

Analysis of Lifetime Medical Cost of Stroke Caused by Obesity and Smoking

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WORKING PAPER 2011-06

**Analysis of Lifetime Medical Cost of Stroke
Caused by Obesity and Smoking**

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ISBN: 978-89-8187-765-1 93510

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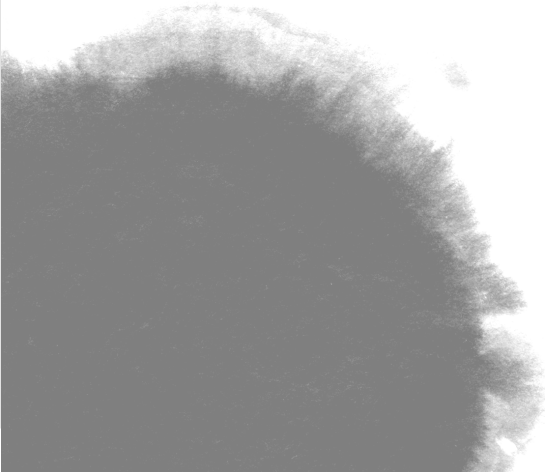
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Introduction



CHAPTER 1

Introduction

The life expectancy of the Korean people at birth increased by 17.1 years from 65.6 years in 1970 to 82.7 years in 2007. Infant mortality, on the other hand, decreased by more than one-tenth from 45 per 1,000 infants in 1970 to 4.1 in 2006. Although the health standards for Koreans improved remarkably in such a short period of time, health care spending and premature deaths due to chronic diseases, in particular of lifestyle habits, are as much as a burden for Korea as they are for other OECD countries.

Chronic illnesses are the main cause of disability and death around the world, including in Korea. According to Sassi and Hurst (2008), 60% of the world's population dies from chronic illnesses. It is a well-known fact that the incidence of chronic diseases is closely related to lifestyle habits such as smoking, drinking and physical activities. The medical cost expenditure spent for obesity-related diseases takes up 5.5%~7.8% of the total medical cost in the U.S. (Kortt et al, 1998). In the case of Canada, 2.5% (as of 1999) of the medical cost is reported to be spent due to lack of exercise (Latzmarzyk et al, 2000).

It is reported that once the risk factors such as smoking, drinking and obesity are eliminated thanks to the change in lifestyle habits, great benefits are reaped. For instance, when the Finnish government intervened to change the lifestyle habits of adult males for a period of 25 years, it was reported that the death rate caused by cardiovascular diseases dropped by 68%, coronary-artery disease by 73%, cancer by 44%, lung cancer by 71%, and overall death rate caused by all other factors by 49% (Sassi and Hurst, 2008).

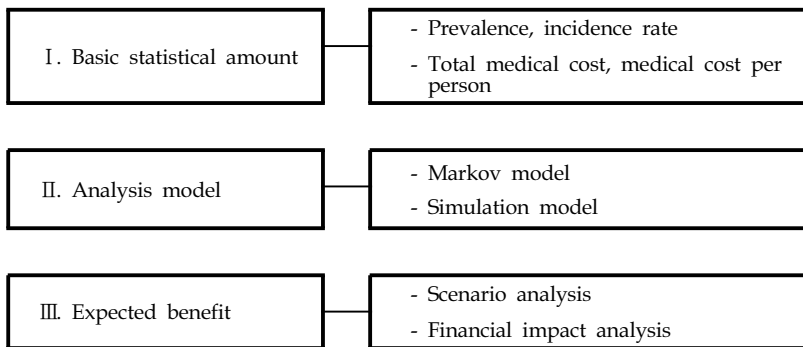
The socioeconomic cost in Korea incurred from illnesses in 2007 was estimated to be 56.633 trillion won, or 6.28% of GDP (Young-Ho Jung, 2009). Of this figure, the cost for treating cerebrocardiovascular diseases accounted for about 13.92%, which included 3.882 trillion won for hospitalization and outpatient treatment, 86.4 billion won for transportation, 387.8 billion won for caregivers' cost, 3.2455 trillion won in the loss of income resulting from premature death, and 1.751 trillion won in the loss of productivity caused by hospitalization and outpatient treatment.

In this report, a micro-analysis is conducted on lifetime medical cost spent by individuals resulting from obesity and smoking, major causes of cerebrocardiovascular diseases and life expectancy, in order to obtain basic data for developing policies related to future health improvement and health and medicine. Lifetime medical cost per person caused by obesity and smoking was calculated, taking into consideration such changes as individual's sex, age, status of the diseased at the

microeconomic level. Moreover, the benefits of health improvement from managing obesity and smoking, which are expected to bring out mid- to long-term financial reduction, were analyzed using the Markov simulation model. The lifetime medical cost of stroke caused by obesity and the cost caused by smoking were compared and analyzed.

In section 2, precedent research is studied to analyze lifetime medical cost. In section 3, a brief explanation of the conceptual framework of the model analyzed in this report is followed by the analysis method and sources used to produce the lifetime medical cost of obesity. The lifetime medical cost of stroke, one of the major causes of death and one of the heaviest socioeconomic burdens of Korea, is estimated under the assumption of the current obesity rate. The financial reduction benefit in the mid- to long-term perspective is also reviewed by controlling obesity. To make an analysis on the stroke, the target group included focused on I60-I69, G45 from 2004 to 2008. An overview of the analysis is shown in Diagram 1. In section 4, the analysis outcome produced using the analysis method mentioned in section 3 was described. The last section, section 5, discusses the contemplations and conclusions.

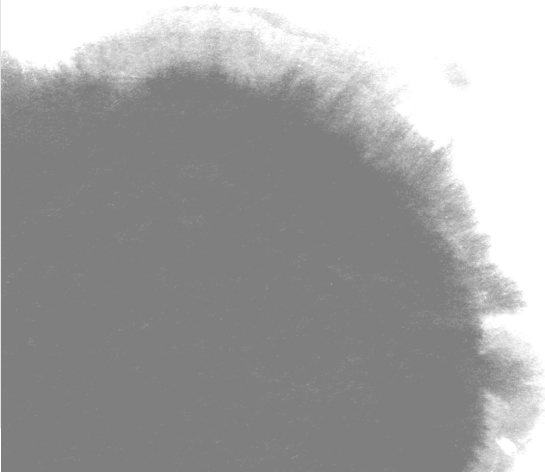
[Figure 1] Analysis process



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Precedent Study



CHAPTER 2

Precedent Study

Chronic illnesses are known to be closely related to lifestyle habits such as smoking, drinking and physical activity level, among others. It was analyzed that about 24% of the total medical cost was spent on health insurance and medical pay was spent on illnesses caused by smoking, drinking and obesity among Korean nationals over 20 years of age(Young-Ho Jung, 2009).

〈Table 1〉 Medical and financial burden caused by smoking, drinking and obesity

(Unit: %)

	20-29	30-39	40-49	50-59	60-69	Over 70	Total
Medical and financial burden from smoking	2.4	3.3	5.3	7.8	9.0	8.5	6.6
Medical and financial burden from drinking	2.1	12.1	28.2	15.0	6.2	1.5	11.4
Medical and financial burden from obesity	0.9	2.1	4.9	7.9	9.0	7.4	6.0

Source: Young-Ho Jung, 2009

In the Goldman et al. (2005) study, a model was built to forecast the medical cost, disease and restriction of physical activity (disability) of the elderly. This model is used to propose the Markov monte-carlo simulation so as to forecast future health and medical expenditure. The first aim of this

study is to examine the impact on the medicare cost, health and functional states in the treatment of the elderly when the current physical condition and restricted activity (disability) is continued. The second aim is to provide a simulation method to assess the "what if" scenario on the future health and medical environments.

The simulation model uses samples on individual level and information about the physical condition enabling the forecast of medical cost must be included. H (healthy) state may be linked to diseases (A, B, C) and also linked to death (D). The main goal is to find the point of transition into another physical condition by examining the individual's life-time after identifying the physical condition of individuals based on samples and to forecast the point reaching death. To make this analysis possible, it is necessary to measure a model that will transit into all possible physical conditions. For instance, a recovery model must be added to transition into A, transition into B, transition into C, and transition into D. However, it is not required to define the percentage of changing from A to A+B and from H to B. This is because those exposed to disease A can be considered as another covariate and a conditional model is built for the existing physical condition.

The first phase of analysis is to measure the transition of the individual's health. For example, the change of the physical condition can be determined using the Logit or

Probit transition model using longitudinal data. The second phase is to forecast the transformation of the future health condition. The percentage of transition can be used to forecast the change of physical condition. If the probability explains the present information, the first-order markovian process is possible. The higher order Markovian process can be produced if lagged covariates, i.e. health-related history is accumulated. Such probability can be shown in a variety of ways depending on the individual's characteristics and the initial condition, unlike the general cell-based model transition probability composed of different individuals.

When considering a person with physical condition A, the model calculates the following four transition probabilities:

- 1) That the person will recover to H condition the following year
- 2) That condition B will be added to condition A ($A \rightarrow A+B$) the following year
- 3) That condition C will be added to condition A ($A \rightarrow A+C$) the following year
- 4) That the person will die the following year

Next, the physical condition is simulated by applying the random number between 0 and 1 in uniform distribution. The transition probability changes depending not only on age or time, but also on physical conditions, for example. If the physical condition aggravates extremely, the probability

to die increases significantly from before.

The important data set in analyzing this is the Medicare Current Beneficiary Survey (MCBS). It is one of the most representative national data designed to identify the use of medicine and medical cost of the population on medicare. The main source for data is MCBS, consisting of transition of the self-administered disease. Vital statistics data is used to calculate the mortality rate. The transition model includes physical condition, the individual's sex and age. To forecast the future physical condition, the functional relation is defined and proposed.

In Caro et al(1999), three modules are built to analyze the long-term socioeconomic impact of stroke. First, the short-term module analyzes with clinical data during a short period of time. Second, the long-term module forecasts the patients' transition state when time changes by building the Markov model. Third, the cost incurred from stroke is forecasted by linking the short-term survivors with the long-term model. The administrative cost in the short-term is estimated to be US\$13,649 and it is forecasted that a range of US\$45,893 to US\$124,564 will be spent in the longer run depending on the seriousness of the illness.

In the meantime, Kolominsky-Rabas et al (2006) estimates the lifetime medical cost of German patients suffering from stroke. The life expectancy and cost of the occurrence of ischemic stroke, the first of its kind, within the unselected population-based cohort of the German SHI (statutorily

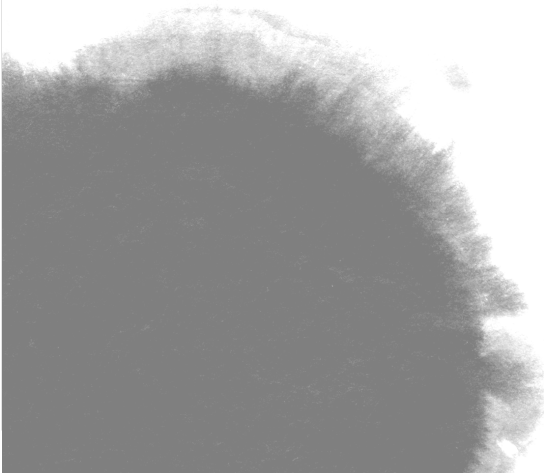
health-insured) patients were measured. The data source called Erlangen Stroke Project (ESPro) was applied. It is a prospective population-based stroke registry conducted for the 102,000 residents of the Erlangen region from 1994.

To analyze this, the cost of illness (COI) research type was used. This type does a tracking survey every three months to 12 months yearly of patients who suffered stroke for the first time in an incidence-based bottom-up approach. The medical records at hospitals and nursing homes are reviewed in addition to making visits to patients' homes to interview patients and family members living together with the patients. All expenses were calculated in the 2004 Euro (EUR) units from the insurer (SHI, healthcare funding source covering about 88% of the population) perspective.

According to the study outcome of Kolominsky-Rabas et al (2006), the survival rate of patients who have had strokes during the first year used the nonparameterized Kaplan-Meier curves. The survival rate during the period of 2 to 10 years since the stroke uses the data from Weibull parameterization, which proved to be more adequate than using the distribution such as the quotient, lognormal, gamma. The risk of death since the first occurrence of stroke is shown to increase in an exponential fashion during the period from 2 to 10 years. The lifetime medical cost of ischemic stroke stood at 43,129 EUR, higher for men (45,549 EUR) than women (41,304 EUR). From the national perspective, it is expected to grow to 57.1 billion EUR by 2025 from 51.5 billion EUR in 2006.

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Material Source and Analysis Method



CHAPTER 3

Material Source and Analysis Method

1. Disease subject to analysis

This study also analyzes lifetime medical cost spent when stroke occurs as a result of obesity. Stroke is an illness that does not frequently occur in people younger than 30 years of age, but the incidence of stroke dramatically rises with the age group over 60. It is an illness that is influenced by factors that cannot be changed, such as age and sex. Stroke is also influenced by such basic diseases as high blood pressure, diabetes, and hypercholesterol, as well as lifestyle and habitual factors such as smoking, drinking, physical activity and eating habits. Furthermore, the social and psychological factors as well as environmental factors have an impact on cerebrocardiovascular disease.

Stroke, the target disease under analysis falls under the category I60-I69, G45 of the International Classification of Diseases 10. The following belong to this category: subarachnoid haemorrhage, intracerebral haemorrhage, other nontraumatic intracranial haemorrhage, stroke, not specified as haemorrhage or infraction, occlusion and stenosis of precerebral arteries,

not resulting in cerebral infarction, occlusion and stenosis of cerebral arteries not resulting in cerebral infarction, other cerebrovascular disease, cerebrovascular disorders in diseases classified elsewhere, sequelae of cerebrovascular disease, transient cerebral ischaemic attacks and related syndromes.

〈Table 2〉 Target scope of stroke

ICD-10	Classification
I60	Subarachnoid haemorrhage
I61	Intracerebral haemorrhage
I62	Other nontraumatic intracranial haemorrhage
I63	Cerebral infarction
I64	Stroke, not specified as haemorrhage or infarction
I65	Occlusion and stenosis of precerebral arteries, not resulting in cerebral infarction
I66	Occlusion and stenosis of cerebral arteries not resulting in cerebral infarction
I67	Other cerebrovascular disease
I68	Cerebrovascular disorders in diseases classified elsewhere
I69	Sequelae of cerebrovascular disease
G45	Transient cerebral ischaemic attacks and related syndromes

2. Conceptual model structure

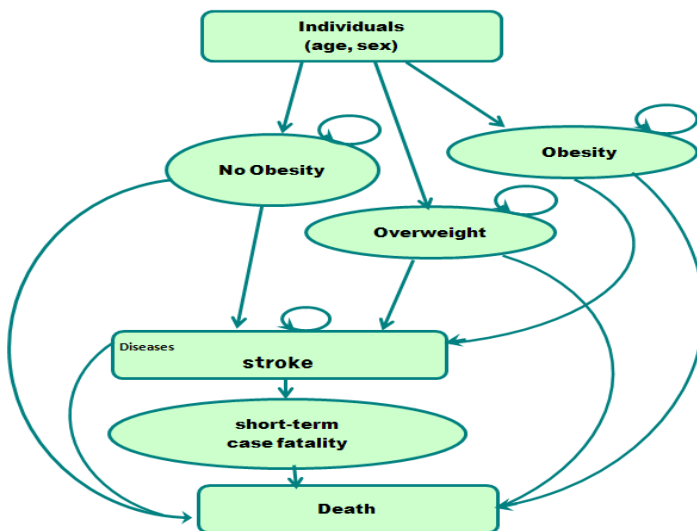
The model used in this study is developed, incorporating factors such as population change by sex and age, population change exposed to risk factors, disease incidence and progression, death, risk factors and the relative risk rate of specific diseases. The states of the model transition with the risk factors, which lead to the disease, then further on to death. In other words, this study attempts to forecast the transition state and mortality by cohort with the change of

time by building the Markov model as shown in [figure 2] below and to estimate the life expectancy and the lifetime medical cost by cohort.

This model is mainly divided into the risk factors, cause-specific disease incidence, progression and cause-specific mortality.

- risk factor: normal/overweight/obese
- cause-specific disease incidence
- progression: stay/move
- cause-specific mortality: alive/dead

[Figure 2] State transition diagram of the markov model for lifetime medical costs



Note: arrow=transition process

3. Method

(1) Analysis method of Lifetime Medical Cost Incurred from Stroke Caused by Obesity

To analyze the lifetime medical cost of stroke caused by obesity, the Markov status was categorized into BMI<25, 25≤BMI<30, and BMI≥30, defined as normal weight, overweight and obesity. Such risk factor groups modeled the process of a person experiencing a stroke and dying.

The present state is influenced only by the statistical distribution of the previous phase. It assumes that the present state is independent of the past state.

$$i(D|Coh_j) = i(D_0) \times RR(D|Coh_j) \quad \dots(1)$$

Here, $i(D|Coh_j)$: Incidence rate of disease D for cohort j

$i(D_0)$: Incidence rate of disease D for cohort 0
(normal weight)

$RR(D|Coh_j)$: Relative risk for disease D of cohort j

An equation (1) is used to produced the incidence rate of disease D of normal weight cohort.

$$i(D_0) = \frac{i(D)}{\sum_j [RR(D|Coh_j) \times Coh_j]} \quad \dots(1-1)$$

Here, $i(D)$ refers to the population incidence rate for disease D.

Similarly, the equation used to calculate the mortality

rate by cohort is as follows.

$$m(all|Coh_j) = m(all_0) \times RR(all|Coh_j) \quad \dots(2)$$

Here, $m(all|Coh_j)$: all cause mortality rate for cohort j

$m(all_0)$: all cause mortality rate for cohort 0 (normal weight)

$RR(all|Coh_j)$: relative risk for all cause mortality rate of cohort j

Using equation (2), all cause mortality rate for normal weight cohort can be calculated as equation (2-1).

$$m(all_0) = \frac{m(all)}{\sum_j [RR(all|Coh_j)] \times Coh_j} \quad \dots(2-1)$$

Here, $m(all)$ is all cause mortality rate of the entire population.

If the all cause mortality rate of the entire population is the sum of the mortality rate caused by disease D and the mortality rate from causes other than disease D, the mortality rate from causes other than disease D can be calculated as follows.

$$m(oth) = m(all) - \sum_d (m(D) \times p(D)) \quad \dots(3)$$

Here, $m(oth)$: mortality rate from causes other than disease D

$m(D)$: mortality rate from disease D

$p(D)$: prevalence rate of disease D

Meanwhile, the mortality rate from disease D can be divided into the short-term case fatality and the long-term mortality, which occurs in a mid- to long-term period. The mortality rate from disease D, therefore, can be split into the following two parts.

$$m(D) = cf(D) \times i(D) + m(D) \times p(D) \quad \dots(4)$$

Here, $cf(D)$: short-term case fatality caused within 1 year of the onset of disease D

$mort(D)$: long-term mortality rate from disease D

In summary, the incidence rates by cohort j proposes the product of incidence rate of disease D with the relative risk level. The change in the diseased population for disease D by cohort changes according to the changes in the incidence rate, prevalence rate, relative risk and the mortality rate. The following equation represents the simple math formula.

$$p(D)_{t+1} = p(D)_t + i(D)_t - m(D)_t - m(oth)_t \quad \dots(5)$$

Here, $p(D)_{t+1}$: incidence rate of disease D in the t+1 period

$p(D)_t$: incidence rate of disease D of the t period

The equation (5) used to estimate the remaining life expectancy by cohort j via simulation is as follows.

$$LE(Coh_j) = \frac{\sum_t Surv(t)}{pop(t_0)}$$

Here, LE: life expectancy

Surv(t): Number of survivors in cohort j during period t

pop(t₀): Number of people in the cohort during period t₀

The lifetime medical cost (LMC) to be estimated in this study is as follows:

$$LMC = \sum_t mc(D|t)$$

Here, $mc(D|t) = ac(D) \times p(D|t) \times Surv(t)$

ac(D): annual cost per patient for disease D for cohort j

(2) Analysis method of Lifetime Medical Cost of Stroke caused by Smoking

To review the scope of lifetime medical cost caused by obesity, a comparison of the lifetime medical cost caused by smoking was made so as to illustrate the impact and implications of obesity, one of the health risk factors.

The current state is influenced only by the probability distribution of the previous stage and it is assumed that it is independent from the previous state.

$$i(d|s_j) = i(d)_0 \times RR(d|s_j)$$

$i(d|s_j)$ = Incidence rate of disease d of cohort j

(non-smoker, previous smoker, present smoker)

$i(d)_0$ = Baseline incidence rate of disease d of non-smoking cohort

$RR(d|s_j)$ = Relative risk of disease d of cohort j

Because the disease incidence rate of the non-smoking cohort must be calculated, the following equation is used.

$$i(d)_0 = \frac{i(d)}{\sum_j (RR(d|s_j) \times s_j)}$$

$i(d)$ = Population incidence rate of disease d

s_j = Prevalence rate of cohort j

The equation to compute the mortality rate by cohort is as follows.

$$m(tot|s_j) = m(tot)_0 \times RR(tot|s_j)$$

$m(tot|s_j)$ = Mortality rate of disease d by cohort j (non-smoker, previous smoker, present smoker) or cohort (obesity, overweight, normal weight)

$m(tot)_0$ = Mortality rate of non-smoking cohort

$RR(tot|s_j)$ = Relative risk of disease d of cohort j

The equation to calculate the mortality rate of the non-smoking cohort is as follows.

$$m(d)_0 = \frac{m(d)}{\sum_j (RR(d|s_j) \times s_j)}$$

$m(d)$ = Mortality rate caused by the death cause of disease d

To compute the lifetime medical cost of smoking, the same factors used in case of obesity were applied. In other words, the cohort built virtually for each cohort of 100,000 people by risk factor for 40-year-old male adults reflected the transition process to the Markov state. In this case, transition occurs when the patient suffered stroke embracing a health risk factor. It was assumed in the model that a stroke patient has no possibility to fully recover from the diseased state.

4. Input data

To produce the incidence rate of obesity in Korea, raw data from the National Health and Nutrition Survey was used to classify the health risk factor groups applied in this analysis.

〈Table 3〉 Incidence rate of obesity: male

Age	No Obesity(%)	Overweight(%)	Obesity(%)
30-39	0.5758	0.3681	0.0561
40-49	0.6192	0.3547	0.0261
50-59	0.5750	0.4111	0.0139
60-69	0.6601	0.3107	0.0292
70-79	0.7870	0.2130	0.0000
Over 80	0.7870	0.2130	0.0000

Source: The National Health and Nutrition Survey Raw Data

The smoking rate for Korean men was 48% for those in their 20s, 58% for those in their 30s, and 49% for those in

their 40s. The percentage of non-smokers who had smoked in the past (more than 100 cigarettes) stood at 33% for those in their 40s and 44% for those in their 50s.

〈Table 4〉 Smoking rate: male

Age	present smoker (%)	Past smoker (%)	Non-smoker (%)
20-29	0.48	0.16	0.37
30-39	0.58	0.24	0.17
40-49	0.49	0.33	0.18
50-59	0.34	0.44	0.22
60-69	0.31	0.45	0.24
Over 70	0.23	0.60	0.17

Source: The National Health and Nutrition Survey Raw Data

The Relative Risk (RR) of obesity for stroke proposed by Wilson et al. (2002) was used in the analysis model.

〈Table 5〉 Relative risk of obesity for stroke

	Overweight	Obesity
age-adjusted	1.21	1.46

Source: Wilson et al.(2002)

According to the research of Shinton and Beevers (1989) that conducted a meta-analysis on stroke and the relative risk of smoking, the risk of developing cerebrovascular disease is higher on average by 1.43 times in smokers and 1.17 times in past smokers than in non-smokers.

〈Table 6〉 Relative risk of smoking for stroke

Age	Present Smoker	Past Smoker
Under 65†	1.43(1.35-1.52)	1.17(1.05-1.30)
65-74‡	3.96	1.42
75-84‡	3.04	1.25
Over 85‡	2.17	1.10

† Shinton and Beevers(1989)

‡ Struijs et al.(2005)

Mortality rate and excess mortality rate from stroke were calculated using the death rate material by death cause provided by the Statistics Korea.

$$Mortality = \frac{Mort_{ijd}}{Pop_{ij}} \times 100,000$$

Here, $Mort_{ijd}$ = Number of deaths by sex, age, specific cause of death

Pop_{ij} = Number of mid-year population by sex, age

〈Table 7〉 Number of deaths from stroke in 2008: male

Age	Number of people dead from cerebrovascular disease (per 10,000 people)	Total number of deaths (per 100,000 people)
30 - 34	2	83
35 - 39	6	134
40 - 44	12	222
45 - 49	22	372
50 - 54	36	530
55 - 59	62	815
60 - 64	102	1,142
65 - 69	205	1,976
70 - 74	401	3,297
75 - 79	719	5,433
80 - 84	1,272	9,446
Over 85	1,987	16,991

Source: 2008 Annual Report on the Cause of the Death Statistics, Statistics Korea

The study by Ji-hye Im and Geon-yeop Kim (2008) divided the death types of hemorrhagic and ischemic strokes into dead on the day of the stroke, dead within 30 days of incidence, dead within 90 days of incidence, and dead within 365 days of incidence using the data claimed to the National Health and Insurance Corporation in 2003. In the study, the data provided by Ji-hye Im and Geon-yeop Kim (2008) was used to reflect the number of deaths from fatal incidences of stroke during one cycle.

<Table 8> Number of patients with fatal incidences of stroke

Age	Haemorrhagic Stroke					Ischemic Stroke				
	Dead on the Day of Stroke	Dead within 30 days of incidence	Dead within 90 days of incidence	Dead within 365 days of incidence	Target Number	Dead on the Day of Stroke	Dead within 30 days of incidence	Dead within 90 days of incidence	Dead within 365 days of incidence	Target Number
Under 40	11	239	366	400	2,522	0	39	47	70	1,384
40-49	40	768	839	986	4,534	1	92	125	199	4,117
50-59	46	801	917	1,115	5,016	8	125	309	524	7,263
60-69	40	997	1,243	1,644	5,704	17	600	926	1708	13,138
70-79	34	920	1,209	1,647	3,727	20	835	1,477	2754	11,129
Over 80	38	733	970	1,229	1,834	29	977	1,637	2588	5,753
Total	209	4,458	5,544	7,021	23,337	75	2,668	4,521	7,843	42,784

Source: Ji-hye Im · Geon-Yeop Kim, Use of Medical Facility of acute stroke patients and Study Tracking Health Results, Health Insurance Review & Assessment Service, 2008

To calculate the incidence rates of stroke patients, patients who have never claimed prior to 2008 for the same illness were selected. In other words, to calculate the incidence rates of cardio-cerebrovascular disease, the patients who have claimed more than one time concerning cardio-cerebrovascular disease in 2008, but never claimed for the use of medical care

due to the same illness in the years between 2004 and 2007.

The Health Insurance Review & Assessment Service suggests the method of calculating the incidence rate targeting adults over 19 years of age who have at least one element in the principal and supplementary diagnosis #1~7. Han-joong Kim et al. (2007) makes an analysis by dividing the group with more than one case of principal and supplementary diagnoses and when there is no intersection of the patients suffering from stroke and other accompanying diagnosis.

In this study, the number of diseased and the prevalence rate for patients including at least one principal and supplementary diagnoses were calculated.

$$\cdot \text{Prevalence rate by disease} = \frac{P_{ijk}}{N_{ij}} \times 100,000$$

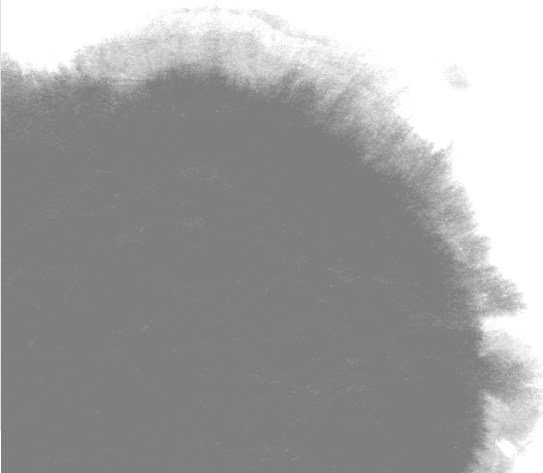
i = sex, j = age, k = disease, P = number of diseased, N = mid-year population

To calculate the medical costs per stroke patient, an analysis was conducted by sex, age, hospitalization and outpatient usage. There may be some restrictions to the calculation of the medical cost for a specific disease because the patients suffering from stroke may have accompanying diseases. For example, if the accompanying diseases are included in the principle supplementary diagnosis, the cost may be calculated in a duplicated way. In cases where the medical cost is spent along with a high-cost medical case

such as cancer, the medical cost may be estimated excessively. Thus, cancer was excluded when it was included as one of the accompanying diseases in the analysis.

04

Research Result



CHAPTER 4

Research Result

1. Incidence rate and prevalence of stroke

The result of calculating the incidence rate of stroke for patients who have claimed more than once for stroke in 2008 but have never made a claim for using medical facility for the same illness for the years between 2004 and 2007 prior to the recent four years is shown in <Table 6>.

The incidence rate of stroke in 2008 shows 149 people per hundred thousand people in the age group of 30~34, 222 in the age group of 35~39, 371 for 40~44, and 5,290 people for those over 85 years of age. The older the men, the higher the incidence rate of stroke. In the case of women, the number stood at 148 per hundred thousand people. The incidence rate of women (4,743) was higher than that of men (4,516) in the age group of 75~79, but men outnumbered women for those aged 80 and over.

〈Table 9〉 Incidence rate of stroke: 2008

(Unit: per ten thousand people)

Category (age)	Male	Female	Total
30~34	151	148	149
35~39	233	210	222
40~44	380	362	371
45~49	634	666	650
50~54	972	1,057	1,014
55~59	1,457	1,556	1,507
60~64	1,999	2,157	2,081
65~69	2,775	3,062	2,931
70~74	3,607	3,950	3,806
75~79	4,516	4,743	4,661
80~84	5,343	5,202	5,246
Over 85	5,644	5,168	5,290

Source: Health Insurance Review & Assessment Service

As of 2008, the number of stroke patients per a population of one hundred thousand was 220 for the age group 30~34, 327 for the age group 35~39, 612 for the age group 40~44, 1,297 for the age group 45~49 and 17,312 for the age group 80~84. The older the group, the higher the number of stroke patients. In terms of sex, the patients suffering from stroke showed the following characteristics: males in their 30~34 years 192 per hundred thousand people, females showed a higher incidence with 250 people. By the time they are between 65 and 69 years of age, 10,285 men and 8,612 women per hundred thousand people suffered from strokes, showing a higher number of patients among males over 65 years of age than women.

〈Table 10〉 Prevalence of stroke: 2008

(Unit: per ten thousand people)

Category (age)	Male	Female	Total
30~34	192	250	220
35~39	289	366	327
40~44	545	681	612
45~49	1,137	1,462	1,297
50~54	2,112	2,715	2,411
55~59	3,717	4,527	4,125
60~64	5,938	6,409	6,181
65~69	10,285	8,612	9,377
70~74	16,250	10,218	12,756
75~79	25,914	10,808	16,212
80~84	33,672	9,980	17,312
Over 85	37,854	7,562	15,324

Source: Health Insurance Review & Assessment Service

2. Medical cost per person incurred from stroke

As of 2008, an average of 6,283,041 won of medical cost per person in the age bracket from 30 to 34 years of males hospitalized because of a stroke was spent (cost borne by the National Health and Insurance Corporation + cost borne by the patient), an average of 7,011,789 won per person for those aged between 45 and 49, 6,312,684 won for men between 55 and 59, 5,842,226 won between 65 and 69, and 4,900,449 won for those over 85.

<Table 11> Hospitalization cost of stroke patients: 2008 males

Age	Number of patients	Total medical cost (Korean Won)	Hospitalization Cost Per Person (Korean Won)
30~34	1,135	7,131,251,260	6,283,041
35~39	2,249	15,545,787,160	6,912,311
40~44	4,003	27,069,349,140	6,762,266
45~49	7,576	53,121,311,080	7,011,789
50~54	10,109	66,404,802,670	6,568,879
55~59	10,681	67,425,779,840	6,312,684
60~64	12,038	72,349,547,770	6,010,097
65~69	16,171	94,474,629,620	5,842,226
70~74	16,513	91,160,890,950	5,520,553
75~79	12,746	70,058,506,410	5,496,509
80~84	8,110	42,295,224,990	5,215,194
Over 85	4,928	24,149,412,130	4,900,449

Note: Treatment cost = Cost borne by the National Health and Insurance + cost borne by patient

As of 2008, the outpatients to the hospital to treat stroke spent an average of 209,814 won per person between 30 and 34 years of age (cost borne by the National Health and Insurance + cost borne by patient), average of 210,853 won for outpatient males between 45~49, 205,641 won between 55~59, 199,346 won between 65~69 and 147,441 won for those over 85.

<Table 12> Outpatient medical cost of stroke patients: 2008 males

Category (age)	Number of patients	Total medical cost	Outpatient medical cost per head
30~34	5,044	1,058,302,680	209,814
35~39	10,078	2,057,762,810	204,184
40~44	17,610	3,530,664,900	200,492
45~49	34,049	7,179,337,670	210,853
50~54	48,224	9,852,496,100	204,307
55~59	55,013	11,312,910,230	205,641
60~64	64,289	12,988,597,080	202,035
65~69	80,127	15,973,001,240	199,346

Category (age)	Number of patients	Total medical cost	Outpatient medical cost per head
70~74	72,483	14,053,641,160	193,889
75~79	48,593	9,021,737,030	185,659
80~84	25,395	4,317,317,290	170,007
Over 85	12,146	1,790,818,820	147,441

Note: Treatment cost = Cost borne by the National Health and Insurance + cost borne by patient

3. Lifetime medical cost of stroke caused by obesity

Assuming that 40-year-old males live until they are 95 years of age, the life expectancy per person by cohort is shown in the <Table 13> below. The life expectancy of normal weight men is 42.01 years, 40.71 for overweight men, and 39.35 years for obese men, all having suffered stroke.

<Table 13> Life expectancy of 40-year-old male stroke patients who are obese

	Normal Weight	Overweight ($25 \leq \text{BMI} < 30$)	Obese ($\text{BMI} \geq 30$)
Potential Life Expectancy	42.01 years	40.71 years	39.35 years

The difference in life expectancy years between men with normal weight and obese men who suffered stroke is about 2.66 more years, with normal weight men living a little longer than obese men. Normal weight men live 1.30 years longer than overweight men and overweight men live 1.36 more years than obese men.

<Table 14> Difference in life expectancy by obese cohort for stroke patients:
40-year-old males

Stroke Patient	Difference in Life Expectancy
Normal weight vs obese	2.66 years
Normal weight vs overweight	1.30 years
Overweight vs obese	1.36 years

The lifetime medical cost spent by 40-year-old men on stroke is differently calculated depending on the level of obesity. Under the assumption that 40-year-old males live until they are 95 years of age, the analysis result of lifetime medical cost per person spent for stroke is displayed in <Table 15>. When 0% discount rate is applied, the lifetime medical cost per person to be spent for stroke for men with normal weight is about 28.24 million won, about 31.20 million won for overweight men, and about 34,10 million won for obese men.

<Table 15> Lifetime medical cost per person spent by 40-year-old male from stroke by obesity cohort: discount rate 0%

(Unit: Korean Won)

	Normal Weight	Overweight ($25 \leq \text{BMI} < 30$)	Obese ($\text{BMI} \geq 30$)
Lifetime medical cost per person	28,237,680	31,199,273	34,099,935

Note: Discount rate of 0% applied.

When applying a 3% discount rate, a normal weight male will spend about 9.07 million won because of stroke, whereas an overweight man will spend about 10.18 million won, with obese men spending about 11.32 million won.

<Table 16> Lifetime medical cost per person suffering from stroke by weight cohort of 40-year-old males: discount rate of 3%

(Unit: Korean Won)

	Normal Weight	Overweight ($25 \leq \text{BMI} < 30$)	Obesity ($\text{BMI} \geq 30$)
Lifetime medical cost per person	9,072,087	10,179,021	11,317,953

Note: Discount rate of 3% applied.

As the <Table 17> suggests, when the social discount rate is applied, an obese 40-year-old man spends an additional 5,862,255 won per person due to stroke compared to the normal weight 40-year-old man. An overweight man is likely to spend an additional amount of 2,961,593 won per person than the normal weight man. An obese 40-year-old man spends 2,900,662 won more per person than the overweight man of the same age because of stroke.

<Table 17> Difference of lifetime medical cost per person caused by stroke by obesity cohort: 40-year-old male

(Unit: Korean Won)

Stroke Patient	Lifetime medical cost per person (Discount rate 0%)	Lifetime medical cost per person (Discount rate 3%)
Normal weight vs obese	-5,862,255	-2,245,866
Normal weight vs overweight	-2,961,593	-1,106,934
Overweight vs obese	-2,900,662	-1,138,932

As shown above, 40-year-old normal weight males has a longer life expectancy of 2.66 years related to stroke than obese men, but an obese 40-year-old will spend 5,862,255 won more in terms of lifetime medical cost caused by stroke compared to normal weight 40-year-old men.

〈Table 18〉 Reduction of lifetime medical cost per person through obesity management: 40-year-old male

(Unit: Korean Won)

	Treatment Cost
Lifetime medical cost per person caused by stroke of obese population	34,099,935 won
Lifetime medical cost reduced per person related to stroke through obesity management	-5,862,255 won

Note: Treatment cost = Cost borne by the National Health and Insurance + cost borne by patient

As a result, it is considered that the expected financial benefits from a longer life expectancy and reduced medical cost will follow if obesity is managed continuously with healthy lifestyle habits. In this study, the target illness is stroke, but if all illnesses related to obesity are included, it is expected that the reduction amount per person will rise significantly.

4. Lifetime medical cost of stroke patients caused by smoking

To analyze the lifetime medical cost of smokers suffering from stroke, the Markov simulation was used. To do this, a virtual cohort was created, comprising non-smoking cohort 100,000 people, previous smoking cohort 100,000 people, present smoker cohort 100,000 people. The lifetime medical cost per person incurred by suffering stroke was estimated with a life expectancy of up to 95 years of age.

The following table shows the life expectancy of male stroke patients among non-smokers, previous smokers and present smokers aged 40 with a life expectancy of 95 years. The life expectancy was 43.05 years for non-smokers, 41.71 years for past smokers and 37.37 years for smokers.

〈Table 19〉 Life expectancy of stroke patients caused by smoking: 40-year-old adult males

	Non-smoker	Previous smoker	Present smoker
Anticipated life expectancy	43.05 years	41.71 years	37.37 years

The difference between non-smokers and present smokers in life expectancy showed about 5.68 more years for non-smokers than smokers. Comparing non-smokers with past smokers, non-smokers lived about 1.34 more years than past smokers, whereas past smokers lived about 4.34 years longer than present smokers.

〈Table 20〉 Difference in life expectancy of stroke patients by smoking cohort: 40-year-old adult male

Stroke Patient	Difference in life expectancy
Non-smoker vs present smoker	5.68 years
Non-smoker vs past smoker	1.34 years
Past smoker vs present smoker	4.34 years

The lifetime medical cost of 40-year-old adult males suffering from stroke is calculated differently depending on the smoking factor. Assuming that the 40-year-old adult male lives until he is 95 years of age, the lifetime medical cost per person is calculated as in the following table. Applying the 0% discount rate, a smoker spends about 24.06 million won per person as lifetime medical cost caused by stroke. For the males who smoked in the past, the cost stood at about 27.33 million won, about 35.28 million won for present smokers.

〈Table 21〉 Lifetime medical cost of 40-year-old adult male per head who suffered from a stroke by smoking cohort: discount rate 0%

	(Unit: Korean Won)		
	Non-smoker	Past smoker	Present smoker
Lifetime medical cost per person	24,062,819	27,328,072	35,282,159

Note: 0% discount rate applied.

The lifetime medical cost to be spent per person resulting from the incidence of stroke by a non-smoking male, with a 3% discount rate, was about 7.97 million Korean won. The amount for past smokers stood at about 9.13 million won and about 11.86 million won for present smokers.

〈Table 22〉 Lifetime medical cost of 40-year-old adult male per person who suffered from a stroke by smoking cohort: discount rate 3%

	(Unit: Korean Won)		
	Non-smoker	Past smoker	Present smoker
Lifetime Medical Cost per person	7,974,447	9,131,079.84	11,860,630

Note: Discount rate of 3% applied.

In terms of lifetime medical cost, a smoker on average spends about 11 million won more than a non-smoker and about 8 million won more than a past smoker. A past smokers is found to spend about 3 million more than a non-smoker.

〈Table 23〉 Lifetime medical cost of 40-year-old adult male per head who suffered from a stroke by smoking cohort

(Unit: Korean Won)

Stroke Patient	Lifetime medical cost per person (Discount rate 0%)	Lifetime medical cost per person (Discount rate 3%)
Non-smoker vs Present smoker	-11,219,340	-3,886,182
Non-smoker vs Past smoker	-3,265,254	-1,156,632
Past smoker vs Present smoker	-7,954,086	-2,729,550

As examined before, the life expectancy longer by 6.68 years for non-smokers than for smokers, whereas smokers spend a higher amount, 11,219,340 won more on average throughout their lifetimes, than non-smokers. Past smokers are like to spend 7,954,086 won more than smokers.

〈Table 24〉 Lifetime medical cost reduction benefit per person through quitting smoking: 40-year-old males

(Unit: Korean Won)

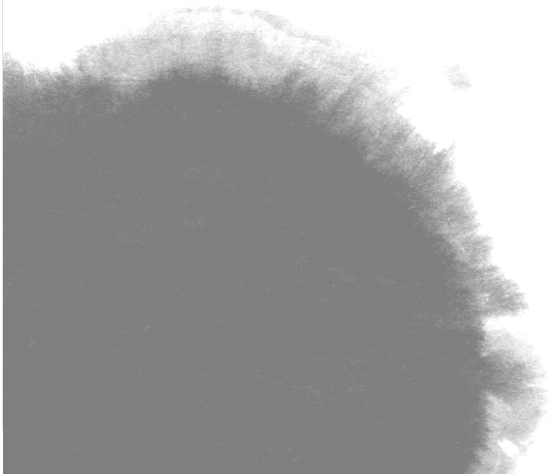
Category	Treatment Cost
Lifetime medical cost per person caused by stroke of smoker	35,282,159 won
Lifetime medical cost amount reduced per person caused by stroke through quitting smoking	-7,954,086 won

Note: Treatment cost = Cost borne by the National Health and Insurance + cost borne by patient

If a 40-year-old male who currently smokes quits smoking, his lifetime medical cost will be reduced by 7,954,086 won. However, continuous health management and early prevention as well as the increase in the number of people who quit smoking, it is expected that the life expectancy will increase and medical cost will be reduced.

05

Policy Implications



CHAPTER 5

Policy Implications

Obesity has an impact on a wide range of illnesses. In this study, however, a virtual cohort of 40-year-old adult males subject to stroke, an illness with a high socioeconomic burden, was created to estimate the life expectancy until 95 years of age and the lifetime medical cost per person incurred from stroke during their surviving years via a simulation. A comparison of lifetime medical costs caused by obesity and smoking was made.

First of all, in the case of obesity, the life expectancy of men with normal weight and obese men who suffered from stroke showed a difference of about 2.66 years, with men with normal weight living longer than the obese men. In the case of smoking, on the other hand, 40-year-old non-smokers are estimated to live 5.68 years longer than smokers. Smokers are also expected to spend about 11 million won more in their lifetime than non-smokers.

〈Table 25〉 Lifetime medical cost per person of stroke by obesity and smoking cohort: 40-year-old males

(Unit: Korean Won)

Stroke Patients	Difference in Life Expectancy	Lifetime Medical Cost per person (Discount rate: 0%)	Lifetime Medical Cost per person (Discount rate: 3%)
Normal weight vs Obese	2.66 years	-5,862,255	-2,245,866
Non-smoker vs Present smoker	5.68 years	-11,219,340	-3,886,182

Comparing the lifetime medical cost per person of the stroke patients caused by obesity vs. smoking, obesity does not seem to trigger a more serious level of problems than smoking, but the number of obese population is continuously increasing, which will lead to a heavy burden on medical finances in the future.

When risk factors such as smoking, drinking and obesity are eliminated by changing lifestyle habits that cause chronic illnesses, the resulting benefits are great (OECD). It is reported in Partnership for Prevention that about 70% of chronic illnesses can be prevented by eliminating the change of lifestyle habits. To this end, the need for public policies that prevent and manage chronic illnesses triggered by the consumption of items harmful to health is increasing. If illnesses are prevented through promotion of health, the quality of life of the Korean people is improved, the quality of the human resources is enhanced and the medical cost is reduced, contributing eventually to the advancement and economic growth of the entire nation. As a result, strategies to invest in health promotion from a larger perspective, namely enhancement of the public's quality of life, economic growth and securing continuous medical finances are required.

In the U.S., emphasis is put on health promotion and prevention in the recently passed bill on medical reform. According to the medical reform bill, the U.S. President is to set up a “National Prevention, Health Promotion and Public Health Council” within the Department of Health and Human Services. In addition, the bill clearly states the following objectives: continuing and expanding investment in the disease prevention and public health as well as controlling the increase of medical expenditure. To further expand investment in public health and prevention, the bill mentions that a "Prevention and Public Health Fund" similar to the Korean Health Promotion Fund was to be set up in the federal government and managed and operated by the Department of Health and Human Services. The scope of the fund to promote and prevent health is specifically mentioned in the bill and it is growing each year. In 2010, the fund started out with US\$ 500 million, growing to US\$ 750 million in 2011, US\$ 1 billion in 2012, US\$ 1.25 billion in 2013, US\$ 1.5 billion in 2014, and US\$ 2 billion in 2015 and after.

Furthermore, the 『2010 Annual Status Report』¹⁾ published by the National Prevention, Health Promotion and Public Health Council of the U.S. also emphasizes the importance of preventive and health promotion strategy, recommending prevention of the major causes of death. The report also suggests that the most effective method to prevent risk factors such as cigarette consumption, lack of exercise and excessive drinking. The effect of cutting the medical cost

1) National Prevention, Health Promotion and Public Health Council, 『2010 Annual Status Report』

expected through the practice of such a healthy lifestyle is estimated to be US\$408 billion (Lewin Group, 2009), taking up about 17% of the total U.S. medical cost of 2008. The reduction of medical cost for specific health risk factors showed US\$ 168 billion for cigarettes, US\$ 144 billion for obesity, and US\$ 96 billion for drinking alcohol.

〈Table 26〉 Effect of reduced medical cost with healthy lifestyle: u.s.

Factor Harmful to Health	Drinking Alcohol	Cigarettes	Obesity
Medical Cost Reduced	US\$96 billion	US\$ 168 billion	US\$ 144 billion

Source: Lewin Group, 2009

1. Policy direction to reduce smoking

A policy that induces changes in the consumer's behavior should be implemented in order to prevent relevant illnesses or to promote health by reducing consumption of cigarettes, an item harmful to health. Such policies could include non-price policies such as tobacco regulation or price policies such as levying a tax or a cost on cigarettes. In this passage, the focus will be put on price policy for cigarettes, an item harmful to health. This is the result of the realization that it is high time that a more active cigarette price policy is required by overcoming the restrictions of the relatively weak cigarette price policy.

In countries such as those in Europe and the U.S., policies were developed to encourage people to control consumption by levying a high percentage of tax on cigarettes and alcohol. Recently, a stronger tax policy on cigarettes has

been in the planning stage. In recent days, a significant number of countries are taking policy steps to levy tax on items that lead to obesity (Young-Ho Jung et al, 2006). Meanwhile, according to a ranking of prices of cigarette of countries around the world done by the WHO, the cigarette price of Korea ranked 78th, a relatively cheap price for cigarettes in international standards. The prices of cigarettes of major nations are as follows: US\$11.27 in Ireland, US\$10.14 in Norway, US\$8.06 in Singapore, US\$7.64 in the U.K., US\$7.48 in France, US\$6.65 in Australia, and US\$6.48 in Canada, with a mere US\$1.98 in Korea. In Europe, cigarette tax is typically adjusted upward each year following the European regulations.

It has been revealed through many studies that one of the most effective regulatory policies of cigarettes is to increase the tax burden on cigarettes. This is especially true of the low-income class and the younger generation that react more sensitively to cigarette prices. Maintenance of a high cigarette price not only helps promote health among the low-income class, but also helps to prevent teenagers from becoming smokers, leading the young smokers to quit smoking at an early stage. The European Strategy for Tobacco control (ESTC) recommends the following in regard to conducting a proactive price policy:

- Maintaining a high price and a high tax burden on cigarette products
- Taxation policy to increase the burden of cigarette price continuously by maintaining cigarette price higher than the price increase rate and income increase rate
- Banning tax-free or tax-exemption measures on

cigarette products

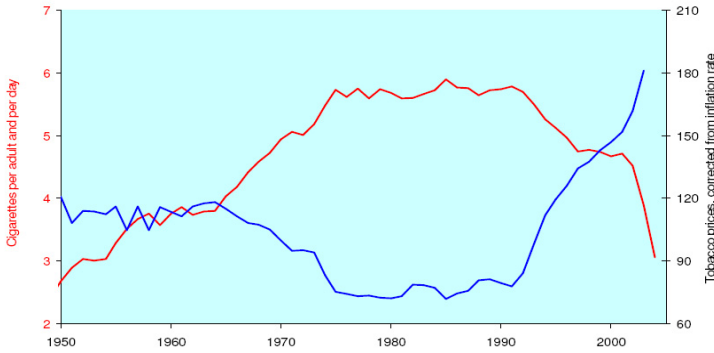
- Active allocation and use of national finances for nationwide cigarette management program
- Tax and price policies in harmony with cigarette substitutes.

France, in particular, is assessed to have made significant achievements by effectively implementing cigarette price policies and major policies that include the following. During the years between 1992 and 2002, the Health Department Tobacco Plan was carried out. The responsibility of the tax decision levied on cigarettes and alcoholic beverages in France was changed from the Ministry of Finance to the Health Department during the same period. This provided an important opportunity to shift the focus of social perspective to public health. This translated into a strong use of price and tax policies as a way to reinforce tobacco regulations. During this period, a new objective tax was introduced. The source of revenue from the new tax was used for public health and social security activities. The government is known to have made intense efforts to draw a social consensus to obtain public support concerning the introduction of objective tax and use of finances on cigarettes.

The Cancer Plan (2003 ~) that called for war with tobacco followed the Health Department Tobacco Plan. This plan uses the strong tax policy as an important tool and carries out a strict non-price regulation at the same time. Some examples of the specific policies include implementation of anti-tobacco laws and strong health education programs stressing no-smoking and smoking prevention. In addition,

an approach to react to political pressures from stake-holders such as cigarette manufacturers, cigarette sellers and smokers was developed. Solid cooperation and a cooperative system with relevant ministries including the Ministry of Finance and Customs are underway. France is assessed to have reaped the following achievements with such policies. First, as seen in the figure below, the government adopted a conservative price policy on tobacco in the period from 1950 to 1991, resulting in the growth of its consumption. The Evin Law Policy, a non-price policy that strengthened restrictions on the purchase and advertising of the tobacco and alcohol, led to the gradual drop in tobacco consumption. The period from 1993 to 2005 was an example of an active price policy, which increased the actual price of tobacco by 5% each year. This led to the decline in the number of smokers, 6.5% for male smokers and 5.8% for female smokers. In the year between January 2003 and January 2004, in particular, the price of cigarettes grew by 40%, seeing a decrease in cigarette sales by 33.5%. In short, the implementation of Evin Law, a non-price policy, in 1991 led to a gradual drop in cigarette consumption, but it was a strong and effective price policy that led to an actual drop in the consumption of tobacco.

[Figure 3] Change in cigarette price and cigarette consumption: france



Source: Hill C, Laplanche A. Tabagisme et mortalité : aspects épidémiologiques. *BEH*, 2003, 22-23:98-100 (http://www.invs.sante.fr/beh/2003/22_23/beh_22_23_2003.pdf, accessed 30 November 2006).

Source: WHO, reused in THE EUROPEAN TOBACCO CONTROL REPORT 2007

Meanwhile, the U.S. faced a phenomenal change in the medical system as the recent medical reform bill was passed. The price policy on items harmful to health and the plan to use finances are full of suggestions for Korea. The U.S. federal government is known to levy a federal tax of \$2 on every pack of cigarettes. The goal is to use the reserves raised through the federal tax to strengthen cigarette regulating programs. The possible assistance to state governments that satisfy the minimum standards of cigarette regulation such as banning smoking indoors or in public places is also considered. Independent of the federal government, the State of New York has significantly raised the cigarette tax recently, increasing the price of cigarette to \$11 a pack. To reduce the obesity rate, the U.S. is trying to grant the state government that has fulfilled certain standards with qualification to receive assistance equivalent

to that of the federal government. The standards are to levy a new federal tax of \$0.01 on every can of carbonated beverage, use of the finances raised through the federal tax system to support the obesity prevention program, and implementation of minimal regulations as well as bans related to obesity and nutrition. Such policies are estimated to bring a reduction of about US\$ 255 billion in medical cost with a substantial drop in cigarette consumption over the next 11 years. The medical cost is thought to reduce by about US\$ 406 billion with a decreased obesity rate (The Commonwealth Fund, 2009).

To reduce the harmful consequences of cigarettes and to promote and prevent health, it is important to change the view of people from seeing cigarettes as a favorite food to an item harmful to health that requires control. To do this, it is necessary to carry out a health-friendly tax policy. In addition, the cases in European countries and other foreign countries need to be benchmarked, and we need to actively review the increase of cigarette price. To enhance the impact of price policy, it is necessary to establish a principle to raise the price of cigarettes higher than that of the price index increase rate and income level increase rate. As illustrated in the table below, when we compare the cigarette price index and the total price index in Korea, the cigarette price index has seen no change since 2005, while the total price index grew since 2003, noticing that the cigarette price index is continuously dropping compared to the total price index.

〈Table 27〉 Cigarette price index and total price index

	2003	2004	2005	2006	2007	2008
Cigarette price index	78.6	78.6	100.0	100.0	100.0	100.0
Total price index	94.0	97.3	100.0	102.2	104.8	109.7

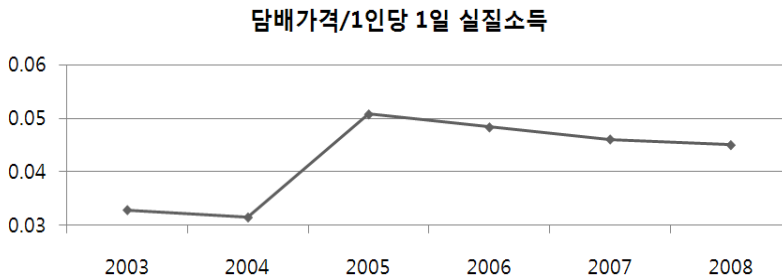
As shown in the table below, the net income per person in Korea vs. cigarette price is declining since the cigarette price increase in 2005.

〈Table 28〉 Net income per person and cigarette price

(Unit: Korean Won)

	2003	2004	2005	2006	2007	2008
Income (1 person/ 1 day)	45,586	47,573	49,205	51,668	54,203	55,475
Cigarette Price	1,500	1,500	2,500	2,500	2,500	2,500

Cigarette price/net income for 1 person per day



To encourage an actual drop in cigarette consumption, it is necessary to maintain the cigarette price higher than the inflation rate and rate of income level increase so as to strengthen price pressure of cigarettes on smokers.

As shown in the case of France, it is recommended that the option of the Ministry of Health and Welfare taking charge in determining the price of cigarettes from the viewpoint of public health be actively reviewed. It is thought to be appropriate and desirable that the tax levied on cigarettes be not used as a policy to collect tax revenue, but to approach it from the public health view to promote and prevent national health. Meanwhile, it is necessary to develop and implement various and comprehensive policies, especially implementing active price policies stressed in this study along with strict non-price regulating policies.

Health-friendly tax policies on cigarettes need to be carried out continuously. In the short-term, a levy on cigarettes in the form of a health promotion fund should be made. It is suggested that the finances raised be used to carry out a project to promote health and non-smoking. A carefully laid-out design to stick by the benefit principle should be used when using the finances.

The issue of the negative impact of the increase of cigarette price on the prices of goods and the financial burden on the working class may be raised. However, cigarette is not among necessities, so it is not right to include it in the price index. The study team thinks that it is right not to include cigarettes when calculating the price index. If need be, the team recommends to announce the two price indices simultaneously, one with the cigarettes included and the other without cigarettes. In the long run, the cigarette price increase will lead smokers to quit smoking or to a drop in cigarette consumption, enhancing the health of the public and reducing the occurrence of

illnesses caused by smoking, which in turn will lead to less medical cost, eventually bringing about a positive effect on household economies. The rise in cigarette price is a policy that helps smokers who wish to quit smoking. Furthermore, a way to use the finances raised by tax levy for the low-income households could be carried out to ensure that the benefits reach the working class.²⁾

To carry out health-friendly tax policies on cigarettes, proactive efforts to obtain social support are needed most of all. In other words, a social consensus on the fact that the cigarette price policy is one that helps promote and prevent the health of the public needs to be reached. A program that can provide practical help to the low-income class then needs to be developed with specific ways to support the program and to eventually form a national consensus throughout the country.

2. Policy direction to reduce obesity

The issue of access to health foods is likely to occur in low-income residential areas or among the socially underprivileged. Therefore, improving access to health foods is significant in terms of policies. According to a report published by the Rudd Center for Food Policy and Obesity, low-income households and residents in underprivileged areas are even in relatively more pain in relation to the illnesses that can be prevented with foods for the following reasons:

2) For example, providing assistance in receiving preventive services such as mammograms and screenings can be considered.

- The areas where low-income households reside have fewer health foods than the grocery stores in higher-income households.
- The grocery stores in the regions where low-income households live have relatively fewer health foods and the quality of the goods is often low.
- Even if healthy foods exist, the price of fresh foods is often not affordable by low-income families.

A good example is to guarantee access to those who have less access to health food. Prevention of obesity and chronic illnesses related to obesity such as diabetes and heart disease result in the reduction of medical cost to a certain extent for both government and individuals.

To increase the supply of health foods in supermarkets or vegetable shops in low-income areas provide the following benefits to both the local community and residents.

- Better access to health foods
- Reduced potential threat of obesity by consuming healthy meals
- Creation of new jobs
- Creation of profit
- Stronger promotion of commercial activities
- Strengthening competencies of the organization and cooperation of the local community

The local businesses also receive the following advantages.³⁾

3) Andreyeva T, Blumenthal DM, Schwartz MB, Long MW, Brownell KD. Availability and prices of foods across stores and neighborhoods. *Health Affairs*. 2008;27(5):1381-88

- Market expansion and profit creation
- Contribution to public health and economic well-being of local community

Policies that prevent obesity and improve access to healthy foods should be developed by establishing a task force team to implement the following matters:

- Survey of incentives and barriers for executing policies (region, city land usage policy, tax incentive, etc.)
- Evaluation of merits and tasks of the local society (market size, purchase power, stability, access to public transportation method)
- Discussion on large market chains with regard to access to low-income region
- Boost of sales on health foods through strengthening of relations between local health organizations and convenience stores/grocery stores.

In addition, the following policies can be considered.

- Tax policies that can attract supermarkets to low-income areas and introduction of city land use policy
- Development of public transportation method in the city planning to improve access to supermarkets and grocery stores by residents
- Establishment of forum with several interested parties or grocery store policy committee on the local community level to enable better access to health foods, information sharing and policy suggestion
- Improve access to grocery store by improving safety through increase of patrols
- Introduction of incentives to install equipment for

grocery stores to store and sell fresh and healthy foods grains (Example: provision of subsidy or loan to buy refrigerator facility)

The factors mentioned above and other elements combined make it difficult for the residents in the low-income class areas to maintain a healthy weight. The result is the emergence of a great deal of money socially and the issues in the public health arena.

Physical conditions are generally influenced by five major factors: hereditary, social, environmental, behavioral factors, and health and medical service. The impact of medical service in reducing the early death rate is surprisingly not too big. This means that even if access to medical service is greatly improved, the decline in the early death rate is expected to be small in reality. According to several studies, the single factor that influences the promotion of physical conditions and decline of early death rate the most is known to be health behavior, i.e. the behavioral factor. About 40% of the deaths in the U.S. is influenced by the behavioral factor. Obesity and smoking covered in this study are major behavioral factors.

The most typical examples of behavioral factors are cases on cigarettes. Korea is also applying a variety of laws and regulations to decrease the harmful consequences of smoking and the government is executing price policies such as levying a health promotion tax on cigarettes. Also, a wide range of programs are in operation to help the smokers quit smoking through telephone counseling. However, the highest percentage of males smoking among OECD countries

(exceeding 40%) is becoming one of the major causes of early deaths. Smoking rate is a bigger problem among people in the relatively vulnerable socioeconomic class. Active interest and policies to find out the reason for smoking and to help the smokers quit smoking are required with the government's leadership.

Two basic strategies, namely the prevention of smoking during the teenage years and activities to help smokers quit smoking are expected to achieve the health promotion 2020 goal defined by the current Ministry of Health and Welfare. What's more important is the assistance to help smokers quit smoking. Most of the smokers have the intention to stop smoking, so it is necessary to provide support and help to increase the percentage of smokers succeeding in quitting. To do this, a variety of policies need to be carried out in harmony with price policies emphasized in this study.

Obesity will also be an important factor in reducing the problem of early death and health. Obesity and tobacco smoking have many things in common. Both begin in the teen years, and both have emerged as social issues after the 20th century. They are both bigger issues for the classes that have lower socioeconomic standing, but are handled in a relatively negligent manner compared to other health risks. Obesity and tobacco have their differences, too. For instance, there is no such thing as 'adequate smoking', but 'adequate consumption of food' is possible. Food is not addictive like nicotine. Finally, with the exception of obesity surgery, only a few prescriptions can be made medically compared to smoking.

Attempts to change policies to prevent the harmful effects

of obesity, which is on the steady increase, have been made. Examples include the following: project to improve regional-specific health behavior, NutriPlus+ project reinforcing intervention for children, Special Act on Children Eating Habit Safety Management. The project to improve regional-specific health behavior is a project allowing all those who want to put healthy lifestyles into practice that include exercise, nutrition, obesity and drink moderation free of charge. The project provides the following services: building an environment for improving health behaviors such as training and counseling by life cycle to improve health behavior, and remodeling the exercise locations, prevention-oriented services such as improvement of lifestyle habits and early detection of illnesses rather than post-treatment. The Special Act on Children Eating Habit Safety Management has been executed since 2008 in an attempt to improve the food selection of children. The policy bans sales of high-calorie, low-nutrition foods within the school zone, provision of a nutrition table, refuses sales of high-calorie, low-nutrition foods in the green food zone near the school and restriction of TV ads of such foods.⁴⁾ The NutriPlus+ project is a program providing nutrition training and specific supplementary foods to pregnant women and infants having nutrition risk factors from low-income households.⁵⁾

It is also required to adopt obesity prevention policies together with price policies on items causing obesity into consideration at great length. Strong opposition in industries stating that such tax policies are a violation of personal

4) Cho-il Kim, "OECD Health Ministers Meeting Preparation Material", mimeo, 2010.

5) *ibid*

freedom is expected and cause for much controversy, but the study to decrease consumption of carbonated beverages through taxation and to find ways to use the finances raised in activities to prevent obesity is desperately needed.

To enhance the level of public health, policies solidifying not only behavioral factors, but also all three factors - social, environmental, and health and medical service - need to be considered.

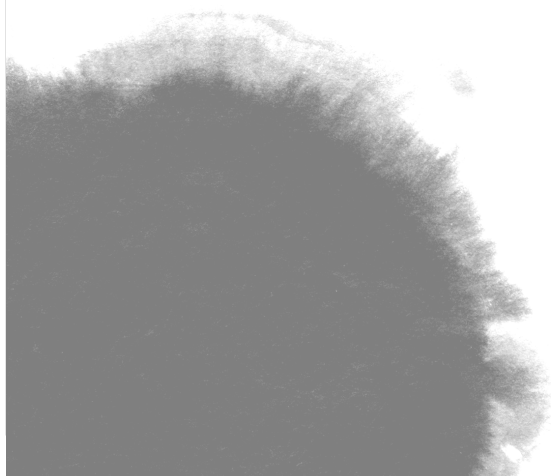
First, the social factor suggests that people in the low socioeconomic class have a shorter life expectancy and a higher percentage of people with disabilities. The socioeconomic class is determined by analyzing factors such as income, wealth, education level and housing environment. People in this vulnerable class are not provided with an environment to pick quality foods or leisure activities, so they have a higher possibility of taking actions harmful to health. If such behavior continues, the likelihood of the lifespan of the vulnerable class will become shorter. Health and medical services and actions are the major interests of policy-makers or researchers, but the 'class' is a field that makes the health and medical policy personnel to take less interest. In this regard, more studies on the correlation between social class and health standard must be carried out. More fundamentally, studies on the relationship between the several factors that influence life such as education, taxation, transportation, housing and the health standard must be conducted. As with an environmental impact assessment made for a newly built architecture, there should be a mechanism set up to ensure that a health impact assessment is made when a new taxation system is introduced. If public

policy is the culprit in widening the gap between the poor and the rich, negative effects shall certainly exist in health standards. In the case of the U.K., the Atchison Committee proposed about 39 policies covering the areas of taxation, education, income, poverty, housing and environment in an attempt to narrow health imbalances, with only three policies directly related to health and medical service. It just shows how much health standards are influenced by the society's overall conditions.

All the factors determining the level of health are mostly related to the low-income class, so strategies concentrating on the low-income class must be established in order to improve physical conditions throughout the entire nation.

06

Conclusion



CHAPTER 6

Conclusion

Establishment of a healthy society is one of the most precious goals of all the members of the society. The life expectancy of the Korean people was remarkably stretched in a short period of time and reached the level similar to the average lifespan of foreign industrialized countries, but the weak life expectancy, which translates into weak quality of life, is a task that needs to be tackled by the policy-makers.

Recently, the burden of chronic illnesses is worsening all over the world, worrying the WHO and nations around the world over the ways to respond to the serious problem. The emphasis is made on policy-making, especially in the preventive and health promotion policies. In the U.S., the importance of prevention and health promotion is included in the recently-passed medical reform bill, proposing specific action strategies.

Korea is also witnessing a rise in the incidence rate of chronic illnesses. The early death, the burden of medical cost are not only greatly influencing the entire society, but also each Korean national. The occurrence of a chronic illness is often the result of unsound lifestyle habits, and smoking, drinking, and obesity are examples of factors

harmful to health. To resolve this issue, the Korean government enacted the National Health Promotion Act in 1995 and it is actively conducting health promotion projects by defining "healthy lifestyle" as its important mission. However, it was analyzed that the 2005 medical treatment cost spent for diseases caused by smoking, drinking and obesity takes up about 24% of the total medical finances, demanding a more active policy implementation and a more effective strategy.

In this study, an analysis of smoking and obesity, two major factors harmful to health, and their impact from an economic perspective was made so as to produce the basic data required to establish policies on health promotion in the future. The analysis of the lifetime medical cost and life expectancy of smoking and obesity will enable the estimation of the impact of prevention and health promotion will have on each Korean person.

To prevent illnesses caused by smoking and obesity and to promote the health of the Korean people, policies reducing the consumption of health harming items such as tobacco and items triggering obesity and increasing the consumption and production of health foods must be considered. In the study, the policy direction focusing on cigarette price policy was discussed for smoking and the possibility of taxation for obesity-triggering products and ways to improve access of the low-income class or neglected class to health foods was emphasized.

The smoking rate of Korean males is the highest among OECD countries, but the price of cigarettes is one of the lowest. The most effective policy to decrease the smoking

population is the price policy, as suggested in many other analyses. Tobacco consumption is relatively higher in the low-income class, so it will be more difficult for the low-income class to afford tobacco if the tobacco price rises along with the price index. In other words, maintaining a passive tobacco price policy will trigger more health problems, making the burden heavier on low-income households. In the study results from analyzing strokes, the smoker's lifetime medical cost was considerably higher than non-smokers. It would be more desirable for the low-income households to develop and put into action the way to increase the price of cigarettes, reducing the smoking population among low-income households and to ensure that the revenue earned ends up in the low-income households. Furthermore, a proactive cigarette price policy is expected to effectively restrict the access of teenagers to tobacco.

Obesity is not showing a serious incidence rate in Korea compared to the industrialized countries, but the rate of increase is worrisome. In industrialized countries, a wide range of methods are in progress to cut the harmful consequences of obesity. One example of such policy is the taxation to a certain extent levied on carbonated beverages or snacks that cause obesity. In the U.S., there are efforts to make a policy where a small amount of tax, has been recently levied on carbonated drinks on the federal government level and use the money to sponsor obesity programs. It is an example of raising funds required for obesity-related policies without burdening the consumer a great deal. Korea should look into adopting such policy.

In the study, a list of foreign books and references was

introduced related to the access to health foods considering the fact that the low-income class or the neglected class is in a relatively vulnerable position when it comes to access to health foods. Although the cases focused on the U.S., it is thought that the implications to Korea are large. Policies related to obesity such as program development and implementation including exercise are important, but it is much more important to improve access of the vulnerable class to fresh vegetables or health foods.

To reduce the harmful consequences of smoking and obesity, a wide range of and comprehensive policies, moving away from a single strategy approach needs to be adopted. The high smoking population raises a bigger problem for those in the vulnerable socioeconomic class. It is also important to develop a basic strategy such as prevention of smoking in teenagers and activities to support smokers to quit smoking. What's particularly important is the activities helping smokers stop smoking. It is necessary to provide support and help for smokers wishing to quit smoking to achieve their goal. To this end, it is required that a price policy emphasized in this study needs to be implemented in harmony with other policies.

Obesity will also play an important role in reducing the issues related to early death and health. Obesity shares many similarities as well as differences with tobacco, but it is necessary to set up and put the effective ways befitting the characteristics of obesity into action. The Korean government is implementing several projects - project to improve region-specific health behavior, NutriPlus+ project, and the Special Act on Children Eating Habit Safety

Management - so as to prevent the harmful consequences of the ever-on-the-rise obesity problem. Along with these programs, it is also required to take an in-depth look at the price policy for items triggering obesity. This will lead to the reduced consumption of items causing obesity and contribute to the raising of finances required for the obesity prevention activities.

To prevent illnesses caused by smoking and obesity and to improve the level of national health, policies that solidify behavioral, social and environmental elements along with three elements of health, medicine, and service must be carried out. Considering the fact that the members of the vulnerable class with a lower socioeconomic standing have a higher risk of taking an action dangerous to health, a more careful consideration on the assignment of priorities for the people benefiting the policy is required. In other words, all determinant factors influencing the level of health are related mostly to the low-income class, so strategies focusing on the low-income bracket must be developed to enhance the physical conditions of the entire nation. More fundamentally, a mechanism allowing a health impact assessment on the relationship between the several factors influencing life such as education, taxation, transportation, and housing and the level of health must be in operation. In the future, it is expected that a study that can develop specific strategies on various and comprehensive policies shall be conducted.

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