ORIGINAL ARTICLE
https://doi.org/10.30773/pi.2023.0123
Print ISSN 1738-3684 / On-line ISSN 1976-3026
OPEN ACCESS

Prevalence and Medical Costs of Intellectual Disabilities and Pervasive Developmental Disorder in Korea: Based on National Health Insurance Service Claims Data from 2007 to 2019

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Objective We aimed to investigate the annual prevalence of intellectual disabilities (ID) and autism spectrum disorder employing claims data registered in Korean National Health Insurance Service. We also estimated the annual average of medical costs incurred from these disorders using same datasets.

Methods In order to obtain the prevalence, we selected patients diagnosed with ID and pervasive and specific developmental disorders (PDD) from 2007 to 2019. The ensuing annual average of medical costs was also estimated from these patients.

Results The annual prevalence of ID and PDD (per 100,000) between 2007 and 2019 ranged from 56.7 to 78.6 and from 22.0 to 44.6 respectively. Regarding the annual average of total medical expenditure per a patient, the expenditure of the ID group was higher than that of PDD throughout the years, as shown that the ID expenditure ranged from 769.7 to 1,501.2 US dollars as opposed to the PDD expenditure in the range of 312.5 to 570.7 US dollars. The further comparison in relation to income levels elaborated that the medical aid beneficiary group constitutes the highest one and the difference of the expenditure across the remaining income groups was not prominent although the very low group generally ranked the highest over the years.

Conclusion The prevalence of ID and PDD constantly increased and the same trend was displayed in ensuing health expenditures throughout the period. This implies that increasing needs exist across these patients with regards to therapeutic interventions, thereby contributing to prioritizing medical policies on national perspectives.
Psychiatry Investig 2023;20(10):972-983

Keywords Intellectual disability; Autism spectrum disorder; Insurance; Health; Prevalence; Health expenditures.

INTRODUCTION

Intellectual disabilities (ID) and autism spectrum disorder (ASD) are widely acknowledged to constitute major proportions of neurodevelopmental disorders, not only because their prevalence has increased steadily, but also because they incur diverse psychological and socioeconomic costs to individuals contracting these conditions as well as their family, and eventually society in general.[1]

The prevalence of both ID and ASD tends to increase over time and has reported variability, depending on diagnostic practices, population characteristics and risk factors subjects has been exposed to.[2] A recent meta-analysis of the ID prevalence employing population-based studies has illustrated that it was distributed from 0.05% to 1.55%.[3] In another recent research using Autism and Developmental Disabilities Data (ADDM) across nine states in US, it was estimated to reach 11.8 per 1,000 children in 2014.[4] Its prevalence based on claims data, particularly gathered from individuals insured through private health plans, ranged from 16 and 20 (per 100,000).[5] Turning to the ASD prevalence in a recent meta-analysis, its prevalence in US studies employing national population data was reported to be 1.70% and 1.85% for 4- and 8-year children, while the prevalence in the UK from national data ranged between 0.38% and 1.4%.[6] Its current estimates, according to the ADDM Network, were identified as 23.0 per 1,000 8-year-olds.[7] On the contrary, datasets claimed from privately-insured patients in early 2000s revealed it ranged

Received: April 19, 2023 **Revised:** July 27, 2023
Accepted: August 8, 2023

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between 95 and 192 (per 100,000).[5]

As for the economic costs of medical and nonmedical areas associated with ID and ASD individuals, given the paucity of research on medical expenditure incurred among ID patients, the majority proportion of studies have been conducted in the US and the UK, while sparsely distributed in Asian counties.[8,9] One study using national-level data, for example, indicated financial costs per a ID child was estimated to be $49,356 in Australia.[10] According to other recent studies, average annual medical costs for ASD children regardless of co-occurring ID was estimated to be $11,453 in the US and the UK,[11] whereas the average of total expenditure spent on healthcare utilization among ASD adults in the US recorded $13,700.[12]

In light of these circumstances, we aim to scrutinize both ID and ASD prevalence and the ensuing total amount of medical expenditure consumed by individuals with these diseases via claims data registered in the Korean National Health Insurance Service (NHIS), so as for our outcomes to represent the whole Korean population diagnosed with these disorders. Therefore, our research design would not only be able to estimate more realistic prevalence of ID and ASD in Korean society, but also contribute to the establishment of public health policies by taking entire medical costs related to these disorders into consideration.

METHODS

Data

In our study, national representative data were extracted from NHIS consisting of membership qualifications, insurance premiums, health-care utilization, and health check-up outcomes. This NHIS dataset can be accessed for the purpose of policy development and academic research, in which medical diagnoses are registered using the International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10) codes. For this research, we requested a customized dataset of patients diagnosed with "ID" and "pervasive and specific developmental disorders" indicated as F70, F71, F72, F73, F78, and F79 as well as F84, F84.x (x refers to a digit number ranging from 0 to 9) codes between the year of 2007 and 2019. Given the fact that ICD-10 codes are used in the registration of NHIS, our study employs nomenclature "pervasive developmental disorder (PDD)" instead of the general term "ASD."

Variables

Customized data obtained from NHIS was scrutinized to estimate prevalence rates, and the total medical expenditures per capita spent on the treatment of ID and PDD groups among entire age population in Korea from 2007 to 2019. All subjects registered in NHIS are composed of the medical aid beneficiary group and other groups including self-employed subscribers or insured employees. For detailed comparison, the socioeconomic status of other groups was further categorized into five subgroups (very low, low, middle, high, and very high) according to quintiles of their income. A US dollar (USD) is used as a monetary unit in our research, so that the currency exchange rates between Korean Won and USD were calculated via Statistics Korea.[13] For instance, the exchange rate that 1 USD is worth 1,156.4 Korean Won was used to covert Korean Won to USD in the year of 2019. Remaining exchange rates were listed under each table.

Case definition

In order to define ID and PDD cases, the ICD-10 was employed for all patients who visited outpatient units or inpatient admissions with the same code at least twice. In addition, a patient registered as both ID and PDD codes was regarded to be one disease group depending on which code is the most frequently used in the NHIS database. All patients were selected from the NHIS database during the 13-year period between 2007 and 2019.

Prevalence of ID and PDD

To obtain the prevalence of ID and PDD per 100,000 population from 2007 to 2019 using the number of identified cases of ID and PDD as above, the individual prevalence was calculated by dividing the number of patients by the number of population of Korea in each year. The entire population of Korea was obtained from the Korean Statistical Information Service managed by Statistics Korea.[14]

Estimation of medical costs of ID and PDD

The total medical costs of ID and PDD in Korea was estimated on a basis of the prevalence of individual diseases. The NHIS database was used to calculate all costs of outpatient and inpatient admissions incurred from nonpsychiatric as well as psychiatric departments. It should be mentioned that medical expenditures in NHIS are solely composed of claims from medical institutions. The total medical expenditure per capita was obtained from dividing the total expenditure by the number of population in Korea.

Ethics statement

This study was approved by the Institutional Review Board (IRB) of Kangwon National University Hospital (IRB No. 2021-09-008-001) and all researchers abided by its ethical codes of conduct. Informed consent was not required from patients due to the characteristic of public data from NHIS.

RESULTS

Table 1 illustrated annual prevalence per 100,000 person of ID and PDD based on NHIS dataset from 2007 to 2019. The prevalence of male patients with ID and PDD was higher than the female counterparts throughout the investigated years respectively, while the ID prevalence was higher than the PDD one. In detail, the ID and PDD prevalence was ranged from 56.7 to 79.9 and from 22.0 to 44.6 respectively over the years. In case of the ID prevalence, its highest point of 79.9 recorded in 2010 after steadily increasing from the beginning of the years. Subsequently, it experienced downward movement over the 4-year-peirod and reached 70.6 in 2014, before the opposite trend appeared with 78.6 being registered in 2019. On the contrary, the PDD prevalence did not reveal any prominent fluctuation, gradually increasing from 22.0 in 2007 to 44.6

Table 1. Annual prevalence of ID and PDD in male and female groups (per 100,000 person)

	Annual prevalence												
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
ID													
Male	71.9	76.2	83.5	99.8	92.5	90.8	91.0	90.2	93.2	98.4	96.7	96.9	101.3
Female	41.4	44.0	48.4	59.9	54.4	52.8	52.3	50.9	52.9	55.3	54.6	54.1	56.0
Total	56.7	60.1	66.0	79.9	73.5	71.8	71.7	70.6	73.0	76.8	75.6	75.4	78.6
PDD													
Male	34.4	37.2	38.1	40.3	43.4	45.3	48.5	51.1	53.8	57.9	61.7	66.0	72.3
Female	9.5	10.3	9.8	10.2	11.0	11.4	12.1	13.0	12.7	13.4	14.3	15.4	17.0
Total	22.0	23.8	24.0	25.3	27.3	28.3	30.3	32.0	33.2	35.6	38.0	40.6	44.6
Total	78.6	83.9	90.0	105.2	100.7	100.2	102.0	102.6	106.2	112.4	113.6	116.1	123.2

ID, intellectual disabilities; PDD, pervasive and specific developmental disorders

Table 2. Annual prevalence of ID and PDD groups (per 100,000 person)

	Annual prevalence												
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
ID													
Mild ID	23.6	25.1	27.9	30.2	29.8	29.0	28.3	27.0	27.9	29.7	29.7	29.4	30.9
Moderate ID	10.3	11.9	13.6	18.3	16.0	15.7	16.5	16.3	17.0	17.5	16.7	16.4	16.5
Severe ID	5.6	6.3	6.7	9.7	8.5	8.3	8.3	8.4	8.7	9.0	9.1	8.7	8.9
Profound ID	1.0	1.3	1.5	2.6	2.1	2.1	2.1	2.3	2.3	2.2	2.2	2.1	2.1
Other and unspecified ID	16.0	15.6	16.3	19.0	17.1	16.8	16.6	16.6	17.0	18.4	17.9	18.9	20.2
Total of ID	56.7	60.1	66.0	79.9	73.5	71.8	71.7	70.6	73.0	76.8	75.6	75.4	78.6
PDD													
Pervasive developmental disorders	1.6	0.6	0.4	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Autistic disorder	5.1	5.8	6.2	6.9	8.0	8.8	9.9	10.9	12.1	13.8	15.5	17.0	19.1
Atypical autism	2.1	2.2	2.3	2.3	2.6	2.6	2.8	2.8	2.9	2.9	2.9	2.9	3.2
Rett's syndrome	0.3	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.6	0.6	0.6	0.7	0.7
Other childhood disintegrated disorder	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0
Overactive disorder*	0.3	0.3	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.3	0.3
Asperger's syndrome	1.6	2.0	2.1	2.0	2.3	2.8	2.9	3.2	3.3	3.4	3.5	4.0	4.5
Others†	10.9	12.5	12.3	12.9	13.5	13.3	14.0	14.3	14.0	14.7	15.2	15.8	16.7
Total of PDD	22.0	23.8	24.0	25.3	27.3	28.3	30.3	32.0	33.2	35.6	38.0	40.6	44.6
Total	78.6	83.9	90.0	105.2	100.7	100.2	102.0	102.6	106.2	112.4	113.6	116.1	123.2

*overactive disorder associated with mental retardation and stereotyped movements; †other pervasive developmental disorders and pervasive developmental, unspecified. ID, intellectual disabilities; PDD, pervasive and specific developmental disorders

in 2019.

As displayed in Table 2, the comparison between each prevalence of ID and PDD subcategories demonstrated that the prevalence of mild ID and autistic disorder recorded the highest score within ID and PDD subcategories respectively. The mild ID prevalence was registered as the highest one with increasing from 23.6 in 2007 to 30.9 in 2019, followed by moderate, severe, and profound ID counterparts in that order. Compared with perturbation shown in the ID prevalence, all of the PDD prevalence increased persistently throughout the years. Especially, the autistic disorder prevalence surged from 5.1 in 2007 to 19.1 in 2019, while the prevalence of several PDD subcategories did not reveal noticeable changes, excluding the prevalence of atypical autism, other and unspecified developmental disorders. Figure 1 provided visual illustrations of outcomes encompassing both Tables 1 and 2.

The annual average of total medical expenditure per capita of each group divided by income level is revealed in Table 3. The expenditure of both ID and PDD groups moved upwards irrespective of sex over the years. The comparison of intergroup in ID and PDD, except the medical aid beneficiary group, revealed that the very low group recorded the highest expenditure throughout the years, such as $1,205.2 (male) and $999.6 (female) in the very low group of ID, with $527.6 (male) and $633.8 (female) in the very low group of PDD group in the year 2019. The further comparison of the expenditure between ID and PDD groups indicated that the expenditure of the ID group surpassed that of the PDD group over the entire period in terms of the subtotal costs of each sex and the total costs of each disease as well, registering $1,588.9 (male) and $1,343.1 (female) in the ID group as compared with $554.1 (male) and $641.1 (female) in the PDD group in 2019.

Further analysis in relation to age groups was depicted in Tables 4 and 5. The under 18 group refers to population less than the age of 18, while the adult group includes the remaining population aged 18 years and above. According to this division, the contrast of the medical expenditure appears not to be prominent across income groups of an individual age group, whereas the adult group recorded much higher expenditure across all income subgroups. This implies that the consistent increase of the total expenditure in each disorder is largely ascribed to adult population. Particularly, the contrast of the total expenditure between age groups is much more distinguished in ID, in which the adult group contributed to the total expenditure approximately 5- to 7-fold of the under 18 one, as opposed to the PDD group. For instance, the expenditure of the adult group in male ID patients is $2,163.4 compared with $336.2 of the under 18 group in 2019 (Table 4), while the

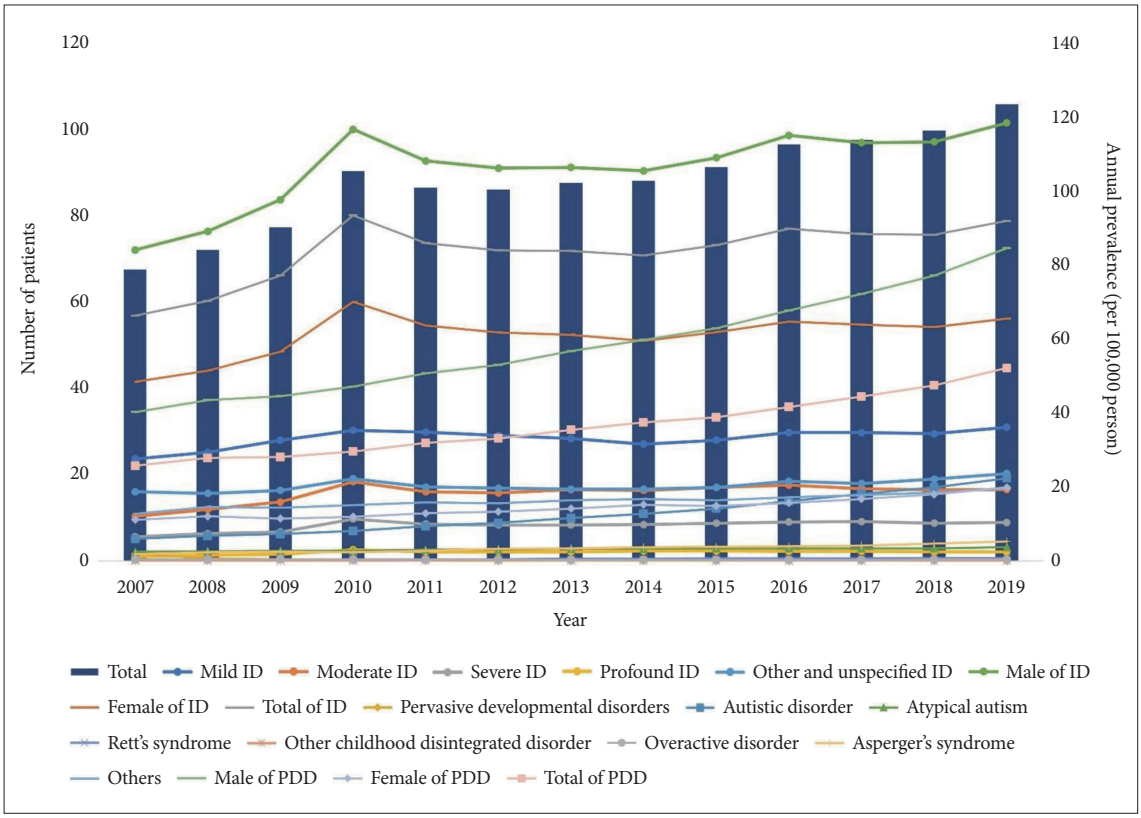

Figure 1. Annual prevalence of ID and PDD groups (per 100,000 person). ID, intellectual disabilities; PDD, pervasive and specific developmental disorders.

Table 3. Annual average of total medical expenditure per person among income groups

Code	Sex	Income level	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
ID	Male	Medical aid beneficiary	1,513.0	1,573.7	1,876.8	2,022.9	2,056.4	2,204.7	2,345.1	2,503.5	2,537.2	2,474.6	2,423.5	2,469.8	2,465.1
		Very low	467.5	588.9	541.1	771.1	1,027.1	1,036.3	1,075.8	1,233.0	1,275.3	1,165.4	1,307.2	1,235.6	1,205.2
		Low	299.5	328.5	427.4	446.7	492.5	558.3	643.1	690.0	701.0	782.2	809.4	867.3	922.6
		Middle	326.0	365.3	467.2	396.4	513.9	606.6	565.8	708.5	755.2	775.7	858.4	941.4	911.6
		High	356.5	411.5	408.0	375.9	533.6	574.7	668.1	724.4	807.4	758.9	771.4	853.8	846.8
		Very high	448.2	497.9	473.4	419.1	522.6	573.6	619.1	735.9	724.5	752.5	874.3	846.0	891.1
		Total*	813.8	897.7	1,042.3	1,001.9	1,186.1	1,279.2	1,368.6	1,513.2	1,556.0	1,526.0	1,572.6	1,588.3	1,588.9
	Female	Medical aid beneficiary	1,195.7	1,236.8	1,408.7	1,473.1	1,490.5	1,651.2	1,755.5	1,883.8	1,904.9	1,828.9	1,822.8	1,866.4	1,893.5
		Very low	515.8	524.5	473.9	572.6	779.7	795.9	893.8	894.3	1,047.5	1,011.1	999.5	1,078.8	999.6
		Low	279.4	285.5	346.6	327.8	453.9	435.3	477.1	514.7	517.0	736.5	853.8	844.2	781.0
		Middle	252.0	360.4	391.9	296.9	359.1	448.6	438.0	553.4	569.9	590.8	559.7	682.3	711.4
		High	264.7	383.0	381.4	326.0	451.6	493.6	557.4	644.2	592.8	744.1	808.8	888.8	877.0
		Very high	275.0	343.7	365.2	265.6	356.1	382.3	471.7	577.6	611.2	524.5	633.0	585.9	712.0
		Total*	693.0	767.0	864.6	778.1	934.1	1,027.6	1,121.5	1,228.3	1,264.7	1,258.8	1,288.9	1,327.9	1,343.1
	Total		769.7	850.0	977.3	918.1	1,092.9	1,186.8	1,278.4	1,410.4	1,450.4	1,429.8	1,469.9	1,494.8	1,501.2
PDD	Male	Medical aid beneficiary	531.9	610.7	695.8	799.3	868.0	1,006.6	1,094.0	1,071.1	1,101.5	1,060.8	1,119.1	1,078.8	1,095.4
		Very low	211.7	258.2	282.6	425.7	560.8	686.8	602.6	672.6	630.8	649.3	634.8	590.8	527.6
		Low	248.8	311.4	365.4	336.6	389.8	457.9	505.9	442.3	518.0	472.3	491.5	489.3	481.1
		Middle	285.3	303.2	350.5	453.2	389.8	426.6	438.4	475.3	474.6	476.4	455.9	467.3	537.0
		High	285.8	322.5	378.3	383.1	418.5	402.5	433.9	466.6	458.1	426.4	453.8	441.7	457.1
		Very high	301.2	340.7	367.1	408.4	458.4	469.4	495.2	513.7	485.2	495.2	474.7	490.9	512.2
		Total*	311.3	354.9	403.0	443.9	487.9	523.4	542.3	564.3	557.0	553.5	552.1	546.1	554.1
	Female	Medical aid beneficiary	549.8	581.9	687.1	761.2	864.5	890.9	966.2	1,216.2	1,011.7	877.7	946.7	1,087.6	1,112.9
		Very low	209.6	300.2	442.2	439.2	682.4	711.4	746.8	816.7	865.5	654.2	686.7	635.0	633.8
		Low	207.3	293.2	268.7	366.4	333.0	407.5	523.0	570.9	665.5	444.3	598.0	659.1	431.4
		Middle	232.2	255.6	358.5	377.8	391.7	422.2	457.5	532.9	519.1	586.6	545.9	546.1	619.8
		High	331.8	358.5	426.4	425.3	485.7	578.7	629.5	519.7	470.7	556.7	467.8	545.9	558.3
		Very high	279.6	340.3	449.7	482.6	514.7	552.0	500.7	539.1	516.7	632.2	534.1	524.9	576.9
		Total*	317.2	361.8	455.0	475.5	538.2	585.2	615.3	659.6	629.6	629.0	599.8	629.6	641.1
	Total		312.5	356.4	413.6	450.3	498.1	535.8	556.9	583.6	570.9	567.7	561.1	562.0	570.7

Unit: US dollars, 1 US dollar=936.1 Korean won (mean exchange rate in 2007); 1,259.5 Korean won in 2008; 1,164.5 Korean won in 2009; 1,134.8 Korean won in 2010; 1,151.8 Korean won in 2011; 1,070.6 Korean won in 2012; 1,055.4 Korean won in 2013; 1,099.3 Korean won in 2014; 1,172.5 Korean won in 2015; 1,207.7 Korean won in 2016; 1,070.5 Korean won in 2017; 1,115.7 Korean won in 2018; 1,156.4 Korean won in 2019.[13] *average of total medical expenditure of individual sex group in ID or PDD. ID, intellectual disabilities; PDD, pervasive and specific developmental disorders

Table 4. Annual average of total medical expenditure per capita among income groups of under 18 years and adult population in ID

Sex	Age group	Income level	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Male	Under 18 yr	Medical aid beneficiary	467.2	408.5	472.5	494.3	466.0	505.7	556.0	679.7	650.1	566.5	572.3	577.2	497.3
		Very low	221.3	194.2	183.2	340.9	296.3	298.7	360.1	428.9	365.1	309.3	306.1	349.5	348.7
		Low	147.3	172.0	225.1	203.0	211.2	197.5	202.8	210.2	215.7	240.6	307.3	242.8	250.9
		Middle	164.9	129.0	185.1	231.8	197.5	197.4	213.7	250.6	305.5	282.6	278.5	297.3	243.5
		High	192.1	193.3	206.5	214.7	215.8	230.9	220.0	253.5	220.5	231.2	238.2	286.2	255.6
		Very high	201.4	219.5	232.7	232.1	224.7	239.6	252.0	276.6	253.2	252.2	316.8	321.2	361.8
		Total*	248.8	239.0	277.3	294.9	279.1	288.7	312.6	363.6	347.1	325.6	346.2	357.9	336.2
	Adult	Medical aid beneficiary	1,937.4	2,041.4	2,439.6	2,480.5	2,513.1	2,625.4	2,762.8	2,871.0	2,890.7	2,883.9	2,769.0	2,799.3	2,791.6
		Very low	614.6	818.9	744.6	970.1	1,487.1	1,439.6	1,445.2	1,563.3	1,652.9	1,549.5	1,726.4	1,580.4	1,573.2
		Low	505.2	550.6	663.6	605.1	741.1	869.8	975.8	1,021.8	1,009.2	1,129.9	1,106.8	1,226.0	1,337.1
		Middle	625.5	783.9	920.8	537.7	893.4	1,102.7	961.3	1,159.3	1,162.4	1,310.5	1,426.6	1,532.1	1,550.2
		High	746.2	883.3	805.1	528.5	1,005.6	1,067.9	1,285.6	1,315.8	1,434.3	1,497.3	1,441.3	1,530.2	1,598.0
		Very high	944.4	1,066.2	896.4	582.6	916.5	988.7	1,019.2	1,172.2	1,152.5	1,258.0	1,349.1	1,321.7	1,391.6
		Total*	1,360.2	1,503.8	1,692.8	1,403.0	1,795.4	1,893.3	1,973.6	2,084.2	2,114.5	2,148.4	2,135.1	2,136.9	2,163.4
Female	Under 18 yr	Medical aid beneficiary	398.7	397.7	446.9	428.0	407.1	428.6	415.0	532.6	564.3	409.6	417.1	455.2	467.4
		Very low	163.7	172.6	156.4	256.3	247.3	325.5	312.9	332.5	303.1	220.2	276.0	288.6	274.5
		Low	167.5	174.9	183.3	170.2	217.9	208.9	218.2	189.9	222.7	202.6	196.4	251.7	243.1
		Middle	158.8	197.6	199.0	235.9	190.1	174.8	179.6	218.0	234.1	219.4	260.9	200.3	207.8
		High	186.5	249.5	231.4	285.2	236.1	291.7	238.7	263.9	246.6	215.8	202.8	249.1	260.6
		Very high	174.0	195.5	187.3	192.3	188.3	236.6	233.8	223.4	221.4	205.2	246.8	259.5	298.6
		Total*	230.7	256.9	271.6	280.9	262.2	292.8	280.5	314.1	320.7	261.8	281.0	297.3	307.4
	Adult	Medical aid beneficiary	1,488.9	1,531.2	1,764.0	1,767.1	1,781.0	1,959.2	2,051.5	2,139.9	2,137.6	2,100.4	2,064.9	2,088.0	2,118.3
		Very low	702.3	739.8	647.1	716.2	1,091.0	1,069.2	1,221.9	1,140.4	1,367.0	1,361.4	1,321.6	1,415.0	1,332.4
		Low	400.9	414.6	514.6	414.8	673.4	628.1	681.5	753.9	692.5	1,060.9	1,260.0	1,175.6	1,147.0
		Middle	416.9	651.0	673.0	343.0	564.0	765.8	712.5	892.3	839.8	949.0	845.3	1,120.6	1,196.5
		High	439.5	661.9	641.6	356.5	765.0	758.6	952.5	1,084.4	951.6	1,335.4	1,595.5	1,661.0	1,611.3
		Very high	482.5	611.5	666.1	320.5	571.7	563.7	745.3	938.4	983.8	883.2	1,024.3	904.0	1,134.2
		Total*	1,078.1	1,172.4	1,303.4	1,020.9	1,341.9	1,448.8	1,560.3	1,646.0	1,655.0	1,702.8	1,718.2	1,744.4	1,777.0

Unit: US dollars, 1 US dollar=936.1 Korean won (mean exchange rate in 2007); 1,259.5 Korean won in 2008; 1,164.5 Korean won in 2009; 1,134.8 Korean won in 2010; 1,151.8 Korean won in 2011; 1,070.6 Korean won in 2012; 1,055.4 Korean won in 2013; 1,099.3 Korean won in 2014; 1,172.5 Korean won in 2015; 1,207.7 Korean won in 2016; 1,070.5 Korean won in 2017; 1,115.7 Korean won in 2018; 1,156.4 Korean won in 2019.[13] *average of the total expenditure in individual age group of ID. ID, intellectual disabilities

Table 5. Annual average of total medical expenditure per capita among income groups of under 18 years and adult population in PDD

Sex	Age group	Income level	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Male	Under 18 yr	Medical aid beneficiary	401.7	447.8	519.3	551.1	548.7	620.3	708.2	676.6	649.8	533.0	551.0	645.0	604.2
		Very low	184.8	224.1	252.7	434.3	484.6	524.2	447.7	517.7	456.9	448.8	444.1	401.1	362.3
		Low	247.7	306.7	328.1	332.3	297.7	361.6	416.0	370.4	351.7	352.3	312.0	273.4	312.0
		Middle	235.7	268.1	299.5	394.7	296.9	329.4	341.9	328.4	357.3	339.8	330.8	337.3	320.5
		High	252.1	282.3	330.3	318.3	356.2	362.4	358.1	387.7	354.5	331.4	328.9	340.8	378.6
		Very high	270.7	282.6	324.8	385.4	403.0	407.3	441.0	436.3	406.1	393.1	362.9	386.5	405.6
		Total*	266.2	295.6	339.3	382.7	385.7	405.8	420.1	426.3	401.1	382.1	365.8	375.7	384.9
	Adult	Medical aid beneficiary	925.8	1,041.5	1,083.5	1,143.5	1,236.7	1,366.1	1,405.2	1,354.7	1,403.0	1,433.9	1,470.7	1,353.5	1,375.3
		Very low	336.6	379.7	356.9	408.4	719.4	971.4	817.1	872.7	813.0	864.4	826.4	764.1	677.8
		Low	259.0	345.1	577.8	351.3	658.7	718.2	703.1	619.4	826.4	684.5	745.9	807.8	735.3
		Middle	677.7	572.6	626.2	690.2	790.5	786.7	759.1	908.1	817.0	868.7	810.6	821.2	1,063.1
		High	640.0	697.8	709.9	702.7	769.9	611.4	770.9	769.2	855.1	788.2	905.3	822.7	761.1
		Very high	492.2	652.4	548.2	478.3	640.6	649.4	650.8	703.5	660.4	726.1	708.0	701.6	729.3
		Total*	602.7	685.4	676.1	630.3	804.2	844.9	841.5	866.8	863.5	889.6	892.1	849.3	848.8
Female	Under 18 yr	Medical aid beneficiary	429.0	489.1	582.0	602.5	565.5	535.9	595.3	731.4	619.4	614.0	506.3	480.7	502.7
		Very low	176.0	338.9	483.6	502.5	781.6	721.2	729.5	748.3	787.2	599.9	534.7	521.6	579.5
		Low	212.2	302.4	268.7	380.2	359.7	364.2	428.1	407.0	478.6	346.8	552.8	542.6	424.0
		Middle	233.7	260.8	375.7	411.0	402.3	443.9	447.2	453.4	432.9	538.4	409.3	455.5	599.2
		High	295.0	318.8	403.4	447.5	453.0	511.2	606.0	540.4	438.4	525.7	427.8	508.6	467.7
		Very high	282.2	320.1	404.3	453.9	484.2	519.3	451.1	477.9	535.5	582.0	474.5	433.0	537.3
		Total*	283.6	330.6	417.4	457.2	483.6	511.2	530.4	535.5	527.8	546.7	467.1	478.7	523.3
	Adult	Medical aid beneficiary	845.4	811.1	920.9	968.3	1,169.6	1,244.1	1,342.7	1,635.6	1,332.4	1,064.0	1,221.7	1,454.8	1,481.3
		Very low	351.0	165.4	259.2	217.2	370.1	680.9	790.7	972.1	1,000.2	752.8	910.9	781.4	710.7
		Low	159.0	175.1	268.6	299.6	205.4	598.2	888.5	1,055.6	1,260.1	688.0	715.2	947.2	450.5
		Middle	207.9	197.2	158.1	167.1	289.3	274.9	520.9	958.3	945.0	814.4	1,283.2	945.0	707.2
		High	879.1	945.1	662.6	293.9	771.8	993.1	786.9	385.0	672.3	749.8	674.3	734.0	1,013.6
		Very high	260.7	473.0	734.0	622.1	679.2	704.3	703.5	777.4	457.6	794.1	713.6	778.2	680.7
		Total*	550.7	568.6	668.4	549.3	766.2	863.0	910.0	1,048.8	909.6	849.2	927.6	973.7	908.7

Unit: US dollars, 1 US dollar=936.1 Korean won (mean exchange rate in 2007); 1,259.5 Korean won in 2008; 1,164.5 Korean won in 2009; 1,134.8 Korean won in 2010; 1,151.8 Korean won in 2011; 1,070.6 Korean won in 2012; 1,055.4 Korean won in 2013; 1,099.3 Korean won in 2014; 1,172.5 Korean won in 2015; 1,207.7 Korean won in 2016; 1,070.5 Korean won in 2017; 1,115.7 Korean won in 2018; 1,156.4 Korean won in 2019.[13] *annual average of the total expenditure in individual age group of PDD. PDD, pervasive and specific developmental disorders

same year underwent $848.8 and $384.9 in adult and under 18 groups in PDD, respectively (Table 5). Female population demonstrated the similar pattern where $1,777.0 and $307.4 went to adult and under 18 ID groups in comparison with $908.7 and $523.3 of adult and under 18 PDD groups in 2019, respectively.

Additionally, the same tendency of increase was also revealed in the annual average of the medical expenditure per capita of both inpatient and outpatient departments (Supplementary Table 1 in the online-only Data Supplement). The medical expenditure of the medical aid beneficiary group spent on hospitalization recorded around nine and six times higher than that of the inpatient unit in male and female ID groups, respectively. Particularly, the average expenditure of the very low income group of ID showed the average cost of hospitalization was approximately four times higher than that of the outpatient area in 2019, registering $961.0 and $244.2 as well as $780.0 and $219.6 in male and female patients, respectively. This gap of the expenditure between inpatient and outpatient, however, is slightly lower among other income groups compared with the gap in the very low group. Turning to PDD categories, while the expenditure of the outpatient unit recorded higher than its counterpart, the difference of two types of expenditure between sex groups is less prominent as compared with that in ID. As an example, PDD male patients in the very high group recorded $181.7 and $330.5, while PDD females in the corresponding group registered $187.0 and $390.0 for the cost of inpatient and outpatient unit respectively in 2019.

DISCUSSION

Both ID and ASD, due to their neurodevelopmental characteristics, frequently lead their socioeconomic impacts to continue throughout individual's life. In light of this perspective, our research demonstrated temporal trajectories concerning the prevalence of two disorders as well as medical costs of their patients by using national-level health insurance data. To our best knowledge, our study is thought to be a first attempt to compare between two disorders in terms of total medical expenditures via national health insurance data in Korea.

Our findings indicated that the ID prevalence ranged between 56.7 in 2007 and 78.6 in 2019. One study using national administrative data in Norway based on the ICD-10 classification displayed it was estimated to be 0.44 per 100 inhabitants in 2010.[15] A recent systemic review of the ID prevalence from studies using administrative data revealed its range is distributed from 0.05% to 1.55%.[3] Although the ID prevalence of our study is seemingly located within this range, another study including both children/adolescents and adults reported 0.10% using health administrative data and the ICD classification system,[16] which far exceeded the ID prevalence of our study. Despite the paucity of studies based on claims data, prior studies demonstrated the ID prevalence calculated from patients with private health insurance was 18.0 (per 100,000) in 2004,[5] whereas the ID prevalence of our study registered 56.7 (per 100,000) in 2007. As for PDD, the PDD prevalence in our study steadily increased from 22.0 in 2007 to 44.6 in 2019. These are substantially lower compared with recent estimates of the ADDM Network where 23.0 (per 1,000 8-years-olds) were recorded as the ASD prevalence.[7] This prevalence is approximately twice higher than 10.0 in 2008 in the ADDM Network, which seems consistent with approximately 2-fold increments in the PDD prevalence of our study from 2007 to 2019. Research based on health insurance claims data of PDD subjects also demonstrated noticeable differences as opposed to our findings. For instance, the autism prevalence using data from private health insurance in the US showed 192 (per 100,000) in 2004.[5] In another study using claims data of Medicaid recipients in the US, the prevalence in adults ranged between 266 in 2006 and 366 (per 100,000) in 2008.[17] Another study using data from national registries in Scandinavian countries indicated the ASD prevalence recorded around 1% in Finland and 1.5% in Sweden.[18] These estimations also far exceed the prevalence of our study. Interestingly, one study based on NHIS in Korea published that the prevalence of autistic disorder rose from 8.52 in 2008 to 18.53 in 2015, in which a case is defined as an individual using outpatient services at least twice or inpatient admissions under the diagnostic code of autistic disorder.[19] On the contrary, our result employing the same dataset revealed it increased from 5.8 to 12.1 over the same period, as the contrast can be mainly ascribed to our case definition encompassing ID.

To our best knowledge, nationwide claims data research on the medical expenditure incurred from ID population is sparse. One prior investigation reported the average expenditure incurred from health care among ID patients with private health insurance in the US reached $10,036 in 2004.[5] A recent literature review elucidated the distribution of studies related to medical costs of developmental disabilities were mostly located in the US and Europe, whereas few studies were conducted in Asia.[19] Moreover, the majority proportion of studies have emphasized developmental disabilities including ID rather than solely ID.[1,20] From this point of view, our study refers to a first attempt to investigate the total medical expenditure incurred from ID population from national-level perspectives in Korea. In our study, the average of total medical expenditure per an ID individual recorded $1,501.2 compared to $570.7 of PDD in 2019 (Table 3). This propensi-

ty that the ID expenditures surpasses the PDD one maintained throughout the years in our study. Turning to ASD, a few studies regarding the ASD-related medical expenditure from national-level-data perspectives have been available and the majority of these studies have been conducted in the US and the UK.[5,21] Leigh and Du[22] speculated that 1.1% prevalence of ASD is expected to yield $460.8 billion in 2025. Our study showed that the total medical expenditure from PDD patients of all age groups amounted to approximately $13 million in 2019. Other investigations claimed privately-insured or employer-sponsored health insurance data to estimate the total medical expenditure.[12,23] Leslie and Martin[5] demonstrated the average health care expenditure of autism patients insured by private health companies recorded $6,706,[5] while the average costs consumed from privately-insured autism patients aged from 1 to 21 years recorded $6,830 in early 2000s.[24] Vohra et al.[12] reported that ASD patients spent more money ($13,700 of average annual expenditures) than individuals without ASD ($8,560) based on health insurance claims data from 2000 to 2008 and outpatient visits mainly accounted for this difference, which is consistent with our findings where the outpatient expenditure of ASD exceeded the inpatient one (Supplementary Table 1 in the online-only Data Supplement). However, the total expenditure of ASD ($356.4 in 2008) in our study was substantially lower than the finding of this study in the same year ($3,048).[12] Another article demonstrated that outpatient behavioral intervention-related expenditure for ASD children increased around 3.5 times during the 7-year-period as compared with around 1.5-time-increase (from $13,000 to $20,000) of the mean spending during that period.[25] Aside from overseas studies, one recent domestic investigation using NHIS data reported continued increase in health expenditures of autistic disorder from $20,931 in 2008 to $65,816 in 2015,[19] as opposed to our findings illustrating that the total health expenditure from PDD patients escalated from $356.4 to $570.9. The difference of two studies on a basis of the same NHIS data can be attributed to definition of case as well as medical costs. Medical costs of this previous study were composed of direct costs considering both medical and nonmedical components and indirect ones,[19] whereas our study only took direct medical costs obtained from NHIS data into account.

Within comparisons of prevalence between ID and PDD of our findings, despite the increased trend of the ID prevalence, its trajectory revealed perturbations relative to continual increase of the PDD one. When taken characteristics of NHIS data into consideration, the prevalence in our study was estimated according to affected individuals' hospital visits, indicating that it may be affected by a number factors including individuals' disease perceptions as well as socioeconomic factors, such as national welfare services. In Korea, patients with ASD can be registered in the name of autism disabilities from 2007 and the term "developmental disability" has encompassed both ID and ASD in the law amendment since 2014.[26] Particularly, new diagnostic criteria of ASD based on Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DMS-5) have world-widely been introduced since 2013. Incorporating with our case relying on frequency of hospital visits, these trends reflecting increased awareness of ASD may amount to different trajectories of prevalence between two disorders, consisting with globally increased public awareness of ASD.[27] Indeed, the status of national registration of developmental disabilities in Korea illustrated that the registered number of ASD increased by roughly 2.5 times (28,678) in 2019 compared with 11,874 in 2007, as opposed to that of ID increasing by around 1.5 times (from 142,589 to 212,936) over the same period.[28]

A number of factors may result in these discrepancies. The majority of research on the ASD epidemiology has virtually been focused on children. On the contrary, our research is based on dataset of the whole population registered in national health insurance. To date, few studies of ASD prevalence has rigorously been conducted in adult population. Outcomes of one study from adult over the age of 16 in the UK, for instance, reported the ASD prevalence as 9.8 per 1,000.[25] However, comparability between those studies and our findings was not likely established, taking heterogeneities in case definition and methodologies into account. In addition, the identification of idiopathic ID appears difficult, since ID is frequently associated with both congenital and acquired diseases and thereby the substantial proportion of ID could be diagnosed with other congenital diseases.[1,20]

Study population and methodologies could also account for gaps between our findings and others. Individual studies adapt their unique case definition, thereby leading to slightly different outcomes of their estimation. Our study was based on data from NHIS, implying that the prevalence in this study reflects the number of treatments rendered for either ID or PDD in medical institutes. This indicates that our study could not contain individuals receiving interventions from nonmedical facilities or treatment modalities not covered by NHIS. To our best knowledge, although research on the proportion of these patients has been meager, one prior study reported around 85% and 56% of ASD patients engaged in speech and sensory integration therapies respectively.[29] Another study in Korea demonstrated that individuals with either ID or ASD experienced diverse intervention modalities, such as speech, play, exercise, and sensory integration therapies with the percentage of around 90%, 62%, 42%, and 42%, respectively.[30] This group of population may be excluded in our study, thereby

contributing to differences of the prevalence compared to other overseas studies. As a result, health expenditures incurred from patients in our study can show discrepancies compared with findings of other investigations. The recent study conducted by Hong et al.[19] in Korea, for example, reported much higher averages of health costs from ASD patients than our outcomes, such as $65,816 in 2015 compared to $570.9 in the same year of our study. Furthermore, another study in Australia quantified costs associated with ID children including both direct and indirect medical expenditure and concluded the total costs were estimated to be $49,352.[10] In contrast, the total expenditure of our study in 2019 is amounted to be $1,501.2 which is based on NHIS composed of claims from only medical institutions. As displayed in Table 3, differences in income levels seemingly translate into differences not so much in medical needs as in medical expenditures. Further analyses divided into young and adult subgroups did not reveal any prominent gaps in terms of the medical expenditure except the finding that the adult group tended to spend more expenditure than the young group. These outcomes seemingly contradict well-acknowledged hypotheses that higher income families may be better capable of incurring additional expenditure in order to satisfy needs of their family members. In spite of requiring further research considering other parameters, such as the amount of families caring, this might be due to the substitution of family-delivered care for one purchased from medical institutions.[8,31] Much higher medical costs were spent on both ID and PDD adult groups than the younger ones (Table 4). This is consistent with a prior research where medical and nonmedical costs were higher for ASD adults than for ASD children in the US and the UK, in which $29 billion and $43 billion per year were recorded for children compared with $3.1 billion in the UK and $4.5 billion in the US, respectively.[11]

Relatively lower medical expenditures of higher income groups may also be ascribed to the fact that other treatment modalities not covered by NHIS were excluded in our study. One prior study in Korea, for instance, illustrated that children with ID and ASD underwent 4.05 and 3.11 types of educational-behavioral therapy although no significant difference existed between two groups.[30] Another domestic research also implied that increased exigencies regarding various behavioral, language, and occupational therapies existed in Korea while a few medical institutes were able to provide these interventions.[32] Incorporating with much higher medical expenditures of the medical aid beneficiary group relative to other income ones, this suggested that higher income groups could spend more money on other interventions not covered by NHIS.

A number of limitations posed from our study need to be elaborated. First of all, as our data is based on claims from NHIS, medical costs in our study were solely composed of expenditure incurred when medical institutions were visited and relevant diagnoses were established. However, ID and/or autism patients frequently cause their parents or caregivers to restrict the participation of their workforce.[31] Indeed, around 70% of families caring for ID children were reported to suffer loss of income and reduction of labor hours.[33] Furthermore, one research also revealed medical costs amounted to 19% of the total surveyed expenditure, while dental care services ranked the highest percentage (45.95%) among them, followed by linguistic interventions and occupational therapies in that order.[31] The Scottish government also reported educational costs for autistic children accounted for three quarters of the total annual service costs.[34] These therapeutic interventions, which are frequently provided from nonmedical institutions in Korea, were not included in this study. Additionally, although much more medical costs were generally spent on the adult groups in our study, this may not correspond to real-world economic burdens imposed on Korean society. Due to the nature of NHIS data, costs from individuals receiving certain types of interventions or education, including applied behavior analysis administered in other facilities not covered by NHIS in Korea, were excluded in our data. Aside from these, cost for direct nonmedical issues, such as, special education services and residential placement or respite care could not be included in our study as well. In other words, discrepancies of the prevalence and health expenditures in this study compared to other research could be due to nature of NHIS database which only registers information from hospital visits, so that the inevitable exclusion of patients, either visiting other health facilities or receiving uninsured services, could contribute to bias our results.

Another limitation is related to case definition of ID and PDD in this study. Our study conservatively set operational definition of ID and PDD, requiring subjects were given each code more than twice (at least two claims on separate service dates with ICD-10 code). One recent systemic review showed various diagnostic references, ranging from DMS, Fourth Edition, Text Revision, DSM-5, ICD-9, and ICD-10 to specific standard psychological tests, were employed to measure the autism prevalence and distinguished median estimates of autism prevalence, by reporting 170 (per 100,000) for autistic disorders as opposed to 62 (per 100,000) for PDD diagnostic categories.[35] This implies that variability of diagnostic boundaries depending on each reference can affect the prevalence estimation across studies.

Last but not least, for the convenience of comparison between two disease groups in our study, individuals with comorbidity diagnosed with both ID and PDD were classified

into only one group depending on more prevalent code of diagnosis during the total days of hospital visits. Incorporating with high rate of codiagnosis between ID and PDD raging up to 40% depending on studies,[36,37] one group of disorder may be substituted for the other one in some clinical situations where certain categories of diagnosis represent more significant needs at the time of hospital visits.[38,39] Consequently, the comparison between two groups in our study may not strictly ensure the extent to which type of disorder imposed more financial burden in national-level perspectives.

Despite several limitations embedded in this study, it has shed light on national-based prevalence and financial burdens imposed on population with ID and PDD obtained from nationally representative claims data. Our study on prevalence estimates of these disorders and ensuing medical expenditures is expected to play an essential part in establishing and prioritizing public health policies in terms of appropriate allocation of medical infrastructure and resources, as well as cost-effectiveness.

Supplementary Materials

The online-only Data Supplement is available with this article at https://doi.org/10.30773/pi.2023.0123.

Availability of Data and Material

The datasets generated or analyzed duing the study are based on the NHIS database, so that they are avaiable from NHIS on reasonable request.

Conflicts of Interest

The authors have no potential conflicts of interest to disclose.

Author Contributions

Conceptualization: all authors. Data curation: all authors. Formal analysis: In-Hwan Oh, Hyeon-Kyoung Cheong. Funding acquisition: Jun-Won Hwang. Investigation: all authors. Methodology: all authors. Project administration: all authors. Software: Hyeon-Kyoung Cheong. Validation: Beomjun Kim, Jun-Won Hwang. Writing—original draft: Beomjun Kim, Jun-Won Hwang. Writing—review & editing: Beomjun Kim, Jun-Won Hwang.

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Funding Statement

This research was supported by Kangwon National University Hospital Behavior and Development Center through its research budget (approval No. 30003024). We also appreciate the NHIS for access to the claims data.

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Supplementary Table 1. Annual average of the total medical expenditure per capita incurred from Inpatient admissions and outpatient visits based on income levels

Code	Sex	Income levels		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
ID	Male	Medical aid beneficiary	Inpatient	1,345.6	1,379.6	1,651.3	1,770.8	1,797.0	1,935.2	2,052.3	2,194.7	2,218.3	2,156.0	2,169.9	2,212.5	2,192.7
			Outpatient	167.4	194.1	225.5	252.1	259.4	269.6	292.8	308.8	318.9	318.6	253.6	257.3	272.4
		Very low	Inpatient	372.0	483.0	423.8	647.1	885.0	882.9	911.7	1,061.9	1,097.9	980.5	1,097.8	1,012.9	961.0
			Outpatient	95.5	106.0	117.3	124.0	142.2	153.4	164.1	171.2	177.4	184.9	209.4	222.7	244.2
		Low	Inpatient	202.3	223.8	310.8	334.6	369.7	431.5	491.0	532.2	538.4	610.8	614.6	666.6	699.1
			Outpatient	97.2	104.6	116.6	112.1	122.8	126.8	152.2	157.8	162.6	171.3	194.8	200.7	223.5
		Middle	Inpatient	216.8	251.8	340.7	271.1	373.2	465.5	415.3	542.3	588.1	613.3	675.0	743.6	700.9
			Outpatient	109.3	113.5	126.5	125.3	140.7	141.1	150.4	166.2	167.1	162.3	183.4	197.8	210.7
		High	Inpatient	234.4	283.8	269.1	247.4	390.7	417.5	506.7	546.5	635.8	581.8	585.8	649.1	628.5
			Outpatient	122.1	127.8	138.9	128.4	142.9	157.2	161.4	178.0	171.6	177.1	185.6	204.7	218.3
		Very high	Inpatient	312.7	343.5	308.5	273.2	358.1	401.5	431.2	532.1	526.0	551.3	660.7	618.5	638.5
			Outpatient	135.5	154.4	164.9	145.8	164.5	172.1	187.8	203.7	198.4	201.2	213.6	227.5	252.6
	Female	Medical aid beneficiary	Inpatient	1,030.2	1,047.0	1,174.5	1,222.2	1,237.9	1,384.3	1,463.9	1,576.1	1,582.9	1,502.1	1,561.2	1,599.2	1,608.3
			Outpatient	165.5	189.8	234.3	250.9	252.6	266.9	291.6	307.7	322.0	326.7	261.6	267.2	285.2
		Very low	Inpatient	424.5	420.7	370.9	464.8	654.3	662.8	752.5	749.3	890.3	843.7	819.1	868.6	780.0
			Outpatient	91.4	103.7	103.0	107.8	125.4	133.1	141.3	145.1	157.2	167.4	180.5	210.2	219.6
		Low	Inpatient	194.6	188.8	243.5	227.8	343.5	319.7	347.8	378.8	369.8	595.8	706.8	672.2	576.7
			Outpatient	84.8	96.7	103.1	100.0	110.4	115.6	129.3	135.9	147.3	140.7	147.0	172.0	204.3
		Middle	Inpatient	148.3	262.9	282.9	185.8	244.8	326.1	302.3	404.6	419.6	439.1	397.3	499.3	523.2
			Outpatient	103.6	97.5	109.0	111.0	114.3	122.5	135.7	148.8	150.3	151.7	162.5	183.0	188.2
		High	Inpatient	158.4	255.8	258.5	217.5	309.9	340.3	402.0	474.3	437.7	588.7	638.4	713.8	692.3
			Outpatient	106.3	127.2	122.9	108.5	141.7	153.4	155.3	169.8	155.1	155.4	170.4	175.0	184.7
		Very high	Inpatient	147.7	203.4	222.4	135.9	204.5	220.4	304.3	397.7	436.2	335.9	431.9	375.0	480.6
			Outpatient	127.3	140.3	142.7	129.7	151.6	161.9	167.4	180.0	175.0	188.6	201.0	211.0	231.4
PDD*	Male	Medical aid beneficiary	Inpatient	230.4	264.3	289.5	360.7	433.2	551.2	608.1	583.3	610.6	606.8	698.7	632.9	646.7
			Outpatient	301.5	346.4	406.3	438.5	434.8	455.5	485.9	487.8	490.8	454.0	420.4	445.9	448.6
		Very low	Inpatient	19.7	42.5	46.8	125.3	256.9	377.2	311.3	352.9	312.7	328.3	294.0	239.2	173.3
			Outpatient	192.0	215.7	235.8	300.4	304.0	309.6	291.3	319.7	318.2	321.0	340.7	351.5	354.4
		Low	Inpatient	58.0	81.0	134.5	91.0	115.0	191.0	221.8	162.8	223.1	187.1	197.0	211.5	170.0
			Outpatient	190.8	230.4	230.9	245.5	274.8	266.9	284.1	279.5	294.9	285.2	294.4	277.8	311.1
		Middle	Inpatient	82.1	102.5	130.0	198.9	144.7	171.8	174.4	226.6	208.4	204.3	186.6	185.0	243.6
			Outpatient	203.1	200.7	220.5	254.2	245.1	254.8	264.0	248.7	266.2	272.0	269.3	282.4	293.4
		High	Inpatient	86.8	97.1	134.0	147.9	174.8	150.2	182.2	207.2	197.1	174.9	190.7	149.5	130.2
			Outpatient	199.0	225.3	244.3	235.2	243.7	252.2	251.7	259.4	261.0	251.5	263.0	292.2	327.0
		Very high	Inpatient	70.0	98.1	106.8	132.1	176.0	180.1	203.5	221.2	198.1	203.4	175.8	176.8	181.7
			Outpatient	231.2	242.6	260.3	276.3	282.4	289.3	291.7	292.5	287.1	291.8	298.9	314.1	330.5
	Female	Medical aid beneficiary	Inpatient	229.9	222.5	310.1	277.7	386.4	439.0	537.7	724.3	506.5	395.3	536.8	643.7	668.3
			Outpatient	319.9	359.3	377.0	483.4	478.1	452.0	428.6	491.9	505.2	482.3	409.9	443.9	444.7
		Very low	Inpatient	36.4	39.8	76.9	52.4	193.5	260.5	274.1	351.2	393.4	218.3	264.6	230.8	207.7
			Outpatient	173.2	260.4	365.3	386.8	488.8	450.9	472.6	465.6	472.1	435.8	422.1	404.2	426.2
		Low	Inpatient	15.4	66.8	23.4	100.9	51.3	96.2	198.3	246.1	303.2	148.1	315.3	326.6	75.3
			Outpatient	191.8	226.4	245.3	265.5	281.7	311.2	324.7	324.8	362.2	296.2	282.7	332.5	356.1
		Middle	Inpatient	12.8	47.3	98.3	114.4	96.8	99.5	173.0	265.7	232.3	302.9	267.0	258.6	258.1
			Outpatient	219.4	208.3	260.2	263.4	294.9	322.6	284.5	267.1	286.7	283.7	278.9	287.4	361.7
		High	Inpatient	101.8	75.7	100.8	102.8	184.3	289.4	318.2	205.0	148.8	246.6	148.6	182.4	171.1
			Outpatient	229.9	282.8	325.6	322.5	301.3	289.3	311.3	314.6	322.0	310.0	319.2	363.5	387.2
		Very high	Inpatient	37.9	66.6	135.8	190.4	177.5	222.5	193.9	212.4	196.7	297.2	178.3	159.4	187.0
			Outpatient	241.7	273.7	314.0	292.2	337.2	329.5	306.8	326.7	320.0	335.0	355.9	365.4	390.0

Unit: US dollars, 1 US dollar=936.1 Korean won (mean exchange rate in 2007); 1,259.5 Korean won in 2008; 1,164.5 Korean won in 2009; 1,134.8 Korean won in 2010; 1,151.8 Korean won in 2011; 1,070.6 Korean won in 2012; 1,055.4 Korean won in 2013; 1,099.3 Korean won in 2014; 1,172.5 Korean won in 2015; 1,207.7 Korean won in 2016; 1,070.5 Korean won in 2017; 1,115.7 Korean won in 2018; 1,156.4 Korean won in 2019.[13] *annual average of the total expenditure in individual age group of PDD. ID, intellectual disabilities; PDD, pervasive and specific developmental disorders