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Mortality Trends in People With Disabilities Before and During the COVID-19 Pandemic in South Korea, 2017–2022

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Mortality Trends in People with Disabilities before and during the COVID-19 Pandemic in South Korea, 2017–2022

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Abstract: ***Background*:** This study aimed to investigate the temporal trends in mortality rates and underlying causes of death in persons with disabilities before and during the coronavirus disease 2019 (COVID-19) pandemic. ***Methods*:** The annual mortality rate and cause of death were analyzed using a database created by linking data for the registered people with disabilities in South Korea with data from the National Statistical Office (2017–2022). ***Results:*** The number of people with disabilities increased from 2017–2022, with a mortality rate five times higher from COVID-19 than the general population. When analyzing the cause of death, the ratio of intellectual infectious diseases and tuberculosis decreased after COVID-19. In contrast, the ratio of other bacillary disorders (A30-A49) increased. Diseases of the respiratory system (J00-J99), influenza and pneumonia (J09-J18), and other acute lower respiratory infections (J20-J22) decreased before the COVID-19 pandemic, while lung diseases due to external agents (J60-J70), other respiratory diseases principally affecting the interstitium (J80-J84), and other diseases of the pleura (J90-J94) increased during the COVID-19 pandemic. ***Conclusions:*** The mortality rate of people with disabilities from all causes did not significantly increase compared to the pre-COVID-19 era. However, COVID-related deaths among people with disabilities increased significantly.

Keywords: COVID-19; mortality; people with disability; South Korea; infection

1. Introduction

On January 30, 2020, the World Health Organization (WHO) declared a public health emergency due to international concern over the outbreak of the coronavirus disease 2019 (COVID-19) [1]. South Korea began social distancing on February 29, 2020, and on March 22, 2020, it began to impose substantial social distancing [2]. Restrictions on the use of religious facilities and the operation of commercial industries were effected. Over time, social distancing was initiated and suspended several times [3]. On May 5, 2023, the WHO declared that COVID-19 was no longer an "international public health emergency." Consequently, on May 11, 2023, Korean health authorities also lifted most of the COVID-19 quarantine measures, declaring it an infectious disease that has become an endemic (infectious disease) [4].

The mortality rate across populations through the COVID-19 pandemic was not constant. Older people [5–7], women [8,9], ethnic minorities, and particular population groups [10,11] were more likely to die after infection with COVID-19. This information helped in the COVID-19 response and may help in responding to future infectious diseases. It was applied in social distancing [12,13], allotting vaccine priority [14,15], and quarantine and public relations [16,17].

In South Korea, men had a higher COVID-19 mortality rate than women [19]. Among COVID-19 patients, older patients had a high case fatality rate and a high rate of symptomatic infection, leading to a high mortality rate. In Korea, about 80% of deaths occurred in people over 70 years [20]. However, it does not separately generate epidemiological indicators such as infection rate,

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hospitalization, mortality rate, and cause of death for people with disabilities whose health is expected to be vulnerable.

As such, information on the current status and risks of COVID-19 mortality for people with disabilities is insufficient. There are reports of mortality limited to some types of disabilities, such as physical disabilities and developmental and mental disorders. However, there seems to be a lack of data on the COVID-19-related mortality rate and mortality risk of all people with disabilities. Therefore, we tried to solve the following research questions.

First, has the pandemic brought about a change in mortality and causes of death for people with disabilities?

Second, are the mortality rates due to the pandemic in people with disabilities similar to that of the general population?

2. Materials and Methods

2.1. Data sources and study population

A death cause database was created by linking Statistics Korea data on the cause of death with the registered disabled data of the Ministry of Health and Welfare in South Korea. Registered people with disabilities are subject to the Korean Emotional Welfare Act (Act on Welfare of Persons with Disabilities), Ministry of Government Legislation [21], which is legally registered with the Korean government (approximately 265 million people names are registered with the Korean government). There are 15 types of disability; each type is divided into severe and mild [22]. The number of registered disabled people by year, disability type, and gender (nationwide) (time, current date, statistics) Name) were recorded. Registered people with disabilities data includes gender, age, main disability type, and overall disability rating. If even one item was missing, the judges treated it as missing and were excluded from the review. The cause of death was classified using the International Classification of Diseases (ICD-10) codes. Cause of death information was recorded on the death certificate and used the ICD-10 classification. It falls within the scope of WHO's 103 items. This study was approved by the Institutional Review Board of the National Rehabilitation Institute (NRC-2023-01-008).

2.2. Statistical analysis

We calculated the crude mortality and age-standardized mortality rates using death data for persons with disabilities in South Korea. The crude death rate for the disabled is an indicator calculated by dividing the total number of deaths of registered disabled people that occurred in a year by the estimated population of the country for that year, expressed per 100,000. The number of deaths of registered disabled people is as at the end of the relevant year. The population of registered disabled people was operationally defined as (registered disabled people in the previous year + registered disabled people in the current year)/2. The overall population crude death rate was set to the same standard as the crude death rate for people with disabilities. However, this figure includes disabled and non-disabled people. Data were analyzed with SAS 9.4. statistical software (SAS Institute Inc, Cary, NC).

3. Results

3.1. Changes in mortality rates among people with disabilities before and after the COVID-19 pandemic

Table 1 shows the changes in the mortality rates of people with disabilities before and after the COVID-19 pandemic. From 2017 to 2022, the number of deaths among the disabled increased. Concurrently, the crude mortality rate also showed an overall increase. The general population showed the same pattern as the people with disabilities. Over the past 5 years, the number of deaths and mortality rates increased. In 2020, there were 240 deaths among people with disabilities due to COVID-19, increasing to 1,414 in 2021 and 10,513 in 2022. Additionally, the mortality rate due to

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COVID-19 also increased from 9.2 to 396.9. The mortality rate gap between people with disabilities and the general population increased by 4.8 times in 2020, 5.5 times in 2021, and 6.5 times in 2022.

Table 1. Mortality trends among people with and without disabilities before and during the COVID-19 pandemic.

Year	People with disability				General population			Absolute difference (times)	
	All death	Crude mortality rate	Total COVID-19 death	COVID-19 Infection fatality rate	All death	Crude mortality rate	Total COVID-19 death	COVID-19 Infection fatality rate	Crude mortality rate	COVID-19 Infection fatality rate
2017	69,478	2,750.6	NA	NA	285,534	557.3	NA	NA	4.9	NA
2018	74,957	2,927.7	NA	NA	298,820	582.5	NA	NA	5.0	NA
2019	75,402	2,903.4	NA	NA	295,110	574.8	NA	NA	5.1	NA
2020	78,879	3,009.6	240	9.2	304,948	593.9	950	1.9	5.1	4.8
2021	83,858	3,181.1	1,414	53.6	317,680	618.9	5,030	9.8	5.1	5.5
2022	102,916	3,885.4	10,513	396.9	372,939	727.6	31,280	61.0	5.3	6.5

NA: not available.

3.2. Changes in causes of death among people with disabilities before and after the COVID-19 pandemic

Table 2 shows changes in ICD-10 codes for causes of death among people with disabilities during the pre-and post-COVID-19 period. The number of deaths among people with disabilities has increased over the past 5 years. Between 2020 and 2022, symptoms, signs, and abnormal clinical and laboratory findings, NEC (R00-R99), and provisional assignment of new diseases of uncertain etiology or emergency use (U00-U18) increased significantly.When the causes of death before and after the COVID-19 period were classified by ICD-10 codes, there was a significant increase in three areas: diseases of the nervous system (G00-G99), certain infectious and parasitic diseases(A00-B99), and diseases of the respiratory system (J00-J99).

Table 2. Causes of death among people with disabilities based on ICD-10 codes from 2017–2022.

ICD-10 categories	2017 (N= 69,478)			2018 (N= 74,957)			2019 (N= 75,402)			2020 (N= 78,879)			2021 (N= 83,858)			2022 (N= 102,916)		
	n (%)	CSMR	SMR	n (%)	CSMR	SMR	n (%)	CSMR	SMR	n (%)	CSMR	SMR	n (%)	CSMR	SMR	n (%)	CSMR	SMR
A00-B99	2,178 (3.13)	86.2	24.7	2,565	100.2	27.7	2,562 (3.40)	98.7	25.6	2,953 (3.74)	112.7	31.4	3,154 (3.76)	119.6	27.2	3,254	122.8	28.3

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					(3.42)											(3.16)			
C00-D48		14,436 (20.78)	571.5	167.7	14,886 (19.86)	581.4	162.5	15,715 (20.84)	605.1	165.7	15,981 (20.26)	609.7	161.8	16,353 (19.50)	620.3	155.0	16,616 (16.15)	627.3	162.4
D50-D89	179 (0.26)	7.1	2.2	214 (0.29)	8.3	3.4	206 (0.27)	7.9	3.3	224 (0.28)	8.5	3.8	223 (0.27)	8.5	2.5	218 (0.21)	8.2	4.2	
E00-E90	3,824 (5.50)	151.4	66.0	3,972 (5.30)	155.1	43.2	3,589 (4.76)	138.2	39.5	3,766 (4.77)	143.7	39.7	3,869 (4.61)	146.8	42.2	4,953 (4.81)	187.0	52.1	
F00-F99	1,155 (1.66)	45.7	11.3	1,089 (1.45)	42.5	9.8	1,077 (1.43)	41.5	8.9	1,011 (1.28)	38.6	9.8	886 (1.06)	33.6	8.5	927 (0.90)	35.0	9.6	
G00-G99	3,854 (5.55)	152.6	89.3	4,366 (5.82)	170.5	96.0	4,290 (5.69)	165.2	84.9	4,643 (5.89)	177.2	73.4	5,085 (6.06)	192.9	84.2	6,520 (6.34)	246.1	101.0	
H00-H59	0 (0.00)	NA	NA	4 (0.01)	0.2	0.1	1 (0.00)	0.04	0.005	0 (0.00)	NA	NA	0 (0.00)	NA	NA	0 (0.00)	NA	NA	
H60-H95	3 (0.00)	0.1	0.01	6 (0.01)	0.2	0.04	5 (0.01)	0.2	0.02	2 (0.00)	0.08	0.007	6 (0.01)	0.2	0.2	5 (0.00)	0.2	0.017	
I00-I99	17,592 (25.32)	696.5	162.8	18,396 (24.54)	718.5	163.3	17,795 (23.60)	685.2	154.6	18,613 (23.60)	710.2	150.9	18,920 (22.56)	717.7	143.9	21,550 (20.94)	813.6	157.5	
J00-J99	9,441 (13.59)	373.8	82.3	11,181 (14.92)	436.7	91.5	11,364 (15.07)	437.6	87.4	11,315 (14.34)	431.7	82.3	11,648 (13.89)	441.9	77.3	13,368 (12.99)	504.7	92.8	
K00-K93	2,760 (3.97)	109.3	38.7	2,888	112.8	42.2	2,887 (3.83)	111.2	39.4	3,083 (3.91)	117.6	41.1	3,200 (3.82)	121.4	42.3	3,535 (3.43)	133.5	47.2	
L00-L99	191 (0.27)	7.6	1.7	207	8.1	1.7	188 (0.25)	7.2	1.6	224 (0.28)	8.5	2.2	191 (0.23)	7.2	1.7	186	7.0	1.5	

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				(0.28)											(0.18)			
M00-M99	441 (0.63)	17.5	5.7	429 (0.57)	16.8	4.8	447 (0.59)	17.2	5.1	458 (0.58)	17.5	4.8	463 (0.55)	17.6	5.0	547 (0.53)	20.7	5.8
N00-N99	3,376 (4.86)	133.7	34.6	3,644 (4.86)	142.3	36.1	3,989 (5.29)	153.6	34.7	4,223 (5.35)	161.1	37.1	4,411 (5.26)	167.3	35.7	4,754 (4.62)	179.5	41.3
O00-O99	2 (0.00)	0.1	0.2	0 (0.00)	NA	NA	1 (0.00)	0.04	0.2	1 (0.00)	0.04	0.1	0 (0.00)	NA	NA	2 (0.00)	0.1	0.3
P00-P96	2 (0.00)	0.1	1.6	1 (0.00)	0.04	0.8	2 (0.00)	0.08	1.4	1 (0.00)	0.04	0.2	3 (0.00)	0.1	1.8	7 (0.01)	0.3	3.9
Q00-Q99	112 (0.16)	4.4	18.3	106 (0.14)	4.1	14.8	110 (0.15)	4.2	14.6	112 (0.14)	4.3	17.9	116 (0.14)	4.4	14.3	129 (0.13)	4.9	21.1
R00-R99	5,424 (7.81)	214.7	53.7	6,312 (8.42)	246.5	59.3	6,583 (8.73)	253.5	59.8	7,448 (9.44)	284.2	60.4	9,449 (11.27)	358.4	71.6	11,077 (10.76)	418.2	77.1
U00-U18	0 (0.00)	NA	NA	0 (0.00)	NA	NA	0 (0.00)	NA	NA	240 (0.30)	9.2	1.7	1,414 (1.69)	53.6	12.3	10,513 (10.22)	396.9	85.3
V01-Y98	4,507 (6.49)	178.4	93.0	4,691 (6.26)	183.2	90.8	4,591 (6.09)	176.8	89.7	4,581 (5.81)	174.8	91.9	4,467 (5.33)	169.5	77.4	4,754 (4.62)	179.5	81.6

A00-B99 (certain infectious and parasitic diseases); C00-D48 (neoplasms); D50-D89 (diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism); E00-E90 (endocrine, nutritional, and metabolic diseases); F00-F99 (mental and behavioral disorders); G00-G99 (diseases of the nervous system); H00-H59 (diseases of the eye and adnexa); H60-H95 (diseases of the ear and mastoid process); I00-I99 (diseases of the circulatory system); J00-J99 (diseases of the respiratory system) K00-K93 (diseases of the digestive system); L00-L99 (diseases of the skin and subcutaneous tissue); M00-M99 (diseases of the musculoskeletal system and connective tissue); N00-N99 (diseases of the genitourinary system); O00-O99 (pregnancy, childbirth, and puerperium); P00-P96 (certain conditions originating in the perinatal period); Q00-Q99 (congenital malformations, deformations, and chromosomal abnormalities); R00-R99 (symptoms, signs and abnormal clinical and laboratory findings, and NEC); U00-U18 (provisional assignment of new diseases of uncertain etiology or emergency use); V01-Y98 (external causes of morbidity and mortality). n: number of deaths; CSMR: cause-specific mortality rate (per 100,000 people); SMR; age-adjusted standardized mortality rate (per 100,000 people); NA: Not Available.

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3.3. Changes in cause of death related to COVID-19 in people with disabilities after the COVID-19 pandemic.

Three diseases with significant changes between 2019 and 2020 before and after COVID-19 were observed: diseases of the nervous system (G00-G99), certain infectious and parasitic diseases (A00-B99), and an intensive study was conducted on diseases of the respiratory system (J00-J99). These are presented in Tables 3–5.

3.3.1. Diseases of the nervous system (G00-G99)

From 2017 to 2020, the number of deaths among people with disabilities due to diseases of the nervous system (G00-G99) increased. During COVID-19, from 2020 to 2022, the number of deaths among people with disabilities increased even more. It is difficult to clearly observe the changes in mortality rates among people with disabilities due to diseases of the nervous system (G00-G99) after COVID-19. However, the diseases that increased the number of deaths since 2020 compared to 2019 were extrapyramidal and movement disorder (G20-G26) and other generic disorders of the nervous system (G30-G32).

Table 3. Causes of death in people with disabilities by ICD-10-based diseases of the nervous system (G00-G99) from 2017 to 2022.

Diseases of the nervous system (G00-G99)	2017 (N = 3,854)	2018 (N = 4,366)	2019 (N = 4,290)	2020 (N = 4,643)	2021 (N = 5,085)	2022 (N = 6,520)
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Inflammatory diseases of the central nervous system (G00-G09)	55 (1.43)	69 (1.58)	72 (1.68)	63 (1.36)	71 (1.40)	90 (1.38)
Systemic atrophies primarily affecting the central nervous system (G10-G14)	408 (10.59)	432 (9.89)	409 (9.53)	370 (7.97)	409 (8.04)	496 (7.61)
Extrapyramidal and movement disorders (G20-G26)	1,564 (40.58)	1,749 (40.06)	1,490 (34.73)	1,589 (34.22)	1,769 (34.79)	2,070 (31.75)
Other degenerative diseases of the nervous system (G30-G32)	1,043 (27.06)	1,318 (30.19)	1,501 (34.99)	1,811 (39.00)	1,935 (38.05)	2,789 (42.78)
Demyelinating diseases of the central nervous system (G35-G37)	16 (0.42)	22 (0.50)	14 (0.33)	21 (0.45)	13 (0.26)	24 (0.37)
Episodic and paroxysmal disorders (G40-G47)	224 (5.81)	238 (5.45)	231 (5.38)	220 (4.74)	251 (4.94)	312 (4.79)
Nerve, nerve root, and plexus disorders (G50-G59)	1 (0.03)	1 (0.02)	0 (0.00)	2 (0.04)	5 (0.10)	3 (0.05)
Polyneuropathies and other disorders of the peripheral nervous system (G60-G64)	14 (0.36)	18 (0.41)	11 (0.26)	13 (0.28)	25 (0.49)	22 (0.34)
Diseases of myoneural junction and muscle (G70-G73)	132 (3.43)	133 (3.05)	117 (2.73)	114 (2.46)	119 (2.34)	119 (1.83)

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Cerebral palsy and other paralytic syndromes (G80-G83)	**149 (3.87)**	**144 (3.30)**	**156 (3.64)**	**126 (2.71)**	**114 (2.24)**	**190 (2.91)**
Other disorders of the nervous system (G90-G99)	**248 (6.43)**	**242 (5.54)**	**289 (6.74)**	**314 (6.76)**	**374 (7.35)**	**405 (6.21)**

n: number of deaths; CSMR: cause-specific mortality rate (per 100,000 people); SMR; age-adjusted standardized mortality rate (per 100,000 people); NA: Not Available

3.3.2. Certain infectious and parasitic diseases (A00-B99)

The number of certain infectious and parasitic diseases among people with disabilities was 2,953 in 2020, 3,151 in 2021, and 3,254 in 2022, with an increasing trend since COVID-19. However, the ratio of intellectual infectious diseases and tuberculosis decreased after COVID-19. In contrast, the ratio of other bacillary disorders (A30-A49) increased.

Table 4. Causes of death in people with disabilities by ICD-10-based certain infectious and parasitic diseases (A00-B99) from 2017 to 2021.

Certain infectious and parasitic diseases (A00-B99)	2017 (N = 2,178)	2018 (N =,2,565)	2019 (N = 2,562)	2020 (N = 2,953)	2021 (N = 3,154)	2022 (N = 3,254)
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Intestinal infectious diseases (A00-A09)	265 (12.17)	301 (11.73)	282 (11.01)	301 (10.19)	297 (9.42)	310 (9.53)
Tuberculosis (A15-A19)	393 (18.04)	412 (16.06)	359 (14.01)	351 (11.89)	368 (11.67)	336 (10.33)
Certain zoonotic bacterial diseases (A20-A28)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (0.03)
Other bacterial diseases (A30-A49)	1,262 (57.94)	1,558 (60.74)	1,625 (63.43)	2,036 (68.95)	2,251 (71.37)	2,318 (71.24)
Infections with a predominantly sexual mode of transmission (A50-A64)	0 (0.00)	1 (0.04)	1 (0.04)	2 (0.07)	3 (0.10)	2 (0.06)
Other spirochaetal diseases (A65-A69)	0 (0.00)	0 (0.00)	0 (0.00)	1 (0.03)	0 (0.00)	0 (0.00)
Other diseases caused by chlamydiae (A70-A74)	0 (0.00)	2 (0.08)	1 (0.04)	3 (0.10)	5 (0.16)	0 (0.00)
Rickettsioses (A75-A79)	9 (0.41)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	13 (0.04)
Viral infections of the central nervous system (A80-A89)	19 (0.87)	16 (0.62)	13 (0.51)	9 (0.30)	21 (0.67)	20 (0.61)
Arthropod-borne viral fevers and viral hemorrhagic fevers (A92-A99)	6 (0.28)	4 (0.16)	10 (0.39)	8 (0.27)	4 (0.13)	7 (0.22)

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Viral infections characterized by skin and mucous membrane lesions (B00-B09)	4 (0.18)	7 (0.27)	8 (0.31)	10 (0.34)	5 (0.16)	10 (0.31)
Viral hepatitis (B15-B19)	114 (5.23)	138 (5.38)	159 (6.21)	125 (4.23)	101 (3.20)	108 (3.32)
Human immunodeficiency virus [HIV] disease (B20-B24)	17 (0.78)	16 (0.62)	9 (0.35)	6 (0.20)	6 (0.19)	7 (0.22)
Other viral diseases (B25-B34)	2 (0.09)	7 (0.27)	4 (0.16)	7 (0.24)	5 (0.16)	7 (0.22)
Mycoses (B35-B49)	21 (0.96)	38 (1.48)	28 (1.09)	37 (1.25)	55 (1.74)	72 (2.21)
Protozoal diseases (B50-B64)	6 (0.28)	12 (0.47)	8 (0.31)	15 (0.51)	0 (0.00)	0 (0.00)
Helminthiases (B65-B83)	2 (0.09)	0 (0.00)	1 (0.04)	2 (0.07)	2 (0.06)	1 (0.03)
Pediculosis, acariasis, and other infestations (B85-B89)	0 (0.00)	0 (0.00)	2 (0.08)	2 (0.07)	0 (0.00)	0 (0.00)
Sequelae of infectious and parasitic diseases (B90-B94)	54 (2.48)	46 (1.79)	50 (1.95)	29 (0.98)	21 (0.67)	37 (1.14)
Bacterial, viral, and other infectious agents (B95-B98)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Other infectious diseases (B99)	4 (0.18)	7 (0.27)	2 (0.08)	9 (0.30)	10 (0.32)	5 (0.15)

n: number of deaths; CSMR: cause-specific mortality rate (per 100,000 people); SMR; age-adjusted standardized mortality rate (per 100,000 people); NA: Not Available.

3.3.3. Diseases of the respiratory system (J00-J99)

In the past 5 years, the diseases of the respiratory system among people with disabilities have increased. Particularly, there were 11,648 people in 2021, higher than from 2017–2020. Influenza and pneumonia (J09-J18), other acute lower respiratory infections (J20-J22), and diseases of the respiratory system decreased after COVID-19. Lung diseases due to external agents (J60-J70), other respiratory diseases principally affecting the interstitium (J80-J84), other diseases of the pleura (J90-J94), and the case of other diseases of the respiratory system (J95-J99) increased after COVID-19.

Table 5. Causes of death among people with disabilities by ICD-10-based diseases of the respiratory system (J00~J99) from 2017 to 2021.

Diseases of the respiratory system (J00-J99)	2017 (N = 9,441) n (%)	2018 (N = 11,181) n (%)	2019 (N = 11,364) n (%)	2020 (N = 11,315) n (%)	2021 (N = 11,648) n (%)	2022 (N = 13,368) n (%)
Acute upper respiratory infections (J00-J06)	9 (0.10)	9 (0.08)	5 (0.04)	6 (0.05)	2 (0.02)	8 (0.06)
Influenza and pneumonia (J09-J18)	5,681 (60.17)	7,075 (63.28)	7,253 (63.82)	7,126 (62.98)	7,247 (62.22)	8,626 (64.53)

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Other acute lower respiratory infections (J20-J22)	18 (0.19)	13 (0.12)	12 (0.11)	10 (0.09)	10 (0.09)	12 (0.09)
Other diseases of the upper respiratory tract (J30-J39)	10 (0.11)	16 (0.14)	9 (0.08)	10 (0.09)	16 (0.14)	12 (0.09)
Chronic lower respiratory diseases (J40-J47)	1,947 (20.62)	1,949 (17.43)	1,953 (17.19)	1,726 (15.25)	1,707 (14.65)	1,950 (14.59)
Lung diseases due to external agents (J60-J70)	916 (9.70)	1,080 (9.66)	1,079 (9.49)	1,300 (11.49)	1,350 (11.59)	1,315 (9.84)
Other respiratory diseases principally affecting the interstitium (J80-J84)	477 (5.05)	534 (4.78)	540 (4.75)	542 (4.79)	637 (5.47)	732 (5.48)
Suppurative and necrotic conditions of the lower respiratory tract (J85-J86)	70 (0.74)	88 (0.79)	90 (0.79)	81 (0.72)	96 (0.82)	86 (0.64)
Other diseases of the pleura (J90-J94)	54 (0.57)	77 (0.69)	72 (0.63)	75 (0.66)	107 (0.92)	94 (0.70)
Other diseases of the respiratory system (J95-J99)	259 (2.74)	340 (3.04)	351 (3.09)	439 (3.88)	476 (4.09)	533 (3.99)

n: number of deaths; CSMR: cause-specific mortality rate (per 100,000 people); SMR; age-adjusted standardized mortality rate (per 100,000 people); NA: Not Available.

4. Discussion

A database was established by linking data for the registered disabled in Korea with data from the Korea National Statistical Office (2017–2020), and mortality rate and cause of death were analyzed using the death database. Analysis of our findings in the context of previous studies are discussed below.

First, the number of deaths among people with disabilities due to COVID-19 increased in 2022 compared to 2020. The mortality rate due to COVID-19 increased from 9.2 in 2020 to 396.9 in 2022. The gap between people with disabilities and the general population was 4.8 times in 2020 and 6.5 times in 2022 [23]. According to a study by Kuper et al., the combined adjusted effect estimate for COVID-19-related mortality compared to those without disabilities was 2.7 times (95% confidence interval 2.4–3.2) [24]. The study highlighted that people with disabilities are experiencing higher COVID-19 case mortality than the general population [25]. Therefore, although there are differences in disability type and country, people with disabilities had a higher mortality rate than the general population.

Second, there was a change in the cause of death among people with disabilities compared to before COVID-19. During the COVID-19 period, between 2020 and 2022, symptoms, signs and abnormal clinical and laboratory findings, NEC (R00-R99), and provisional assignment of new diseases of uncertain etiology or emergency use (U00-U18) increased significantly. This means that R00-R99 in the ICD-10 code contains fever (R50) and headache (R51) associated with COVID-19 syndrome. Therefore, the increase due to COVID-19 is believed to be disease-induced [26].

Third, the cause of death related to COVID-19 in the disabled after COVID-19 was confirmed through ICD-10 code changes. The ratio of intestinal infectious diseases and tuberculosis and certain

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infectious and parasitic diseases (A00-B99) decreased after COVID-19. It shows that continuous monitoring of information, prevention mechanisms, relevant knowledge, and health education following the COVID-19 epidemic can play a role in preventing and controlling intestinal infections against COVID-19 [27]. In previous studies, the daily notification of tuberculosis outbreaks decreased by 30% during the COVID-19 pandemic, which aligns with the findings of this study [28].

In this study, diseases of the respiratory system (J00-J99), including influenza and pneumonia (J09-J18) and other acute lower respiratory infections (J20-J22) decreased after COVID-19. Overall, the seasonal duration of influenza has been shortened with COVID-19 prevention and control, and the influenza positivity rate decreased significantly within 7−12 weeks in 2020 [28,29]. Generally, it was confirmed that respiratory infectious diseases most clearly decreased during COVID-19 [28,30]. In this study, lung diseases due to external agents (J60-J70), other respiratory diseases principally affecting the interstitium (J80-J84), and other diseases of the pleura (J90-J94) increased during COVID-19. The mortaility rate of respiratory diseases in Spain did not return to pre-pandemic levels in 2021, still high at 30.3% (95% CI 30.2−30.4) compared to 2019 [29,30].

This study had some limitations. First, we utilized a short duration after COVID-19. It is judged that extensive research results and interpretations will be made only when the results of observations for additional years are included. Second, this study was analyzed using the middle classification of the ICD-10 code. Due to the limitations of the information provided by the National Statistical Office in Korea, it was not possible to analyze the ICD-10 code into sub- and detailed classifications. Consequently, we could only observe the comprehensive status of the investigation rate and cause of death related to COVID-19. Third, we did not conduct a detailed analysis of diseases related to COVID-19. Through a detailed analysis related to COVID-19, strategies to respond to diseases in the event of a new infectious disease, as well as COVID-19, are required. However, through this study, the death patterns of the disabled in Korea after COVID-19 were broadly confirmed. However, it is also necessary to reveal differences in the 15 types of disabilities in Korea, and international comparisons are also required.

5. Conclusions

Our findings revealed that the mortality rate of people with disabilities from all causes did not significantly increase compared to before the COVID-19 pandemic, and people with disabilities experienced a higher mortality rate from COVID-19 than the general population. Considering the high mortality associated with COVID-19 among people with disabilities, it is important to address the attendant poor health risk factors so that the mortality gap due to COVID-19 between people with disabilities and the general population is reduced. Additionally, short- and long-term public health interventions addressing COVID-19 risks are required.

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Data Availability Statement: The database used in this study was provided gy the Korea Statistics (KOSTAT). Researchers who aim to use the KOSTAT data for their research must access the KOSTAT's data sharing service

webpage (https://mdis.kostat.go.kr), obtain the approval for use, and our research team was the Korea govermnet organization, so it was used free of charge.

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