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Master's Thesis of Public Administration

Systemic investigation of the  
prevalent diseases in vulnerable  
populations and policy implication;  
A nationwide population based  
retrospective analysis

– A comparative study of the prevalent  
diseases in the medical aid group, the patriot  
and wounded veterans groups using Korean  
National Health Insurance claims database –

취약계층 유병 질환의 체계적 조사 및 정책함의;  
전국민 기반 후향 연구 (건강보험심사평가원  
청구자료를 이용한 의료급여 및 국비보훈  
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# Abstract

Generally, socioeconomically disadvantaged populations have a different health status. Their access to medical facility and health information are more restricted than the case of the general populations. If this disparity is accumulated for decades, it can affect the mortality and diseases epidemiology. Based on these results, vulnerable groups request a different health policy for themselves. However, there are not many nationwide researches for their actual health conditions. That means that rational and proper health policy cannot be established due to absence of these data.

The Korean government has been operating a national health insurance system for about 40 years. Today, this policy covers every single person residing in Korea for a period of at least one month. Due to this system, big data on national health has been built up electronically on a large scale. National health insurance offers three types of insurance programs for (1) the general population, (2) the medical aid group, (3) the patriots and wounded veterans' groups. Among them, the medical aid group, patriots and wounded veterans groups could be defined as vulnerable population. Until now, there is no research on epidemiology and medical expense of vulnerable groups through nationwide health big data. Thus, the current dissertation conducts research on the frequency of each disease in vulnerable groups through big data analysis. This research can suggest more elaborate health policy for the vulnerable groups.

The health status of the last two groups was markedly different from the general population. The frequency of inflammatory infectious disease observed as the most common disease in general population decreased, and senile disorders such as chronic medical illness generally increased in vulnerable populations. Furthermore, the most common five diseases group in patriots and wounded veterans group were totally different;

hypertension, benign prostate hyperplasia, diabetes mellitus, gingivitis and periodontitis, and angina pectoris. With regard to medical expenses, the largest part of the budget was spent on the musculoskeletal disease group in the general population. Secondly, mental disorders such as schizophrenia and dementia consumed the largest portion in the medical aid group. Thirdly, chronic medical illnesses such as diabetes mellitus, angina pectoris, chronic kidney disease are the major medical expense items in patriots and wounded veterans. This situation might be due to the ageing phenomenon within the veterans' group. Regarding differences in the health status between the three groups, they require delicate health policies such as the expansion of health security system, health care delivery system based on integrated primary complex intervention, mobile health and home care based on the high-tech technology, the globalization of health care policy, sustainable finding of the neglected class.

The present study has the following limitation; We could not control other independent variable such as age, sex, chart review and laboratory findings. Moreover, we excluded non-insurance coverage health care and extreme poverty groups. Uncertainty of entered diagnostic codes could be another limitation because of health insurance coverage system. However, this study is the first big data study of the nationwide population based on retrospective analysis about the frequency of diseases in vulnerable groups. Thus, as the complete enumeration, it offers higher reliability and validity in comparison to single or multi - center sample studies. Henceforth, it provides fundamental information for more practical study founded on social class and each specific disease.

**Keyword : Big data, Epidemiology, National Health Insurance, Vulnerable groups**

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# Chapter 1. Introduction

## 1.1. Health care as public policy.

Health care as public policy always has been on a complex and controversial field. Furthermore, the gravity of health care has being of great importance in all developed countries. Health issue such as aging phenomenon, development of new technology, increasing medical expense, complicated health insurance system, the inequality of medical service, who has the responsibility of medical source, make itself the top of public agenda. However, the solutions of each nation are far different, even between the developed countries.

Regarding the universal demand of the health problem, simply disbursing budget more from the personal pocket, the treasury or the enterprise cannot improve the health issue. If not, what could be the best selection for the health problem across diverse approaches? Also, these days, health discrimination among social class is becoming a sensitive topic on executing health policy ecumenically.

Health care policy like other public policy can be categorized as four types of policy; regulatory, distributive, redistributive, constituent policy (Lowi, 1972). For example as regulatory health policy, approval of new drug, licensing requirement, restriction on medical practice is encompassed in this part. Second, medical education, supply of public health service and health promotion activity conforms to distributive health policy. Third, redistributive health policy is relevant to the inequality of health issues. So, this policy tends to transfer health resource from healthy to non-healthy nationals. Government has the responsibility to redistribute general revenues for the poor, the elderly, children and veterans. So, this dissertation analyses the health difference and trends across social class in Korea, and will focus on health redistributive policy to resolve this gap.

## **1.2. The inequality of health problem across social classes.**

Socioeconomic disparity can induce the inequality of health status. Because the income or health information gap has an impact on person's nutrition, housing, health habits and health care. Also, health risk behavior, education and income is well-known factors affecting increasing mortality. As a result, this disparity developed different kinds of diseases for vulnerable populations, such as mental illness, drug addiction, infectious diseases and physical trauma (Breakey et al., 1989). Even though this discrimination about health problems would not show immediately after the socioeconomic gap appears, it takes usually from 5 to 12 years (a peak at 7 years) to affect mortality risk (Zheng, 2012).

## **1.3 Ageing phenomenon**

The proportion of population aged 65 and over was increasing during the last 50 years and will increase over the next 30 years in almost every country (Table 1). This is called as ageing phenomenon. And there are several causes for this situation. First, the decline of the birth rate since 1970s. After World War II, a sharp increase of birth rate produced a baby boom generation. However, after this generation was educated about birth control and reaching the retiring age, the proportion of the elderly has been increased. Second, the life expectancy increased as well. This results from the reduced infant mortality, improved health education and habit, the developed medical technology. Third, the regional gap in the age-structure of population has been aggravated in Korea. Because, the young generation tend to live in urban.

[Table 1] The proportion of population aged 65 and over (Data from OECD 2009)

	1960	1980	1990	2000	2020	2030	2040	2050
Australia	8.5	9.6	11.1	12.4	18.3	22.2	24.5	25.7
Germany	11.5	15.6	14.9	16.4	22.7	27.8	31.1	31.5
Japan	5.7	9.1	12.1	17.4	29.2	31.8	36.5	39.6
Netherland	9.0	11.5	12.8	13.6	19.8	23.4	25.0	23.5
New Zealand	8.7	9.7	11.2	11.8	16.7	21.1	23.8	24.6
Singapore	n/a	4.9	6.0	7.0	18.5	21.0	26.0	27.3
Sweden	11.8	16.3	17.8	17.3	21.1	22.8	24.0	23.7
Taiwan	n/a	5.8	6.2	8.6	13.6	24.0	31.8	33.0
UK	11.7	15.0	15.7	15.8	19.0	21.9	23.7	24.1
USA	9.2	11.3	12.5	12.4	16.3	19.7	20.4	20.7

Though the ageing phenomenon is not a social ill by itself, it has been linked to a lot of social issues. First, increased health care cost could be a burden to the young generation. Because those over 65 and older is a big user for health expenditure, especially population aged 80 and over is the heaviest consumer of health care. So, this is inevitably associated not only with health funding problems, but also a type of health care focused. Second, this financial burden could affect the persisting low fertility rate in young people of childbearing age. Naturally, many factors are affecting the low birth rate. However, ageing phenomenon could one of these social factors. Because the increased social health insurance charge can reduce a disposable income of the childbearing generation. Third, the imbalance of gender ratio could be resulted from the increased proportion of elderly women. Generally, the life expectancy of women is from 5 to 10 years higher than that of man. This phenomenon is not making a visible social problem right now, but it induced a point to be considered in health policy making. Fourth, the employment rates and social productivity would be decreased due to a shrinking workforce.

## 1.4 Health supporting policy for vulnerable groups under the present circumstances

Most of countries worldwide have their own health supporting program for medically poor groups according to their cultural, economic and social situations. Korean Ministry of Health and Welfare is running health supporting program as well. Selection criteria for whom acquired medical aid is as follows.<sup>①</sup>

- 1) People who cannot work and get any salary or have wage below 661,172 won per person and month (July, 2017).
- 2) People who have rare and intractable diseases or severe cancer.
- 3) Homeless
- 4) The victims from natural disasters
- 5) The martyrs or wounded persons for the righteous cause
- 6) North Korean refugees
- 7) People who has an intangible cultural treasure

After these persons are registered as whom subject to medical aid, their medical expense is discounted and the hospital can get this charge from the government instead. For example, most of hospital bills are set at a price for free and doctor's consultation fee is set from 1,000 to 2,000 won per single visit. Furthermore, the detailed types of rare intractable diseases and cancers are settled by the Minister of Health and Welfare's enforcement ordinance.

For the patriot and wounded veterans' group, Korean government has its own health supporting program. In Korea, there are 5 veterans hospital in Seoul, Busan, Daejeon, Gwangju and Daegu. Besides, another hospital is under construction in Incheon (completion by 2018). The qualifications of patriot and wounded veterans are decided by the Minister of Patriots and Veterans Affairs

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<sup>①</sup>Webpages of Ministry of Health and Welfare.  
([http://www.mohw.go.kr/front\\_new/policy/index.jsp?PAR\\_MENU\\_ID=06&MENU\\_ID=063503&PAGE=1&topTitle=의료급여](http://www.mohw.go.kr/front_new/policy/index.jsp?PAR_MENU_ID=06&MENU_ID=063503&PAGE=1&topTitle=의료급여))

and are as follows. <sup>②</sup>

- 1) The patriot for Korean independence from Japan in early 20<sup>th</sup> century
- 2) Wounded soldiers, firemen and polices due to their duty
- 3) War veterans
- 4) 5.18 patriotic martyrs
- 5) Vietnam war veterans damaged by agent orange
- 6) A man of merit from the special assignment
- 7) A discharged soldier who serve more than 10 years

If these people use the veterans hospital, their medical expense is discounted from 50 to 100 % according to their grade. Their grade is divided to seven classes by their disease severity. This severity is fixed by the committee of physicians who work for veteran hospital. Also, if they use other hospitals rather than a veteran hospital, they can ask to have their expense reimbursed by a branch office of Ministry of Patriots and Veterans Affair.

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<sup>②</sup>Webpage of Ministry of Patriots and Veterans Affair.  
(<http://www.mpva.go.kr/support/support111.asp>)

## 1.5 Purpose of the Research

Socioeconomically disadvantaged class people such as the medically poor group or the wounded veterans and patriot groups are suffering from many categories of diseases. However, their diseases differ markedly from diseases of the general population. So, I will investigate the frequency of each disease and medical expense in the vulnerable group through health big data analysis and suggest a more appropriate health policy for them. The present subject of research as follows.

- 1) The fifty frequent diseases of (1) the general population, (2) the medical aid group, (3) the patriots and wounded veterans groups show the different prevalence.
- 2) Total medical expenses of three groups also show the different patterns.
- 3) The variable patterns of major diseases over five years will be compared in three groups.
- 4) According to socioeconomic class, a differentiated service and policy should be implemented for their prevalent diseases and total medical expenses.

## 1.6 Research Questions

Most of person can ideologically think that vulnerable populations are more exposed to the high risky health circumstances such as nutrition, inappropriate health habit, poor access to medical facility, the ignorance of health information and economic affordability. So, many of scholars are trying to reveal the factor and result of this phenomenon. Because most of health expenditure is consumed by this population. Also, health policy makers tend to focus their policy plan on this population to decrease the health status gap between vulnerable population and general population.

Until now, many investigations are performed in a detailed disease group of a sample group. However, a large scaled study based on whole nation or international coordination should be required for more integrated health policy. Fortunately, Republic of Korea is running one of a biggest National Health Insurance (NHI) system. It means that it can offer an integrated health information for the qualified investigator and NHI started to open their information from 2014. Furthermore, NHI divided whole population to three groups; 1) general population, 2) medical aid group, 3) patriots and wounded veterans group. In this classification of social class by NHI, I can study the actual health information for the last two groups considered as vulnerable populations. In the context of this database, the present study has been planned to investigate the gap of health status between three groups. Therefore, research questions of this study are as follows;

- 1) What is the difference of the prevalent diseases in three groups over all residents living in Korea?
- 2) How much of medical expenditure is consumed for each disease in three groups in Korea?
- 3) What is the emerging health problem over last 5 years in Korea?
- 4) What type of the detailed health policy should be though for vulnerable populations?

## 1.7 Hypothesis of the Research

The diverse social classes exist in the nation. Each of social class has different epidemiologic features and health status. Especially, vulnerable populations such as medical aid group, patriots and wounded veterans group take the biggest part of health expenditure. So, the systemic investigation of the prevalent diseases and medical expense in each class should be done to improve health status of vulnerable populations before the detailed health policy enforcement. Regarding the different health status and policy implementation in each social class, this study was performed with the following hypothesis of the research.

- 1) “The diverse social class would lead to the different prevalent diseases, medical expenditure and change pattern of endemic illness in each group.”
- 2) “The systemic investigation of the different health status in each class should be proceed to the detailed health policy for vulnerable populations.”



## Chapter 2. Literature review

### 2.1 Comparative health policy

Before entering into the detail, we have to tell the difference of meaning between health policy, health care policy and health care politics. Health policy is generally performed by government. And it would overlaps with other policy, such as employment, population control, economic and social welfare. So it could be every action influencing health implication in a broad sense of word. Health care policy is more specialized term in policy implementation process, that directly affects on supply or governance of health service. Lastly health care politics is the interactions of policy maker and multiple health-related groups. This politics could be very local-specific according to their own cultural, historical, economic and social state.

During last decades, comparative policy analysis has grown up. The comparative perspectives are widely useful for policy study and cross-countries or society comparison (Clasen, 1999). Comparative health policy tries to reveal the similarity or differences in various policy making and implication among several countries. Therefore, it affords a source of public health policy generalization. For cross-social class comparative health policy, baseline data should be examined and accumulated first. Besides, it can show what factor is truly critical or not through investigation of international or cross-society experience. As well, one factor thought as crucial factor often show divergent outcomes or militate against health care policy in other countries or society due to political and customary difference. Policy makers should decide what does work or not in context of cross-cultural perception. Considering the complexity of health care system, comparative health policy across various social class or countries can prove the evidence to elucidate the cause and effect of the difference.

## 2.2 Categorization of health care system

Health care policy decision is political matter. In this process, the formal institution, informal institution, tons of interest groups, political parties, individual government official and politicians are intermingled each other, so that their decision give diverse advantages and disadvantages to various groups in their nation. They try to tailor their ideal model for health care system depending on the national cultural, historical, political and geographical characteristics. To understand a complex health care system, it requires to simplify typologies of health care system.

Organization for Economic Co-operated and Development (OECD) categorized health care system by main agent of health service provision and funding (OECD, 1987;24). Both extreme models are operated by free market system or government monopoly. Between these two systems, three types of insurance system exist; 1) private insurance, 2) social insurance, 3) national health service. First, private insurance system is determined by employee or employer to hold private insurance company or private hospital, which is observed in USA. The intervene of government is limited to do only the restriction on moral hazard or imposture. However, it has a weak point that cannot cover the vulnerable groups such as the poor, the elderly or veterans. Second type is the social insurance system based on a concept of social unification. Generally insurance charge is shared by employee and employer through non-profit public national insurance institution. Although the provision of health service depends on private health establishment, the pricing of medical service is under the national control except high-tech new technology or cosmetic purpose. A representative sample of nations are Korea and Taiwan. The third type is the national health service. The typical model is identified in the United Kingdom and New Zealand. A majority of people can access open-ended health service. Also the provision, delivery, distribution is controlled by state. However, the bureaucratization and delayed service of health care system could be one of drawback.

## **2.3 The introduction of the Korean National Health Insurance system.**

The Korean government runs one of the biggest national health care systems worldwide. This National Health Insurance (NHI) has been covering almost every single person living in Korea since 1999 (Song et al., 2014). This service is mandatory and compulsory for every person living more than 1 month in Korea (n=51,744,948, July, 2017). Also, it provides different tracks of medical registration services for vulnerable populations in both the medical aid and wounded veterans' groups. It means that NHI has a large collection of medical information including all about medical facilities, expenses, claims, medications and others with regard to the vulnerable groups. Recently, the NHI began to offer this database to qualified researchers and scientists from 2015. So, we conducted a nationwide retrospective analysis of health information through the NHI database in vulnerable populations.

## **2.4 Emerging financial problem in the health care**

Although variable health care systems exist in each nation, there is one biggest common problem in worldwide health care systems. That is an increasing health expenditure in a percentage of their gross domestic product (GDP). Every country, regardless of their own political, cultural, social and economic transformations, is facing a struggle in the funding, delivery and provision of health care financing (Table 2). It means that the increasing rate of health costs is overrunning the rate of total economic growth. However, the growing health care expense is not the problem by itself. The problem is that excessive spending on health care can result in a dilemma of the opportunity cost for other problems such as education, social welfare, the gap between rich and poor and eco-friendly industrial policy. Also, the growing demand for health care services is associated with the continuous shortage of health workforce, so

that this phenomenon induced imbalance and maldistribution of health personnel worldwide (Buchan et al., 2013). Ageing phenomenon and rapid progress of health technology is aggravating this financial problem.

[Table 2] Increasing health expense in a percentage of GDP (Data from OECD 2008a, 2012, 2016)

	1990	2000	2005	2015	%change
Australia	6.9	8.3	8.8	9.3	2.4
Germany	8.3	10.3	10.7	11.1	2.8
Japan	6.0	7.7	8.2	11.2	5.2
Netherland	8.0	8.0	9.2	10.8	2.8
New Zealand	6.9	7.7	8.9	9.4	2.5
Singapore	2.8	n/a	3.8	4.6	1.8
Sweden	8.2	8.2	9.2	11.1	2.9
Taiwan	5.5	5.9	6.3	6.9	1.4
UK	6.0	7.2	8.2	9.8	3.8
USA	11.9	13.2	15.2	16.9	5.0

Another big feature in 21<sup>st</sup> century health expenditure is that the majority of budget is concentrating on the minority of patients. Generally, the top 1 % of patients is spending over 20% of the health expenditure, the top 5 % of patients is over 50% and the top 10% is over 70% of budget (Bor et al., 2017). This situation is not limited USA. It can be observed in diverse countries such as Canada, Japan, Taiwan and New Zealand. We can think that anyone of us could be ill and injured seriously. So that this circumstance is the natural phenomenon resulted from the concept of social safety net. However, the problem is that those people who spend most of health budget are not replaced year by year and tend to be chronically ill. In other words, the elderly and people in high-risk action or a congenital disease, these two groups are the biggest high user of health expenditure. For example, persons over 65 years old are comprising of about 14.7% of USA total population. They occupied the 43.9% of total health expenditure in 2013

(Cohen., 2015). As a result, the control of high-need and high-cost patients is the most important factor for health policy implication.

## **2.5 The features of health information in medically poor group.**

Generally, health information of vulnerable populations is difficult to acquire for analytic purpose. For instance, more than 5,000 persons are assumed becoming homeless every year in Korea (Yoon et al., 2011). This number is increasing due to soaring numbers of single-households and other socioeconomic factors. Homeless have a limited accessibility to medical facilities, and no registered official health number. Namely, their overall health information could not be estimated in official statistic calculations. Because of this, they could be easily ignored in aspect of health policy-making (Larimer et al., 2009). But, the mortality rate of homeless is 3 times higher than general population and their life expectancy is measured to be 42 to 52 years (Hwang, 2000). Furthermore, these severities of homelessness can actually provide more significant health information and a specialized experience to medical staffs compared to the general population. That is why policy makers and health experts should not abandon this population.

## **2.6 Actual health and socioeconomic conditions of patriots and wounded veterans in Korea**

Military service in Korea is mandatory for about 2 years for every man who holds Korean nationality except the handicapped or the destitute. Historically, Korea suffered two major wars (Korean war and Vietnam wars). During this period, many soldiers were injured and registered as disabled veterans. Besides, their aging phenomenon is inducing more health problems in accordance with flow of time. Also, elderly veterans are exposed to homelessness about two times more than elderly nonveterans in poverty (9% vs

4 %) (van den Berk–Clark and McGuire, 2013). Above this, even in a cease–fire situation between South and North Korea, many young South Korean soldiers become hurt or disabled during military exercises. Such injuries raise mental, physical and behavioral health problems for them. However, these people are social minorities and it is hard to satisfy their medical and social demand. So, wounded veterans and patriots could be one of a vulnerable population. Therefore, it should acquires another epidemiologic insights for impact of service on mental, physical behavioral health (Gaziano et al., 2015).

# Chapter 3. Materials and Methods

## 3.1 Data source and study design

We performed the study through the NHI claim database. Among this database, we collected the number of patients, the frequency of treatment, total medical expenses according to diagnostic codes of the International Classification of Diseases, Tenth revision (ICD-10) codes in study populations visited to every hospital from 2012 to 2016 in Korea (Bramer, 1988). These diagnostic codes are classified according to four digits such as K1234. However, we combined similar diseases having the same last two digits into one category, such as K12 for purposes of statistical convenience. Henceforth, we select and categorize these codes into the one representative diagnosis.

## 3.2 Study populations

The NHI system divided the whole population into three groups. The first group is composed of the general population who pays the medical insurance charge. The second group is comprised of the medical aid group (persons subject to medical care) who cannot socioeconomically afford an insurance fee. The third group is from the patriots and wounded veterans group. For this study, we compared data of the three groups with each other.

Who is eligible for being persons subject to medical care? Generally, persons getting basic living subsidies from government can be categorized as the similar population of second medical aid group of persons subject to medical care. Their qualification is decided according to the minimum income fixed by the Minister of Health and Welfare. Furthermore, the natural disaster victims, homeless, adoptee under 18 year old and North Korean refugee are eligible for medical care. For the third group, the patriots and wounded veterans are designated after the approval of a

qualification screening committee appointed by the Minister of Patriot and Veterans Affairs.

### **3.3 The frequency of each disease and a comparison with a general population**

The NHI offers big data on the frequency of each disease in the general population on their website.<sup>③</sup> However, we requested three groups' frequent diseases from all patients' visits from 2012 to 2016 through the public data portal site.<sup>④</sup> Henceforward, we compared the general population's data to the health database of the last two groups we collected. And, we analyzed the variable patterns of six significant diseases for 5 years in those three groups. We divided the first two groups by their ratio to the veterans group as the latter group had the smallest population. Because, there was a big difference between the total numbers of the three groups' population.

### **3.4 A comparison of each group's total medical expenses**

We asked the required medical expense of each disease during the same period in the same manner. Afterwards, we conducted a comparison of these big data sets between the three groups. Again, we equally divided the proportion of each disease in each group, and compared and divided by the ratio of three groups for equal comparison.

### **3.5 Statistical analysis**

This study is based on a descriptive statistics through a complete

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<sup>③</sup>Webpage of National Health Insurance Corporation.  
(<http://opendata.hira.or.kr/home.do#none>)

<sup>④</sup>Webpage of National public data portal site.  
(<https://www.data.go.kr/main.do>)



enumeration survey rather than inferential statistics. Top 50 most common diseases are presented for three groups. The rankings are based on the number of patients diagnosed with disease. Statistical verification is not requested for analysis. However, as the total population of the three groups was expected to show a great difference, we divided the number of the largest two populations by the ratio to the smallest group for comparison of 5 year changing pattern of prevalent diseases. All statistical analyses were performed using SAS 9.0 (SAS Institute Inc., Cary, NC, USA).

## Chapter 4. Results

### 4.1 The prevalent diseases of the general population

The frequent diseases, number of patients, number of visits to the hospital, and total required medical expenses from rank one to fifty diagnosis are presented in table 1. These data came from the general population in 2016 by extracting the whole population data from the national health insurance in Korea. Therefore, original data contained ranks up to 1,724<sup>th</sup>. However, we targeted the upper 50<sup>th</sup> diseases due to enormous amount of information. Most common diagnosis is acute bronchitis (n= 16,432,021) followed by gingivitis and periodontitis (n=14,196,044), radiculopathy and lower back pain (n=7,917,695), rhinitis (n= 7,917,695) and tonsillitis (n=6,471,869). Moreover, the number of patients in each disease group is presented in figure 1. Usually infectious inflammatory diseases such as acute bronchitis, rhinitis, upper respiratory infection were taking up the largest proportion. The second most common patients were comprised of dental diseases such as gingivitis, periodontitis and dental caries. The third common diseases were musculoskeletal diseases groups like radiculopathy, lower back pain, lumbar sprain and Rotator cuff syndrome.

[Table 3] The prevalent diseases, number of patients, number of visit and total medical expense in the 2016' s general population

Rank	Diagnosis	No. of patients (1,000 persons)	No. of visit (1,000 visits)	Total medical expense (1,000 won)
1	Acute bronchitis	16,432	57,868	894,434,894
2	Gingivitis, Periodontitis	14,196	28,926	1,114,259,727
3	Radiculopathy, Lower back pain	7,917	47,552	1,172,818,720
4	Rhinitis	7,914	19,600	313,999,910
5	Tonsillitis	6,471	13,284	239,574,208
6	Upper respiratory infection	6,323	12,858	209,277,358

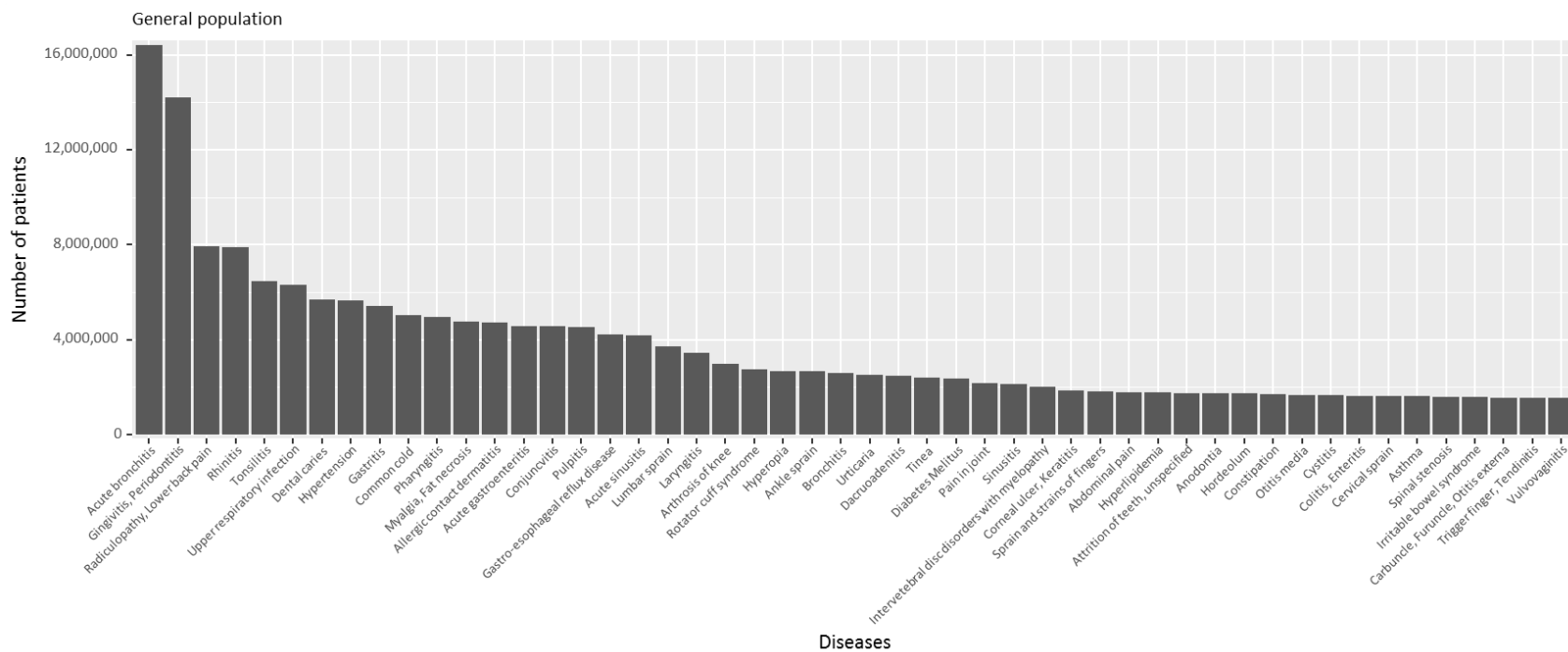
7	Dental caries	5,687	9,458	331,480,083
8	Hypertension	5,651	42,039	841,263,996
9	Gastritis	5,438	10,154	232,128,751
10	Common cold	5,023	11,005	157,996,396
11	Pharyngitis	4,964	10,226	166,138,710
12	Myalgia, Fat necrosis	4,754	16,792	371,949,119
13	Allergic contact dermatitis	4,710	9,471	143,310,910
14	Acute gastroenteritis	4,585	7,489	367,880,858
15	Conjunctivitis	4,577	7,883	141,791,001
16	Pulpitis	4,517	15,843	591,125,576
17	Gastro-esophageal reflux disease	4,201	9,281	237,353,848
18	Acute sinusitis	4,185	11,230	176,224,904
19	Lumbar sprain	3,721	13,875	410,151,233
20	Laryngitis	3,444	6,896	108,983,546
21	Arthrosis of knee	2,979	20,892	1,167,961,990
22	Rotator cuff syndrome	2,745	14,232	530,877,565
23	Hyperopia	2,684	3,695	119,199,536
24	Ankle sprain	2,671	8,614	275,423,873
25	Bronchitis	2,593	5,241	115,749,519
26	Urticaria	2,528	4,999	97,353,063
27	Dacryoadenitis	2,471	4,599	106,836,758
28	Tinea	2,391	5,343	76,776,888
29	Diabetes Mellitus	2,373	16,929	554,721,566
30	Pain in joint	2,161	7,986	197,436,642
31	Sinusitis	2,123	5,980	154,509,632
32	Intervetebral disc disorders with myelopathy	2,018	11,646	635,617,601
33	Corneal ulcer, Keratitis	1,850	3,520	71,937,166
34	Sprain and strains of fingers	1,821	4,711	132,262,019
35	Abdominal pain	1,789	3,029	146,211,408
36	Hyperlipidemia	1,780	5,587	116,491,119
37	Attrition of teeth, unspecified	1,750	2,638	117,261,018
38	Anodontia	1,740	3,144	71,893,683
39	Hordeolum	1,724	2,928	59,737,996
40	Constipation	1,689	2,893	83,985,829

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41	Otitis media	1,655	6,926	133,987,240
42	Cystitis	1,645	3,792	91,123,706
43	Colitis, Enteritis	1,621	2,301	57,131,026
44	Cervical sprain	1,619	4,792	134,457,547
45	Asthma	1,615	4,840	141,242,900
46	Spinal stenosis	1,602	10,531	544,503,804
47	Irritable bowel syndrome	1,576	2,536	88,383,334
48	Carbuncle, Furuncle, Otitis externa	1,553	3,518	53,906,921
49	Trigger finger, Tendinitis	1,541	4,388	126,052,461
50	Vulvovaginitis	1,538	3,036	68,365,364

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[Figure 1] Total number of patients in the 2016's general population



## 4.2 The prevalent diseases of the medical aid group

The frequent diseases, number of patients, number of visit and total required medical expense from the medical aid group in 2016 are shown in table 2. Also, we investigated the top 50th diseases as well. Most common diagnosis were acute bronchitis (n= 501,234) followed by gingivitis & periodontitis (n=382,370), radiculopathy & lower back pain (n=376,281), hypertension (n=319,621) and gastritis (n=235,204). Also, number of patients of each disease are presented in figure 2. Like general population, infectious inflammatory diseases such as acute bronchitis, rhinitis, upper respiratory infection were taking up largest proportion. The second most common patients were comprised of dental diseases such as gingivitis, periodontitis and dental caries. The third common diseases were musculoskeletal diseases like radiculopathy, lower back pain, spinal stenosis, Rotator cuff syndrome.

[Table 4] The prevalent diseases, number of patients, number of visit and total medical expense in the 2016's medical aid group

Rank	Diagnosis	No. of patients (1,000 persons)	No. of visit (1,000 visits)	Total medical expense (1,000 won)
1	Acute bronchitis	501	1,683	31,839,209
2	Gingivitis, Periodontitis	382	872	29,167,713
3	Radiculopathy, Lower back pain	376	3,537	105,409,100
4	Hypertension	319	2,614	85,965,001
5	Gastritis	235	592	14,772,674
6	Arthrosis of knee	226	2,003	111,454,055
7	Rhinitis	225	581	10,149,256
8	Myalgia, Fat necrosis	220	1,139	33,721,531
9	Allergic contact dermatitis	186	485	7,461,825
10	Upper respiratory infection	184	408	7,347,100
11	Diabetes Mellitus	182	1,505	88,146,724
12	Gastro-esophageal reflux disease	174	525	15,154,027

13	Dental caries	169	314	11,581,459
14	Common cold	162	382	5,629,403
15	Tonsillitis	162	350	6,987,825
16	Conjunctivitis	153	327	6,872,909
17	Pulpitis	151	567	19,475,797
18	Spinal stenosis	147	1,343	74,494,304
19	Acute gastroenteritis	146	269	27,583,062
20	Rotator cuff syndrome	129	865	31,739,199
21	Lumbar sprain	123	595	19,965,093
22	Pharyngitis	121	257	4,450,891
23	Intervetebral disc disorders with myelopathy	120	1,203	52,916,119
24	Dacryoadenitis	118	289	8,602,830
25	Tinea	117	295	4,367,886
26	Pain in joint	111	539	16,840,736
27	Bronchitis	109	271	9,667,145
28	Acute sinusitis	99	259	5,510,278
29	Laryngitis	95	222	3,877,677
30	Constipation	92	222	7,056,021
31	Ankle sprain	91	337	11,331,607
32	Urticaria	89	212	4,068,914
33	Toothache	88	319	87,910,060
34	Spondylosis	87	676	26,420,218
35	Hyperopia	85	131	5,031,526
36	Schizophrenia	82	985	442,232,802
37	Asthma	80	330	17,168,116
38	Abdominal pain	79	164	9,417,426
39	Arthritis	79	371	12,319,768
40	Hyperlipidemia	77	277	6,992,788
41	Depressive disorder	73	570	54,899,189
42	Corneal ulcer, Keratitis	73	178	4,596,046
43	Dementia in alzheimer's disease	69	488	308,897,645
44	Benign prostate hyperplasia	68	382	12,534,493
45	Osteoporosis	67	260	9,363,688
46	Cataract	67	251	27,138,554
47	Cystitis	67	181	5,952,202

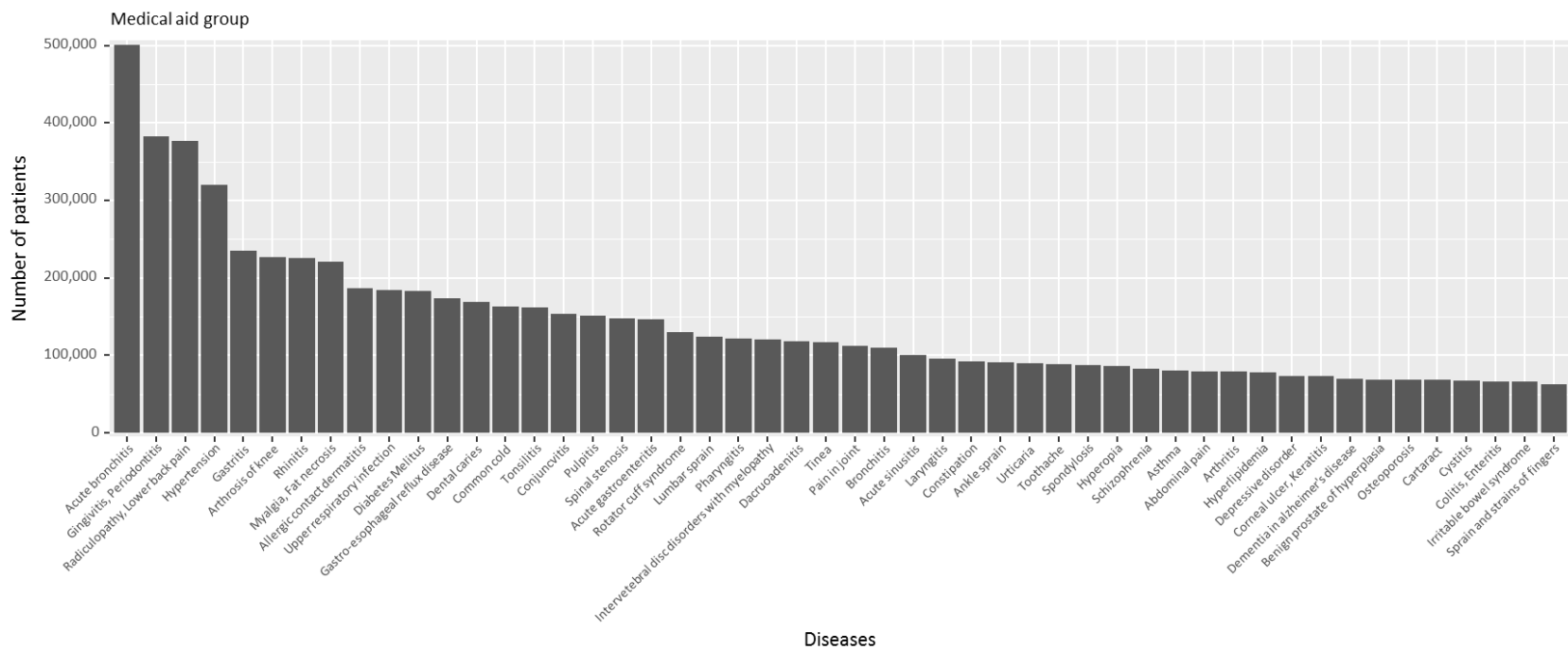
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48	Colitis, Enteritis	66	118	4,224,866
49	Irritable bowel syndrome	66	139	4,472,850
50	Sprain and strains of fingers	62	191	5,689,695

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[Figure 2] Total number of patients in the 2016's medical aid group



### 4.3 The prevalent diseases of the patriots and wounded veterans group

The frequent diseases, number of patients, number of visit and total required medical expense from the patriots and wounded veterans group in 2016 are shown in table 3. Also, we selected the top 50th diseases. Most common diagnosis were hypertension (n=30,113) followed by benign prostate hyperplasia (n=26,200), diabetes mellitus (n=21,976), gingivitis & periodontitis (n=20,219), and angina pectoris (n=14,116). Also, number of patients of each disease was presented in figure 3. Generally chronic cardiovascular diseases such as hypertension, angina pectoris, and hyperlipidemia were taking up the largest proportion. The second most common patients were comprised of urologic problem such as benign prostate hyperplasia and prostate cancer. The third common disease groups were dental diseases like gingivitis, periodontitis, toothache and dental caries. The fourth common disease group was ranked by musculoskeletal diseases like spinal stenosis, arthrosis of knee, intervertebral disc disorder with myelopathy, radiculopathy and lower back pain.

[Table 5] The prevalent diseases, number of patients, number of visit and total medical expense in the 2016's patriots and wounded veterans group

Rank	Diagnosis	No. of patients (1,000 persons)	No. of visit (1,000 visits)	Total medical expense (1,000 won)
1	Hypertension	30	139	6,818,068
2	Benign prostate hyperplasia	26	114	7,454,395
3	Diabetes Mellitus	21	130	11,581,221
4	Gingivitis, Periodontitis	20	48	1,350,067
5	Angina pectoris	14	60	10,756,587
6	Spinal stenosis	10	55	6,389,017
7	Cataract	10	27	2,109,337
8	Dacryoadenitis	10	27	1,194,286
9	Arthrosis of knee	8	40	4,609,643

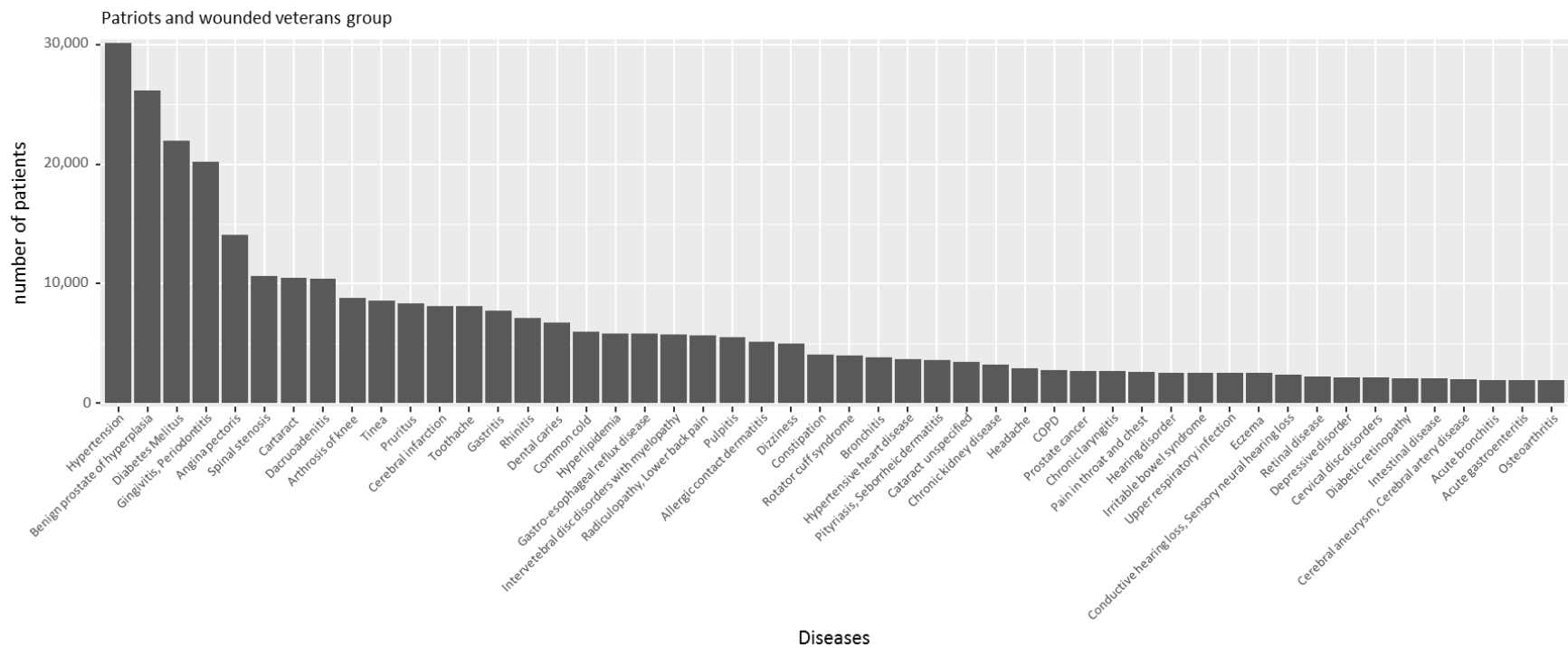
10	Tinea	8	22	628,250
11	Pruritus	8	23	843,446
12	Cerebral infarction	8	42	6,099,536
13	Toothache	8	26	8,235,495
14	Gastritis	7	21	1,408,584
15	Rhinitis	7	19	850,467
16	Dental caries	6	19	538,032
17	Common cold	5	13	435,307
18	Hyperlipidemia	5	20	961,145
19	Gastro-esophageal reflux disease	5	18	1,168,681
20	Intervetebral disc disorders with myelopathy	5	42	3,209,532
21	Radiculopathy, Lower back pain	5	30	1,407,215
22	Pulpitis	5	16	610,512
23	Allergic contact dermatitis	5	13	434,753
24	Dizziness	4	14	985,335
25	Constipation	4	9	665,992
26	Rotator cuff syndrome	3	19	1,947,008
27	Bronchitis	3	9	387,027
28	Hypertensive heart disease	3	13	724,985
29	Pityriasis, Seborrheic dermatitis	3	12	297,160
30	Cataract unspecified	3	6	439,607
31	Chronic kidney disease	3	32	10,296,198
32	Headache	2	8	493,575
33	Chronic Obstructive Pulmonary Diseases	2	12	1,886,320
34	Prostate cancer	2	18	3,227,387
35	Chronic laryngitis	2	7	361,563
36	Pain in throat and chest	2	7	712,939
37	Hearing disorder	2	8	344,624
38	Irritable bowel syndrome	2	6	503,135
39	Upper respiratory infection	2	5	182,814
40	Eczema	2	7	204,752
41	Conductive hearing loss, Sensory neural hearing loss	2	6	727,504
42	Retinal disease	2	7	573,006
43	Depressive disorder	2	11	721,484
44	Cervical disc disorders	2	16	1,159,720

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45	Diabetic retinopathy	2	7	390,525
46	Intestinal disease	2	4	953,590
47	Cerebral aneurysm, Cerebral artery disease	2	7	1,111,461
48	Acute bronchitis	1	4	204,102
49	Acute gastroenteritis	1	3	632,802
50	Osteoarthritis	1	7	623,355

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[Figure 3] Total number of patients in the 2016's patriots and wounded veterans group



## 4.4 A comparison of each group's frequent diseases in 2016

We visualized the common diseases of three groups by the word cloud format (Figure 4). The third common disease of the general population was same as the medical aid group. However, each component of infectious inflammatory diseases showed the difference between two groups. For example, rhinitis and tonsillitis were ranked at 4<sup>th</sup> and 5<sup>th</sup> in the general population. But these two diseases were placed at 7<sup>th</sup> and 15<sup>th</sup> in the medical aid group. Also, in musculoskeletal diseases, each disease showed different ranks between the two groups. For instance, spinal stenosis and Rotator cuff syndrome were in the lower rank in general population (46<sup>th</sup> and 22<sup>nd</sup>). While these two diseases were more frequent in medical aid group (28<sup>th</sup> and 20<sup>th</sup>). Discriminately, the most common five diseases in the patriots and wounded veterans group were totally different from the former two groups except gingivitis and periodontitis. Also each component of disease groups presented different patterns.

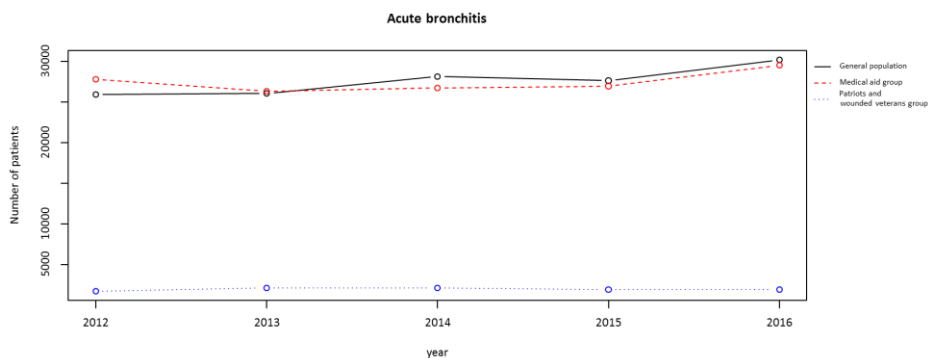


## 4.5 The variable patterns of significant diseases over five years

The ratio of three group's patient population is about 545:17:1. It means that total patient demographics was integrated with about 96.80% of the general population, 3.02% of the medical aid group and 0.17% of the patriots and wounded veterans group. For more accurate comparison with veterans group, we divided general population's patient number by 545 and medical aid group by 17. Then, we chose six meaningful typical diseases to compare the changing patterns of patient's number over 5 years in each group.

At first, acute bronchitis was the most common disease in the general population and the medical aid group. It showed almost the same prevalence in both groups. However, it was ranked at 48<sup>th</sup> in patriots and wounded veterans group. Also, this disease did not show considerable change in three groups for 5 years (Figure 5A).

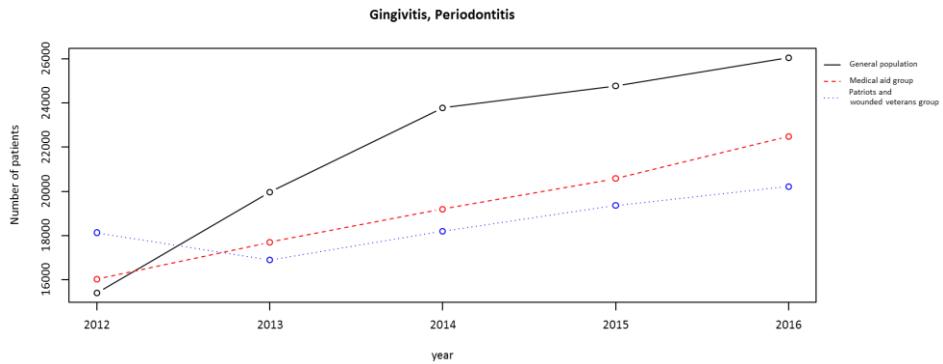
[Figure 5A] The variable patterns of acute bronchitis for 5 years



Secondly, gingivitis and periodontitis was the second most common disease in the general population and the medical aid group in 2016. However, it was the 4<sup>th</sup> common disease in the medical aid group from 2012 to 2013 and in the patriots and wounded veterans' group for five years. Also, it went up the rank from 4<sup>th</sup> to 2<sup>nd</sup> in medical aid group. Generally, it showed the increasing pattern in three groups for 5 years.

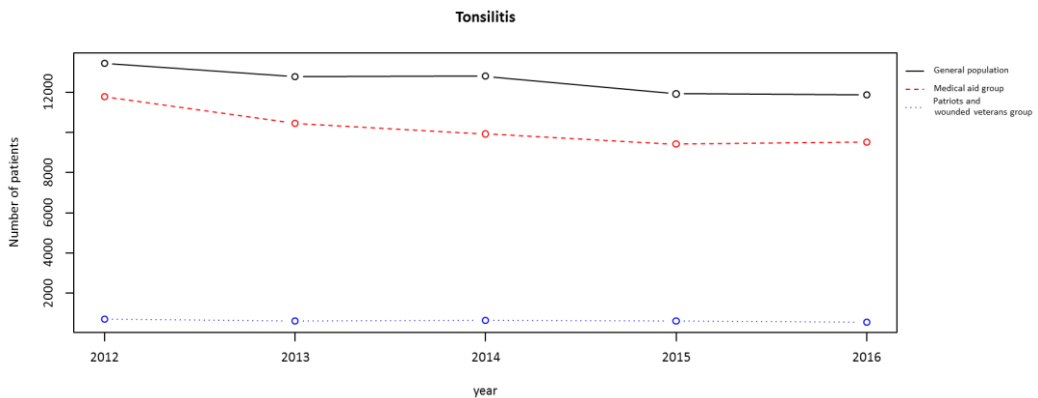


[Figure 5B] The variable patterns of gingivitis and periodontitis for 5 years



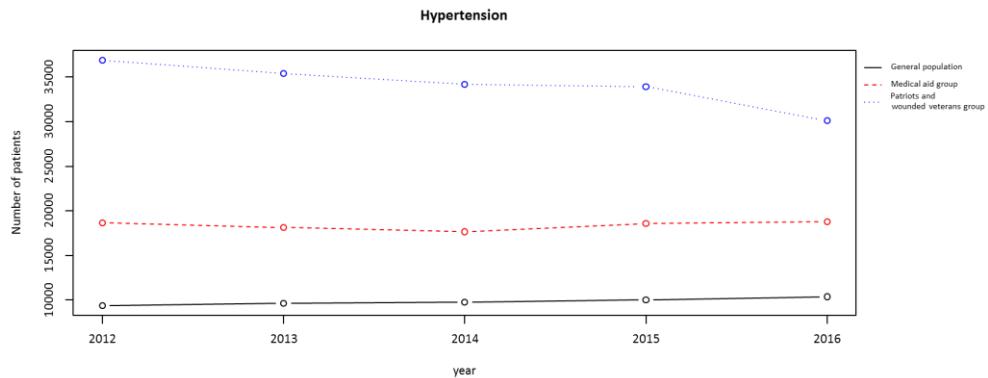
Thirdly, tonsillitis was the 4<sup>th</sup> or 5<sup>th</sup> common diseases in the general population for five years. On the other hand, it showed decreasing pattern in the medical aid group from 9<sup>th</sup> in 2012 to 15<sup>th</sup> in 2016. And it showed extremely low prevalence in the patriots and wounded veterans' group, and it was out of 50<sup>th</sup> rank.

[Figure 5C] The variable patterns of tonsilitis for 5 years



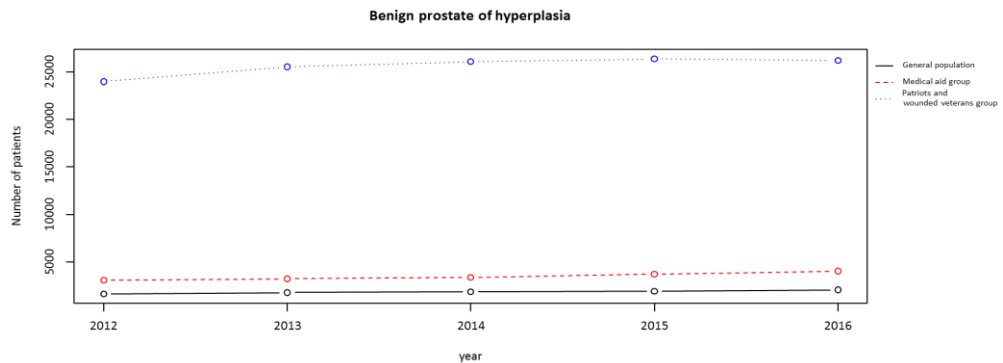
Fourthly, hypertension was the most common disease in the patriots and wounded veterans group for 5 years. While it has decreased a bit in 2016, it went up the rank from 11<sup>th</sup> to 8<sup>th</sup> in general population for 5 years.

[Figure 5D] The variable patterns of hypertension for 5 years



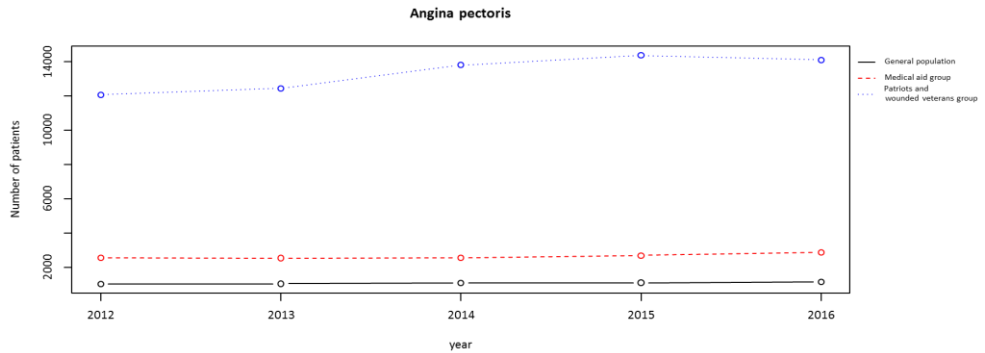
Benign prostate hyperplasia was the second most common disease in the patriots and wounded veterans’ group for five years. This was not on the 50<sup>th</sup> rank in general population for five years. However, it gradually increased in medical aid group. It was ranked 49<sup>th</sup> in 2014, 48<sup>th</sup> in 2015 and 44<sup>th</sup> 2016.

[Figure 5E] The variable patterns of benign prostate hyperplasia for 5 years



Angina pectoris was the 5<sup>th</sup> common disease in patriots and wounded veteran group from 2013. Actually it was the 6<sup>th</sup> common disease in 2012. As compared with veterans group, these diseases were not prevalent and out of 50<sup>th</sup> rank in the general population.

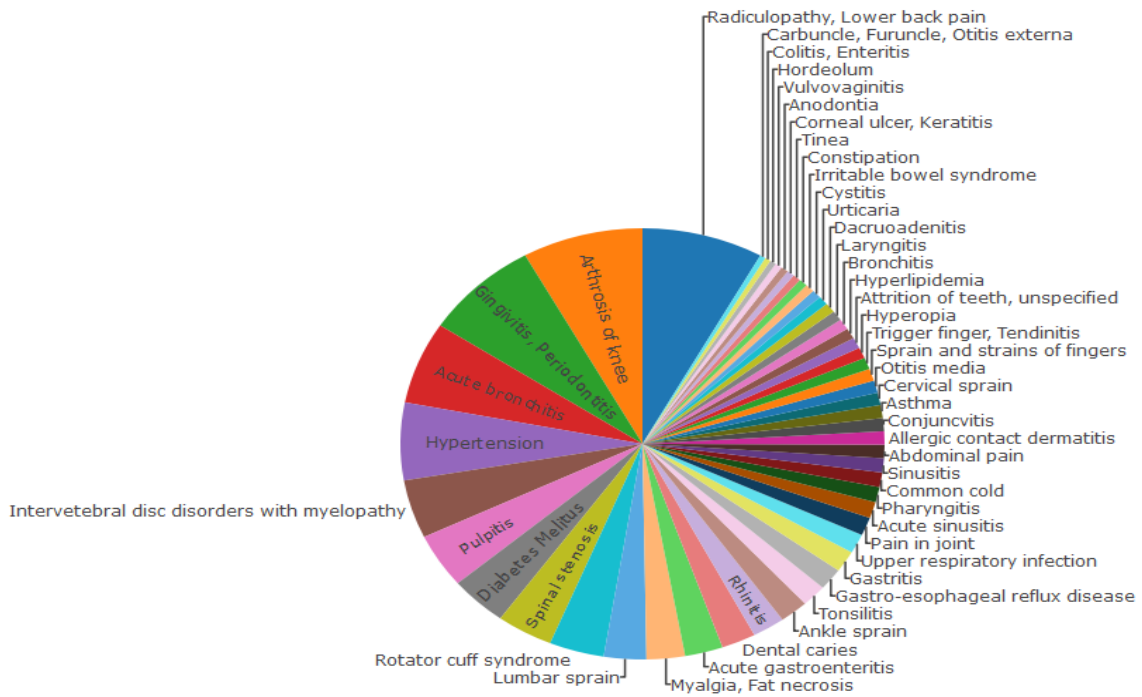
[Figure 5F] The variable patterns of angina pectoris for 5 years



## 4.6 A comparison of total required medical expenses in three groups

The required medical expenses for each disease of the general population in 2016 are drawn in a format of pie graph (Figure 6A). The highest proportion was spent on musculoskeletal disease group. In other words, NHI bears the biggest expense for radiculopathy (1,172,818,720,910 won), arthrosis of knee (1,167,961,990,980 won), intervetebral disc disorders with myelopathy (635,617,601,200 won), spinal stenosis (544,503,804,890 won), Rotator cuff syndrome (530,877,565,010 won), and lumbar sprain (410,151,233,890 won). And the second biggest part was taken by dental disease group such as gingivitis and periodontitis (1,114,259,727,720 won), pulpitis (591,125,576,730 won), dental caries (331,480,083,910 won) and attrition of teeth (117,261,018,830 won). The third group was infectious inflammatory diseases like acute bronchitis (894,434,894,380 won), acute gastroenteritis (367,880,858,280 won), and tonsillitis (239,574,208,820 won). The fourth groups were chronic internal medicine diseases such as hypertension (841,263,996,890 won), diabetes mellitus (554,721,566,440 won), and gastroesophageal reflux diseases (237,353,848,640 won).

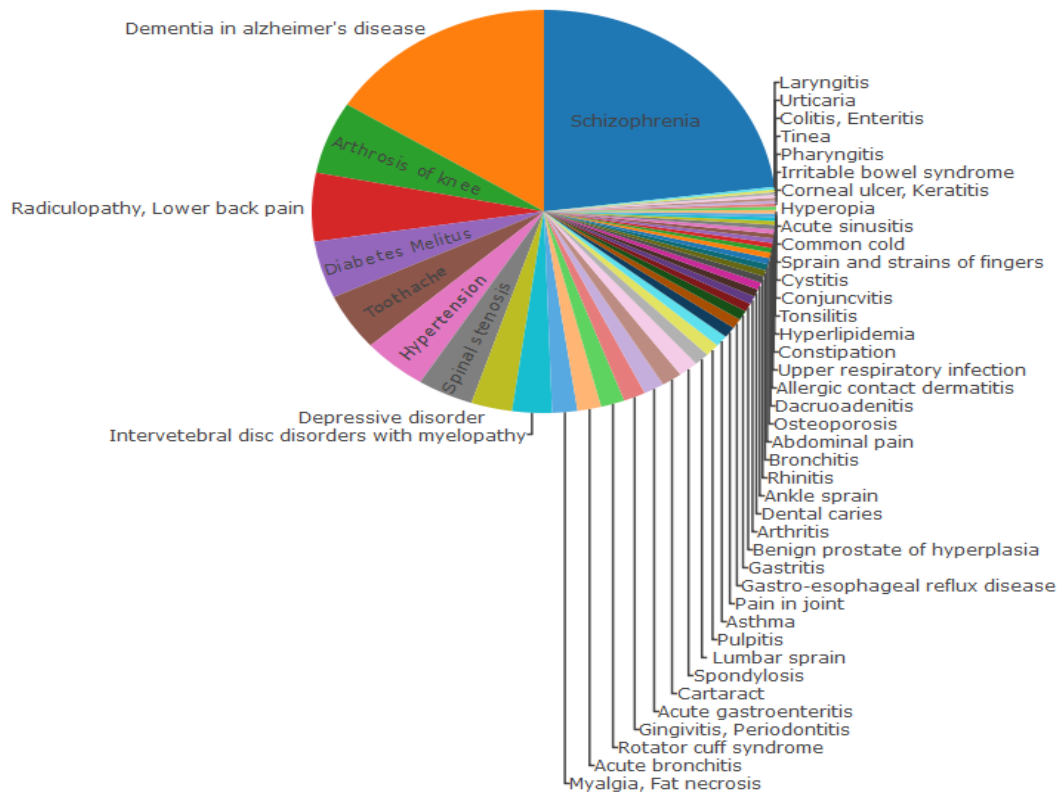
[Figure 6A] Total required medical expenses of the general population in 2016



The required medical expenses in medical aid groups during same period are shown in figure 6B. The highest proportion was spent on psychological disease group such as schizophrenia (442,232,802,030 won), dementia in alzheimer's disease (308,897,645,520 won), and depressive disorder (54,899,189,160 won). The second portion was taken by musculoskeletal disease group; arthrosis of knee (111,454,055,750 won), radiculopathy with lower back pain (105,409,100,880 won), spinal stenosis (74,494,304,800 won), intervetebral disc disorders with myelopathy (52,916,119,060 won), Rotator cuff syndrome (31,739,199,450 won), and lumbar sprain (19,965,093,610 won).

And the third biggest part was chronic internal medicine diseases such as diabetes mellitus (88,146,724,670 won), hypertension (85,965,001,050 won), and gastroesophageal reflux diseases (15,154,027,160 won).

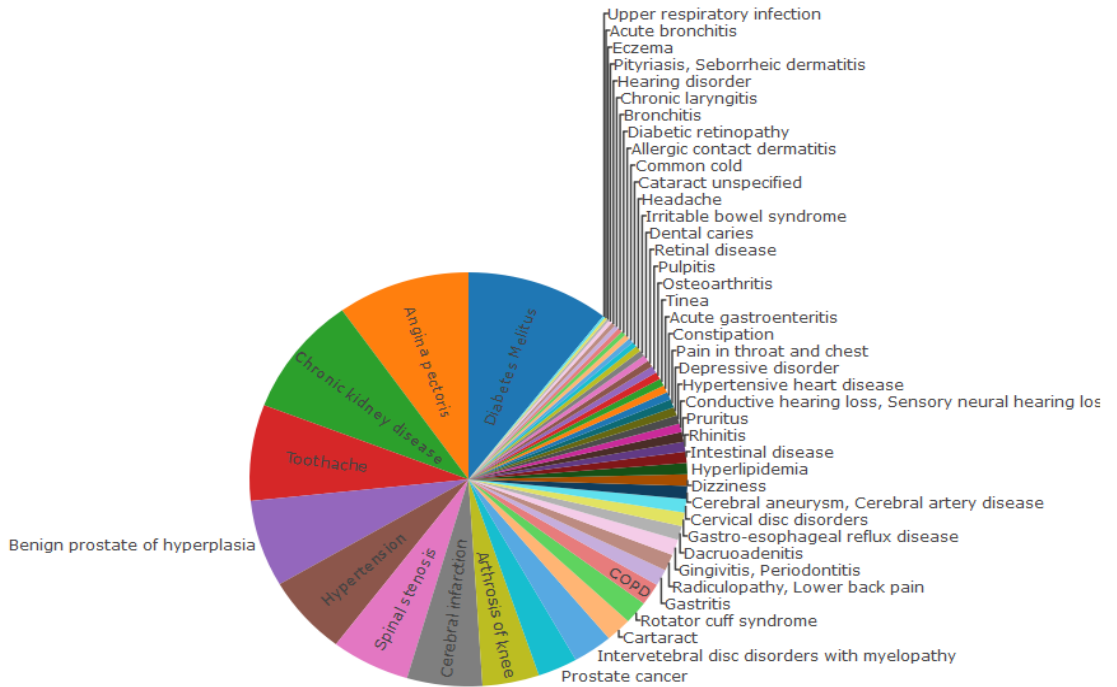
[Figure 6B] Total required medical expenses of the medical aid group in 2016



The required medical expenses in the patriots and wounded veterans' group are shown in figure 6C. The highest proportion was comprised of chronic internal medicine diseases; diabetes mellitus (11,581,221,930 won), angina pectoris (10,756,587,590 won), chronic kidney disease (10,296,198,130 won), and hypertension

(6,818,068,230 won). The second biggest part occupied by dental diseases group such as toothache (8,235,495,270 won), gingivitis and periodontitis (1,350,067,790 won) and dental caries (538,032,070 won). The third group was urologic diseases like benign prostate hyperplasia (7,454,395,090 won) and prostate cancer (3,227,387,300 won).

[Figure 6C] Total required medical expenses of the patriots and wounded veterans' group in 2016



The ratio of three group's medical expense is about 101:38:1. In other words, about 72.14% of total medical expenses are consumed for general population, 27.14% for the medical aid group and 0.71% for the patriots and wounded veterans group.

We presented the medical expenses of three groups in figure 6D. The pattern of medical expense in three groups was different each other unlike the pattern of number of patients. In the general population, the biggest budget was paid for musculoskeletal diseases. On the other hand, the medical aid group was paying the largest medical expense for mental disorders like schizophrenia. Lastly, the biggest expense for chronic medical illness was required by the patriots and wounded veterans' group.





## Chapter 5. Discussions

### 5.1 Definition and socioeconomic characteristics of vulnerable populations

Vulnerability in its broad spectrum can be defined diversely and change from moment to moment according to social circumstances. The definition of vulnerable populations is usually the person living below the level of subsistence. However, this is not only defined by the economic status, but is also defined by social class, level of education, physical disabilities, isolated residency, refugee status and near poverty group membership. Individual factor such as age, sex, ethnicity, displacement and health state can increase this kind of vulnerability of person or social class. The social consensus for this is not identical throughout the world. It depends on each country's own sociocultural standard and law. In Korea, the vulnerable population is defined by the criteria established by the Ministry of Health and Welfare and the Ministry of Patriots and Veterans Affairs, as we explained above in chapter 1.

Generally, vulnerable populations have limited access to medical facilities due to economic, geographic, physical and intellectual lack of information. At first, they cannot afford medical expenses without government subsidies. Moreover, the government is running the supporting health system yet, it does not cover full reimbursement of expenses. In addition, secondly, major hospitals are located in city centers. And, local hospitals tend to locate in non-suburban areas. Because, most of physicians choose urban areas to open their own clinic due to cultural and educational infrastructure. So, the residents living in suburban areas face a difficulties to access medical services geographically. Third, physically handicapped people cannot walk outside their house due to their somatic disorder. For instance, the patient in a bed-ridden state cannot leave their home, so that they cannot get medical examinations and treatment. Fourth, less-educated person do not

have appropriate medical health information. They often miss the golden time for treatment. Some of them rely on bush or traditional medicine.

The wounded veterans group has a history of physical and mental trauma. Therefore, they tend to make a closed association and have no relationship with other populations due to awareness of difference. This kind of the closed society occasionally takes an unfriendly attitude to medical staff, and people in positions of authority. As a result, they could become neglected social class or alienated information groups. This difficulties can turn them into medically disadvantaged groups (Dubbert et al., 2017).

## **5.2 Different health status of two vulnerable populations; (1) medical aid group, (2) patriots and wounded veterans' group.**

In this study, the medical aid, the patriots and wounded veterans' group displayed the different prevalent diseases. Generally, pediatric and young–adult diseases such as rhinitis and tonsillitis are not common in the medical aid group. On the other hand, senile diseases like spinal stenosis and hypertension show up in higher proportions in the medical aid group. For example, metabolic syndromes are induced by impaired glucose tolerance. So it leads to the occurrence of diabetes mellitus, hypertension, hyperlipidemia and arteriosclerosis. It is related to socioeconomic status and causes the inequalities of the incidence of metabolic disease (Agyemang et al., 2010). Among this, hypertension prevalence increases with low–educated level and small income in Korea (Lee, 2017). Besides, spinal stenosis is associated with ageing people, heavy manual labor for males, house–chores for females (Abbas et al., 2013). From this result, we can assume that advanced age and qualities of job could be one major factor to enter the medical aid group.

In the patriots and wounded veterans group, the frequent diseases were totally different from the former two groups. Among

these diseases, benign prostate hyperplasia is the 2<sup>nd</sup> most common disease in this group. Commonly, benign prostate hyperplasia is known as the senile disease. The aging phenomenon within the veterans' group is manifested worldwide just as in the Korean case. About half of Korean veterans group are made up of Vietnamese war veterans. Most of them were exposed to agent orange to blight a heavy plant. 2,3,7,8 – tetrachlorodibenzo – p – dioxin (TCDD) is the major ingredient of agent orange. According to previous studies, exposure to this chemical is associated with decreasing levels of testosterone and decreasing risk of benign prostate hyperplasia (Gupta et al., 2006). In the recent analysis, prostate cancer risk was not associated with cumulative TCDD level as well (Chang et al., 2014). Although a higher prevalence of benign prostate hyperplasia and prostate cancer in veterans group, it means that aging phenomenon is more important than a history of agent orange exposure.

However, Vietnam War veterans are suffering from the most serious illnesses in general. The mortality of general cause of death in Vietnam War veterans has been increasing in Korea (Yi et al., 2014). According to this study, hazard ratio of angina pectoris was checked at 1.22 (95% Confidence interval; 1.05 – 1.41). Also, this was ranked at 5<sup>th</sup> in this group in the present study, while it is ranked below the 50<sup>th</sup> in the general population and the medical aid group. If the effect of agent orange would combine with the aging phenomenon and male factor, the incidence of angina pectoris could be expected to soar. Also, hypertension was the most common disease in the veterans group. This is mainly because veterans are more likely to be older (59.9 years vs 43.4 years), and obese (42.6% vs 33.7%,  $p < 0.01$ ) than the general population (Fryar et al., 2016).

### 5.3 Medical expenses depending on the social class and disease severity

In contrast with the total number of patients, medical expenses show the different rank in all groups. Generally, medical expense is associated with disease severity and duration, and existence of major surgery. Although, population of medical aid and veterans group constitute only 2.9% of total population (1,529,000 / 52,273,000 person), the medical expense in the medical aid group and the veterans group is spent more by NHI than the general population (4,337,000 vs 954,000 won per person).<sup>⑤</sup> This is because the vulnerable population tend to have more severe diseases. Second, the proportion of people aged 65 and over is larger than in the general population (32.9% vs 12.7%). Third, vulnerable population can overuse the medical service due to discounted medical charge.

In the general population, the biggest budget is paid for musculoskeletal disease in Korea. The spectrum of patients is wide, from minor sprain to total joint replacement. In addition to this spectrum, the duration of these disease groups is longer than infectious inflammatory diseases and it costs more. Moreover, there exists more work intensification and lack of work safety systems for musculoskeletal diseases in Korea. This disease group can be called work-related musculoskeletal disorders, and it especially aggravated after 1997 economic crisis followed by mass dismissal, job instability and increased work flexibility, increased work incentives and competition (Kang et al., 2014). Also, musculoskeletal disease is cared by orthopedic surgeons, rheumatologists, rehabilitative medical doctors, anesthesiologists, radiologists and neurosurgeons. A part of patients could be confused at the complicated medical system, so that they tend to do more hospital shopping and consequently pay more.

In the medical aid group, psychiatric diseases occupied the

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<sup>⑤</sup>2016 medical care statistic annual report (www.nhis.or.kr)

largest portion of medical expenses. Even schizophrenia and dementia in Alzheimer's disease was ranked at 36<sup>th</sup> and 43<sup>th</sup> in the total number of patient, these were ranked 1<sup>st</sup> and 2<sup>nd</sup> in medical expenses. These diseases are non-curable diseases and tend to become worse year by year. Especially schizophrenia occurs at an early age. Furthermore, they cannot find a job and face medical expenses continuously, so that their economic status becomes worse. In a German study, schizophrenia patients spend about 10 times more than the control group from the societal perspective (23,028 vs 2,419 euro per year person) (Frey, 2014). Additionally, they visit emergency department the most frequently and spend more in Korea (Woo et al., 2016).

In the patriots and wounded veterans group, the largest payment accounted for chronic medical illness like diabetes mellitus, angina pectoris and chronic kidney disease. We assumed that people aged over 65 years old is larger even than the medical aid group because of the aging phenomenon of veterans. Diabetes mellitus usually occurs in the elderly and induces a lot of related-complications such diabetic nephropathy, diabetic cardiomyopathy, diabetic neuropathy, diabetic foot ulcer, diabetic dermopathy and diabetic retinopathy. This is why diabetes mellitus occupied the biggest portion of medical expenses in the veterans' group. As compared with the general population without diabetes mellitus, Unites States Veterans disburse higher expense more than 4 time in inpatient clinic (\$3,051 vs. \$424), emergency room (\$127 vs. \$39), physician office (\$2,934 vs. \$875), outpatient clinic (\$3,299 vs. \$971), pharmacy (\$610 vs. \$224) and total costs (\$6,958 vs. \$1,618,  $p < 0.0001$ ) than the control group (Xie et al., 2014).

Chronic kidney disease is the third biggest part in veterans' medical expenses. Chronic kidney disease acquires hemodialysis and peritoneal dialysis three times a week or kidney transplant at the terminal stage. It takes three or four hours and costs on every site visit. It is inevitably associated with high medical expenses and low quality of life (Saban et al., 2010). This cost depends on treatment type, sustainable dialysis, the possibility of kidney

transplantation and other comorbidity. The shorter period of dialysis without comorbidity and successful kidney transplantation are important for their costs reduction (Damien et al., 2016).

#### **5.4 Current condition of health support for vulnerable population**

These days, expansion of health and social security coverage is a big issue on public sphere. Especially patients with chronic or rare diseases who need the newest and expensive drug or treatment assert the more expanded insurance coverage on medical field. On the one hand, this request comes into an economic burden to whom paid insurance fee and government. As national income and economic scale in Korea is enlarging year by year, their demands would be become to realize. Also, national policy has a plan to expand the health security program.

As we mentioned above, the criteria of being the medical aid, the patriots and wounded veterans' group has been established by the Ministry of Health and Welfare, the Ministry of Patriots and Veterans Affairs. However, these program supported by the government is not enough to guarantee their health security sometime. Therefore, a part of vulnerable population buys private health insurance. But, against social expectations, it does not alleviate burden of total medical expense for them. It implies that the appropriate balance between private health insurance and the NHI should be established, compared with other OECD country (Shin, 2012). Furthermore, the NHI faces many challenges to their own sustainability because of low birth rate, ageing phenomenon, low economic growth rate and unification of each insurance program. So, Kang et al suggest that the old paradigm of low contribution – low coverage – unfair insurance fee charge imposition should be change to the new paradigm of adequate contribution – proper coverage – fair insurance charge fee imposition (Kang et al., 2012).

## 5.5 Policy implication for the future

Naturally, the consumer in medical service shows the wide spectrum from health persons to the elderly or handicapped. Of course, medical insurance program focuses on the vulnerable population who use medical service and spend medical expense more than the general population. However, in public NHI system, some of health persons who do not acquire public medical service can be dissatisfied with their unfair insurance fee imposition. However, this is a kind of social safety net and anyone of society can be descended into poverty and vulnerable people. So, that's why medical expenses collection and expenditure should be allocated according to the social class and the disease severity.

How can we spend medical expense effectively? We are looking for the government to curb unnecessary and unproductive medical expenditure and concentrate it to more desirable value. At first, integrated program for musculoskeletal and other disease care system could be one of an effective candidate policy (Soto-Gordoa et al., 2017). These days the aging population is not limited to the vulnerable population. Also, the elderly has not the only one disease. They are suffering from chronic multimorbid at the same time. So they tend to visit more than two or three clinic due to low medical cost particularly in Korea. So to reduce laborious visit to hospital, the integrated program and complex intervention should be done at primary clinic. It could be linked to the health care delivery system; primary, secondary and tertiary clinic connection. The patient who has hypertension or hyperlipidemia without other comorbidity should be care at the primary clinic's complex intervention rather than tertiary hospital outpatient service (Lee et al., 2014).

Second, telemedicine or mobile health care program should be activated to spend medical expense more efficiently. Actually, president Park Geunhye administration had settled the policy of telemedicine in 2014. However, it could be not proceed due to medical doctor's noncooperation and opposition to that plan. Because, they concerned about the misdiagnosis or medical

irresponsibility due to the medical service's own complexity. However, the technological advancements for mobile health are leading to the scientific breakthrough, and it begins to cover this problem. Especially, vulnerable populations have the difficulty to visit to hospital. So the first stage of mobile health should be established for vulnerable populations. Also, Gabrielian et al. suggested home telehealth technology for homeless veterans after a definite enrollment system (Gabrielian et al., 2013). Generally, new medical technology is related to the increasing medical expenditure. However, this system can reduce the transportation and administrative cost.

Third, home care service or home based primary clinic for vulnerable population should be extended more. Actually, veteran affair and veteran hospital in Korea is running the program of home nursing care. However, the shortage of manpower and budget, this service is limited to the small minority of wounded veterans by nurse only. So, this home care or home based primary clinic team should be comprised of physician or other physician assistant as well. Moreover, as we see above, vulnerable population spent the most of expenses on mental diseases. So, mental health care should be integrated into home based primary clinic program (Karlin and Karel, 2014).

Fourth, health policy convergence across diverse countries should be considered. Many of nations are sharing the similar health circumstance such as demographic change, increasing demands of health service, high-tech medical technology. As a result, the spectrum of health policy between countries tends to be narrower through the international dependence and diffusion as the globalization proceed more (Labonte et al., 2009). Also, World Health Organization (WHO) or other international organizations are trying to make a universal outline or paradigm for health care policy. Of course, health care policy should be forfended to transform to international or domestic monopoly or oversimplification across countries. However, policy maker keep trying to be influenced other idea around the world.



Lastly, we should find vulnerable population who comprised of the elderly with severe disease without the protection from the national basic livelihood security System (Jeon et al., 2017). This group is called as the near poverty group in Korea. The group and national economic burden of medical care deepens even though they don't visit to hospital due to their low income. Also, the hidden characters of this population would make themselves to become more vulnerable, desperate and isolated. This finding should be supported by the social concern and even by personal consideration.

## 5.6 The limitations and strength of this study

There were partial limitations in this study. First, age and sex of three group's demographics were not matched equally, and it could be a confounding variable. So that statistical discrepancy could occur because medical aid group had a higher age than general population and veterans group mainly were constituted with the old males. Second, we could not verify other reason variables or covariates such as dietary habit, smoking habit, life style and family history. It should be checked through patient's chart review by physician. Third, the inaccuracy of diagnostic codes could be a possible confounding factor due to health insurance system. To get more health insurance coverage, it could be possible to input over-diagnostic codes by physicians. Fourth, disease care without insurance coverage such as the newest drug and cosmetic treatment was not calculated in this study. Fifth, people living in extreme poverty like homeless could have been excluded for this analysis. Because, they have no information about being registered as the recipient of livelihood program and have difficulties to access to local office.

However, the present study had the strengths. We analyzed almost the entire population of South Korea, therefore providing a higher reliability and validity than selected sample group studies. As far as we know, this is the first nationwide retrospective population-based analysis to evaluate the frequent diseases in vulnerable populations.

## Chapter 6. Conclusions

The NHI divided the whole population to the three groups; (1) the general population, (2) the medical aid group, (3) the patriots and wounded veterans group. According to this separate insurance program, we conducted analysis to prove the different health status of the last two groups. The frequent diseases in vulnerable population including the medical aid group, the patriots and wounded veterans' group showed the different pattern from general population. In vulnerable groups, senile diseases and musculoskeletal disease was prevalent. Especially, in the veterans' groups, senile disease and chronic medical illness was the most common disease. On the other hands, the biggest medical expenses was consumed for mental disorder in the medical aid group. And chronic internal medicine was the biggest budget in the veterans' group because of their aging phenomenon. Although their proportion of total population was smaller than 2.9%, their annual medical expense per person was more than 4 times.

Definitely, their health status requires a more appropriate public approach to solve them. We suggest that government should expand the health security and proper coverage program. And integrated program and complex intervention must be offered as an adequate service for vulnerable populations at the primary clinic. Telemedicine, mobile health and home care have to be activated more than the present as well. International health policy convergence should be considered. Lastly, we keep continuously found the neglected and hidden vulnerable populations.

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## 국문 초록

# 취약계층 유병 질환의 체계적 조사 및 정책함의; 전국민 기반 후향 연구

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일반적으로 사회경제적으로 불리한 조건에 있는 인구집단은 다른 건강 상태를 가진다. 이 집단은 의료 시설 및 의료 정보의 접근성에 대해서 일반인들보다 제한되기 때문이다. 만약 이러한 차이가 수 십 년간 축적이 된다면, 이는 이들의 사망률과 질환의 역학에 영향을 미치게 된다. 하지만, 현재까지 전국적으로 그들의 건강상태를 조사한 연구는 없었으며, 이는 이러한 자료의 부재로 합리적이고 적절한 건강 정책이 그 동안 수립되지 못했다는 것을 의미한다.

한국 정부는 전국민 건강보험 제도를 약 40년간 운영해왔다. 근래 이 제도는 수많은 진화를 거듭하여 취약계층을 보장하기 시작했다. 이는 이 제도로 인해 전국민을 바탕으로 한 전국적 대규모 전자 건강정보를 보유하기 시작했음을 의미한다. 국민건강보험은 총 인구 집단을 건강보험군, 의료급여군, 국비보훈군 세 군으로 나누어서 의료보험서비스를 제공하고 있다. 의료급여군 및 국비보훈군을 취약계층으로 정의할 수 있으며 현재까지 이들에 대한 전국적으로 축적된 취약계층의 건강 정보와 의료비에 대한 연구는 없었다. 이에 본 논문은 전국민 기반 빅데이터를 이용하여 취약계층의 건강 실태를 후향적으로 조사하고 향후 이들을 위한 보다 정교한 정책을 제시하고자 한다.

의료급여군과 국비보훈군의 질병 양상은 건강보험군과 달랐다. 일반적으로 건강보험군에서 관찰되는 감염성 염증 질환의 빈도는 감소하고 만성 내과 질환을 비롯한 노인성 질환의 빈도가 증가하였다. 또한 국비보

훈군의 질병 양상은 상위 5개 질환이 고혈압, 전립선 비대증, 당뇨, 치주염, 협심증 등으로 두 군과 모두 달랐다. 또한 총 의료 비용에서 건강보험군은 근골격 질환 비율이 가장 높은 반면, 의료급여군은 정신분열증과 치매를 비롯한 정신질환이 가장 높았으며, 국비보훈군에서는 당뇨, 협심증 및 만성 신부전을 비롯한 만성 내과 질환의 비율이 높게 관찰되었다. 이는 국비보훈군의 고령화 현상이 주요 원인으로 추정된다. 이에 대해, 취약계층을 위한 적절한 의료보장 확대, 의료전달 체계의 확립, 모바일 진료 및 가정 간호 등 첨단기술을 이용한 의료서비스의 확대, 보건정책의 국제화, 지속적인 소외계층 발굴 등의 보다 정교한 정책이 필요할 것이다.

본 연구는 나이와 성별, 진료 및 검사 기록 등의 기타 독립 변수를 조절하지 않았으며, 비보험 영역의 배제, 극도의 취약계층 배제 및 보험보장 시스템의 오류로 진단코드 입력의 불확실성 등의 제한점이 있다. 하지만, 전국민을 바탕으로 한 첫 취약계층 다빈도 질환의 빅데이터 연구로서, 표본집단 연구에 비해 높은 신뢰도와 타당성을 제공하며, 향후 각 계층별, 질환별, 연령별, 등으로 보다 구체적인 실증 연구에 기본 정보를 제공할 것으로 사료된다.

**Keywords :** 국민건강보험, 빅데이터, 역학, 취약계층

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