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A Comparison of the Prevalence Rates of Hypertension between People with Disabilities Due To Brain Injury and Non-Disabled People in 2016 and 2017

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ABSTRACT

This study sought to compare the prevalence rates of hypertension and its related factors between people with disabilities due to braininjury and non-disabled people in 2016 and 2017.Data from 2016 and 2017 were obtainedfrom the National Health Insurance Service of South Korea. Health check-up data on blood pressure, weight, height, waist circumference, and blood glucose were collected; then, the prevalence rates of high blood pressure, obesity, and abnormal blood glucose were calculated. These data were compared between people with disabilities due to braininjury and non-disabledpeople using Chi-square tests.A total of 42,443 people with disabilities due tobraininjury participated in the national health checkup program, while 13,256,766 non-disabled people were included in this study. The hypertension prevalence rate in 2016 among people with disabilities due to braininjury was 23.8%, while that among non-disabled people was 12.4%. For 2017, the hypertension prevalence rate was 24.3% among people with disabilities due to braininjury, while that of non-disabled people was 12.6%. Based on waist circumference, 35.3% of people with disabilitiesdue to braininjury were obese or overweight in 2016,compared with 22.7% of non-disabled people;based also on this factor, it was shown that 36.4% of people withdisabilities due to braininjury and 23.4% of non-disabled people exceeded the obesity standard in 2017. Hypertension prevalence rates($p<.001$), obesity rates, ($p<.001$), and abnormal blood glucose levels ($p<.001$)were significantly higher among people withdisabilities due to brain injury than those of non-disabled people. People with disabilities due to braininjury were found to have a high risk of chronic disease. Additionally, it isnecessary to develop strategies for managing hypertension.

Keywords: Brain injury; Disability;Glucose;Health;Hypertension

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INTRODUCTION

There are about 2.68million disabled people in South Korea(Ock et al., 2016). The number of people with disabilities is increasing every year (Ock et al., 2016), and their health problems are becoming a burden to the government. According to a national survey in 2017, about 10% of disabled peoplehad brain injury as the reason for their disability, and among these people, regular health monitoring was shown to be poor because of their physical and social limitations(National Health Insurance System, 2015; Song et al., 2020).

Regular health checkups are conducted once every two years for the entire population in South Korea, including for people with disabilities. People with disabilities due to brain injury are more vulnerable in terms of medical accessibility. According to a study by Song et al., about 3-4% of those with disabilities due tobraininjury could not participate in the national health checkup program, and this group's non-participation rates were significantly higher than those of people without a disability(Song et al., 2020).

A brain injury can result from spontaneous events and traumatic accidents (Krishnamoorthy et al., 2017), butregardless of its cause, hypertension and its related risk factors, such as abnormal body mass index (BMI) and waist circumference, should be monitored (Bhallaet al., 2001; Brown et al., 2006; Bulger et al., 2010; Heet al., 2014). Previous studies have reported that people with mobility disabilities,such as disabilitydue to braininjury, had a high prevalence of hypertension and diabetes (Bulger et al., 2010; Heet al., 2014; Ministry of Health and Welfare, 2015). Through the national regular health checkup program, many people that can potentially be classified as at risk for cardiovascular problems can be identified. Therefore, systematicallyanalyzing this information and comparing it with non-disabled people may beessential to identify those at risk among those withdisabilities due to braininjury.

Thus, the purpose of this study was to compare hypertension prevalence, abnormal BMI, waist circumference, and blood glucose levels between people with disabilities due to brain injury and non-disabled people.

MATERIALS AND METHODS

Sample and sampling

Data from 2016 and 2017 were obtained from the National Health Insurance Service of South Korea. Chi-squaretestswere performed to compare the hypertension prevalence rates, BMI, waist circumference, and blood glucose levels between people with disabilities due to brain injury and non-disabled people. TheJung-Bu Institutional Review Board (JIRB2019070801-01-190710) approved the research protocol, and the National Health Insurance Service approved the extraction of all the data of the investigated subjects(NHIS-2019-1-457).

Materials

Levels of disability: The levels of disabilityrefer to the severity of a disability due to brain injury. In South Korea,disabilitycan be classified into six levels (from index 1 to 6) by a physician according to legal standards. Index 1 indicates the most severe degree of disability, while index 6 indicates a less serious degree.

Household income class: Household income was classified into 20 classes by percentage;the greater the score, the higher the income.

Risk factors: The criteria for determining risk concerningblood pressure, BMI, waist

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circumference, and fasting blood glucose followed the Korea Center for Disease Control's (CDC) guidelines. Resting blood pressure was considered as blood pressureabove 140/90 mmHg,and a fasting blood glucose value of 126 mg/dL or higher was considered as risky. The risk criteria aredetailed in Table 1.

Table 1: Health checkup items and criteria

Health checkup item	Risk criteria
High blood pressure (BP)	Systolic BP ≥ 140mmHg Diastolic BP ≥ 90mmHg
Obesity(body mass index, BMI)	BMI ≥25kg/m^2
Waistcircumference	Men > 94cm Women > 80cm
Abnormal fasting blood glucose	≥ 126mg/dL

Statistical Analysis

Descriptive statisticswere used to compare demographic data such as sex, age, household income, and disability level. Chi-square tests were performed using SAS software (Carey, NC, USA) to compare the distribution of hypertension prevalence rates, obeseor overweightBMI, waist circumference, and abnormal blood glucose levels between people with disabilities due to brain injury and non-disabledpeople. The data of subjects were excluded from the analysis if there were any missing data. The significance level was set at .05.

RESULTS AND DISCUSSION

Demographics of participants

Table 2 summarizesthe demographic data of the health check-up participants in 2016 and 2017. In 2016, 63.2% of the people with disabilities due tobraininjury were male, while in 2017,52.9% of the non-disabled people were male. In 2016, the mean age was 63.35 years among people with disabilities due to braininjury, while that amongnon-disabled people was 48.77 years. Similar to 2016, the mean age of people with disabilities due to braininjury was 63.42 in 2017. Based on classifying household income into five, the poorest class (1-5) comprised 23.2% in 2016 and 24.0% in 2017 of people with disabilities due to brain injury, while they comprised 18.3% in 2016 and 18.4% in 2017 of non-disabled people.

The levels of disability were categorized into six and ranged from index 1 to 6. Indexes3 to 6 indicate mild disability that includes people capable oftaking care of themselves, even if some of them require personal support. Severity indexes between 1 and 2refer to being severely disabled that includes those who are highly dependent on assistants or assistive equipment(Ministry of Health and Welfare, 2015). The reason for classifying people with disabilities into serious and minor groupsis that not only do they have different medical and social needs but also some benefits/helps are determined by these definitions of severity(Jeonet al., 2017).

Among the six index groups(National Health Insurance Service, NHIS), index 3 (23.8% in 2016; 23.1% in 2017) had the largest number of people with disabilities due to brain injury. The

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proportion of index 1 (the greatest severity index group) was 10.7% in 2016, and 10.9% in 2017.

Table 2:Demographic data in 2016 and 2017

Characteristic	Category	2016		2017	
		Disabled due to brain injury	Non-disabled	Disabled due to brain injury	Non-disabled
Sex	Male, n (%)	26,853 (63.2)	7,010,648 (52.9)	26,262 (62.8)	7,106,969 (52.6)
	Female, n (%)	15,617 (36.8)	6,246,752 (47.1)	15,530 (37.2)	6,400,764 (47.4)
Age, years	Mean (±SD)	63.35 (±12.40)	48.77 (±14.02)	63.42 (±12.47)	49.06(±14.05)
Household income class, percentile	1-5	8,536 (23.2)	2,351,110 (18.3)	8,700 (24.0)	2,413,638 (18.4)
	6-10	6,911 (18.8)	2,897,587 (22.6)	6,822 (18.8)	2,960,699 (22.6)
	11-15	8,657 (23.5)	3,505,775 (27.3)	8,568 (23.7)	3,581,238 (27.3)
	16-20	12,753 (34.5)	4,086,229 (31.8)	12,103 (33.5)	4,142,670 (31.7)
Disability level	Index 1, n (%)	4,559 (10.7)	-	4,549 (10.9)	-
	Index 2, n (%)	7,057 (16.6)	-	6,768 (16.2)	-
	Index 3, n (%)	10,090 (23.8)	-	9,663 (23.1)	-
	Index 4, n (%)	6,516 (15.3)	-	6,328 (15.1)	-
	Index 5, n (%)	6,770 (15.9)	-	7,052 (16.9)	-
	Index 6, n (%)	7,478 (17.7)	-	7,432 (17.8)	-

The prevalence rates of hypertension, abnormal blood glucose levels, and obesity rate

Figure 1 shows the prevalence rates of hypertension and abnormal blood glucose levels between people with disabilities due to braininjuryand non-disabled people in 2016. The hypertension prevalence rate in 2016 of people with disabilitiesdue to braininjury was 23.8%, while that of non-disabled people was 12.4%. The proportion of people with an abnormal blood glucose level in 2017 was 16.9% amongpeople with disabilitiesdue to braininjury, while it was 16.9% in 2016. That is, the prevalence rates of hypertension and abnormal blood glucose level between people with disabilitiesdue to braininjury and non-disabled people in 2016 were statistically significantly different ($p<.001$) (Figure 1).

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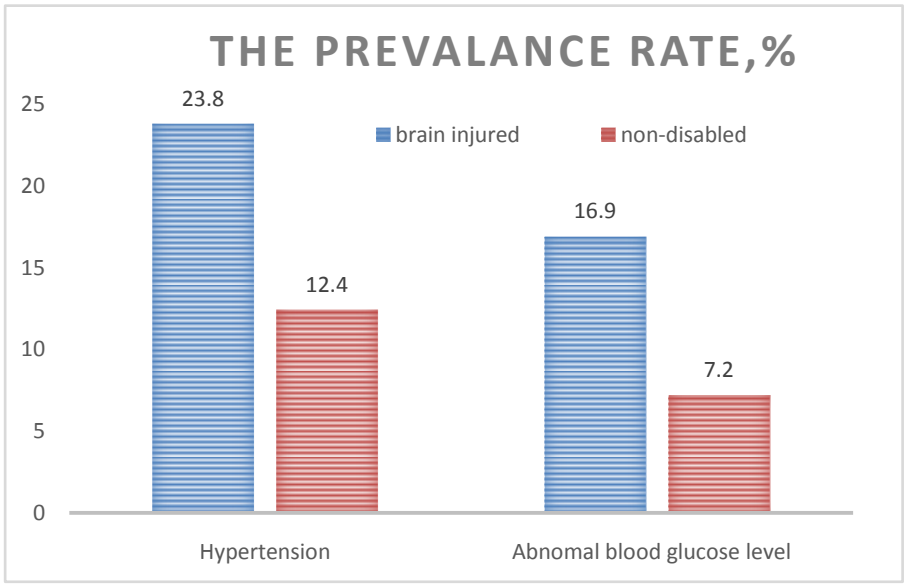

Figure 1:Prevalence rates of hypertension and abnormal blood glucose level in 2016

Figure 2 shows the prevalence rate of hypertension and abnormalblood glucose level of people with disabilitiesdue to brain injury and non-disabled people in 2017. The prevalence rate of hypertension was 24.3% among people with disabilitiesdue to brain injury while that of non-disabled people was 2.6%. Among people with disabilitiesdue to brain injury, 16.9% hadabnormal blood glucose levels, whereas for non-disabled people the rate was 7.5%in 2017 (Figure 2).

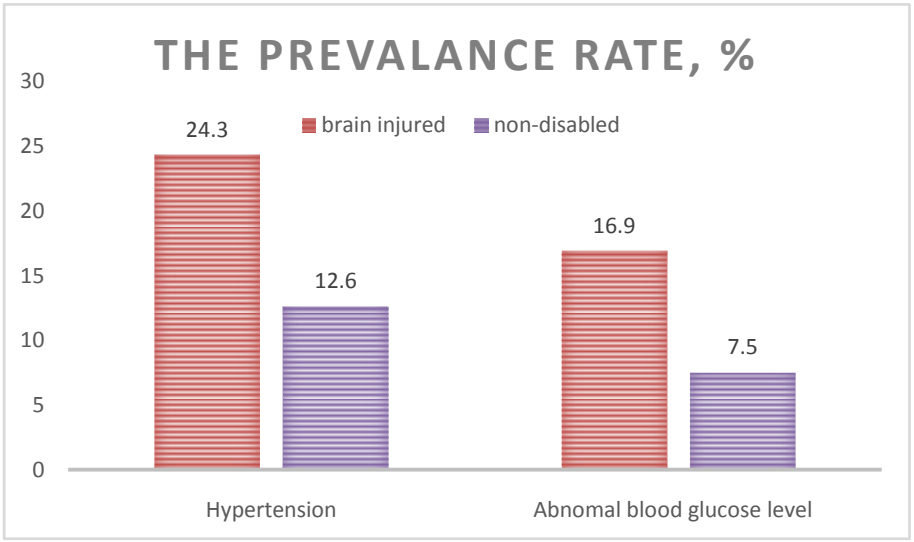

Figure 2. Prevalence rates of hypertension and abnormal blood glucose level in 2017

Acomparison of obesity rates in 2016 between people with disabilitiesdue to brain injury and non-disabled people is shown in Figure 3. Obesity was determined using BMI and waist circumference. When based on BMI, the obesity rate of people with disabilitiesdue to brain injury was 5.4%, and that of non-disabled people was 5.1%. However, when based on waist circumference, the obesity rate was 35.3% among people with disabilitiesdue to brain injury, and 22.7% among non-disabled people. In terms of waist circumference, the difference between the two groups was statistically significant ($p < .001$) (Figure 3).

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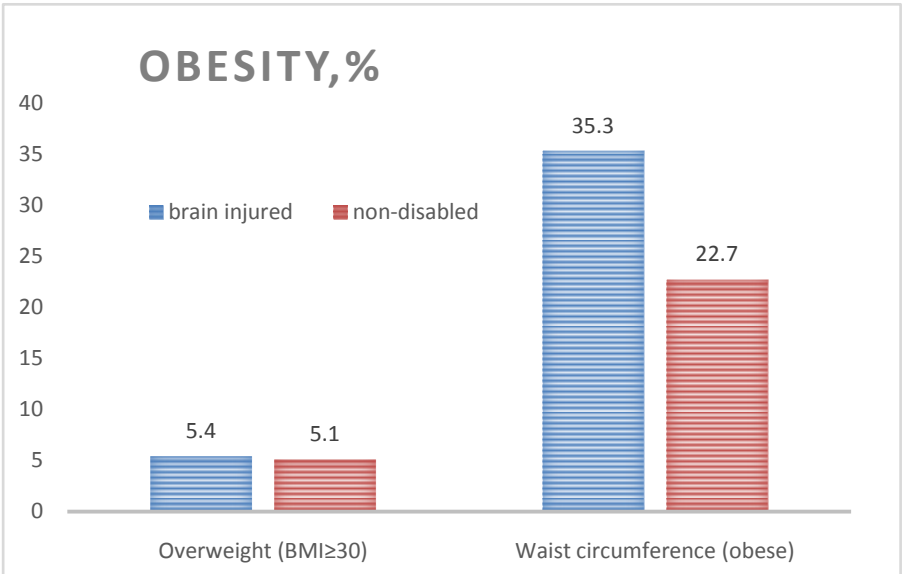

Figure 3:Obesity rates between people with disabilities due to braininjury and non-disabled people in 2016

Figure 4 presents the obesity rates between people with disabilitiesdue to braininjury and non-disabled people in 2017.Similar to thedata from 2016, when based on BMI, 5.6% of people with disabilitiesdue to braininjury and 5.1% of non-disabled people were obese or overweight. However, when based on waist circumference, 36.4% of people with disabilitiesdue to brain injuryand 23.4% of non-disabled peopleexceeded the standard determinant measure of obesity (male >90cm, women >80cm). The differences in obesity rates in terms of waist circumference between the two groups were statistically significant (p<.001) (Figure 4).

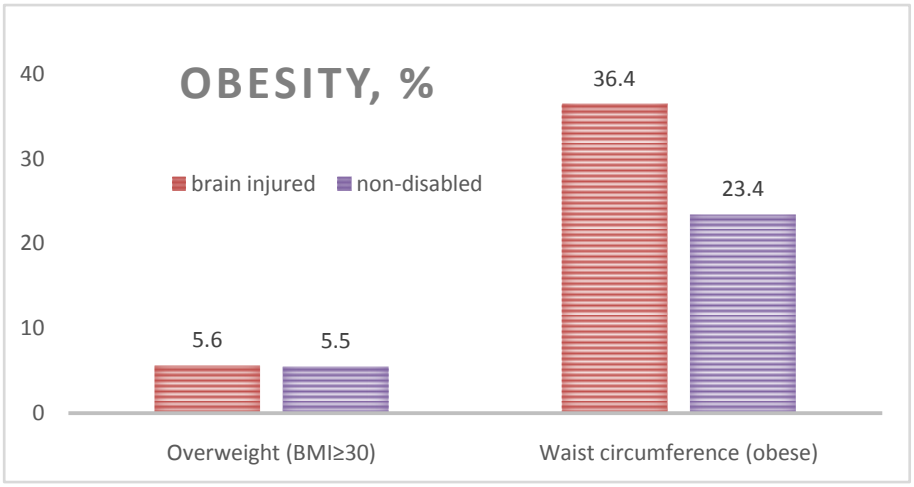

Figure 4: Obesity rates between people with disabilities due to brain injury and non-disabled people in 2017

The findings from this study showed that people with disabilities due to braininjury havemore prevalent high blood pressure and abnormal blood glucose levels thanthose of non-disabled people in 2016 and 2017. When comparing the obesity rates in 2016 and 2017 between the two groups, a similar pattern was found. That is, the prevalence rates of hypertension and abnormal blood glucose level among people with disabilitiesdue to brain injury was twice that of non-

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disabled people. Hypertension is a risk factor for obesity (Brown et al., 2006). In this study, the obesity rate of people with disabilities due tobrain injury as measured by waist circumference was 1.5 times higher than that of non-disabled people. With limited interpretation, the high obesity and high blood pressure rates among people with disabilities due to braininjury in this study might be related to each other. However, there was no difference between the two groups when comparing obesity levels with BMI. A prior study hassuggested the unsuitability of using the BMI in Asian populations, and that waist circumference would be more appropriate. This unsuitability is because BMI cannot distinguish between the proportions of weight due to body composition such as fat and muscle, and itis less accurate among certain groups, including people with disabilities(Fujimoto et al., 1991). Thus, waist circumference would be a better measurementtool of relative disease risk than BMIamong Asians(Fujimoto et al., 1991). Based on our findings, we recommend that waist circumference be reflected when measuring the obesity rate of disabled people.

The close relationship between chronic diseases and disabilities has been consistently reported inprevious studies(Brown et al., 2006; Fujimoto et al., 1991). For example, in a report by Dixon-Ibarra & Horner-Johnson (using data from the National Health Interview Surveys from 2006 to 2012), people with disabilities were found to have 2.18 times higher high blood pressure and 1.81 times higher obesity than non-disabled people (Dixon-Ibarra et al., 2014).Disabled people with chronic diseases such as coronary artery disease, stroke, cancer, asthma, and diabetes are reportedly at a high risk of becoming overweight and obese or overweight due to low physical activity, and the threat from secondary diseases such as high blood pressure and high cholesterol increases (Dixon-Ibarra et al., 2014). People with disabilities due to braininjury have more complex health problems such as cognitive, sensory, communication, and emotional difficulties than others(Bhalla et al., 2001; Brown et al., 2006; Bulger et al., 2010; He et al., 2014), as damage to brain functioning can affect every aspect of life. Among people with disabilities, those whose disabilities were caused by braininjury may be more vulnerable healthwise. Accordingly, the need for people with disabilitiesdue to braininjury to gain access to health checkups and treatment facilities with reducedchronic diseases such as hypertension and obesity should be emphasized.

CONCLUSION

The prevalence rates of hypertension, abnormal blood glucose level, and obesity in 2016 and 2017 were higher among people with disabilities due tobraininjury than those of people without disabilities.To adapt to long-term changes and to establish a stable welfare model, the South Korean government has established regular health checkup programs for people with and without disabilities and has provided chronic disease prevention services in their communities. To efficiently manage chronic diseases, it is necessary to develop customized and tailored programs based on the disability type and situation.

Active health-monitoring programs,such as aerobic physical activity and healthy food supply,should be developed for people with mobility disabilities. Moreover, a specific continuous health monitoring system for people with mobility disabilities should be implemented by the government.

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