smoker as compared with the non-smoker (Table 4).

The days of medication and the length of

Table 1. Age specific prevalence rates for acute diseases by smoking history among males

Age	Non-smoker			Ex-smoker				Current smoker			
	No. of subjects	No. of cases	Rate	No. of subjects	No. of cases	Rate	R.R	No. of subjects	No. of cases	Rate	R.R
20~29	125	19	15.2	35	11	31.4	2.1	448	60	13.4	0.9
30~39	142	16	11.3	94	25	26.4	2.4	680	99	14.6	1.3
40~49	102	22	21.6	77	22	28.6	1.3	387	76	19.6	0.9
50~59	42	12	28.6	80	30	37.3	1.3	218	61	28.0	1.0
Total	411	69	16.8	286	88	30.8	1.9‡	1733	296	17.1	1.1‡

R.R.: Relative risk to non-smoker, ‡Age adjusted relative risk

Table 2. Age specific prevalence rates for acute diseases by smoking history among females

Age	Non-smoker			Current smoker			
	No. of subjects	No. of cases	Rate	No. of subjects	No. of cases	Rate	R.R.
20~29	769	115	15.0	27	6	22.2	1.5
30~39	824	188	22.8	16	6	37.5	1.6
40~49	534	154	28.8	35	16	45.7	1.6
50~59	375	172	45.9	68	35	51.5	1.1
Total	2502	629	25.1	146	63	43.2	1.6‡

R.R.: Relative risk to non-smoker, ‡Age adjusted relative risk

Table 3. Age specific rates for admission and oupatient visit by smoking history among males

Age	Non-smoker			Ex-smoker				Current smoker			
	No. of subjects	No. of cases	Rate	No. of subjects	No. of cases	Rate	R.R.	No. of subjects	No. of cases	Rate	R.R.
Admission											
20~39	248	5	2.0	122	3	2.5	1.3	1066	30	2.8	1.4
40~59	130	5	3.8	140	8	5.7	1.5	543	16	3.0	0.8
Total	378	10	2.6	262	11	4.2	1.4‡	1609	46	2.9	1.1‡
Outpatient											
20~39	248	30	12.1	122	31	25.4	2.1	1066	124	11.6	1.0
40~59	130	27	20.8	140	44	31.4	1.5	543	93	17.1	0.8
Total	378	57	15.1	262	75	28.6	2.0‡	1609	217	13.5	1.0‡

R.R.: Relative risk to non-smoker, ‡Age adjusted relative risk

Table 4. Age specific rates for admission and outpatient visit by smoking history among females

Age	Non-smoker			Current smoker			
	No. of subjects	No. of cases	Rate	No. of subjects	No. of cases	Rate	R.R.
Admission							
20~39	1438	43	3.0	35	2	5.7	1.9
40~59	796	24	3.1	84	5	6.0	1.9
Total	2234	67	3.0	119	7	5.9	2.3‡
Outpatient							
20~39	1438	226	15.7	35	10	28.6	1.8
40~59	796	229	28.8	84	34	40.5	1.4
Total	2234	455	20.4	119	44	37.0	1.6‡

R.R.: Relative risk to non-smoker, ‡Age adjusted relative risk

Table 5. Length of stay and days of medication by smoking history among males

Age	Non-smoker	Ex-smoker	Current smoker	F
	Mean (S.D.)	Mean (S.D.)	Mean (S.D.)	
Length of stay	18.8(11.2)	17.7(16.5)	18.1(17.5)	0.5
Medication day				
20~39	3.4(3.5)	7.5(6.2)	5.3(5.1)	4.7**
40~59	6.2(5.5)	8.1(5.8)	6.6(5.1)	1.5
Total	4.7(4.7)	7.8(6.0)	5.9(5.2)	6.1**

S.D.: Standard Deviation, **: $p<0.01$

stay were observed according to the smoking status for the subjects with inpatient and outpatient experience. For males, the length of stay was not significantly different according to the smoking status. However, the days of medication was 4.7 days for the non-smoker; 7.8 days for the ex-smoker; and 5.9 days for the current smokers which were statistically significant (Table 5). On the other hand, there was no significant difference either in

Table 6. Multiple logistic regression analysis for risks of acute and chronic diseases according to smoking history among males

Smoking history	Acute disease			Chronic disease		
	No. of cases	R.R.	95% CI	No. of cases	R.R.	95% CI
Non-smoker	140	1.0		76	1.0	
Ex-smoker	79	1.9	1.3~2.9	57	1.4	0.9~2.2
Duration						
1~19 years	55	1.8	1.3~2.6	39	1.6	1.1~2.3
≥20 years	24	1.6	0.9~2.7	18	1.2	0.7~2.1
Current smoker	303	1.2	0.8~1.5	232	1.0	0.7~1.3
Duration						
1~19 years	160	0.9	0.6~1.1	102	0.8	0.6~1.1
≥20 years	143	0.9	0.7~1.1	130	0.9	0.6~1.2
Amount(packs/day)						
<2 packs	262	1.0	0.6~1.9	171	0.9	0.5~1.7
≥2 packs	25	1.1	0.4~2.8	17	1.1	0.5~2.6
Age started smoking						
>18 years	214	0.9	0.5~1.6	173	0.9	0.5~1.8
≤18 years	73	2.4	1.1~5.4	51	1.6	0.6~4.2

R.R.: Relative risk to non-smoker
Variables in the multiple logistic model included age, education, marital status, and drinking status.

Table 7. Multiple logistic regression analysis for outpatient visit among males

	Total sample		Interaction model	
	R.R.	95% CI	R.R.	95% CI
Age	1.0	0.9~1.2	1.2	1.1~1.2
Smoking history				
Ex-smoker	2.1	1.3~3.0	0.8	0.3~1.8
Current smoker	1.1	0.7~1.4	0.7	0.4~1.2
Ex-smoker* Hlth			3.4	1.3~9.2
Current smoker* Hlth			1.7	0.8~3.4
Education	0.9	0.7~1.2	0.9	0.7~1.4
Marital status	0.9	0.6~1.4	0.9	0.6~1.4
Economic status	1.2	0.9~2.1	1.2	0.8~2.2
Drinking status	0.8	0.4~1.4	0.9	0.7~1.2
Region(rural)	0.9	0.7~1.1	0.9	0.7~1.1
Health concerned	1.0	0.8~1.4	0.6	0.3~1.1
LRS		1225.8**		1231.8**

LRS: Likelihood ratio statistics, **P<0.01

the length of stay or in the days of medication from the aspect of the smoking status for female.

Table 6 shows the multiple logistic regression for the prevalence of acute and chronic diseases among males. The relative risk was calculated after controlling for the factors such as age, education level, marital status, weight status, amount of exercise, drinking, and self-concern on health status. When the other factors were constant, the prevalence rate of acute diseases for ex-smokers was 1.9 times higher than non-smokers. Also, if the ex-smoker's duration of smoking was less than 20 years, the prevalence rate of acute diseases was 1.8. If the duration was over 20

Table 8. Multiple logistic regression analysis for health service utilization among females

	Admission		Outpatient	
	R.R.	95% CI	R.R.	95% CI
Age	1.0	0.8~1.1	1.3	1.2~1.3
Smoking history				
Current smoker	2.5	1.1~7.5	1.5	1.0~2.2
Education	0.4	0.1~1.2	0.9	0.6~1.3
Marital status	0.8	0.4~1.8	0.8	0.5~1.3
Economic status	0.6	0.4~1.3	1.2	0.5~1.2
Insurrance(none)	0.6	0.2~1.3	1.5	1.1~2.0
Exercise	0.6	0.3~1.2	1.1	0.8~1.4
Drinking status	0.9	0.2~4.4	0.7	0.3~1.5
Health concerned	1.2	0.7~2.2	0.9	0.7~1.1
LRS		2604.2**		2334.9**

LRS: Likelihood ratio statistics, **P<0.01

Table 9. Multiple logistic regression analysis for risks of admission and outpatient visit by amount and duration of smoking among males

Smoking history	Admission			Outpatient		
	No. of cases	R.R.	95% CI	No. of cases	R.R.	95% CI
Non-smoker	22	1.0		122	1.0	
Ex-smoker						
Duration						
1~19 years	4	0.7	0.3~2.0	45	1.9	1.3~2.7
≥20 years	7	3.9	1.6~9.5	24	2.6	1.5~4.4
Current smoker						
Duration						
1~19 years	30	1.0	0.5~1.8	128	0.8	0.4~1.6
≥20 years	17	0.7	0.4~1.5	98	0.9	0.4~1.9
Amount(cig/day)						
<2 packs	43	1.0	0.4~3.4	206	1.1	0.6~1.9
≥2 packs	4	1.1	0.1~9.1	20	1.3	0.5~3.7
Age started smoking						
>18 years	26	1.0	0.3~3.1	170	1.0	0.5~1.7
≤18 years	21	2.2	0.5~9.9	56	2.3	1.0~5.2

R.R.: Relative Risk to never smoker

Variables in the multiple logistic model included age, education, marital status, and drinking status.

years, the prevalence rate was 1.6, which was not statistically significant. If the beginning age of smoking was under 18, the relative risk was 2.4, which was statistically significant.

If the other factors were constant in the model for the chronic disease status, the ex-smoker had a risk factor of 1.4 for the prevalence of chronic diseases, which was statistically significant. If the ex-smoker's duration of smoking was less than 20 years, the prevalence of chronic diseases was 1.6 times higher than non-smokers, which was statistically significant.

As seen in table 7, the outpatient utlization for the ex-smoker was 2.1 times higher than non-smokers, when the other factors were constant. The outpatient utilization of cur-

Table 10. Weighted least square regression analysis for days of medication among males

Variable	Coefficient	S.E.	t	D.E.[a]
(1) Unweighted, ignoring the data structure (SPSS PC)				
Age	0.014	0.006	2.470	
Smoking history				
Ex-smoker	0.393	0.179	2.199	
Current smoker	0.199	0.180	1.105	
Education	−0.134	0.133	−1.105	
Marital status	−0.092	0.178	−0.516	
Drinking status	−0.145	0.160	−0.906	
Region (rural)	0.131	0.111	1.178	
Constant	0.858	0.277	3.102	
R^2	0.070			
Adjusted R^2	0.050	F=3.12**		
(2) Weighted, ignoring the data structure (SPSS PC)				
Age	0.015	0.006	2.709	
Smoking history				
Ex-smoker	0.466	0.172	2.709	
Current smoker	0.345	0.177	1.955	
Education	0.002	0.126	0.021	
Marital status	−0.030	0.169	−0.180	
Drinking status	−0.059	0.154	−0.382	
Region (rural)	0.173	0.125	1.386	
Constant	0.649	0.263	2.465	
R^2	0.080			
Adjusted R^2	0.060	F=3.63***		
(3) Weighted, considering the data structure (PC CARP)				
Age	0.015	0.006	2.551	1.000
Smoking history				
Ex-smoker	0.466	0.184	2.536	1.144
Current smoker	0.345	0.169	2.046	0.917
Education	0.002	0.155	0.015	1.513
Marital status	−0.031	0.169	−0.185	1.000
Drinking status	−0.060	0.144	−0.419	0.874
Region (rural)	0.172	0.127	1.351	1.032
Constant	0.650	0.250	2.599	0.904
R^2	0.080			
Adjusted R^2	0.060	F=3.63***		

[a] Design effect: square of the ratio of the standard error in (3) to the standard error in (2).
**p<0.01, ***p<0.001

rent smokers was 1.1, which was statistically insignificant.

In the model with the interaction term, for those with concern for their health, the relative risk of outpatient utilization for ex-smokers was 3.4 and the relative risk for current smokers was 1.7 as compared with non-smokers, which was statistically insignificant.

Table 8 shows the result of the logistic regression analysis on both inpatient and outpatient utilization among females. Because the number of ex-smokers was smaller among females, we used only the current smokers as the independent variable and excluded the interaction term. When the inpatient utilization status was the dependent variable, the current smoker's relative risk was 2.5, which was statisticallly significant. When the outpatient utilization status was the dependent variable, the current smoker's relative risk for outpatient utilization, as compared with the non-smoker, was 1.5, which was also statistically significant.

Table 9 shows the effects that the duration of smoking, the amount of smoking and the beginning age of smoking each has on the inpatient and outpatient utilization among males. This model used age, education level, marital status, amount of exercise, drinking habit and self-concern on health status as the control variables. As a result, ex-smokers with a smoking duration of more than 20 years, as compared with non-smokers had a relative risk of inpatient utilization of 3.9, which was statistically significant. There was no clear pattern in the duration of smoking. In outpatient utilization, ex-smokers with a smoking duration of more than 20 years had a relative risk of 2.6, which was also statistically significant. In addition, in cases where the begnning age of smoking was 18 and under, the relative risk was 2.3, which was also statistically significant.

Table 10 shows the results of both the OLS (ordinary least square) regression analysis and the WLS regression analysis for the days of medication. It shows the clear effects of smoking. The effects of smoking for males was shown to be stronger in the WLS than in the OLS. In other words, the results of the OLS regression analysis showed that there was more effect on the days of medication for the ex-smokers than the current smokers. The WLS regression analysis, however, showed that current smoking substantially affect the days of medication. For females, the sign of smoking was negative and statistically insignificant. Therefore, smoking did not affect the days of medication for females.

DISCUSSION

The data for this study were collected from the cluster sampling of men and women between the ages of 20 and 59, who were randomly selected from the entire nation. While the sample covers the entire nation, it fails to establish a causal-effect relationship because it consists of cross-sectional data.

In addition, there are several problems that may affect validity of the results. First, there is the possibility of a healthy worker effect. That is, this type of study may include only healthy ones in the smoking group excluding unhealthy ones who gave up smoking due to illness (Emmons and Goldstein, 1992). To account for the problem, this study classified such a group as "ex-smokers" and handled them separately. Second, there may be a problem with the precision of the diagnosis or the medical utilization data because this study relies mostly on the respondents' memory. However, the probable recalling bias may not cause serious problems since the medical treatment and disease contraction of smokers are not significantly influenced by the smoker's memory, as sugested by Gutzwiller etc (1989).

In the study of smoking and health, age has widely been accepted as one of the most influencing factors for disease incidence and clinical process (Mausner and Kramer, 1985). While most studies have used age in a quadratic term (Anderson, 1968; Ohmura, 1982), this study uses age in a linear term in the regression model on utilization because age and utilization showed a linear relationship. Futhermore, this study included the smoker's self-concern on health status, which has beeen mentioned as an important factor in a number of studies (Gutzwiller *et al.* 1989;

Ashford, 1973; Vogt, 1983), even though it had not been empirically proved in this study.

Futhermore this study excluded the non-smoking related diseases (e.g. childbirth, accidents) from the analysis in order to reduce the dilution effect caused by irrelevant cases. The number of non-smokers excluded from this study were 24.3% of the acute diseases and 27.8% of the chronic diseases. The results of the study also proved that the outcome with and without the non-smoking related diseases did not show a significant difference. Therefore, the bias caused by excluding the non-smoking related diseases can be said to be minimal.

In the explanatory model for the prevalence of acute diseases, the relative risk for ex-smokers was 1.9 ($p<0.05$), but among current smokers, the relative risk was not significant. However, in the explanatory model for the prevalence of chronic diseases, the relative risk for ex-smokers was 1.4 and showed no difference from the current smoker's case. This may be due to the fact that the data used in this study were only cross-sectional. That is, the relative risk for the ex-smoker was higher than the smokers because the ex-smoker might have given up smoking when they became ill. The study carried out by Vecchia and others (1988) also showed that the prevalence rate of ex-smokers was high. We believe that the effect of smoking proved to be more serious for acute diseases than chronic diseases because smokers either gave up smoking after discovering the chronic diseases or did not smoke at all. The similar phenomenon was also observed among the females.

The results also showed that the duration of smoking was proportionate to the relative risk for both acute and chronic diseases. The relative risk was increased as the ex-smoker's duration of smoking was increased. However, the prevalence of disease was higher for the cases where the ex-smoker's duration of smoking was less than 20 years, as compared with over 20 years. This could be explained by the facts that the smoker's ill-health inspired them to give up of smoking and this may shorten the duration of smoking. The study carried out by Kim and Kim (1991) showed that the smoker's ill-health and development of disease were predictive of cessation. Freund *et al.* (1992) found also that recent hospitalization was predictive of cessation.

Among males, the number of inpatient utilization was 92; too small to show statistical significance. However, in the explanatory model of utilization of outpatient services, a sufficient number of samples enabled the interaction term to be statistical significant. The more the ex-smokers concern on health, the more their out-patient utilization increased. The similar result was shown to the current smokers. In the case of ex-smokers, the rate of inpatients and outpatients increased substantially in accordance to the duration of smoking; the relative risk of inpatient and outpatient utilization of ex-smokers with a duration of smoking over 20 years were 3.9 and 2.6, respectively. In the case of outpatient utilization, the relative risk for the group who began smoking before 18 years of age was 2.3 ($p<0.05$). Shimizu (1988) and Balarajan and Yuen (1985) also found the dose-response relationship between the beginnig age of smoking and health service utilization.

A low rate of disease prevalence among the current smokers confirmed that they had a comparatively smaller degree of disease recognition than non-smokers. (Brownson *et al.* 1992; Vogt, 1983) That is, the degree of disease recognition of current smokers differed from, or was lower than that of non-smokers. A relatively lower opportunity for health service utilization caused a lower rate of disease detection (Vogt and Schweitzer, 1985). Therefore, we assumed that the diseases recognized by the smokers were more serious than those of non-smokers and that the days of medication among the smokers were longer than those of the non-smokers.

The length of stay was almost same for smokers and non-smokers. Vogt (1985) noted that the ex-smokers suffering from cardiovascular diseases had substantially longer lengths of stay as compared with the non-smokers. With regard to utilization of outpatient services, the days of medication increased in the order of ex-smokers, current smokers, and non-smokers. This explained that smoking affected the serverity of diseases and increased health service utilization.

However, the same could not be said for

females. Analytic studies on the days of medication are rare. Newcomb and Butler (1987) reported that smoking, drinking, and drug use manifested the effect of smoking on the lengths of stay and the days of medication.

Putting these results together, we found that smoking habits was more closely related with acute and chronic diseases to the ex-smokers as compared with non-smokers, and similarly, utilization of inpatient and outpatient services among ex-smokers were also increased. On the other hand, there were no significant different in acute and chronic disease and utilization of inpatient and outpatient services between current smokers and non-smokers. However, in the case of utilization of outpatient services, current smokers had longer days of medication than non-smokers.

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