Original Article

Data Analytic Process of a Nationwide Population-Based Study on Obesity Using the National Health Information Database Presented by the National Health Insurance Service 2006–2015

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Background: In Korea, the prevalence of obesity has steadily increased, and the socioeconomic burden of obesity has increased along with it. In 2015, the National Health Insurance Service (NHIS) signed a memorandum of understanding with the Korean Society for the Study of Obesity (KSSO), providing limited open access to its databases so that the status of obesity and obesity management could be investigated.

Methods: Using NHIS databases, we analyzed nationwide population-based studies for obesity using the definition of obesity (body mass index ≥ 25 kg/m^2) in subjects over the age of 20. Age and sex standardization were used for all data.

Results: The KSSO released the 'Obesity Fact Sheet 2016' using the 2006-2015 NHIS Health Checkup database. The prevalence of obesity steadily increased from 28.7% in 2006 to 32.4% in 2015, and the prevalence of abdominal obesity also steadily increased from 18.4% in 2009 to 20.8% in 2015. The prevalence of class II obesity steadily increased from 2006 to 2015, such that the total prevalence was 4.8% in 2015 (5.6% in men and 4.0% in women). The highest prevalence of obesity was found in Jeju Island, while the lowest prevalence was found in Daegu City. The highest prevalence of abdominal obesity was also found in Jeju Island, while the lowest prevalence was found in Gwangju City.

Conclusion: Based on the Obesity Fact Sheet 2016, a strategy for reducing the prevalence of obesity is needed, especially in Korean men.

Key words: Obesity, Abdominal obesity, Fact sheet, National Health Insurance Service

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INTRODUCTION

In Korea, the prevalence of obesity has steadily increased, along with the accompanying socioeconomic burden.[1] Both obesity and abdominal obesity are risk factors for several cardiovascular diseases[2], so obesity prevention and management are important. In an effort to reduce the prevalence of obesity and examine the risk factors and comorbidities of obesity, the National Health Insurance Service (NHIS) signed a memorandum of understanding with the Korean Society for the Study of Obesity (KSSO) in 2015, providing limited open access to its databases so that the status of obesity and obesity management could be investigated. In this manuscript, we introduce the NHIS database and the 2016 Obesity Fact Sheet based on NHIS data from 2006 to 2015.

METHODS

The NHIS database

The NHIS is a nonprofit organization and a single-payer organization in Korea, and all Koreans must join the NHI.[3,4] The NHIS provides universal coverage for all residents of Korea and pays healthcare providers based on a fee-for-service system. The NHIS obtains patients' demographic information, such as age, sex, region, insurers' payment coverage, medical utilization/transaction information, and deductions and claims data. This database can be used for a population-based cohort study, according to the operational definition of some diseases.[5]

National Health Checkup program and database

The NHI provides regular health checkups and cancer screenings biannually at no cost for all insured Koreans over the age of 40, as a way to discover and treat diseases in their early stages and improve the health status of the population. Employee subscribers over the age of 20 should have their health status checked annually. The health checkup program has four areas: general health checkups, cancer checkups, baby/infant health checkups, and lifetime transition period health checkups.[4] In the NHI Health Checkup program, height, weight, and blood pressure have been measured since 2002, and waist circumference (WC) has been measured since 2009. Hearing and visual acuity, along with fasting glucose levels, total

cholesterol, high-density lipoprotein cholesterol, low-density lipoprotein cholesterol and triglyceride levels, are also checked. In addition, health behaviors such as alcohol consumption, smoking history, and regular exercise are surveyed, along with family, medical and surgical history. In the cancer program, specific cancers are screened: stomach and breast cancer for those ≥ 40 years old, colon cancer for those ≥ 50 years old, liver cancer for those ≥ 40 years old with high risk for hepatic cancer, and cervical cancer for women ≥ 30 years old. Each person pays only 10% of the cost.

Database population

Since 2006, information about Medical Aid (MA) beneficiaries has been included in a single database. Thus, we used the NHIS database from 2006 to 2015. In 2015, 14,049,447 Koreans participated in the National Health Checkup. Among these participants, we only included those who were over the age of 20. The protocol of this study was reviewed and approved by the institutional review board of the Korea National Institute for Bioethics Policy (P01-201603-21-005).

Data assessment and contents of the database

We used the Claim database, Qualification database, Health Checkup database, and death information in this study. The Claim database included general information on payment specifications (20 tables), consultation statements (30 tables), diagnosis statements [as defined by the International Classification of Diseases 10th revision (ICD-10)] (40 tables), and detailed prescription statements (60 tables). The Qualification database included information such as age, sex, region, income, and qualification type. For the Health Checkup database, we used the general health checkup database: (1) MA beneficiaries who are householders 20 to 64 years old and household members 41 to 64 years old, (2) employee subscribers' dependents and household members over the age of 40, and (3) regional insurance subscribers and employee subscribers who are regional householders.

Definition of obesity, abdominal obesity, and class II obesity

We were able to use body mass index (BMI) data to obtain the prevalence of obesity from 2006 onwards, but the prevalence of ab-

Table 1. Distribution of Korean National Health Insurance beneficiaries aged ≥ 20 years by sex and age group

	Year (person)									
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total	8,327,558	7,856,071	9,726,190	10,453,909	11,414,770	11,655,549	12,110,550	11,707,070	13,178,602	14,049,447
Sex										
Men	4,819,165	4,550,648	5,511,019	5,764,815	6,275,852	6,390,782	6,595,994	6,366,902	7,134,153	7,545,139
Women	3,508,393	3,305,423	4,215,171	4,689,094	5,138,918	5,264,767	5,514,556	5,340,168	6,044,449	6,504,308
Age (year)										
20-29	1,199,882	1,188,440	1,464,229	1,296,005	1,225,183	1,235,678	1,141,052	1,135,424	1,202,339	1,231,048
30-39	1,867,641	1,749,879	2,209,596	2,000,018	2,227,467	2,196,907	2,238,344	2,112,746	2,364,734	2,451,573
40-49	2,238,405	1,833,700	2,281,497	2,734,149	3,009,953	3,063,905	3,137,201	3,045,112	3,394,521	3,619,681
50-59	1,590,341	1,607,738	2,096,517	2,219,663	2,584,506	2,697,441	2,931,465	2,775,611	3,183,981	3,417,878
60-69	968,609	905,275	1,019,084	1,417,413	1,511,045	1,516,628	1,633,237	1,598,083	1,861,051	2,078,738
70-79	407,865	493,984	571,824	682,192	736,535	806,638	876,792	873,147	969,255	1,013,237
≥ 80	54,815	77,055	83,443	104,469	120,081	138,352	152,459	166,947	202,721	237,292

dominal obesity could only be determined after 2009, when WC began to be measured. Obesity was defined as a BMI (weight in kilograms divided by the square of height in meters) $\geq 25.0 \text{ kg/m}^2$ in adults, in accordance with the Asia-Pacific criteria of the World Health Organization guidelines.[6] Abdominal obesity was defined as a WC ≥ 90 cm in men and ≥ 85 cm in women, in accordance with the definition by the KSSO. A BMI $\geq 30.0 \text{ kg/m}^2$ was defined as class II obesity.[7]

Data presentation

Age and sex standardization (based on the 2010 Census Korean population) were used to present all data. We calculated the prevalence of obesity (%) by dividing the number of patients who were obese by the total number of subjects with NHI Health Checkup data.

RESULTS

Table 1 shows the total number of subjects and the distribution of the population from the NHIS database from 2006 to 2015 by sex and age group. Over time, the total number of National Health Checkup participants increased, especially in the elderly population.

Obesity Fact Sheet 2016
The prevalence trends of obesity, abdominal obesity, and class II obesity from 2006 to 2015

The prevalence of obesity steadily increased from 28.7% in 2006

to 32.4% in 2015, and the prevalence of abdominal obesity also steadily increased from 18.4% in 2009 to 20.8% in 2015. In 2015, the prevalence of obesity was 40.7% in men and 24.5% in women, while the prevalence of abdominal obesity was 24.6% in men and 17.3% in women. The prevalence of class II obesity has steadily increased since 2006. In 2015, the prevalence of class II obesity was 4.8% overall, 5.6% in men and 4.0% in women (Table 2).

Regional prevalence of obesity and abdominal obesity in 2015

The highest obesity prevalence was found in Jeju Island (41.1%), while the lowest prevalence was found in Daegu City (30.3%). The highest abdominal obesity prevalence was found in Jeju Island (30.0%), while the lowest prevalence was found in Gwangju City (18.4%) (Table 3).

DISCUSSION

In this study, we found that the prevalence of obesity steadily increased from 2006 to 2015, as did the prevalence of class II obesity. The prevalence of abdominal obesity also steadily increased from 2009 to 2015. Jeju Island was the region with the highest prevalence of both obesity and abdominal obesity.

As the NHIS database represents the entire Korean population, we can apply this result to the creation of a policy to reduce the prevalence of obesity, especially in a specific group or region. The NHIS database will be updated continuously, so we can use this

Table 2. The prevalence trends for obesity, abdominal obesity, and class II obesity from 2006 to 2015

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Obesity (%)										
Total	28.7	29.1	29.4	29.6	29.6	30.2	30.2	30.6	31.1	32.4
Men	34.4	34.5	35.5	35.6	36.3	37.0	37.3	37.8	38.7	40.7
Women	23.3	24.0	23.5	23.9	23.3	23.7	23.3	23.7	23.7	24.5
Abdominal obesity (%)										
Total				18.4	18.2	18.6	18.6	19.2	19.5	20.8
Men				20.6	20.8	21.3	21.3	22.2	22.8	24.6
Women				16.2	15.8	16.0	15.9	16.4	16.4	17.3
Class II obesity (%)										
Total	2.7	2.9	3.1	3.3	3.4	3.7	3.8	4.1	4.3	4.8
Men	2.9	3.1	3.3	3.5	3.7	4.1	4.2	4.6	4.9	5.6
Women	2.6	2.8	2.9	3.1	3.1	3.3	3.3	3.6	3.7	4.0

Age and sex standardization (based on the 2010 Census Korean population) were used for all data.

Table 3. Regional prevalence of obesity and abdominal obesity in 2015

Region	Prevalence (%)	
	Obesity	Abdominal obesity
Seoul	31.6	21.6
Busan	31.6	18.9
Daegu	30.3	18.9
Incheon	34.3	22.4
Gwangju	31.8	18.4
Daejeon	32.0	20.3
Ulsan	31.4	19.6
Sejong	32.1	20.2
Gyeonggi	33.2	22.0
Gangwon	36.8	21.4
Chungbuk	33.1	20.8
Chungnam	33.6	23.1
Jeonbuk	33.3	20.1
Jeonnam	33.8	20.4
Gyeongbuk	31.8	20.6
Gyeongnam	30.8	18.6
Jeju Island	41.1	30.0

Age and sex standardization (based on the 2010 Census Korean population) were used for all data.

database in a prospective longitudinal nationwide cohort study to reveal the causal relationships between variables. Other laboratory measurements, medications, procedures, surgeries, and survey data can also be used in various studies. Moreover, since the NHIS database contains mortality data, we can determine disease-related mortality and discover the causal risk factors that increase or reduce mortality. As in this study, combining laboratory and survey data from the Health Checkup database with information from the

Claim database will allow researchers to overcome the limitations of the Claim database.

The limitation of the NHIS database is the discrepancy between the disease diagnoses from the Claim database and from real practice. This discrepancy was observed more often in outpatient clinics, primary care clinics, and less-severe illness cases than in inpatient hospitals, general or tertiary hospitals, and severe illness cases, respectively. Therefore, the NHIS database might not reflect the real utilization pattern of healthcare institutions.[8] To minimize this discrepancy, therefore, an appropriate operational definition of each disease is needed. Second, this NHIS database only includes insured benefits; thus, uninsured payments for services such as esthetics clinic visits, over-the-counter drugs and obesity medications could not be estimated. It has been reported that approximately 28% of total healthcare payments in Korea occur in the uninsured healthcare area.[9] Third, the interval between health checkups depends on the participant's employment status and health checkup program, and the completeness of the health checkup differs each year; therefore, researchers should consider various situations during their study design. Fourth, we only included subjects ≥ 20 years old, so we cannot report the exact prevalence of obesity in children and adolescents.

In conclusion, based on information from the Obesity Fact Sheet 2016, a strategy for reducing the prevalence of obesity and class II obesity is needed, especially in Korean men. An obesity reduction policy and an analysis of the risk factors for obesity will be needed, especially in Jeju Island. As the NHIS database is based on manda-

tory and serial population data, we can predict the disease incidence or the progress for disease prevention after data mining. Further studies would be better to consider this trend and the status of obesity in the next studies.

CONFLICTS OF INTEREST

There was no conflict of interest relevant to this article.

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