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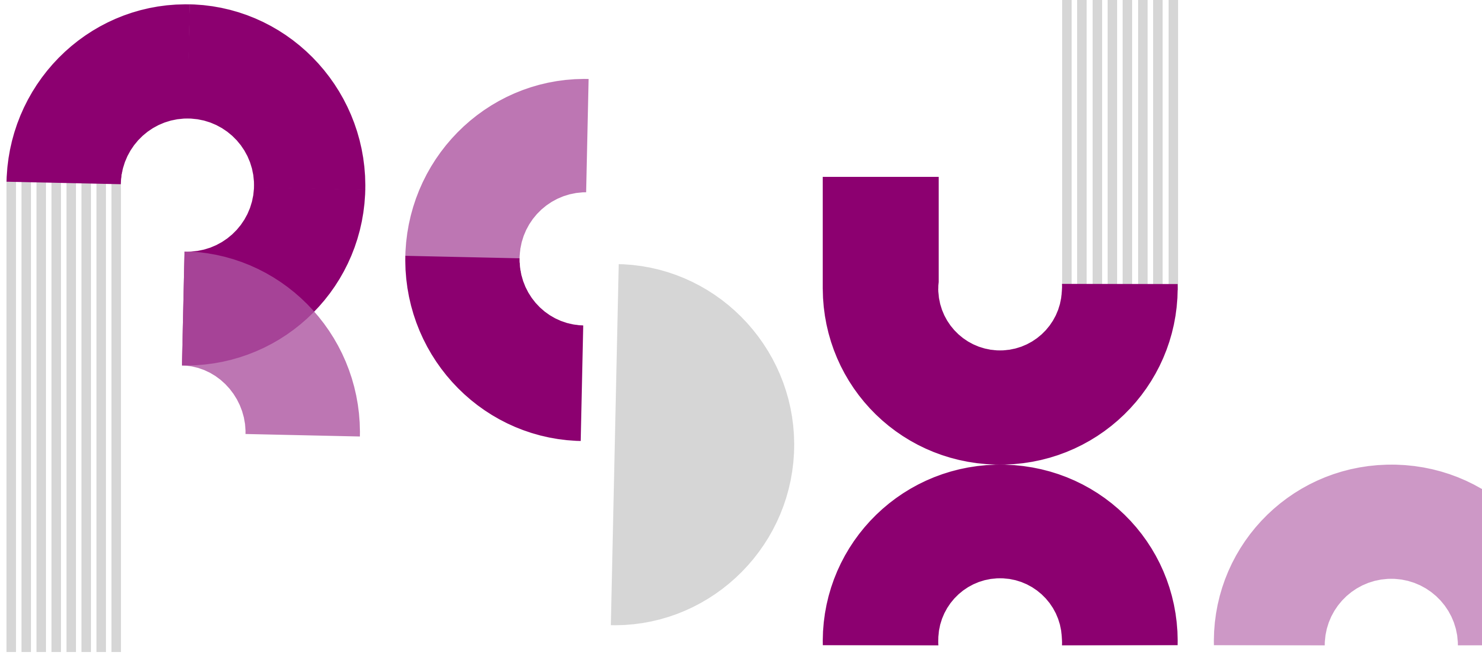

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Aims and Scope

The Research in Community and Public Health Nursing (RCPHN) is the official journal of the Korean Academy of Community Health Nursing.

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RCPHN coverage includes theoretical, practical, and educational issues related to community and public health nursing. Articles include original research articles, reviews, and editorials. This journal aims to provide worldwide access to timely research and practice features of use to community health nurses, educators, school health teachers, occupational nurses, and administrators in the field of community and public health nursing.

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Bidirectional Relationship Between Depression and Frailty in Older Adults aged 70-84 years using Random Intercepts Cross-Lagged Panel Analysis

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Purpose: Depression and frailty are common health problems that occur separately or simultaneously in later life. The two syndromes are correlated, but they need to be distinguished to promote successful aging. Previous studies have examined the reciprocal relationship between depression and frailty, but there are limitations in the methods or statistical analysis. This study aims to confirm the potential prospective bidirectional and causal relationship between depression and frailty.
Methods: We used data from 887 older adults aged 70 to 84 from the Korean Frailty and Aging Cohort Study (KFACS) in 2016, 2018, and 2020 (3 waves). We separated the within-individual process from the stable between-individual differences using the random intercepts cross-lagged panel model.
Results: Significant bidirectional causal effects were observed in 2 paths. Older adults with higher depression than their within-person average at T1 had a higher risk of frailty at T2 (β=.22, p=.008). Subsequently, older adults with higher-than-average frailty scores at T2 showed higher depression at T3 (β=.14, p=.010). Autoregressive effects were only significant from T2 to T3 for both constructs (Depression: β=.16, p=.044; Frailty: β=.13, p=.028). At the between-person level, the correlation was significant between the random intercepts between depression and frailty (β=.47, p<.001).
Conclusions: We find that depressed older adults have an increased risk of frailty, which contributes to the onset of depression and the maintenance of frailty. Therefore, interventions for each condition may prevent the entry and worsening of the other condition, as well as prevent comorbidity.

Keywords: Depression; Frailty; Aging

Introduction

Older adults experience a number of physical and psychological difficulties during the aging process. Among them, depression and frailty are common health problems, either separately or concurrently [1]. The two syndromes have a similar prevalence of approximately 10-20% in older adults [2]. In South Korea, 13.5% of older adults suffer from late-life depression (LLD), which increases with age, reaching 24% among those aged 85 and older [3]. Older adults are more vulnerable to depressive symptoms due to the unique circumstances of later life such as health-related problems, retirement, loss of social contact [4]. However, they tend not to express their feelings verbally, making it difficult to detect. Undiagnosed or untreated LLD can worsen depressive symptoms and lead to a risk of morbidity associated with decreased cognitive, physical, and social functioning [5].

On the other hand, frailty is “a biologic syndrome in which vulnerable conditions occur when exposed to multiple stressors,

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resulting in reduced functioning of multiple physiological systems [6].” The prevalence of frailty in community-dwelling older adults varies by definition and population characteristics, but most studies show a prevalence of 26.8 to 62.8% for prefrailty and 5.9 to 17.4% for frailty [7]. In the context of aging, frailty is an important issue in gerontology as it is a composite measure of physiology, psychology, and functional aspects of older adults. Despite the variety of definitions and screening methods, frailty is a dynamic and reversible process, so exploring its determinants is crucial [8]. Both geriatric syndromes reduce quality of life (QOL) in later life and are significantly associated with adverse health outcomes such as falls, functional decline, hospitalization, and death [9,10].

The relationship between depression and frailty has been referred to as an overlapping syndrome, due to similarities in risk factors, symptoms, outcomes, and even diagnostic criteria [11]. Several confirmatory factor analyses and latent class analyses have shown that the two syndromes are highly correlated but distinct constructs [11,12]. The relationship between depression and frailty has been consistently demonstrated to be mutually influenced by a number of shared pathophysiological mechanisms. However, the direction of causality is still inconsistent. A number of longitudinal studies have filled in the causal gaps left by cross-sectional designs [13]. However, many cohort studies have only two waves, limiting their overall causal dynamics [14,15]. Another recent study examining the relationship between depression and frailty at the within-individual level using six panel waves did not find a relevant cross-lagged effect, concluding that the two syndromes are related by common causes [16].

As such, the causal relationship between depression and frailty is disputed, and studies in a variety of settings and methodologies continue to provide evidence. This is because the discovery of a precursor condition may delay the onset of the other condition it affects, and prevent the development of other comorbid health issues. Therefore, this study aims to systematically investigate the bidirectional and causal relationship between depression and frailty through multiple waves by applying the random intercepts cross-lagged panel model (RI-CLPM).

Methods

1. Participants

The data used in this study are from the Korean Frailty and Aging Cohort Study (KFACS), a longitudinal study of frailty in community-dwelling older adults. KFACS recruited 3,014 older adults aged 70-84 from 10 medical centers in different urban and rural areas in Korea. Each center recruited participants from a variety of settings such as local senior welfare centers, community health centers, and outpatient clinics using quota sampling stratified by age and sex. The baseline survey was conducted from May 2016 to November 2017 [17]. We studied in three waves with data followed up every two years after baseline: 2016 (T1; baseline), 2018 (T2; 1st follow-up), 2020 (T3; 2nd follow-up). Of the 1,559 older adults who volunteered to participate in the baseline survey, 656 with missing values for frailty were excluded. We further excluded individuals with an MMSE score of less than 18 (n = 16), which is considered severe cognitive decline [18], as the symptomatology of low cognitive level and depression may overestimate the impairment of mood and frail status [19]. Therefore, the total number of study participants was 887. Ethical approval for the study was obtained from the Institutional Review Board of Seoul National University (IRB No. E2301/003-005).

2. Variables

Frailty

Frailty was defined according to Fried 's phenotype in the Cardiovascular Health Study (CHS) [6]. It consists of five components, with one point assigned for each corresponding factor: (i) For unintentional weight loss, participants were asked “In the last year, have you lost more than 4.5 kg unintentionally?” (1 point was given for ‘yes’ to the question). (ii) Exhaustion was assessed by asking questions from the Center for Epidemiological Studies Depression (CES-D) scale on three or more days per week: “I felt that everything I did was an effort” and “I could not get going.” (1 point was given for ‘yes’ to either question) [20]. (iii) Weakness is the maximal grip strength after measuring twice for each hand using a hand grip dynamometer (T.K.K.5401; Takei Scientific Instruments Co, Tokyo, Japan) (1 point was given for strength of less than 26 kg for males and 18 kg for females) [21]. (iv) Slow walking speed was measured by walking 4m twice, with acceleration and deceleration phase of 1.5m. (1 point was given if the average speed value was less than 0.8 m/s) [21]. (v) Physical activity levels were measured using the International Physical Activity Questionnaire (IPAQ) by asking about the duration and frequencies of exercise over the past week [22]. The total number of minutes of physical activity in a week was multiplied by the metabolic equivalent of task (MET) value and categorized as high, moderate, or low according to the proposed IPAQ scoring protocol (https://sites.google.com/view/ipaq/score). Participants with a score of 0 were classified as ‘robust’, a score of 1-2 as 'prefrail', and a score of 3-5 as 'frail'. In this study, we defined frailty as a total score (range: 0 to 5).

Depression

Depression was measured using the Geriatric Depression Scale-15 (GDS-15). Participants answered yes or no to 15 questions about current or recent depressive symptoms, and the scores ranged from 0 to 15 points. A score of 0 indicates normal, and a higher score indicates more severe depressive symptoms [23]. The internal consistency of GDS-15 for each wave was good (Cronbach's $\alpha = .82$ in 2016, .86 in 2018, and .84 in 2020).

3. Statistical Analysis

We analyzed the data using SPSS 28.0 (IBM Corp., Armonk, NY, USA) for a description of general characteristics, and Pearson's correlation analysis of depression and frailty. Mplus version 8.8 software was used to estimate the autoregressive and cross-lagged effects of depression and frailty. Any further non-normality was corrected through the maximum likelihood estimator with robust standard errors (MLR).

Traditionally, cross-lagged panel models (CLPM) have been used to explore prospective effects between constructs [24]. However, since the CLPM has mixed, within- and between-individual sources of variance, it may be ambiguous in terms of knowing whether the results of the model are derived from the within- or between-person effect, or a combination (mixed) path [25]. The RI-CLPM, an alternative to CLPM, separates longitudinal data into stable, trait-like between differences and time-specific, within-unit dynamics to investigate fluctuations in the lagged relations within units [26]. In other words, by adding a RI factor to CLPM, the factor load between the RI-factor and the measurement variable is fixed to 1, and the variance of the measurement variable is fixed to 0, so that the variance of the observation scores can be explained only by latent variables in between- and within-person effects [27].

Results

Of the 887 people in this study, 48.3% (n = 428) were male, and the average age was 75.60 ± 3.75 years (Table 1). Descriptive statistics and prevalence of depression and frailty for each wave are described in Table 2. Depression and frailty had significantly positive correlations at all measurement points (Table 3).

Figure 1 shows evidence of the association between within- and between-person effects between depression and frailty. First, a significant bidirectional effect was observed in cross-lagged

Table 1. Characteristics of Participants at T1 (2016) (*N*=887)

Variables	Categories	n	M ± SD or %
Gender	Female	459	51.7
Age (years)			75.60 ± 3.75
	70-74	390	44.0
	75-79	335	37.8
	80-84	162	18.3
Residence (*N* = 885)	Urban	284	32.1
	Suburban	384	43.4
	Rural	217	24.5
No spouse		287	32.4
Low education level [< 7 years]		391	44.1
Basic livelihood security or medical care aid recipient		54	6.1
Current smoker		38	4.3
Alcohol intake	≥ 2-3 times/week	174	26.7
BMI (kg/m^2)			24.52 ± 2.97
	> 25 kg/m^2	367	41.4
	≤ 25 kg/m^2	520	58.6
Cognitive impairment	MMSE < 24	160	18.0
(risk of) malnutrition	MNA < 12	103	11.7
Number of comorbidities[†]			1.53 ± 1.19

MMSE=mini-mental state examination; MNA=mini-nutritional assessment.

[†] Number of comorbidities; self-reported physician-diagnosis of hypertension, myocardial infarction, dyslipidemia, diabetes mellitus, congestive heart failure, angina pectoris, peripheral vascular disease, cerebrovascular disease, osteoarthritis, rheumatoid arthritis, asthma, and chronic obstructive pulmonary disease [49].

Table 2. Prevalence of Depression and Frailty

Variables		T1 (2016)	T2 (2018)	T3 (2020)
Depression	Mean ± SD	2.95 ± 3.37	2.94 ± 3.46	3.69 ± 3.80
	Range	0-15	0-15	0-15
	Skewness	1.40	1.39	1.01
	Kurtosis	1.41	1.37	0.13
Frailty	Mean ± SD	0.68 ± 0.85	0.72 ± 0.90	0.74 ± 0.98
	Range	0-4	0-4	0-5
	Skewness	1.35	1.26	1.43
	Kurtosis	1.80	1.15	1.73
	Robust n (%)	463 (52.2)	459 (51.7)	477 (53.8)
	Pre-frail n (%)	391 (44.1)	378 (42.7)	349 (39.3)
	Frail n (%)	33 (3.7)	50 (5.6)	61 (6.8)

pathways. Older adults with higher depression scores than their within-person average at T1 had a significantly higher risk of frailty at T2 ($\beta = .22$, $p = .008$). Subsequently, older adults with higher-than-average frailty scores at T2 showed higher-than-average depression scores at T3 ($\beta = .14$, $p = .010$). However, these effects were not observed in the other waves ($\text{Frailty}_{T1} \rightarrow \text{Depression}_{T2}$; $\beta = .12$, $p = .174$, $\text{Depression}_{T2} \rightarrow \text{Frailty}_{T3}$; $\beta = .08$, $p = .208$). Autoregressive effects were only significant from T2 to T3 for both constructs ($\text{Depression}_{T2 \rightarrow T3}$); $\beta = .16$, $p = .044$, $\text{Frailty}_{T2 \rightarrow T3}$); $\beta = .13$, $p = .028$). This finding indicates that if the depressive symptoms are higher than usual at T2, they tend to be continuously higher than usual at T3 (vice versa). Finally, at the

Table 3. Correlation Coefficients among Key Variables across the Three Waves

	1	2	3	4	5	6
	r (*p*)					
1. Depression T1[†]	1					
2. Depression T2[‡]	.59 (< .001)	1				
3. Depression T3[§]	.58 (< .001)	.66 (< .001)	1			
4. Frailty T1	.38 (< .001)	.30 (< .001)	.22 (< .001)	1		
5. Frailty T2	.35 (< .001)	.43 (< .001)	.33 (< .001)	.50 (< .001)	1	
6. Frailty T3	.28 (< .001)	.31 (< .001)	.36 (< .001)	.46 (< .001)	.53 (< .001)	1

[†]T1(2016); [‡]T2 (2018); [§]T3(2020)

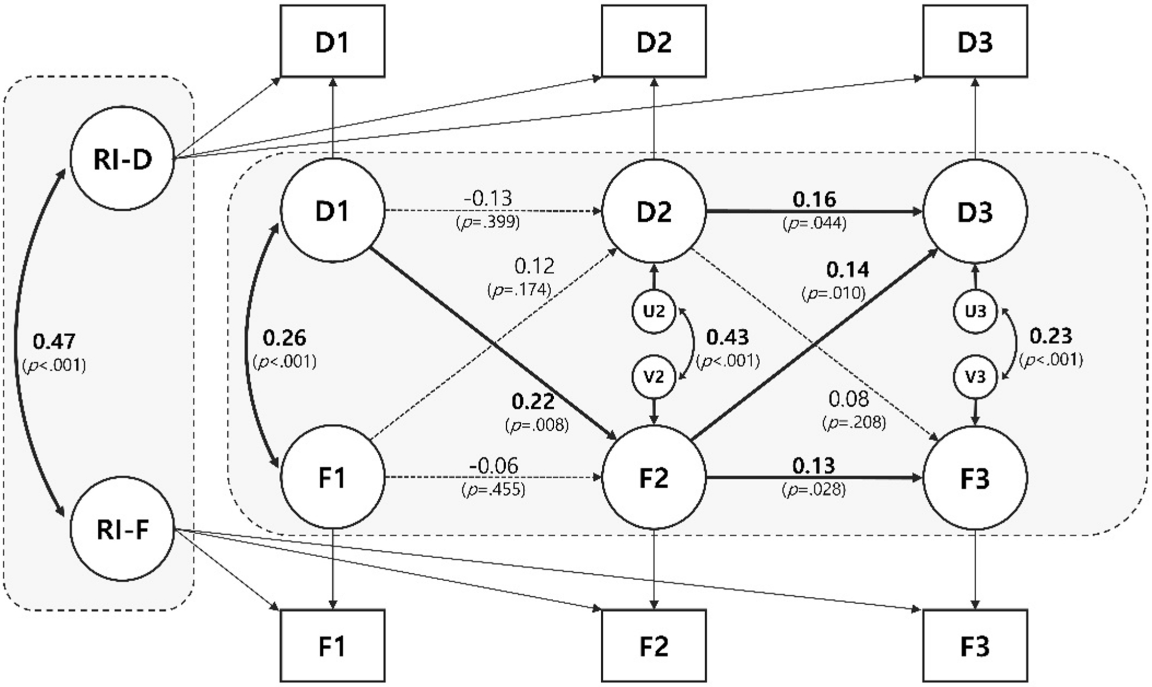

Figure 1. Simplified random intercepts cross-lagged panel model with standardized coefficients.
D=depression; F=frailty; RI=random intercept factor; 1=T1 (2016); 2=T2 (2018); 3=T3 (2020).

between-person level, the correlation between the RIs between depression and frailty was significant ($\beta = .47$, $p < .001$), which indicates that older adults with higher levels of depression tended to also have higher frailty scores (vice versa). RI-CLPM including depression and frailty showed a good fit [28]: CFI = .99; TLI = .98; RMSEA = .04; SRMR = .01.

Discussion

In this study, we found the significant (i) bidirectional and causal relationships between depression and frailty at the within-person level, (ii) autoregressive effect from T2 to T3, (iii) correlation between RIs at the between-person level in community-dwelling older adults aged 70-84 within three-wave RI-CLPM. The results of reciprocal causality between two syndrome are consistent with a systematic review and meta-analysis that found depression to be a risk factor for frailty and frailty to be a risk factor for depression (4.42 and 4.07 odds, respectively) [29], and a recent study that found a bidirectional causal relationship even after adjusting for potential confounders using multivariate Mendelian randomization analysis [30].

Although the direction of causality is not yet consensus, our findings add to the evidence that LLD may affect frailty, which in turn contributes the development of subsequent depression and the maintenance of frailty. This direction of causality can be explained by a set of pathophysiology mechanisms shared by LLD and frailty in the context of aging. The elderly develop a chronic low-grade inflammatory phenotype at the cellular and molecular level, referred to as immunosenescence [31]. First of all, the age-related inflammatory process increases inflammatory markers in the blood, such as interleukin (IL)-1β, IL-6, tumor necrosis factor (TNF)-α and C-reactive protein (CRP), which increases vulnerability to depression.

Peripheral inflammation also signals to the brain through various pathways, such as the vagus nerve, blood-brain barrier, and cytokine transport system, to cause major depressive disorder [32]. In addition, age-related medical conditions such as hypertension, diabetes, and musculoskeletal pain syndromes (at least partially) mediate pro-inflammatory processes, leading to increased allostatic load on the brain, resulting in regional atrophy, loss of white matter microstructure, and increased neuropathology that can contribute to new onset of depression [32]. In particular, increased IL-6 is known to weaken muscle mass and strength in the elderly, causing changes in motor function, fatigue, and a depressive affect [33]. Regardless of the inflammation hypothesis, LLD can lead to sedentary behavior, malnutrition, and sleep disorders, which in turn increases the risk of muscle atrophy, poor physical condition and the subsequent development of depression [34].

However, the two significant causal effects were observed asymmetrically in different waves. The first of these results may be due to the characteristics of the RI-CLPM. According to the suggestion that time-dependent variables such as psychological and developmental processes should be analyzed longitudinally with multiple measures [35], this study applied RI-CLPM to isolate within-person effects in order to clarify the origin of the supposed causal relationship between the two syndromes. However, in RI-CLPM, as the number of assessments increases, the residualized scores repeatedly return to the trait level, which is commonly used to detect short-term or temporary cross-lagged effects [36]. In this respect, the relatively long time gap in this study may have been insufficient to detect a sustained-time lagged effect. Second, as mentioned above, the complex pathophysiologic interactions between the two syndromes and aging process may have confounded the results. In particular, the use of antidepressants, which was not investigated in KFACS, is a potential confounder for causality estimation. Age-related physiologic changes such as altered pharmacodynamics and pharmacokinetics, multimorbidity, and drug interactions due to polypharmacy can reduce the effectiveness of drugs or lead to unexpected consequences [37]. Depressed and frail elderly people have been reported to have a more attenuated response to antidepressants [38].

The reciprocal relationship found in between-person stability can also be explained by pathophysiological mechanisms (trait-like) such as chronic inflammation, oxidative stress, immuno-metabolic dysregulation, mitochondrial dysfunction, and hypothalamic-pituitary-adrenal (HPA) axis dysregulation [39,40]. For example, if white matter lessions are anterior, they are susceptible to LLD [41], and if they are posterior, they affect motor control components of frailty such as grip strength, gait speed [42]. In addition, increased IL-6 in older adults with LLD reduces muscle mass and strength, causing motor slowing, fatigue, and depressive affects [43].

On the other hand, the autoregressive effects were only significant from T2 to T3 for both syndromes. In RI-CLPM, since trait-like factors are captured by RIs, the autoregressive effect can be considered additional moment-to-moment stability (i.e., inertia or carry-over) of within unit fluctuations over time [27]. The reason why the autoregressive effect of both syndromes was not significant from T1 to T2 may be due to the dynamic nature of frailty and depression. According to a meta-analysis [33] of 16 cohort studies related to frailty transitions, changes were found an average of 3.9 years later in 40.6% of non-frail to frail group, 18.2% of prefrail to frail, and 3.3% of frail to non-frail. LLD, which is based on multifactorial etiologies, also has a variable trajectory with within-individual variation, particularly based on clinical attributes (e.g., initial onset of depression, length and number of depressive episodes) [44,45].

However, there may have been no more significant fluctuations in depression and frailty status from T2 where the average age was over 77 years old. Ding et al.'s study [46] also found that people aged 75 and older with physical frailty had a lower increase (slope) in frailty scores over time. Depressive symptoms also tend to become more chronic with age, as remission time is delayed [47]. In other words, the carry-over effects of depression and frailty tend to change over time, but can eventually become chronic and stabilize due to ceiling effect.

This study has several strengths. First, the way depression and frailty were defined in this study may increase the reliability of the findings. Frailty was assessed directly for physical deficits using Fried's phenotype, the gold standard for measuring frailty in community-dwelling older adults [48]. Also, to minimize the risk of phenomenological overlap with depression, which has similar diagnostic criteria, depression was defined using the GDS-15, which does not include somatic symptoms. Second, as most studies in this context have been conducted on populations in western countries [13], this study can provide new evidence for individuals in a similar settings to the Korean elderly. Nevertheless, this study has some limitations. First, of the 1,559 participants in the KFACS baseline, there were a number of dropouts (n = 656, 42%) due to the burden of frailty measurement. However, the general characteristics of the baseline participants and dropouts were not statistically different, so the generalizability of the results should not be compromised. Second, due to the use of secondary data and limitations of methodology, we were unable to fully adjust for multidimensional covariates that could potentially interfere with the causal relationship between the two constructs.

Conclusions

This study confirms that older adults with depression are at increased risk for frailty, which may contribute to the development of new depression and the maintenance of frailty. Therefore, early detection and intervention for each condition may prevent entry into and exacerbation of the other condition, thus preventing the comorbidity of depression and frailty.

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Conflict of interest

Ju Young Yoon has been editorial board member of the Research in Community and Public Health Nursing. She was not involved in the review process of this manuscript. No conflict of interest has been declared by all authors.

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Authors' contributions

Ji Hye Shin contributed to conceptualization, data curation, formal analysis, funding acquisition, methodology, writing – original draft, review & editing, investigation, and software. Gyeong A Kang contributed to funding acquisition, methodology, writing – review & editing, resources, software, and validation. Sun Young Kim contributed to data curation, resources, and writing – review & editing. Won Chang Won contributed to data curation, project administration, resources, and writing – review & editing. Ju Young Yoon contributed to conceptualization, formal analysis, methodology, project administration, writing – review & editing, investigation, resources, supervision, and validation.

Data availability

Data can be obtained after applying and being approved by following the procedures guided on the Korean Frailty Aging Cohort Study (http://www.kfacs.kr). More details on the data collection process are available (https://doi.org/10.1136/ bmjopen-2019-035573).

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References

1. Nascimento PPPd, Batistoni SST. Depression and frailty in old age: A narrative review of the literature published between 2008 and 2018. Interface-Comunicação, Saúde, Educação. 2019;23:e180609. https://doi.org/10.1590/Interface.180609
2. Rodda J, Walker Z, Carter J. Depression in older adults. BMJ. 2011;343:d5219. https://doi.org/10.1136/bmj.d5219
3. Ministry of Health and Welfare. 2020 Survey on older adults in South Korea [Internet]. Seoul: Ministry of Health and Welfare. 2021 [cited 2023 Dec 6]. Available from: https://www.mohw.go.kr/board.es?mid = a10411010100&bid = 0019&act = view&list_no = 366496.
4. Thapa DK, Visentin DC, Kornhaber R, Cleary M. Prevalence and factors associated with depression, anxiety, and stress symptoms among older adults: A cross-sectional population-based study. Nursing & Health Sciences. 2020;22(4):1139–1152. https://doi.org/10.1111/nhs.12783
5. Balsamo M, Cataldi F, Carlucci L, Padulo C, Fairfield B. Assessment of late-life depression via self-report measures: a review. Clinical Interventions in Aging. 2018;13:2021–2044. https://doi.org/10.2147/CIA.S178943
6. Fried LP, Tangen CM, Walston J, Newman AB, Hirsch C, Gottdiener J, et al. Frailty in older adults: evidence for a phenotype. The Journals of Gerontology Series A: Biological Sciences and Medical Sciences. 2001;56(3):M146–M157. https://doi.org/10.1093/gerona/56.3.M146
7. He B, Ma Y, Wang C, Jiang M, Geng C, Chang X, et al. Prevalence and risk factors for frailty among community-dwelling older people in China: A systematic review and meta-analysis. The journal of Nutrition, Health & Aging. 2019;23(5):442–450. https://doi.org/10.1007/s12603-019-1179-9
8. Kwak D, Thompson LV. Frailty: Past, present, and future? Sports Medicine and Health Science. 2021;3(1):1–10. https://doi.org/10.1016/j.smhs.2020.11.005
9. Hussenoeder FS, Jentzsch D, Matschinger H, Hinz A, Kilian R, Riedel-Heller SG, et al. Depression and quality of life in old age: A closer look. European Journal of Ageing. 2021;18:75–83. https://doi.org/10.1007/s10433-020-00573-8
10. Chu W, Chang SF, Ho HY. Adverse health effects of frailty: Systematic review and meta-analysis of middle-aged and older adults with implications for evidence-based practice. Worldviews on Evidence-Based Nursing. 2021;18(4):282–289. https://doi.org/10.1111/wvn.12508
11. Mezuk B, Lohman M, Dumenci L, Lapane KL. Are depression and frailty overlapping syndromes in mid-and late-life? A latent variable analysis. The American Journal of Geriatric Psychiatry. 2013;21(6):560–569. https://doi.org/10.1016/j.jagp.2012.12.019
12. Lohman M, Dumenci L, Mezuk B. Depression and frailty in late life: evidence for a common vulnerability. Journals of Gerontology Series B. 2016;71(4):630–640. https://doi.org/10.1093/geronb/gbu180
13. Chu W, Chang SF, Ho HY, Lin HC. The relationship between depression and frailty in community-dwelling older people: A systematic review and meta-analysis of 84,351 older adults. Journal of Nursing Scholarship. 2019;51(5):547–559. https://doi.org/10.1111/jnu.12501
14. Marconcin P, Barak S, Ferrari G, Gouveia ÉR, de Maio Nascimento M, Willig R, et al. Prevalence of frailty and its association with depressive symptoms among european older adults from 17 countries: A 5-year longitudinal study. International Journal of Environmental Research and Public Health. 2022;19(21):14055. https://doi.org/10.3390/ijerph192114055
15. Wang X, Shen K. The reciprocal relationship between frailty and depressive symptoms among older adults in rural China: A cross-lag analysis. Healthcare. 2021;9(5):593. https://doi.org/10.3390/healthcare9050593
16. Mayerl H, Stolz E, Freidl W. Frailty and depression: Reciprocal influences or common causes? Social Science & Medicine. 2020;263:113273. https://doi.org/10.1016/j.socscimed.2020.113273
17. Won CW, Lee S, Kim J, Chon D, Kim S, Kim CO, et al. Korean frailty and aging cohort study (KFACS): cohort profile. BMJ open. 2020;10(4):e035573. https://doi.org/10.1136/bmjopen-2019-035573
18. Shrestha K, Ojha SP, Dhungana S, Shrestha S. Depression and its association with quality of life among elderly: An elderly home-cross sectional study. Neurology, Psychiatry and Brain Research. 2020;38:1–4. https://doi.org/10.1016/j.npbr.2020.08.003
19. Maştaleru A, Abdulan IM, Ştefăniu R, Lefter N, Sandu IA, Pîslaru AI, et al. Relationship between frailty and depression in a population from North-Eastern Romania. International Journal of Environmental Research and Public Health. 2022;19(9):5731. https://doi.org/10.3390/ijerph19095731
20. Orme JG, Reis J, Herz EJ. Factorial and discriminant validity of the Center for Epidemiological Studies Depression (CES-D)

scale. Journal of Clinical Psychology. 1986;42(1):28–33. https://doi.org/10.1002/1097-4679(198601)42:1<28::AID-JCLP2270420104>3.0.CO;2-T

21. Chen LK, Liu LK, Woo J, Assantachai P, Auyeung TW, Bahyah KS, et al. Sarcopenia in Asia: consensus report of the Asian Working Group for Sarcopenia. Journal of the American Medical Directors Association. 2014;15(2):95–101. https://doi.org/10.1016/j.jamda.2013.11.025
22. Craig CL, Marshall AL, Sjöström M, Bauman AE, Booth ML, Ainsworth BE, et al. International physical activity questionnaire: 12-country reliability and validity. Medicine & Science in Sports & Exercise. 2003;35(8):1381–1395. https://doi.org/10.1249/01.MSS.0000078924.61453.FB
23. Yesavage JA. Geriatric depression scale. Psychopharmacol bull. 1988;24(4):709–711.
24. Finkel SE. Causal analysis with panel data. Sage; 1995. 24 p.
25. Usami S, Hayes T, McArdle JJ. Inferring longitudinal relationships between variables: Model selection between the latent change score and autoregressive cross-lagged factor models. Structural Equation Modeling: A Multidisciplinary Journal. 2016;23(3):331–342. https://doi.org/10.1080/10705511.2015.1066680
26. Hamaker EL, Kuiper RM, Grasman RP. A critique of the cross-lagged panel model. Psychological Methods. 2015;20(1):102–116. https://doi.org/10.1037/a0038889
27. Mulder JD, Hamaker EL. Three extensions of the random intercept cross-lagged panel model. Structural Equation Modeling: A Multidisciplinary Journal. 2021;28(4):638–648. https://doi.org/10.1080/10705511.2020.1784738
28. Hu Lt, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. Structural Equation Modeling: A Multidisciplinary Journal. 1999;6(1):1–55. https://doi.org/10.1080/10705519909540118
29. Soysal P, Veronese N, Thompson T, Kahl KG, Fernandes BS, Prina AM, et al. Relationship between depression and frailty in older adults: a systematic review and meta-analysis. Ageing Research Reviews. 2017;36:78–87. https://doi.org/10.1016/j.arr.2017.03.005
30. Sang N, Li BH, Zhang MY, Wei M, Fang RX, Liu WJ, et al. Bidirectional causal relationship between depression and frailty: a univariate and multivariate Mendelian randomisation study. Age and Ageing. 2023;52(7):afad113. https://doi.org/10.1093/ageing/afad113
31. Leng SX, Margolick JB. Aging, sex, inflammation, frailty, and CMV and HIV infections. Cellular Immunology. 2020;348:104024. https://doi.org/10.1016/j.cellimm.2019.104024
32. Majd M, Saunders EFH, Engeland CG. Inflammation and the dimensions of depression: a review. Frontiers in Neuroendocrinology. 2020;56:100800. https://doi.org/10.1016/j.yfrne.2019.100800
33. Brown PJ, Rutherford BR, Yaffe K, Tandler JM, Ray JL, Pott E, et al. The depressed frail phenotype: the clinical manifestation of increased biological aging. The American Journal of Geriatric Psychiatry. 2016;24(11):1084–1094. https://doi.org/10.1016/j.jagp.2016.06.005
34. Deng MG, Liu F, Liang Y, Wang K, Nie JQ, Liu J. Association between frailty and depression: A bidirectional Mendelian randomization study. Science Advances. 2023;9(38):eadi3902. https://doi.org/10.1126/sciadv.adi3902
35. Hajek A, Brettschneider C, Posselt T, Lange C, Mamone S, Wiese B, et al. Predictors of frailty in old age-results of a longitudinal study. The Journal of Nutrition, Health & Aging. 2016;20(9):952–957. https://doi.org/10.1007/s12603-015-0634-5
36. Orth U, Clark DA, Donnellan MB, Robins RW. Testing prospective effects in longitudinal research: Comparing seven competing cross-lagged models. Journal of Personality and Social Psychology. 2021;120(4):1013–1034. https://doi.org/10.1037/pspp0000358
37. Gutsmiedl K, Krause M, Bighelli I, Schneider-Thoma J, Leucht S. How well do elderly patients with major depressive disorder respond to antidepressants: a systematic review and single-group meta-analysis. BMC Psychiatry. 2020;20(1):102. https://doi.org/10.1186/s12888-020-02514-2
38. Brown PJ, Ciarleglio A, Roose SP, Garcia CM, Chung S, Alvarez J, et al. Frailty worsens antidepressant treatment outcomes in late life depression. The American Journal of Geriatric Psychiatry. 2021;29(9):944–955. https://doi.org/10.1016/j.jagp.2020.12.024
39. Pilotto A, Custodero C, Maggi S, Polidori MC, Veronese N, Ferrucci L. A multidimensional approach to frailty in older people. Ageing Research Reviews. 2020;60:101047. https://doi.org/10.1016/j.arr.2020.101047
40. Kuo C-Y, Lin C-H, Lane H-Y. Molecular basis of late-life depression. International Journal of Molecular Sciences. 2021;22(14):7421. https://doi.org/10.3390/ijms22147421
41. Lin C, Huang CM, Karim HT, Liu HL, Lee TM-C, Wu CW, et al. Greater white matter hyperintensities and the association with executive function in suicide attempters with late-life depression. Neurobiology of Aging. 2021;103:60–67. https://doi.org/10.1016/j.neurobiolaging.2020.12.016

42. Ducca EL, Gomez GT, Palta P, Sullivan KJ, Jack Jr CR, Knopman DS, et al. Physical frailty and brain white matter abnormalities: The atherosclerosis risk in communities study. The Journals of Gerontology: Series A. 2023;78(2):357–364. https://doi.org/10.1093/gerona/glac111
43. Kojima G, Taniguchi Y, Iliffe S, Jivraj S, Walters K. Transitions between frailty states among community-dwelling older people: a systematic review and meta-analysis. Ageing Research Reviews. 2019;50:81–88. https://doi.org/10.1016/j.arr.2019.01.010
44. Jellinger KA. The heterogeneity of late-life depression and its pathobiology: a brain network dysfunction disorder. Journal of Neural Transmission. 2023;130:1057–1076. https://doi.org/10.1007/s00702-023-02648-z
45. Ly M, Karim HT, Becker JT, Lopez OL, Anderson SJ, Aizenstein HJ, et al. Late-life depression and increased risk of dementia: a longitudinal cohort study. Translational Psychiatry. 2021;11:147. https://doi.org/10.1038/s41398-021-01269-y
46. Ding YY, Kuha J, Murphy M. Multidimensional predictors of physical frailty in older people: identifying how and for whom they exert their effects. Biogerontology. 2017;18:237–252. https://doi.org/10.1007/s10522-017-9677-9
47. Alexopoulos GS. Mechanisms and treatment of late-life depression. Translational Psychiatry. 2019;9(1):188. https://doi.org/10.1038/s41398-019-0514-6
48. Choi J, Ahn A, Kim S, Won CW. Global prevalence of physical frailty by Fried's criteria in community-dwelling elderly with national population-based surveys. Journal of the American Medical Directors Association. 2015;16(7):548–550. https://doi.org/10.1016/j.jamda.2015.02.004
49. Lee S, Kim M, Lee Y, Kim J, Jang HC, Cho B, et al. The effect of sex and physical frailty on incident disability after 2 years among community-dwelling older adults: KFACS study. BMC geriatrics. 2022;22:588. https://doi.org/10.1186/s12877-022-03263-5

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Home-based walking intervention for middle-aged migrant women using 360-degree virtual videos and a wearable activity tracker: A mixed-methods pilot study

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Purpose: To sustain behavior change, an intervention strategy that considers the contribution of affect to daily physical activity behavior regulation is needed. Although virtual reality-based physical activity interventions have the potential to improve emotional status, interventions using virtual reality videos in a free-living environment are lacking. This pilot study assessed the feasibility and preliminary efficacy of a home-based intervention using 360-degree virtual videos and wearable activity trackers to improve mood and physical activity.

Methods: A one-group pilot study of 12 middle-aged migrant women asked participants to watch virtual reality videos and perform moderate-intensity walking 5 days per week for 4 weeks, then complete surveys and focus group interviews. The intervention's feasibility and preliminary efficacy were assessed by examining recruitment, retention, adherence, acceptability, mood, physical activity, and exercise self-efficacy.

Results: A word-of-mouth approach was effective for recruiting participants. Although the weekly intervention adherence rate ranged from 53.5% to 83.5%, retention (92.3%) and acceptability (91.7%) were high. Participants were satisfied with the "visual status indicators," "sense of accomplishment and confidence," "emotional engagement and sense of presence," "joy from exercise," "external motivation through supervision," "easy to control virtual reality device," and "extra benefits" of the intervention. Participants had significant decreases in negative affect (p=.016). Positive affect, physical activity, and exercise self-efficacy showed trends toward improvement.

Conclusion: This home-based intervention employing virtual reality videos and Fitbit activity trackers is feasible and shows preliminary efficacy in improving mood. Further research is warranted to evaluate its effectiveness in a more rigorous randomized controlled trial.

Keywords: Affect; Exercise; Migrant; Virtual reality; Women

Introduction

1. Background

The health benefits of physical activity, including improved mental health and quality of life, are well established [1]. Yet globally, more than a quarter of all adults do not participate in enough physical activity [2]. The Korea National Health and Nutrition Examination Survey results reported that regular participation in aerobic physical activity among Korean adults has tended to decline over time. Regular participation in physical activity is high-

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est in people's 20s and declines with age, and women tend to engage in less physical activity than men [3]. Both physical inactivity and depressive symptoms have been found to be common in migrants 50 years and older [4,5]. For instance, a recent study reported that only 15.8% of middle-aged Japanese migrant women in Korea engaged in regular physical activity [6].

Many studies have examined the relationship between physical activity and affective responses. Overall, these studies have shown that physical activity influences positive affect [7,8]. However, in the physical activity-affect relationship, physical activity not only elicits an affective response but affect also regulates physical activity behavior. Specifically, positive affect increases physical activity, while negative affect decreases physical activity [9]. Therefore, to sustain long-term behavior change, an intervention strategy that considers the contribution of affect to daily physical activity behavior regulation is needed. Using immersive technology such as virtual reality (VR) as part of a physical activity intervention strategy could serve this purpose.

Providing an immersive experience could be a crucial element of physical activity interventions for physically inactive people. Immersive experiences can facilitate authentic engagement in stimulating the senses and emotions [10]. Such immersive experiences bring delightful psychological states to individuals who are deeply participating [11-14]. VR is a way to produce such immersive engagement for physical activity interventions [15,16]. VR-based environments create intensive immersion, in which users are engaged in and involved with desirable emotional states.

In recent studies, VR use has been found to improve emotional well-being [11,12,14]. For example, VR videos of nature improved positive affect by helping middle-aged women with depression feel connected to nature [14]. And among older adults, 360-degree video-based VR produced enjoyable experiences with low levels of physical and emotional discomfort [11]. However, VR-based health care studies have mainly focused on rehabilitation and physical function and mainly involved one-time experiments in laboratories with researchers supervising or assisting [17-20]. Although VR-based physical activity interventions have great potential to improve people's emotional status, studies of the usability and acceptability of VR video-based interventions in community settings are lacking [19]. One of the primary motivations for the present study is to address interventions for physical activity behavior change using VR videos in a free-living environment.

Due to limited previous studies on physical activity behavior change using VR videos in a free-living environment, a small-scale test of methods and procedures to assess the feasibility of the intervention before a large-scale study is an important step in the development phase [21]. This offers insight into the advantages or disadvantages, practicability, or any modifications needed in the research methods or protocols. The purpose of this pilot test was to assess the feasibility and preliminary efficacy of a home-based intervention for middle-aged migrant women that employed VR videos and wearable activity trackers.

2. Theoretical Framework

Based on recent studies [22,23] examining the feasibility of innovative 4-week digital device-based interventions to promote physical activity, we developed a 4-week home-based intervention called *Create a Healthy Lifestyle Routine*. Self-efficacy has been reported as a major psychosocial mechanism with positive effects on initiating and maintaining physical activity [24,25], and this intervention was developed to address the four main sources of self-efficacy identified by Bandura: mastery experience, vicarious experience, verbal persuasion, and emotional arousal [26]. The intervention included a wearable activity tracker, weekly summary report, goal-setting consultation, logbook (for mastery experience), short animation video (for vicarious experience), text messages (for verbal persuasion), and 360-degree VR nature videos (for emotional arousal). Because knowledge of health risks and the benefits of health practices is a precondition for change [27], a 30-minute in-person education session was also provided (Table 1, Figure 1).

Methods

1. Study Design

This mixed-methods pilot test employed a quantitative one-group pre-posttest design and qualitative focus group interviews.

2. Setting and Sample

The study was conducted between April and July 2021 in Gwangju and Jeollanam Provinces of South Korea. Potential participants were recruited from five churches, which were attended predominantly by Japanese migrant women. A Japanese research staff member contacted leaders of the five churches to obtain their permission to conduct recruitment activities and to request contact information for church members. Then a recruitment letter with a hyperlink to an online screening survey (Google Surveys) was sent to potential participants through social networking service (SNS) and text messages. Migrant women who had an interest in participating were asked to respond to the online screening survey.

Table 1. Intervention Strategies Based on Self-efficacy Theory

Sources of self-efficacy[†]	Intervention strategies
Mastery experience	Physical activity feedback - Fitbit weekly summary report Achievement notification - Fitbit alarm for daily goal achievement Tailored goal setting - Physical activity goals set based on the individual's baseline assessment Logbook - Daily log to record VR use and physical activity
Vicarious experience	Animation video (2 minutes) - A middle-aged woman character practices the intervention in her daily routine - Produced in versions with Korean and Japanese subtitles - Content provided for VR and smartphone devices
Verbal persuasion	Weekly text message - A total of 4 encouraging text messages - Example: Hello! Have you become accustomed to the VR and new exercise habits? It is said that 21 days are usually needed to create a habit. You may have some difficulties at first, but this will help you improve your health. Please try your best! If you have any concerns, doubts, or troubles, please feel free to contact us.
Emotional arousal	360-degree VR videos - Head-mounted display VR device provides hyperlink icons to YouTube videos - Twelve nature-related VR videos selected after consulting with a psychology professor: 6 underwater, 2 mountain, 2 other scenery, 1 space, and 1 bamboo forest
Knowledge	Education and practice - Education on physical activity for the intervention (10–15 minutes in person using a brochure) - Practice in using the head-mounted display device (15–20 minutes in person)

Abbreviation: VR, virtual reality.
[†] Bandura & Adams (1977)

Under the study inclusion criteria, participants had to be women aged 40 to 64 years, be a migrant in Korea, use a smartphone and Wi-Fi at home, not be engaging in regular exercise (i.e., at least 150 minutes of moderate-to-vigorous physical activity [MVPA] weekly), not have any illnesses that would prevent walking and VR use, not be currently enrolled in any other exercise program, and speak and understand Korean. Research staff confirmed the eligibility of each prospective participant by telephone and then scheduled an in-person meeting. Four cohorts of 3-4 participants each were recruited sequentially, with a total of 13 migrant women who consented to participate in the pilot test. One individual did not complete the intervention due to back pain, thus we analyzed data for the 12 participants who completed the intervention (Figure 2).

3. Intervention

One week before the beginning of the intervention, participants were provided with a Fitbit Charge 3 (Fitbit Inc, San Francisco, CA, USA) with an education on the Fitbit device and asked to wear it during their walking hours for 7 days. The following week, research staff provided the 30-minute in-person education on physical activity and body composition, and participants practiced head-mounted display use and completed a baseline assessment. Then participants set their individual physical activity goals in consultation with research staff. During the 4-week intervention period, participants were asked to watch VR videos for 5-10 minutes at least 5 days per week and perform moderate-intensity walking for at least 30 minutes at least 5 days per week. For the VR videos, the research staff initially selected a pool of 14 360-degree VR nature videos of less than 5 minutes' duration from YouTube. Next, a psychologist rated how appropriate each of the 14 videos was for improving emotional well-being on a 4-point scale (1 = *not appropriate*, 2 = *somewhat appropriate*, 3 = *quite appropriate*, and 4 = *very appropriate*). Twelve videos rated 3 or 4 were used for the intervention.

4. Data Collection

Quantitative data were collected using surveys administered at baseline and at 4 weeks, immediately post-intervention. Qualitative data were collected through 30- to 60-minute focus group interviews conducted after participants completed the post-intervention survey. The interviews started with questions such as "What changes did you feel while participating in the program?" and "How was your experience using VR device and Fitbit?" All interviews were conducted by the first author, who has extensive experience in migrant healthcare, using a semi-structured interview guide. All interviews were audiotaped and were immediately transcribed and analyzed.

5. Measures

1) Primary outcomes: Feasibility

The primary outcome of this study was feasibility, which was assessed using recruitment rate, retention rate, adherence rate, and acceptability. *Recruitment rate,* which assesses the feasibility of recruiting a sufficient number of participants for the study [28], was measured as the number of individuals agreeing to participate divided by the number of potential participants screened.

Animation video

Hyperlink icons to YouTube virtual videos

健康のための生活パターンづくり VR身体活動ガイド

전남대학교 간호대학 THE INSTITUTE OF EDUCATIONAL RESEARCH

III. 身体活動のめやす

1. 基本共通指針

- 身体活動は移動のためのウォーキング、自転車、職業活動、家事、レジャー時間の運動を含みます。生活全体的に活動的になる習慣をつくることが大事です。
- 推奨される身体活動は基準であり、健康状態により良い影響を及ぼすためには回数や強度を順を追って増やしていくことが望ましいです。
- 身体活動は生涯の段階別に、幼少期およ青少年期、成人、６５歳以上の老年期に区別し、それぞれの段階にあわせて実践します。

25

Participant practice head-mounted disply use

Education brochure

Figure 1. Intervention materials and participant practice

Retention rate, which assesses the ability to maintain an adequate proportion of participants [28], was measured as the number of participants completing the 4-week post-intervention survey divided by the 13 initial participants. *Adherence rate*, which assesses the degree to which participants adhere to intervention protocols [28], was measured as the number of participants who completed the home-based intervention (based on the VR viewing log recorded by participants and the exercise time recorded by the Fitbit) divided by 12 participants. *Acceptability*, which assesses the extent to which the intervention is acceptable to intervention recipients [28], was measured using a single question, "How satisfied are you with this program overall?" with a 5-point response scale (ranging from 1 = *very dissatisfied* to 5 = *very satisfied*). Acceptability was further explored through focus group interview questions about participants' experiences with using the Fitbit and VR videos as well as their approval and/or disapproval of components of the intervention.

2) *Secondary outcomes: Preliminary efficacy*

The secondary outcome of this study was preliminary efficacy, which was assessed using mood, physical activity, and exercise self-efficacy. Among these, mood and exercise self-efficacy were measured using self-report questionnaires. To reduce measurement errors that may arise due to language and cultural differences, we used Japanese versions of instruments that were psychometrically validated for Japanese adults [29,30].

Mood was measured using the 22-item Japanese Positive and Negative Affect Schedule (11 items each for positive and negative affect) [29]. Responses were scored on a 5-point scale (ranging from 1 = *felt very slightly or not at all* to 5 = *felt very much*), with a higher score indicating a stronger corresponding emotion. The Cronbach's alpha in the present study was . 92-.95 for positive affect and .84-.89 for negative affect.

Physical activity was measured by the daily time MVPA at ≥ 3 metabolic equivalents and daily step count recorded on each par-

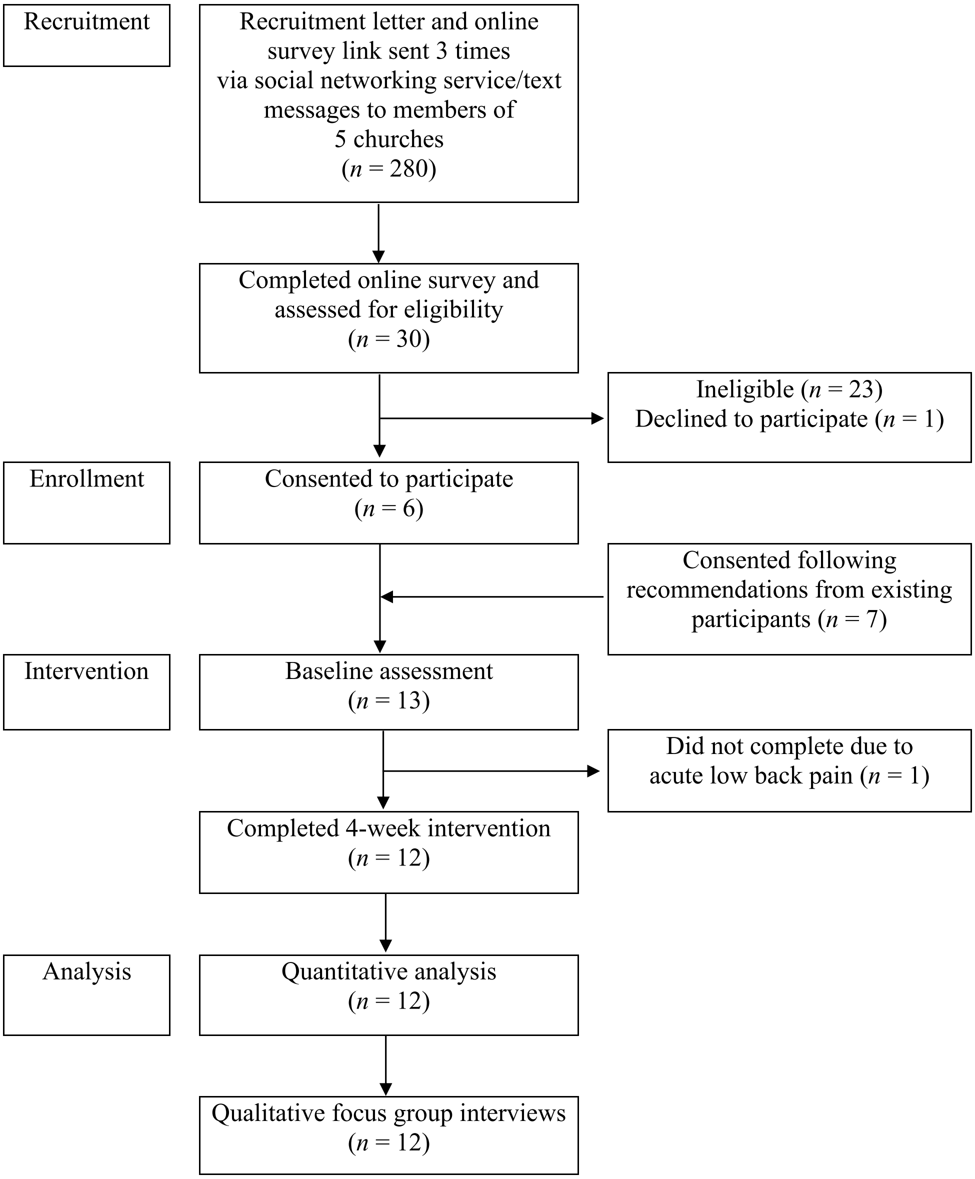

Figure 2. Study recruitment, retention, and analysis

ticipant's Fitbit Charge 3. Participants were instructed to put the device on every morning at the start of the day's activity and take it off in the evening at the end of the day's activity.

Exercise self-efficacy was measured using the 5-item Japanese Self-Efficacy for Exercise scale [30], which measures belief in one's ability to perform exercise regularly. Responses were scored on a 5-point scale (ranging from 1 = *strongly disagree* to 5 = *strongly agree*), with a higher score indicating a stronger corresponding self-efficacy. The Cronbach's alpha in the present study was .70-.79.

6. Data Analysis

The quantitative data were analyzed using IBM SPSS v.23.0 with the significance level $\alpha = .05$. Paired t-tests and Wilcoxon signed-rank tests were conducted to examine participants' mood, physical activity, and exercise self-efficacy between baseline and week 4. In addition, standardized effect size measures were calculated. In an attempt to correct for the small sample size, the Hedges' g effect size and its 95% confidence interval were employed [31].

Inductive content analysis was used to analyze the qualitative data [32]. From the interview transcriptions, units of meaning (words, sentences) describing acceptability were identified and condensed into descriptive texts. Then, the data were categorized by combining statements that belonged together. Subsequently, these consolidated statements were further combined into two categories: advantages of the intervention and areas needing improvement. The three authors analyzed these texts through repeated discussions concerning interpretations and categorizations until consensus was attained.

7. Ethical Considerations

This study was approved by the institutional review board of Chonnam National University (No. 1040198-200720-HR-078-04). Information concerning the purpose of the study, participant anonymity, and voluntary participation was provided to all participants, and written, informed consent was obtained from all participants. All materials provided to participants were written in Japanese. The education sessions and qualitative focus group interviews were conducted in a mixture of Japanese and Korean. During the study period, we prioritized the protection of participants according to local COVID-19 prevention and quarantine procedures. All participants received US$25 in remuneration after completing each of the baseline and final assessment visits (for a total of US$50).

Results

1. Study Participants

The participants' mean age was 54.23 (SD = 4.43) years, and their mean years of living in Korea was 23.56 (SD = 3.46). All had a high-school diploma or had completed a higher level of education. Most (83.3%) were married and employed. The majority (66.6%) had a monthly household income of less than 3 million Korean won (Supplemental Table 1).

2. Feasibility

Study recruitment letters were sent to a total of 280 Japanese migrant women. We assessed interest and study eligibility in 30 women who responded to the recruitment letter. Of those, one woman who was eligible declined to participate and 23 women were found ineligible because of health conditions, regular exercise, or no contact information. In addition, seven migrant women agreed to participated in the study at the recommendation of the six initial participants (Figure 2). In total, 37 potential participants were screened over 14 weeks, of which 13 agreed to participate, resulting in a recruitment rate of 35.1%.

During the 4-week intervention, one of the 13 initial participants stopped participating in the intervention due to back pain, resulting in a retention rate of 92.3%. The adherence rate for watching the VR videos was 66.7% in the first week, 75.0% in the second week, 66.7% in the third week, and 75.0% in the fourth week. Participants mostly watched the videos between 5 and 7 a.m. and 6 and 11 p.m. The adherence rate for moderate-intensity physical activity was 83.3% in the first and second weeks, 58.3% in the third week, and 75.0% in the fourth week (Figure 3). Acceptability was high, with 91.7% of participants saying they were "satisfied" or "*very satisfied*" with the overall intervention (mean = 4.08 out of 5.00).

Participants' comments regarding satisfaction with the intervention and areas requiring improvement are summarized in Supplemental Table 2. The "visual status indicators" provided by the Fitbit encouraged the participants to achieve their daily exercise goals, and through this process, participants felt a "sense of accomplishment and confidence." The VR videos increased participants' "emotional engagement and sense of presence." The "easy-to-control VR device" allowed the participants to watch videos without difficulty in their homes. The text messages provided participants with "external motivation through supervision." Participants experienced not only "joy from exercise" but also the "extra benefits" of being able to talk with their children while walking and get a good night's sleep. The areas of the intervention that required improvement included "discomfort caused by equipment," "video content diversity," and "additional intervention elements."

3. Preliminary Efficacy

The results of paired *t*-test analyses indicated that only negative affect was significantly changed (reduced) after the intervention ($p = .016$). Changes in physical activity, positive affect, and exercise self-efficacy showed trends, but did not reach statistical significance. The Hedges' *g* standardized mean difference effect size was 0.72 (95% CI = 0.09, 1.43) for changes in self-efficacy and -0.52 (95% CI = -0.99, -0.10) for changes in negative affect (Table 2).

Discussion

1. Feasibility

The ability to effectively recruit participants in a timely manner is a key determinant of an intervention's ultimate success [33]. In this study, a culturally matched research staff member recruited participants from church-based community networks using passive (SNS and text messages) and active (word-of-mouth) ap-

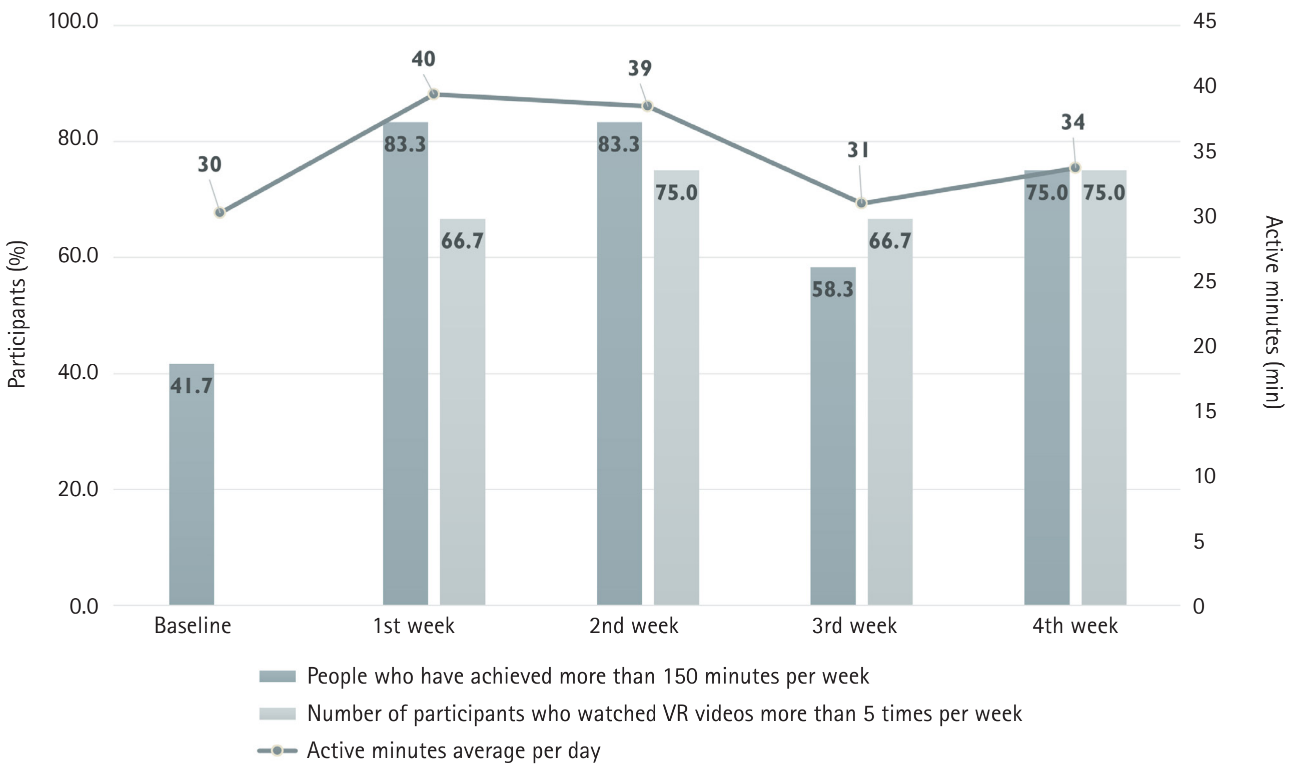

Figure 3. Participants' adherence to the intervention

Table 2. Comparisons of pre- and posttest outcome measures (*N*=12)

	Pre-test	Post-test	*t*	*p*	*g*	95% CI for *g*	
	Mean (SD)					Lower	Upper
Daily time performing MVPA	30.47 (29.98)	33.94 (15.09)	0.51	.622	0.14	-0.43	0.71
Daily step count	10134.83 (3646.03)	10215.37 (2903.71)	0.95	.926	0.02	-0.48	0.53
Positive affect	31.75 (5.63)	35.42 (8.27)	1.77	.104	0.48	-0.10	1.12
Negative affect	24.25 (6.52)	20.67 (6.36)	-2.85	.016	-0.52	-0.99	-0.10
Exercise self-efficacy	11.33 (2.23)	13.17 (2.52)	1.70	.117	0.72	0.09	1.43

MVPA=Moderate-vigorous physical activity.

proaches. Many walking studies use more than one recruitment approach [33,34]. Compared to word-of-mouth, the SNS and text messages reached a larger number of migrant women; however, the expected yield of eligible participants was lower with passive messaging (20% recruited) than with word-of-mouth (100% recruited). These results are similar to those of Gilliss and colleagues [35] in their community-based study of healthy ethnic minority women, where face-to-face recruiting yielded the highest percentage of eligible participants (74%), and internet website recruiting yielded the lowest (21%). Interestingly, in our study, all migrant women recruited via word-of-mouth had already known about the intervention from our recruitment letter but had postponed their participation until they received positive opinions on the intervention from an acquaintance. Therefore, when planning health interventions for migrant women, it is crucial to identify the role of opinion leaders in advance, identify opinion leaders using multiple methods, and then involve them in the recruitment stage [36].

In this study, the weekly intervention adherence rates were 66.7% to 75.0% for VR videos and 58.3% to 83.3% for MVPA. To maintain motivation for behavior change, additional strategies seem necessary after the initial 2-3 weeks of the intervention. More specifically, the adherence rate for MVPA among our study participants maintained at 83.3% during the initial two weeks, then dropped to 58.3% in the third week, but tended to rise again (75.0%) in the fourth week. Nyenhuis et al. [37] conducted a 7-week walking intervention for urban African American women, with similar intervention elements as this study (e.g., self-monitoring with Fitbit, goal setting, group sessions, and text messages) besides VR videos. While adherence to step goals reached 71.4-72.6% in the initial weeks, it dropped to 55.1% in week four and remained within 51.0-60.5% until the end, showing no significant recovery. Understanding whether VR intervention can mitigate the rebound in adherence to physical activity requires a randomized controlled trial.

In the case of the VR videos, the limited video selection options appear to have influenced adherence. Half the videos used in this study depicted underwater scenes, and some participants had unpleasant memories or fears of water, so their options were even more limited, and their interest decreased over time. A user-friendly virtual environment has a greater effect on the user's emotions than a general virtual environment and thus improves immersion [18]. In fact, some participants wanted to see VR videos showing the scenery of their hometown or of famous tourist destinations. In this study, we provided links to YouTube VR videos; by doing this, we avoided content production costs, but it was not possible to provide customized content reflecting participant preferences.

Most of the participants (91.7%) were satisfied or very satisfied with the intervention. Wearable devices are known to serve as a facilitator in motivating and accelerating physical activity [38], and in our focus group interviews, study participants reported similar experiences with this study's head-mounted display and Fitbit. In planning the intervention, we considered engaging middle-aged migrant women in an intervention involving a new technology to be the greatest challenge. However, we found that participant acceptance of the VR videos was good, and no adverse events were reported. We conclude that, with 20 minutes of practice, middle-aged migrant women can enjoy VR videos on their own at home while wearing an immersive headset. This suggests that VR technology has strong potential for use in home-based interventions.

2. Preliminary Efficacy

This study demonstrated that a home-based intervention combining a Fitbit and VR videos has the potential to improve emotional well-being and exercise self-efficacy in middle-aged migrant women. In particular, the intervention showed preliminary efficacy at reducing negative affect. This finding differs from some previous studies in which physical activity improved positive affect but did not decrease negative affect [7,8]. On the other hand, when Browning et al. [39] tested the effects of outdoor nature exposure and 360-degree VR nature videos on mood, negative affect was significantly decreased by both outdoor nature exposure and the VR nature videos, whereas positive affect showed a significant change only with outdoor nature exposure. Therefore, we assume that the emotional engagement our participants reported experiencing while viewing the 360-degree VR videos, such as stability, comfort, and freedom, may have contributed to decreased negative affect. However, given our one-group study design, it is not possible to determine whether the decrease in negative affect was due to physical activity, the VR videos, or the intervention as a whole.

All the participants initially described themselves as inactive, but during their baseline assessments with the Fitbit, we found that their average daily MVPA time was 30 minutes or more, indicating that they were already achieving an acceptable level of physical activity. This finding may be due to their domestic and work-related physical activities, as most participants cared for families and were employed. In addition, women who are mainly engaged in manual labor at work tend to be more physically inactive in their leisure time [40]. Our study participants were usually inactive during their leisure time, but during the intervention, they reported experiencing joy after exercise and feeling intrinsic and extrinsic motivation to exercise. Although a 4-week home-based intervention may not be sufficient to create a physical activity habit, our observations of increases in exercise self-efficacy and decreases in negative affect indicate the potential benefits of the intervention. Further studies are needed to evaluate the efficacy of the intervention on the enhancement of leisure time physical activity in migrant women.

During the focus group interviews, participants identified areas of the intervention that need improvement. First, participants indicated that some face-to-face sessions would be desirable. As adding human support is known to promote engagement with many interventions [41], it is not surprising that migrant women reported wanting some face-to-face time. However, a face-to-face behavior change intervention requires participants to attend a set number of scheduled sessions, whereas a digital behavior change intervention can engage individuals whenever they are available [42]. Moreover, programs and devices using digital technology have been shown to improve health by supporting healthy behaviors [42-45]. In any case, because providing our intervention face-to-face would increase the cost, it would be necessary to devise a strategy for cost-effectively providing some face-to-face sessions [42].

As two other areas for improvement, participants suggested increasing the diversity of content in the VR videos and taking measures to reduce the discomfort caused by the wearable devices. Regarding the second suggestion, device-measured physical activity has the advantage of producing more reliable and valid results. However, some participants reported that they often forgot to wear the Fitbit, so their physical activity were not accurately measured. Thus, there is a possibility that a statistically significant change in their physical activity was not captured in the study. We did use in-person education and an animation video to encourage regular Fitbit wear, but these were insufficient. The same problem was reported in a previous study conducted to promote physical activity in migrant women [46]. To obtain accurate measurements of physical activity levels, additional strategies such as physical activity logs and text message reminders are needed to promote adherence to protocols for wearable activity trackers.

Limitaions

This study had a few limitations. Given its one-group design, this study poses limitations in establishing causal relationships and is susceptible to the influence of confounding factors [47]. Moreover, it was not possible to determine which components of the intervention (VR videos or activity trackers or both) affected participants' mood changes. Utilizing a randomized controlled trial design will enhance the validity and interpretation of the study outcomes. Another limitation is that the small sample size raises the risk of a Type II error, potentially hindering the statistical significance detection of the intervention effect. In addition, the number and content of the VR videos used for the intervention were limited, and the participants' preferences were not known during video selection. This may have affected the efficacy of the VR video use for improving emotional well-being and physical activity. The study participants were Japanese women who had lived in Korea for an average of 23.56 years, all holding at least a high school diploma. Furthermore, considering the low recruitment rate of 35.1%, individuals participating in this study may also possess characteristics suggestive of a willingness to adopt new technologies and devices, such as VR or Fitbit. Therefore, there are limitations in generalizing the results of this study to other immigrant women. Finally, physical activity was consistently assessed in participants' natural settings utilizing Fitbit, while moods were assessed using a self-reported questionnaire in a paper-and-pencil mode once before and after the intervention. In future research, it is recommended to employ ecological momentary assessment, which involves repeated real-time assessments of participants' mood in their natural environments [48]. This will better help understand how interventions experienced in real life impact mood changes.

Conclusions

This study's home-based intervention, employing VR videos and wearable activity trackers, is feasible in terms of high retention and acceptability. To maximize recruitment of middle-aged migrant women, multiple recruitment approaches, including word-of-mouth, are needed. To increase the intervention adherence rate, additional strategies are needed, including diversifying VR video content and providing face-to-face intervention sessions with appropriate frequency. The intervention shows preliminary efficacy in improving mood, especially negative affect. Further research is warranted to evaluate the intervention's effectiveness in a more rigorous randomized controlled trial.

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Supplementary materials

Supplementary materials can be found via https://doi.org/10.12799/rcphn.2023.00339.

Conflict of interest

Duckhee Chae has been editorial board member of the Research in Community and Public Health Nursing. She was not involved in the review process of this manuscript. No conflict of interest has been declared by all authors.

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Authors' contributions

Duckhee Chae contributed to conceptualization, data curation, formal analysis, funding acquisition, methodology, project administration, visualization, writing - original draft, review & editing, investigation, resources, supervision, and validation. Keiko Asami, Jaseon Kim, and Kukhyeon Kim contributed to conceptualization, data curation, formal analysis, methodology, project administration, visualization, writing - original draft, review & editing, investigation, resources, and software. Jeeheon Ryu contributed to conceptualization, data curation, methodology, project administration, writing - review&editing, supervision, and validation. Ardith Z. Doorenbos contributed to writing - review&editing, supervision, and validation.

Data availability

Please contact the corresponding author for data availability.

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References

1. 2018 Physical Activity Guidelines Advisory Committee. 2018 Physical activity guidelines advisory committee scientific report [Internet]. Washington: Office of the Assistant Secretary for Health; 2018 [cited 2018 Feb 1]. Available from https://health.gov/sites/default/files/2019-09/PAG_Advisory_Committee_Report.pdf
2. Guthold R, Stevens GA, Riley LM, Bull FC. Worldwide trends in insufficient physical activity from 2001 to 2016: A pooled analysis of 358 population-based surveys with 1·9 million participants. The Lancet Global Health. 2018;6(10):e1077–e1086. https://doi.org/10.1016/S2214-109X(18)30357-7
3. Korea Disease Control and Prevention Agency. Physical activity [Internet]. Cheongju: Korea Disease Control and Prevention Agency. 2022 [Cited 2023 Jan 23]. Available from https://knhanes.kdca.go.kr/knhanes/sub01/sub01_05.do#header
4. Aichberger MC, Schouler-Ocak M, Mundt A, Busch MA, Nickels E, Heimann HM, et al. Depression in middle-aged and older first generation migrants in Europe: Results from the Survey of Health, Ageing and Retirement in Europe (SHARE). Europian. 2010;25(8):468–475. https://doi.org/10.1016/j.eurpsy.2009.11.009
5. Kristiansen M, Razum O, Tezcan-Güntekin H, Krasnik A. Aging and health among migrants in a European perspective. Public Health Reviews. 2016;37(1):1–14. https://doi.org/10.1186/s40985-016-0036-1
6. Asami K, Chae D. Influencing factors on health-related quality of life among Japanese middle-aged marriaged-based immigrant women in South Korea: A cross-sactional study. Journal of Korean Academy of Community Health Nursing. 2022;33(2):188–195. https://doi.org/10.12799/jkachn.2022.33.2.188
7. Mata J, Thompson RJ, Jaeggi SM, Buschkuehl M, Jonides J, Gotlib IH. Walk on the bright side: Physical activity and affect in major depressive disorder. Journal of Abnormal Psychology. 2012;121(2):297–308. https://doi.org/10.1037/a0023533
8. Liao Y, Shonkoff ET, Dunton GF. The acute relationships between affect, physical feeling states, and physical activity in daily life: A review of current evidence. Frontiers in Psychology. 2015;6:1975. https://doi.org/10.3389/fpsyg.2015.01975
9. Niermann CYN, Herrmann C, von Haaren B, van Kann D, Woll A. Affect and subsequent physical activity: An ambulatory assessment study examining the affect-activity association in a real-life context. Frontiers in Psychology. 2016;7:677. https://doi.org/10.3389/fpsyg.2016.00677
10. Flavián C, Ibáñez-Sánchez S, Orús C. Impacts of technological embodiment through virtual reality on potential guests' emotions and engagement. Journal of Hospitality Marketing & Management. 2021;30(1):1–20. https://doi.org/10.1080/19368623.2020.1770146
11. Brimelow RE, Dawe B, Dissanayaka N. Preliminary research: Virtual reality in residential aged care to reduce apathy and improve mood. Cyberpsychology, Behavior, and Social Networking. 2020;23(3):165–170. https://doi.org/10.1089/cyber.2019.0286
12. Heyse J, Torres Vega M, De Jonge T, De Backere F, De Turck F. A personalised emotion-based model for relaxation in virtual reality. Applied Sciences. 2020;10(17):6124. https://doi.org/10.3390/app10176124
13. Schutte NS, Stilinović EJ. Facilitating empathy through virtual reality. Motivation and Emotion. 2017;41:708–712. https://doi.org/10.1007/s11031-017-9641-7
14. Yeo NL, White MP, Alcock I, Garside R, Dean SG, Smalley AJ, et al. What is the best way of delivering virtual nature for improving mood? An experimental comparison of high definition TV, 360 video, and computer generated virtual reality. Journal of Environmental Psychology. 2020;72:101500.

https://doi.org/10.1016/j.jenvp.2020.101500
15. Miller KJ, Adair BS, Pearce AJ, Said CM, Ozanne E, Morris MM. Effectiveness and feasibility of virtual reality and gaming system use at home by older adults for enabling physical activity to improve health-related domains: A systematic review. Age and Ageing. 2014;43(2):188–195. https://doi.org/10.1093/ageing/aft194
16. Song H, Peng W, Lee KM. Promoting exercise self-efficacy with an exergame. Journal of Health Communication. 2011;16(2):148–162. https://doi.org/10.1080/10810730.2010.535107
17. Alshaer A, O'Hare D, Archambault P, Shirley M, Regenbrecht H. How to observe users' movements in virtual environments: Viewpoint control in a power wheelchair simulator. Human Factors. 2020;62(4):656–670. https://doi.org/10.1177/0018720819853682
18. Benzina N, Morgiève M, Euvrard M, Dos Santos JFA, Pelissolo A, Mallet L. Personalised 360° video exposure therapy for the treatment of obsessive-compulsive disorder: A single case study. French Journal of Psychiatry. 2020;1:31–38. https://doi.org/10.1016/j.fjpsy.2020.02.004
19. Dermody G, Whitehead L, Wilson G, Glass C. The role of virtual reality in improving health outcomes for community-dwelling older adults: Systematic review. Journal of Medical Internet Research. 2020;22(6):e17331. https://doi.org/10.2196/17331
20. Lee N, Choi W, Lee S. Development of an 360-degree virtual reality video-based immersive cycle training system for physical enhancement in older adults: A feasibility study : Development of immersive virtual cycle for older adults. BMC Geriatrics. 2021;21(1):325. https://doi.org/10.1186/s12877-021-02263-1
21. Teresi JA, Yu X, Stewart AL, Hays RD. Guidelines for designing and evaluating feasibility pilot studies. Medical Care. 2022;60(1):95–103. https://doi.org/10.1097/MLR.0000000000001664
22. Li J, Hodgson N, Lyons MM, Chen KC, Yu F, Gooneratne NS. A personalized behavioral intervention implementing mHealth technologies for older adults: A pilot feasibility study. Geriatric Nursing. 2020;41(3):313–319. https://doi.org/10.1016/j.gerinurse.2019.11.011
23. Sporrel K, Wang S, Ettema DDF, Nibbeling N, Krose BJA, Deutekom M, de Boer RDD, Simons M. Just-in-time prompts for running, walking, and performing strength exercises in the built environment: 4-week randomized feasibility study. JMIR Formative Research. 2022;6(8):e35268. https://doi.org/10.2196/35268
24. Kandola A, Ashdown-Franks G, Hendrikse J, Sabiston CM, Stubbs B. Physical activity and depression: Towards understanding the antidepressant mechanisms of physical activity. Neuroscience & Biobehavioral Reviews. 2019;107:525–539. https://doi.org/10.1016/j.neubiorev.2019.09.040
25. Rajati F, Sadeghi M, Feizi A, Sharifirad G, Hasandokht T, Mostafavi F. Self-efficacy strategies to improve exercise in patients with heart failure: A systematic review. ARYA Atherosclerosis. 2014;10(6):319.
26. Bandura A, Adams NE. Analysis of self-efficacy theory of behavioral change. Cognitive Therrapy and Research. 1977;1(4):287–310. https://doi.org/10.1007/BF01663995
27. Glanz K, Rimer BK, Viswanath K. Health behavior: Theory, research, and practice. 5th ed. San Francisco, CA: John Wiley & Sons; 2015. 485 p.
28. Polit DF, Beck CT. Nursing research: Generating and assessing evidence for nursing practice. 10th ed. Philadelphia: Wolters Kluwer Health; 2017. 814 p.
29. Clark L, Watson D. The Japanese Positive and Negative Affect Schedule: Factor-based scales for the assessment of mood. University of Iowa. 1989 (Unpublished).
30. Oka K. Stages of change for exercise behavior and self-efficacy for exercise among middle-aged adults. Nihon Koshu Eisei Zasshi. 2003;50(3):208–215. https://doi.org/10.11236/jph.50.3_208
31. Goulet-Pelletier JC, Cousineau D. A review of effect sizes and their confidence intervals, Part I: The Cohen'sd family. The Quantitative Methods for Psychology. 2018;14(4):242–265. http://doi.org/10.20982/tqmp.14.4.p242
32. Elo S, Kyngäs H. The qualitative content analysis process. Journal of Advanced Nursing. 2008;62(1):107–115. https://doi.org/10.1111/j.1365-2648.2007.04569.x
33. Benham JL, Booth JE, Friedenreich CM, Rabi DM, Sigal RJ. Comparative success of recruitment strategies for an exercise intervention trial among women with polycystic ovary syndrome: Observational study. Journal of Medical Internet Research. 2021;23(3):e25208. https://doi.org/10.2196/25208
34. Foster CE, Brennan G, Matthews A, McAdam C, Fitzaimons C, Mutrie N. Recruiting participants to walking intervention studies: A systematic review. The International Journal of Behavioral Nutrition and Physical Activity. 2011;8(1):1–28. https://doi.org/10.1186/1479-5868-8-137
35. Gilliss CL, Lee KA, Gutierrez Y, Taylor D, Beyene Y, Neuhaus J, Murrell N. Recruitment and retention of healthy minority women into community-based longitudinal research. Journal

of Women's Health & Gender-Based Medicine. 2001;10(1):77–85. https://doi.org/10.1089/152460901750067142

36. Valente TW, Pumpuang P. Identifying opinion leaders to promote behavior change. Health Education & Behavior. 2007;34(6):881–896. https://doi.org/10.1177/1090198106297855
37. Nyenhuis SM, Balbim GM, Ma J, Marquez DX, Wilbur J, Sharp LK, Kitsiou S. A walking intervention supplemented with mobile health technology in low-active urban African American women with asthma: Proof-of-concept study. JMIR Formative Research. 2020;4(3):e13900. https://doi.org/10.2196/13900
38. Jo A, Coronel BD, Coakes CE, Mainous III AG. Is there a benefit to patients using wearable devices such as Fitbit or health apps on mobiles? A systematic review. American Journal of Medicine. 2019;132(12):1394–1400. e1. https://doi.org/10.1016/j.amjmed.2019.06.018
39. Browning MHEM, Mimnaugh KJ, van Riper CJ, Laurent HK, LaValle SM. Can simulated nature support mental health? Comparing short, single-doses of 360-degree nature videos in virtual reality with the outdoors. Frontiers in Psychology. 2020;10:2667. https://doi.org/10.3389/fpsyg.2019.02667
40. Seiluri T, Lahti J, Rahkonen O, Lahelma E, Lallukka T. Changes in occupational class differences in leisure-time physical activity: A follow-up study. International Journal of Behavioral Nutrition and Physical Activity. 2011;8(1):1–8. https://doi.org/10.1186/1479-5868-8-14
41. Baumeister H, Reichler L, Munzinger M, Lin J. The impact of guidance on Internet-based mental health interventions — A systematic review. Internet Interventions. 2014;1(4):205–215. https://doi.org/10.1016/j.invent.2014.08.003
42. Michie S, Yardley L, West R, Patric K, Greaves F. Developing and evaluating digital interventions to promote behavior change in health and health care: Recommendations resulting from an international workshop. Journal of Medical Internet Research. 2017;19(6):e232. https://doi.org/10.2196/jmir.7126
43. Brickwood KJ, Watson G, O'Brien J, Williams AD. Consumer-based wearable activity trackers increase physical activity participation: Systematic review and meta-analysis. JMIR mHealth and uHealth. 2019;7(4):e11819. https://doi.org/10.2196/11819
44. Gal R, May AM, van Overmeeren EJ, Simons M, Monninkhof EM. The effect of physical activity interventions comprising wearables and smartphone applications on physical activity: a systematic review and meta-analysis. Sports Medicine-Open. 2018;4(1):1–15. https://doi.org/10.1186/s40798-018-0157-9
45. Laranjo L, Ding D, Heleno B, Kocaballi B, Quiroz JC, Tong HL, et al. Do smartphone applications and activity trackers increase physical activity in adults? Systematic review, meta-analysis and metaregression. British Journal of Sports Medicine. 2021;55(8):422–32. http://dx.doi.org/10.1136/bjsports-2020-102892
46. El Masri A, Kolt GS, George ES. Feasibility and acceptability of a culturally tailored physical activity intervention for Arab-Australian women. BMC Womens Health. 2021;21(1):1–14. https://doi.org/10.1186/s12905-021-01250-3
47. Knapp TR. Why is the one-group pretest-posttest design still used? Clinical Nursing Research. 2016;25(5):467–472. https://doi.org/10.1177/1054773816666280
48. Shiffman S, Stone AA, Hufford MR. Ecological momentary assessment. Annual Review of Clinical Psychology 2008;4:1–32. https://doi.org/10.1146/annurev.clinpsy.3.022806.091415

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Factors influencing dementia preventive behaviors of older adults at high risk of dementia: Application of extended health belief model

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Purpose: The purpose of this study was to identify the factors influencing dementia preventive behaviors of older adults at high risk of dementia based on extended health belief model.
Methods: The subjects were 140 older adults at high risk of dementia living in H-gun, Gyeongsangnam-do, Republic of Korea. The data was collected from April 21 to May 28, 2021 by using structured questionnaires. The data was analyzed using t-test, ANOVA, Scheffé test, Pearson's correlation coefficient, and hierarchical multiple regression by SPSS/WIN 24.0 program.
Results: The mean score of dementia preventive behaviors of older adults at high risk of dementia was 3.47±0.49 (range 1-5). The factors influencing dementia preventive behaviors were self-efficacy (β=.82, p<.001), cues to action(β=.17, p=.013), ages 75-79 (β=0.35, p=.003; reference: ages 65-69), ages ≥80 (β=0.27, p=.021; reference: ages 65-69), which together explained 82.0% of total variance in dementia preventive behaviors (F=25.21, p<.001).
Conclusion: Based on the results of this study, it is highly recommended to develop and apply the dementia prevention program that can increase self-efficacy and cues to action for improving dementia preventive behavior of older adults at high risk of dementia.

Keywords: Aged; Behavior; Dementia; Self efficacy, Prevention and Control

Introduction

1. Background

In Korea, with the continuously growing elderly population, the prevalence of dementia in people aged 65 or older is estimated to rapidly increase from 10.3% in 2020 to 12.7% in 2040 to 17.7% in 2060 [1].

Dementia refers to a condition in which complex symptoms of cognitive decline, including memory loss, occur in people who have been leading a normal life due to various acquired causes, and seriously affect individuals' cognitive and daily functioning, making it difficult for them to perform daily activities independently [2]. There is currently no treatment for dementia that can cure cognitive impairment and restore deteriorated cognitive functions to their previous states after a person is diagnosed with dementia. Therefore, the only realistically feasible approaches to dementia are to reduce the incidence of dementia by preventing dementia through managing risk factors for dementia, and to slow down the progression of dementia through early diagnosis and interventions in cases where a person is diagnosed with dementia [3].

Dementia prevention is generally focused on lifestyle factors, which can be managed through lifestyle changes [3]. The World Health Organization (WHO) has suggested the following behaviors as effective ways to reduce the risk of dementia: management of diseases such as diabetes, hypertension, and hyperlipidemia,

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regular exercise, weight management, healthy eating, smoking cessation, avoiding excessive alcohol use, improving lifestyle habits, and depression management [4]. In Korea, the National Institute of Dementia developed the '3.3.3 Rules for Dementia Prevention' in 2014, which include disease management for diseases such as high blood pressure, diabetes, and hyperlipidemia, improvement of lifestyle habits such as exercise, dietary habits, and cognitive activities, and regular early dementia screening tests and health checkups, in order to encourage people, including older adults, to practice dementia preventive behaviors in their daily life [5]. In addition, as national spending on dementia care is expected to increase continuously with an increase in dementia patients, the Ministry of Health and Welfare has established the 4th National Dementia Plan (2021-2025). Accordingly, to ensure that high-risk groups for dementia can be managed mainly through dementia care centers, the Ministry of Health and Welfare has been expanding dementia screening tests for people ages 75 and older who are living alone, has been attempting to identify older adults with suspected cognitive impairment in connection with the home visiting healthcare services of public health centers to guide them to visit and use a dementia care center, and has been distributing dementia prevention programs to senior welfare centers [6]. However, a previous study by Ha [7] reported that the degree of dementia preventive behavior practice among community-dwelling older adults in Korea was found to be a low level of 42.35 points out of 100. Therefore, it is most urgently needed to develop strategies to encourage older adults to voluntarily participate in and practice dementia preventive behaviors.

A high-risk group for dementia means a group at high risk of developing dementia, so it is a group that needs to perform activities for dementia prevention more actively than other people to prevent the development of dementia. The Ministry of Health and Welfare has been managing the following groups as high-risk groups for dementia: people with mild cognitive impairment, people aged 75 and older classified as the old-old group, and older adults living alone [6]. With respect to the empirical bases for categorizing these groups as high-risk groups for dementia, mild cognitive impairment refers to the intermediate stage between cognitive decline observed in the normal aging process and mild dementia, and the annual incidence rate of dementia is reported to be 1-2% in normal older people and about 10-15% in people with mild cognitive impairment [2]. Also, old age has been shown to be a representative risk factor for dementia [2-4], and a prior study reported that the likelihood of developing dementia was found to be 5.82 times higher in the 75-80 age group and 35.15 times higher in the ≥85 age group, compared to the 60-64 age group [2]. In addition, social isolation, such as living alone and the absence of the spouse, has also been found to be a risk factor for dementia [2-4]. Older adults living alone were found to have decreased cognitive abilities, compared to those living with others [8], and the proportions of dementia risk factors, such as old age, a low education level, high nutritional risk, and depression, were reported to be higher among older adults living alone [8,9]. Moreover, older adults living alone were found to be at 2.9 times higher risk for dementia [2].

In order to prevent the development of dementia in older adults at high risk for dementia, research needs to be conducted to identify factors influencing the practice of dementia preventive behaviors. In the majority of previous studies on dementia preventive behaviors, study participants were community-dwelling older people [7,10-12] or middle-aged people [13,14]. Among previous studies of community-dwelling older people, two studies [11,12] conducted research on older adults at high risk for dementia, and the participants of these studies were older adults aged 65 or older living alone. More specifically, Kang et al. [11] conducted research on dementia knowledge, internal health locus of control, and dementia preventive behaviors, and Han & Suh [12] investigated dementia knowledge, dementia attitudes, and dementia preventive behaviors. Other studies of community-dwelling older adults have been conducted without any limitation on the age of participants, and there has been no research on people aged 75 or older, a high-risk group for dementia. Thus, there is a need for research on older adults at high risk for dementia.

The health belief model is a model developed in the early 1950s by social psychologists Hochbaum, Rosenstock, and Kegels to explain preventive behaviors, and the major concepts of this model are perceived susceptibility, perceived severity, perceived benefit, perceived barrier, and cues to action [15]. The concept of general health motivation was subsequently added to the health belief model to explain sick role behavior [16], and as the focus of health behavior has been shifted to lifestyle behaviors that need long-term changes, this model was further extended by adding the concept of self-efficacy [17]. The health belief model is a useful theory for explaining health behaviors for various diseases, but has the limitation that it does not sufficiently reflect the psychosocial factors of diseases [18]. Therefore, research has been actively conducted on the extended health belief model, which was constructed by adding general health motivation and self-efficacy to the health belief model, and it has been demonstrated that the extended health belief model is an appropriate theoretical framework for explaining influencing factors for health behaviors [19,20]. Since dementia preventive behaviors are preventive activities and mostly lifestyle habits [4], the extended health belief model can be applied as a conceptual framework for analysis of dementia preventive behaviors among older adults at high risk for dementia.

Prior studies on dementia based on the health belief model have analyzed dementia preventive behaviors [10], dementia preventive behavior intention [20,21], fear of dementia [22], and performance of the dementia screening test [23,24], and there is currently a lack of research on dementia preventive behaviors. In addition, in a previous study on dementia preventive behaviors [10], only health beliefs were analyzed among the concepts of the extended health belief model, so there is a need to analyze influencing factors for dementia preventive behaviors by applying all concepts of the extended health belief model (general health motivation, health beliefs, cues to action, and self-efficacy).

Meanwhile, the Ministry of Health and Welfare has defined high-risk groups for dementia as: people with mild cognitive impairment, people aged 75 and older, and older adults living alone. However, a previous study [2] reported that the level of awareness of dementia was significantly lower in older adults with mild cognitive impairment than those with normal cognitive function. In addition, it has been shown that a higher level of dementia knowledge was associated with a higher level of dementia preventive behavior practice [11-13]. These findings of previous studies suggest that there may be differences in the degree of dementia preventive behavior practice and influencing factors for them between older adults with mild cognitive impairment and those with normal cognitive function. Therefore, this study defined older adults at high risk for dementia as older adults aged 65 or older living alone or older adults aged 75 or older among older people without cognitive impairment, and purported to identify factors influencing dementia preventive behaviors among older adults at high risk for dementia by applying the extended health belief model with the aim of presenting basic data for the development of a dementia prevention program for older adults at high risk for dementia.

2. Objectives

The aim of this study was to identify factors influencing dementia preventive behaviors among older adults at high risk for dementia by applying the extended health belief model, and specific objectives are as follows:

1) To investigate the levels of dementia preventive behaviors, general health motivation, health beliefs, cues to action, and self-efficacy among older adults at high risk for dementia;
2) to investigate the degree of dementia preventive behaviors according to the general characteristics of older adults at high risk for dementia;
3) to examine the relationships between dementia preventive behaviors, general health motivation, health beliefs, cues to action, and self-efficacy among older adults at high risk for dementia;
4) to identify factors affecting dementia preventive behaviors among older adults at high risk for dementia.

Methods

1. Study design

This study is a descriptive correlational research to identify factors affecting dementia preventive behaviors among older adults at high risk for dementia.

2. Participants

The participants of this study are older adults at high risk for dementia living in H-gun, Gyeongsangnam-do who understood the purpose of the study and gave written informed consent to participate in the study. The inclusion criteria were as follows: older adults aged 65 or older living alone or those aged 75 or older, who are high-risk groups for dementia; no cognitive impairment (a score of 24 or higher on the Korea version of Mini-Mental State Examination (MMSE-K)); able to read and understand Korean or able to listen and verbally respond to the questions of the questionnaire. The exclusion criteria were as follows: 1) people diagnosed with dementia or mild cognitive impairment; 2) people diagnosed with and receiving treatment for a mental disorder such as schizophrenia and bipolar disorder.

The sample size was calculated using G·Power version 3.1.9 [25]. More specifically, in the multiple regression analysis, the significance level (α) was set at .05 and power was set at .80. As for the effect size, since there were no previous studies on dementia preventive behaviors among older adults at high risk for dementia, the effect size was set as a medium effect size (.15), based on the research results of a study by Ha [7] on dementia preventive behaviors among community-dwelling older adults, and the number of predictor variables was set to 11. As a result, the minimum sample size for this study was determined as 123 people. In this study, considering a dropout rate of 20%, questionnaires were distributed to a total of 148 people, and 140 respondents were finally included in the analysis, excluding 8 copies of the questionnaire with insincere responses.

3. Measures

1) Dementia preventive behaviors

The degree of dementia preventive behaviors was measured by a modified version of the assessment tool for dementia preventive behaviors developed by Lim et al. [26], and the used tool was created by the researcher by modifying and supplementing the original tool developed by Lim et al. [26]. The instrument developed by Lim et al. [26] contains a total of 15 questions on the following items: five rules of recommended behaviors (moderate-intensity exercise for 30 minutes or more, balanced intake of nuts and vegetables, three meals a day, adequate good-quality sleep, and reading and writing), five rules of prohibited behaviors (drinking, smoking, traumatic brain injury, obesity, and chronic diseases), and five rules of necessary behaviors (stress reduction, depression prevention, communication, early dementia screening test, and regular health check-ups). The researcher added one question about hand movements to the original tool, based on the Ten Rules for Dementia Prevention presented by the Ministry of Health and Welfare [27], so the tool used in this study includes 16 questions in total. Each item is assessed on a 5-point Likert scale, ranging from 1 point (='Never') to 5 points (='Always').

Higher scores indicate higher frequencies of performing dementia preventive behaviors. As to the reliability of the instrument, the value of Cronbach's α was reported as .77 in Lim et al. [26], and it was calculated as .79 in this study.

2) General health motivation, health beliefs, and cues to action

Among the variables of the extended health belief model, general health motivation, health beliefs (perceived susceptibility, perceived severity, perceived benefit, and perceived barrier), and cues to action were measured using the subscales from an adapted version of the scale developed by Kim et al. [28]. Kim et al. [28] devised the Motivation to Change Lifestyle and Health Behaviors for Dementia Risk Reduction (MCLHB-DRR) Scale for adults aged 50 or older, and its adapted version used in this study was developed by Choi et al. [20]. Kim et al. [28] developed the MCLHB-DRR Scale to assess motivation for changing lifestyle habits and health behaviors to reduce one's risk of dementia by modifying questions from previous studies that applied the health belief model to breast cancer screening and cognitive tests, based on focus group interviews with 34 middle-aged and older Australians aged 50 years or older [28]. The scale contains a total of 27 questions and 7 subscales, and this study used the tool except for the self-efficacy subscale. More specifically, the scale used consists of 4 questions about general health motivation, 4 questions about perceived susceptibility, 5 questions about perceived severity, 4 questions about perceived benefit, 4 questions about perceived barrier, and 4 questions about cues to action. Each item is scored on a 5-point Likert scale, ranging from 1 point (='Not at all') to 5 points (='Very much'), and higher scores indicate higher levels of general health motivation, perceived susceptibility, perceived severity, perceived benefit, perceived barrier, and cues to action. Regarding the reliability of each subscale, the values of Cronbach's α were reported as .60 for general health motivation, .86 for perceived susceptibility, .72 for perceived severity, .69 for perceived benefit, .74 for perceived barrier, and .68 for cues to action in Kim et al. [28]. In this study, the values of Cronbach's α were calculated as .83 for general health motivation, .92 for perceived susceptibility, .74 for perceived severity, .91 for perceived benefit, .92 for perceived barrier, and .82 for cues to action.

3) Self-efficacy

Self-efficacy for dementia preventive behaviors was measured using the self-efficacy scale developed by the researcher. This tool was created based on the guidelines for development of a self-efficacy scale presented by Bandura [29] by referring to the self-efficacy scale developed by Gu [30], which was also developed based on the guidelines presented by Bandura [29]. The researcher devised 10 questions in connection with the questions of the assessment tool for dementia preventive behaviors in order to measure confidence in specific dementia preventive behaviors according to Bandura's [29] definition of self-efficacy. Then, assessment of the content validity of the developed scale was performed through evaluations by two nursing professors. As a result, the content validity index was more than 0.8 for all items, so all the items were adopted and the scale was finalized. This scale consists of 10 questions in total, and each item is assessed on a 5-point Likert scale, ranging from 1 point (='Not at all confident') to 5 points (='Very confident'). Higher scores indicate a higher level of self-efficacy for dementia preventive behaviors. Regarding the reliability of the tool, the value of Cronbach's α was reported as .77 in the study by Gu [30] and it was calculated as .72 in this study.

4. Data collection

In this study, data collection was conducted from April 21 to May 28, 2021 among older adults at high risk for dementia who visited a public health center and its dementia care center after obtaining consent from the director of the public health center in H-gun, Gyeongsangnam-do. Data was collected using questionnaires from the older adults at high risk for dementia who gave written informed consent after they were informed of the purpose, necessity, and procedures of the study. It took approximately 15 to 20 minutes to complete the questionnaire. When some participants had difficulty filling out the questionnaire due to presbyopia or illiteracy or needed assistance in completing the questionnaire, the researcher read aloud each item of the questionnaire to the participants and asked them to respond verbally.

5. Ethical considerations

This study was conducted only with people who gave written informed consent to participate in the study after receiving approval from the IRB of Gyeongsang National University (IRB approval No.: GIRB-A21-Y-0005) before data collection. The study participants were given explanations about the purpose and methods of the study, rights of research participants, anonymity of information collected from them, and their right to withdraw from the study at any time. They were also informed that the collected data would not be used for purposes other than research and would be stored for 3 years after the completion of the study and then discarded. To guarantee the anonymity of the participants, unique codes were assigned to the collected data and personal information. The participants were given a small gift along with a leaflet on dementia prevention as a token of appreciation for their participation in the study.

6. Statistical analysis

The collected data were analyzed using SPSS/WIN 24.0.

To analyze general characteristics, dementia preventive behaviors, general health motivation, health beliefs, cues to action, and self-efficacy of the participants, the frequency, percentage, mean, and standard deviation were calculated. The *t*-test and ANOVA were performed to analyze differences in the degree of dementia preventive behaviors according to the characteristics of the participants, and a post-hoc test was conducted using the Scheffé test. In addition, Pearson's correlation coefficient was used to examine the relationships between dementia preventive behaviors, general health motivation, health beliefs, cues to action, and self-efficacy among the participants. Furthermore, a hierarchical multiple regression analysis was conducted to analyze factors influencing dementia preventive behaviors in the participants.

Results

1. General and dementia-related characteristics of older adults at high risk for dementia

With respect to the general characteristics of the participants, 78 people (55.7%) were female, and the mean age of the participants was 78.39 ± 5.46 years. In education level, uneducated people without formal education were 39 people (27.9%), accounting for the largest proportion of the participants. For the presence of family members living together, 92 people (65.7%) lived with one or more family members. As to the presence of religion, 106 people (75.7%) believed in no religion.

Regarding the presence of a job, 109 people (77.9%) had a job. In average monthly income, people with an average monthly income of ≤ 1 million won took up 67.9% (95 people) of the participants. As for subjective health status, 67 people (47.9%) rated their subjective health status as not healthy. As to the presence of underlying diseases, 87 people (62.1%) had underlying diseases.

Regarding dementia-related characteristics of the participants, 128 people (91.4%) had no family members with dementia, 121 people (86.4%) had no acquaintances with dementia, and 129 people (92.1%) had no experience of caring for dementia patients. In addition, 104 people (74.3%) answered that they were very interested in preventing dementia. Also, 87 people (62.1%) had experience of receiving dementia prevention education, and 102 people (72.9%) had no experience of receiving a dementia screening test (Table 1).

2. Levels of dementia preventive behaviors, general health motivation, health beliefs, cues to action, and self-efficacy among older adults at high risk for dementia

In this study, the total scores of dementia preventive behaviors in older adults at high risk for dementia ranged from 16 to 80 points, with a mean of 55.48 ± 7.83 points, and the mean score of items was 3.47 ± 0.49 points out of 5 (Table 2). With respect to the degree of each dementia preventive behavior, the dementia preventive behavior with the highest score was 'I make sure to eat three meals a day' (4.21 ± 0.77 points out of 5), followed by 'I take care not to hurt my head' (4.11 ± 0.82 points), 'I do not smoke' (4.09 ± 1.52 points), 'I maintain a healthy body weight' (3.97 ± 0.77 points), 'I do not drink more than 3 glasses of alcohol at a time' (3.89 ± 1.44 points), and 'I properly manage my chronic conditions such as high blood pressure, diabetes, and hyperlipidemia' (3.78 ± 0.91 points). The dementia preventive behavior with the lowest score was 'I get an early dementia checkup every year' (2.51 ± 1.00 points), followed by 'I read or write

Table 1. Differences in Dementia Preventive Behaviors according to Characteristics (*N*=140)

Characteristics	Categories	n (%)	Mean ± SD	t/F (*p*) Scheffé
General characteristics				
Gender	Male	62 (44.3)	3.47 ± 0.53	0.06 (.955)
	Female	78 (55.7)	3.47 ± 0.46	
Age (year)	65 ~ 69^{a}	5 (3.6)	2.93 ± 0.68	5.26 (.002)
	70 ~ 74^{b}	11 (7.9)	3.63 ± 0.53	c > a
	75 ~ 79^{c}	80 (57.1)	3.56 ± 0.49	
	≥ 80^{d}	44 (31.4)	3.32 ± 0.39	
Living arrangement	Living with others	92 (65.7)	3.52 ± 0.49	1.60 (.111)
	Living alone	48 (34.3)	3.38 ± 0.49	
Education Level	Uneducated	39 (27.9)	3.40 ± 0.36	3.20 (.015)
	Elementary school	35 (25.0)	3.40 ± 0.54	
	Middle school	23 (16.4)	3.33 ± 0.40	
	High school	28 (20.0)	3.60 ± 0.56	
	≥ University	15 (10.7)	3.80 ± 0.53	
Religion	Yes	106 (75.7)	3.52 ± 0.51	2.28 (.026)
	No	34 (24.3)	3.32 ± 0.42	
Job	Yes	109 (77.9)	3.61 ± 0.58	1.84 (.068)
	No	31 (22.1)	3.43 ± 0.46	
Monthly income (10,000 Won)	< 100^{a}	95 (67.9)	3.41 ± 0.51	4.94 (.008)
	100 ~ 199^{b}	31 (22.1)	3.49 ± 0.38	c > a
	≥ 200^{c}	14 (10.0)	3.83 ± 0.41	
Subjective health status	Healthy^{a}	45 (32.1)	3.70 ± 0.57	8.41 (< .001)
	Moderate^{b}	28 (20.0)	3.36 ± 0.34	a > b, c
	Not healthy^{c}	67 (47.9)	3.36 ± 0.43	
Underlying disease	Yes	87 (62.1)	3.39 ± 0.44	-2.42 (.017)
	No	53 (37.9)	3.60 ± 0.54	
Dementia-related characteristics				
Family member with dementia	Yes	12 (8.6)	3.15 ± 0.32	-2.39 (.018)
	No	128 (91.4)	3.50 ± 0.49	
Acquaintances with dementia	Yes	19 (13.6)	3.61 ± 0.69	0.96 (.349)
	No	121 (86.4)	3.45 ± 0.45	
Experience of caring for family with dementia	Yes	11 (7.9)	3.22 ± 0.48	-1.80 (.075)
	No	129 (92.1)	3.49 ± 0.49	
Interest in dementia prevention	High	104 (74.3)	3.47 ± 0.51	0.82 (.445)
	Moderate	33 (23.6)	3.44 ± 0.44	
	Low	3 (2.1)	3.81 ± 0.49	
Experience of dementia prevention education	Yes	87 (62.1)	3.45 ± 0.47	-0.51 (.609)
	No	53 (37.9)	3.50 ± 0.53	
Experience of dementia screening test	Yes	38 (27.1)	3.49 ± 0.56	.022 (.829)
	No	102 (72.9)	3.46 ± 0.47	

diligently' (2.63 ± 1.06 points), 'I perform activities such as hand exercise, drawing pictures, and making things to use my hands more frequently' (2.64 ± 1.03 points), and 'I exercise for more than 30 minutes a day to such a degree that I sweat a little' (2.98 ± 1.07 points), Among older adults at high risk for dementia, the score for general health motivation ranged from 4 to 20 points, with a mean of 15.84 ± 1.92 points, and the mean score of items was 3.96 ± 0.48 points out of 5. With respect to health be-

Table 2. Levels of Dementia Preventive Behaviors, General Health Motivation, Health Beliefs, Cues to action, Self-efficacy (*N*=140)

Variables		Range	Min	Max	Total mean ± SD	Item mean ± SD
Dementia preventive behaviors		16~80	31	77	55.48 ± 7.83	3.47 ± 0.49
General health motivation		4~20	7	20	15.84 ± 1.92	3.96 ± 0.48
Health beliefs	Perceived susceptibility	4~20	4	20	10.81 ± 2.95	2.70 ± 0.74
	Perceived severity	5~25	5	21	15.33 ± 2.81	3.07 ± 0.56
	Perceived benefit	4~20	6	20	13.53 ± 2.46	3.38 ± 0.62
	Perceived barrier	4~20	4	19	8.89 ± 3.37	2.22 ± 0.84
Cues to action		4~20	7	19	11.80 ± 2.82	2.95 ± 0.70
Self-efficacy		10~25	17	48	15.84 ± 1.92	3.49 ± 0.50

liefs, the mean of total scores and the mean score of items (out of 5 points) of each subdomain are as follows. For perceived susceptibility, the total scores ranged from 4 to 20 points, with a mean of 10.81 ± 2.95 points, and the mean score of items was 2.70 ± 0.74 points out of 5. For perceived severity, the total scores ranged from 5 to 25 points, with a mean of 15.33 ± 2.81 points, and the mean score of items was 3.07 ± 0.56 points. For perceived benefit, the total scores ranged from 4 to 20 points, with a mean of 13.53 ± 2.46 points, and the mean score of items was 3.38 ± 0.62 points. For perceived barrier, the total scores ranged from 4 to 20 points, with a mean of 8.89 ± 3.37 points, and, and the mean score of items was 2.22 ± 0.84 points. As for cues to action, the total scores ranged from 4 to 20 points with a mean of 11.80 ± 2.82 points, and the mean score of items was 2.95 ± 0.70 points. Regarding self-efficacy, the total scores ranged from 10 to 25 points with a mean of 15.84 ± 1.92 points, and the mean score of items was 3.49 ± 0.50 points (Table 2).

3. Differences in the degree of dementia preventive behaviors according to the general characteristics of older adults at high risk for dementia

The characteristics that showed a significant association with the level of dementia preventive behavior among older adults at high risk for dementia were age (F = 5.26, p = .002), education level (F = 3.20, p = .015), presence of religion (t = 2.28, p = .026), monthly income (F = 4.94, p = .008), subjective health status (F = 8.41, p < .001), presence of underlying disease (t = -2.42, p = .017), and presence of a family member with dementia (parents, siblings) (t = -2.39, p = .018). The Scheffé test was performed to determine whether there are significant differences between groups. In terms of age, the degree of dementia preventive behaviors was higher in the 75-79 age group (3.56 ± 0.49), compared to the 65-69 age group (2.93 ± 0.68). As to the presence of religion, the degree of dementia preventive behaviors was higher in the group with religion (3.52 ± 0.51) than in the group without religion (3.32 ± 0.42). In the case of monthly income, the degree of dementia preventive behavior was higher in the group with a monthly income of ≥ 2 million won (3.83 ± 0.41) than the group with a monthly income of ≤ 1 million won (3.41 ± 0.51). In terms of subjective health status, the level of dementia preventive behavior was higher in the 'healthy' group (3.70 ± 0.57) than the 'moderate' group (3.36 ± 0.34) and the 'not healthy' group (3.36 ± 0.43). Regarding the presence of underlying diseases, the level of dementia preventive behavior was higher in the group without underlying diseases (3.60 ± 0.54) than the group with one or more underlying diseases (3.39 ± 0.44). As to the presence of family members with dementia, the level of dementia preventive behavior was higher in the group without family members (parents, siblings) with dementia (3.60 ± 0.54) than the group with a family member with dementia (3.15 ± 0.32).

4. Dementia preventive behavior, general health motivation, health beliefs, cues to action, and self-efficacy among older adults at high risk for dementia

Among older adults at high risk for dementia, the degree of dementia preventive behaviors showed a weak positive correlation with general health motivation (r = .21, p = .012) and perceived benefit (r = .26, p = .002) among health beliefs, and had a strong positive correlation with self-efficacy (r = .87, p < .001). In addition, the degree of dementia preventive behaviors showed a weak negative correlation with perceived susceptibility (r = -.24, p = .004). In other words, the level of dementia preventive behavior was associated with a higher level of general health motivation, a lower level of perceived susceptibility, a higher level of perceived benefit, and a higher level of self-efficacy (Table 3).

Table 3. Correlations among Study Variables (*N*=140)

Variables		1	2	3	4	5	6	7	8
		r (*p*)	r (*p*)	r (*p*)	r (*p*)	r (*p*)	r (*p*)	r (*p*)	r (*p*)
1. Dementia preventive behaviors		1							
2. General health motivation		.21 (.012)	1						
Health beliefs	3. Perceived susceptibility	-.24 (.004)	.20 (.021)	1					
	4. Perceived severity	-.05 (.532)	.39 (< .001)	.45 (< .001)	1				
	5. Perceived benefit	.26 (.002)	.45 (.001)	.13 (.129)	.35 (< .001)	1			
	6. Perceived barrier	-.13 (.122)	-.09 (.275)	.03 (.723)	.18 (.037)	.25 (.003)	1		
7. Cues to action		.07 (.387)	.24 (.004)	.27 (.001)	.44 (< .001)	.65 (< .001)	.50 (.001)	1	
8. Self-efficacy		.87 (< .001)	.15 (.075)	-.25 (.003)	-.15 (.074)	.14 (.103)	-.30 (< .001)	-.12 (.154)	1

5. Influencing factors for dementia preventive behavior among older adults at high risk for dementia

In order to check whether the assumptions of regression analysis were satisfied before regression analysis, the P-P plot and scatter plot were examined, and they were close to a 45-degree straight line, indicating that the normality of residuals was satisfied. The residuals were evenly distributed around 0, so the linearity and homoscedasticity of the model were satisfied. The Durbin-Watson test was performed as a test for autocorrelation between error terms, and the Durbin-Watson statistic was calculated to be 1.87, a value close to 2, indicating that there was no autocorrelation between error terms. Additionally, the tolerance and variance inflation factor (VIF) values were calculated to check multicollinearity between independent variables. As a result, tolerance values were greater than 0.10, ranging from 0.13 to 0.94, and VIF values were less than 10, ranging from 1.07 to 8.02, so it was confirmed that there was no multicollinearity between the independent variables.

A hierarchical multiple regression analysis was conducted to analyze the impact of variables of the extended health belief model on dementia preventive behaviors after controlling for general and dementia-related characteristics of the participants. In the first step of hierarchical multiple regression analysis, among general characteristics of the participants, the following six factors identified as significant factors affecting dementia preventive behaviors were entered into the regression model (Model 1): age (reference: ages 65-69), education level (reference: uneducated), religion (reference: having no religion), monthly income (reference: less than 1 million won), underlying disease (reference: absence of underlying disease), and subjective health status (reference: not healthy). As a result of regression analysis, compared to ages 65-69, ages 70-74 ($\beta = 0.35$ $p = .010$), ages 75-79 ($\beta = 0.64$, $p = .003$), and ages ≥ 80 ($\beta = 0.45$, $p = .034$) were found to significantly influence dementia preventive behavior. The explanatory power of these variables was 27% (Adjusted $R^2 = .19$, $F = 3.50$, $p < .001$). In Model 2 of hierarchical multiple regression analysis, among dementia-related characteristics of the participants, only the presence of a family member with dementia (reference: absence of a family member with dementia), which was found to have a significant influence on dementia preventive behaviors, was additionally entered. Regression analysis was conducted after controlling for the general characteristics of participants. As a result, among the dementia-related characteristics of the participants, the presence of a family member with dementia ($\beta = -0.18$, $p = .021$) was found to significantly influence dementia preventive behaviors, when people without family members with dementia were used as the reference group. In addition, in terms of age among the general characteristics of the participants, compared to ages 65-69, ages 70-74 ($\beta = 0.35$, $p = .008$), ages 75-79 ($\beta = 0.68$, $p = .002$), and ages ≥ 80 ($\beta = 0.50$, $p = .017$) were found to be significant influencing factors for dementia preventive behaviors. Model 2 of hierarchical multiple regression analysis showed a higher explanatory power by 3%, compared to Model 1, and the variables of Model 2 explained 30% of the total variance (Adjusted $R^2 = .22$, $F = 3.76$, $p < .001$). In the third step of hierarchical multiple regression analysis, regardless of whether a variable has a significant impact on dementia preventive behavior, the following seven variables of the extended health belief model were additionally entered into the regression model: general health motivation, cues to action, self-efficacy, four variables of health beliefs, which are perceived susceptibility, perceived severity, perceived benefit, and perceived barrier. Regression analysis was performed after controlling for general characteristics and dementia-related characteristics of the participants. As a result, among the variables of the extended health belief model, cues to action ($\beta = 0.17$ $p = .013$) and self-efficacy ($\beta = 0.82$, $p < .001$)

were found to significantly affect dementia preventive behaviors. In addition, regarding age among general characteristics of the participants, compared to ages 65-69, ages 75-79 (β = 0.35, *p* = .003) and ages ≥ 80 (β = 0.27, *p* = .021) were found to significantly influence the degree of dementia preventive behaviors. In other words, the degree of dementia preventive behaviors was higher in the 75-79 age group and the ≥ 80 age group, compared to the 65-69 age group, and a higher level of cues to action and a higher level of self-efficacy were linked to a higher degree of dementia preventive behaviors. As a result of hierarchical multiple regression analysis, the explanatory power of Model 3 was increased by 52%, compared to Model 2, and the variables of Model 3 explained 82% of the total variance (Adj-R^2 = .79, F = 25.21, *p* < .001) (Table 4).

Discussion

This study attempted to identify influencing factors on dementia preventive behaviors among older adults at high risk for dementia by applying the extended health belief model with the aim of

Table 4. Factors influencing Dementia Preventive Behaviors (*N*=140)

	model 1				model 2				model 3			
	B	β	t	*p*	B	β	t	*p*	B	β	t	*p*
(Constant)	2.79	-	11.74	< .001	2.78	-	11.93	< .001	-0.08	-	-0.31	.757
Age (year)												
- 70~74	0.63	.35	2.60	.010	0.64	.35	2.68	.008	0.25	.14	1.88	.062
- 75~79	0.64	.64	2.99	.003	0.68	.68	3.22	.002	0.35	.35	2.99	.003
- ≥ 80	0.47	.45	2.14	.034	0.53	.50	2.41	.017	0.29	.27	2.34	.021
Education Level												
- Elementary school	-0.04	-.04	-0.38	.702	-0.05	-.05	-0.52	.606	-0.02	-.02	-0.33	.740
- Middle school	-0.09	-.07	-0.73	.466	-0.10	.08	-0.85	.400	-0.08	-.06	-1.12	.266
- High school	0.07	.05	0.52	.607	0.09	.07	0.71	.476	0.03	.02	0.37	.714
- ≥ University	0.16	.10	0.91	.367	0.19	.12	1.10	.272	0.02	.01	0.18	.859
Religion												
- Yes	0.16	.14	1.72	.088	0.17	.15	1.86	.066	0.01	.01	0.19	.851
Monthly income*												
- 100~200^{b}	0.03	.02	0.25	.802	0.01	.01	0.15	.883	0.01	.01	0.21	.832
- ≥ 200^{c}	0.19	.12	1.16	.248	0.14	.09	0.85	.396	-0.01	-.01	0.09	.926
Subjective health status*												
- Healthy	0.18	.17	1.63	.106	0.15	.14	1.41	.162	0.04	.04	0.74	.463
- Moderate	-0.05	-.04	-0.48	.632	-0.06	-.05	-0.58	.564	0.00	.00	-0.07	.947
Diagnosed with disease												
- Yes	-0.12	-.12	-1.33	.187	-0.13	-.13	-1.38	.170	0.03	.03	0.51	.613
Family member with dementia												
- Yes						-0.18	-2.34	.021	-0.14	-.08	-1.91	.059
General health motivation									0.04	.04	0.72	.474
Perceived susceptibility									-0.04	-.06	-1.13	.260
Perceived severity									-0.02	-.03	-0.47	.642
Perceived benefit									0.01	.01	0.17	.867
Perceived barrier									0.03	.05	0.81	.420
Cues to action									0.12	.17	2.54	.013
Self-efficacy									0.81	.82	16.24	< .001
R^2	.27				.30				.82			
Adj-R^2	.19				.22				.79			
F(*p*)	3.50 (< .001)				3.76 (< .001)				25.21 (< .001)			
Durbin-Watson = 1.87, Tolerance = 0.13~0.94, VIF = 1.07~8.02												

Note. Dummy variable (reference group): Age (65-69), Education level (Uneducated). Religion (No), Monthly income (≤100), Subjective health status (Not healthy), Diagnosed with disease (No), Family member with dementia (No).

presenting basic data for developing a dementia prevention program for older adults at high risk for dementia.

In this study, the degree of dementia preventive behaviors among older adults at high risk for dementia was measured by using a modified version of the assessment tool for dementia preventive behaviors developed by Lim et al. [26]. The modified version of the tool developed by Lim et al. [26] was created by the researcher by modifying and supplementing the original tool. In this study, the mean score for dementia preventive behaviors was 3.47 points out of 5 (69.4 points out of 100). There are no previous studies using the same tool to investigate dementia preventive behaviors among older adults at high risk for dementia. The study by Kang et al. [11] measured dementia preventive behaviors among older adults aged 65 or older living alone by using the tool developed by Lee et al. [14], and reported that the mean score for dementia preventive behavior practice was 2.29 points out of 3 (76.3 points out of 100). In addition, the study by Han & Suh [12] reported that the mean score for dementia preventive behaviors was 2.26 points out of 3 (75.33 points out of 100). A relatively low score for dementia preventive behaviors in this study may be attributed to the tools used. The tool developed by Lee et al. [14] measures the degree of dementia preventive behavior practice on a 3-point Likert scale ('I never perform it (1 point)'; 'I perform it sometimes (2 points)'; 'I perform it almost every day (3 points)'), and allowed the participants to respond based on subjective judgements. On the other hand, this study assessed the behavior frequency on a 5-point Likert scale ranging from 1 point (='Never' corresponding to 0 times a week) to 5 points (='Always' corresponding to 6 to 7 days a week). Thus, the score for each item of dementia preventive behaviors indicates the frequency of performing the behavior per week, so the assessment tool of this study allowed respondents to give a more objective response to the question about the degree of dementia preventive behavior practice, which is thought to have had an impact on the scores. In addition, the tool developed by Lee et al. [14] did not include the following items recommended in the 3.3.3 Rules for Dementia Prevention [5] among the questions included in the tool used in this study: 'I try to be careful not to injure my head', 'I get an early dementia screening test at a public health center every year', and 'I receive regular health checkups.' The tool made by Lee et al. [14] did not include an item on depression prevention presented as an efficient dementia management method by WHO [4], either. In terms of the items of the tool used, it is thought that this study used a more valid tool to assess dementia preventive behaviors, and the results of this study suggest that there is a need to increase the practice rate of dementia preventive behaviors among older adults at high risk for dementia.

In the analysis of the degree of each item of dementia preventive behaviors among older adults at high risk of dementia, the dementia preventive behavior with the highest score was 'I make sure to eat three meals a day', followed by 'I take care not to hurt my head' and 'I do not smoke' in descending order. These results are similar to the findings of the study of older adults living alone by Kang et al. [11], which reported that participants showed a relatively high degree of practice in items such as smoking cessation, avoiding excessive drinking, and regularly eating meals among dementia preventive behaviors.

Among dementia preventive behaviors, the item with the lowest score was 'I get an early dementia screening test every year.' This result is consistent with the results of the study by Ha [7], which reported a low score for the item 'I receive a dementia screening test every year.' In this connection, according to previous studies, the most common reason for not receiving an early dementia screening test was found to be 'I do not feel the need for receiving a dementia screening test' among community-dwelling older adults living, and the performance rate of the dementia screening test was higher among people who had a family member or acquaintance that had undergone a dementia screening test than those who did not [23,24]. Therefore, in order to increase the performance rate of the early dementia screening test among older adults at high risk for dementia, it is necessary to actively carry out education and promotion to raise public awareness about the need for early dementia screening tests by using social networks such as the family and friends. The dementia preventive behavior with the second lowest score was 'I read or write diligently.' This result is consistent with previous studies that reported a relatively low score for reading and writing among dementia preventive behaviors in community-dwelling older adults [7,10-12]. A low practice rate of reading and writing is thought to be related to the age and education level of participants. In other words, the mean age of the participants of this study was 78.39 years and most of them were people aged 75 or older, and people with the education level of elementary school or less accounted for more than half (52.9%), so it is presumed that a majority of the participants had difficulty reading or writing due to illiteracy or poor eyesight. The dementia preventive behavior with the third lowest score was 'I do activities such as hand exercises, drawing, and making things to use my hands more frequently.' This result is consistent with previous studies [7,10] reporting a relatively low score of the item about hand movements among dementia preventive behaviors. These activities involving hand movements are required for all older people because they can improve cognitive function like reading and writing, and they are cognitive activities especially suitable for illiterate elderly people who have difficulty reading and writing. Therefore, it is necessary to provide older adults at high risk for dementia with education about methods of hand exercises as well as dementia prevention programs that include activities requiring frequent hand movements, such as drawing pictures and making things.

With respect to the results of descriptive statistical analysis of the variables of the extended health belief model among older adults at high risk for dementia, the mean score for health beliefs was 2.70 points out of 5, and the mean score for each subdomain of health beliefs was 2.70 points for perceived susceptibility, 3.07 points for perceived severity, 3.38 points for perceived benefit, and 3.38 points for perceived barrier. Regarding previous studies using the same tool, Choi et al. [20] reported that mean scores for health beliefs were 2.31 points for perceived susceptibility, 2.63 points for perceived severity, 3.49 points for perceived benefit, and 2.38 points for perceived barrier among older adults living in the community. Meanwhile, Seo et al. [21] measured health beliefs among adults diagnosed with hypertension and diabetes (mean age: 61.70 years), and reported that the mean scores for each subdomain were 2.49 points for perceived susceptibility, 2.62 points for perceived severity, 3.62 points for perceived benefit, and 2.43 points for perceived barrier. The findings described above suggest that levels of perceived susceptibility and perceived severity are higher but levels of perceived benefit and perceived barrier are lower in older adults at high risk for dementia, compared to community-dwelling older adults. In this study, the mean score for general health motivation was 3.96 points out of 5, which is a similar level to 4.10 points in a study using the same tool by Choi et al. [20]. These results seem to show that older adults at high risk for dementia consider it important to maintain health and have a relatively high level of general health motivation to avoid disease states. Cues to action refer to stimuli that prompt people to perform dementia preventive behaviors to reduce the risk of dementia, and the mean score for cues to action was 2.95 points out of 5, which was a lower level compared to 3.27 points in the study by Choi et al. [20], which measured cues to action among older adults aged 65 years or older by using the same tool. In other words, study results indicate that there are few intrinsic and extrinsic stimuli that induce older adults at high risk of dementia to perform dementia preventive behaviors. A low level of cues to action among older adults at high risk of dementia in this study may be attributed to the following reasons. First, the mean age of the participants was 78.39 years and people with the education level of elementary school or lower took up 52.9% of them, so it is thought that many of them are not likely to get information about dementia through mass media such as broadcast media or promotional leaflets. Moreover, it is presumed that since they perceive dementia as a natural aging process rather than a disease [2,3], even intrinsic stimuli such as the occurrence of dementia symptoms do not give rise to motivations for performing dementia preventive behaviors. The mean score of self-efficacy among the participants was 3.49 points out of 5 (69.8 points out of 100), which is a similar level to 3.47 points out of 5 among community-dwelling older people in a study by Ha [7], although it is difficult to directly compare study results because the study by Ha [7] used a general self-efficacy scale [31], not a self-efficacy scale specific to dementia preventive behaviors. The level of self-efficacy among participants in this study suggests that there is a need to improve self-efficacy in older adults at high risk for dementia. According to Bandura [29], who proposed the concept of self-efficacy, Self-efficacy is defined as an individual's belief that they can exert themselves sufficiently to attain designated levels of behaviors, so it should be measured as confidence for a specific behavior. However, in previous studies [7,10], since self-efficacy was measured using not a self-efficacy scale for dementia preventive behaviors but a scale for general self-efficacy [31], which refers to an individual’s belief in his or her ability to perform necessary behaviors in various areas of achievement situation, self-efficacy for dementia preventive behaviors was not measured in a valid manner. Therefore, it is necessary to measure self-efficacy for dementia preventive behaviors by using a valid measure in future research.

In this study, age among general characteristics and self-efficacy and cues to action among the variables of the extended health belief model were identified as significant influencing factors for dementia preventive behaviors among older adults at high risk for dementia. Specifically, the degree of dementia preventive behaviors was found to be higher in the 75-79 age group and the ≥80 age group than in the 65-69 age group. Among the participants of this study, people in the 65-69 age group were all older adults living alone, and the participants aged 75 or older included older adults living with others as well as those living alone. In this study, analysis of differences in the level of dementia preventive behaviors according to the general characteristics of the participants showed that there was no significant difference in the degree of dementia preventive behaviors according to the presence or absence of a family member living together. Therefore, a relatively low degree of dementia preventive behaviors in the 65-69 age group is thought to be not a characteristic of older adults living alone but show a difference between age groups. Since no previous studies on dementia preventive behaviors used the same selection criteria for participants as those of this study, it is difficult to directly compare study results, but some prior studies of older people living alone as a high-risk group for dementia [11,12] reported that there was no significant difference in the degree of dementia preventive behaviors according to age. In view of this inconsistency among studies, it is necessary to examine the impact of age on dementia preventive behaviors by dividing older adults at high risk for dementia into those living alone and those living with others in future studies. Among the variables of the extended health belief model, self-efficacy was found to have the greatest impact on dementia preventive behaviors among older adults at high risk for dementia. Previous studies of older people living in the community [7,10] used a general self-efficacy scale [31], so it is difficult to make a direction comparison of research results, but prior studies have shown that self-efficacy is a significant influencing factor for dementia preventive behaviors. Also, the study by Oh [10] reported that self-efficacy was the variable that had the greatest impact on dementia preventive behaviors, and this finding indirectly supports the results of this study.

It is thought that since most dementia preventive behaviors are lifestyle habits, self-efficacy, which is an important factor in the maintenance of particular behaviors, was shown to have a greater impact than other factors. Therefore, in order to increase the practice rate of dementia preventive behaviors among older adults at high risk for dementia, it is necessary to make an intensive effort to improve self-efficacy, which can be seen as confidence in dementia preventive behaviors. Bandura [29] proposed that individuals can develop self-efficacy through sources such as enactive attainment, vicarious experience, and verbal persuasion. Therefore, in relation to the development of intervention programs for dementia prevention, an effective strategy for improving self-efficacy among older adults at high risk for dementia would be to lead them to set step-by-step goals and perform dementia preventive behaviors so as to increase their attainment experience, and it can also be a useful strategy to help them gain vicarious experiences by giving them opportunities to talk about their experience of performing these dementia preventive behaviors in front of other older adults. Additionally, it can also be helpful to encourage them to practice dementia preventive behaviors, and apply the verbal persuasion strategy of giving them praise and encouragement when they perform dementia preventive behaviors.

Cues to action were identified as a significant factor affecting dementia preventive behaviors among the participants. Although it is difficult to directly compare study findings, a study by Seo et al. [21] reported that cues to action were identified as an influencing factor for dementia preventive behavior intention among adults diagnosed with high blood pressure and diabetes. Additionally, in Werner's study of people aged 50 years or older in Israel [32], cues to action were found to be an influencing factor for intention to seek a cognitive status examination. The results of these two studies indirectly support the findings of this study. Therefore, in view of the fact that cues to action have been shown to be a variable that has a direct or indirect effect on health behaviors [33], there is a need to increase the level of cues to action in order to increase dementia preventive behaviors in older adults at high risk for dementia. In this study, older adults at high risk for dementia showed a low level of cues to action. Regarding the strategy for increasing cues to action as a way to increase dementia preventive behaviors among older people at high risk for dementia, this study found that there was a strong positive correlation between cues to action and perceived benefit, so it is presumed that perceived benefit generates cues to action, which are motivation for performing dementia preventive behaviors. In addition, a study of adults aged 40 or older in Turkey by Akyol et al. [34] reported that a higher level of willingness to know about one's risk for developing dementia was associated with a higher level of cues to action. These findings suggest that it can be an effective strategy for increasing cues to action if we provide education about risk factors for dementia to older adults at high risk of dementia as a method to lead them to perceive dementia as a disease rather than an aging process, and actively give them information about the scientific bases and positive effects of recommended dementia preventive behaviors, especially focused on dementia preventive behaviors with a low rate of practice. In addition, since existing research on the relationship between cues to action and dementia preventive behaviors is highly insufficient, there is a need for a replication study.

Among the variables of the extended health belief model, general health motivation, perceived susceptibility, and perceived benefit were significantly correlated with dementia preventive behaviors, but they were found not to be significant influencing factors. In this study, general health motivation showed a significant positive correlation with dementia preventive behaviors. Although there is difficulty in comparing study results due to the lack of previous research on the relationship between general health motivation and dementia preventive behaviors, the results of this study about general health motivation are indirectly supported by the study by Choi et al. [20], which showed that general health motivation had a positive correlation with dementia preventive behavior intention among older adults aged 65 years or older. Regarding the reason why general health motivation was not identified as a significant influencing factor for dementia preventive behaviors, it may be attributed to the fact that although general health motivation was not significantly correlated with self-efficacy, the relationship between these variables closely approximated a significant correlation ($r = .15$, $p = .075$). In other words, it is presumed to be due to the relationship between general health motivation and self-efficacy that general health motivation had no effect on dementia preventive behaviors when controlling for self-efficacy. Perceived susceptibility was found to have a significant negative correlation with dementia preventive behaviors. This finding is indirectly supported by a study by Park et al. [35], which reported that a higher level of optimistic bias about health crisis was associated with a higher level of health behavior practice. However, in this study, perceived susceptibility did not have a significant impact on dementia preventive behaviors, and the reason may be attributed to the fact that perceived susceptibility showed a negative correlation with self-efficacy in this study. In other words, it is thought to be due to the relationship between these variables that perceived susceptibility did not have a significant effect on dementia preventive behaviors when controlling for self-efficacy. Perceived benefit was shown to have a significant positive correlation with dementia preventive behavior. Since there is little prior research on the relationship between perceived benefit and dementia preventive behavior, it is difficult to directly compare study findings. However, the results of this study about perceived benefit are indirectly supported by a study by Seo et al. [21], which reported that perceived benefit was significantly correlated with dementia preventive behavior intention. As to the reason why perceived benefit was not identified as a significant influencing factor for dementia preventive behaviors, it is thought to be related to the fact that perceived benefit showed a positive correlation with cues to action in this study. In other words, it is presumed that due to the relationship between these two variables, perceived benefit did not have a significant effect on dementia prevention when controlling for cues to action. In view of the fact that health beliefs such as perceived susceptibility and perceived benefit represent an individual's beliefs about dementia preventive behavior, study findings suggest that it is necessary to increase cues to action and improve self-efficacy for dementia preventive behaviors through intrinsic and extrinsic stimuli in order to lead older adults to initiate and maintain dementia preventive behaviors.

This study attempted to identify factors influencing dementia preventive behaviors among older adults at high risk for dementia who need to more actively practice dementia preventive behaviors than other older adults by applying the extended health belief model in order to prevent the development of dementia in high-risk groups. Thus, the results of this study can be utilized as basic data for developing dementia preventive intervention programs for older adults at high risk for dementia and for establishing policies for the prevention and management of dementia. This study has limitations in generalizing the research findings since the present research was conducted only with a high-risk group for dementia living in a single region.

Conclusions

This study aimed to identify factors influencing dementia preventive behaviors in older adults at high risk for dementia by applying the extended health belief model. In this investigation, self-efficacy, cues to action, and age were identified as significant influencing factors for dementia preventive behaviors among older adults at high risk for dementia. These results suggest that it is necessary to improve self-efficacy for dementia preventive behaviors and increase cues to action, which are intrinsic and extrinsic stimuli that trigger dementia preventive behaviors, in order to improve dementia preventive behaviors among older adults at high risk of dementia.

In future research, a replication study needs to be conducted with a larger sample from diverse residential areas in size and characteristics. In addition, since the participants of this study did not include people with mild cognitive impairment among the high-risk groups for dementia presented by the Ministry of Health and Welfare, there is a need to investigate and identify factors influencing dementia preventive behaviors among older adults with mild cognitive impairment. Additionally, based on the results of this study, further research should be conducted for the development and validation of a nursing intervention program to promote dementia preventive behaviors in older adults at high risk for dementia through evaluation of the effectiveness of the intervention by its application.

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Conflict of interest

The authors declared no conflict of interest.

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Authors' contributions

So Hee Jung contributed to conceptualization, data curation, formal analysis, methodology, project administration, writing -original draft, review & editing, and investigation. Mee Ock Gu contributed to conceptualization, methodology, writing -review & editing, supervision, and validation.

Data availability

Please contact the corresponding author for data availability.

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References

1. National Institute of Dementia. 2021 Korean Dementia Observatory [Internet]. Seoul: National Institute of Dementia; 2022 Apr 21 [cited 2023 Apr 11]. Available from: https://www.nid.or.kr/info/dataroom_view.aspx?bid=243
2. National Institute of Dementia. 2016 Nationwide Survey on the Dementia Epidemiology of Korea [Internet]. Seoul: National Institute of Dementia; 2017 Jun 30 [cited 2020 Nov 15] Available from: www.nid.or.kr/info/dataroom_view.aspx?bid=182
3. Jo MJ. The prevalence and risk factors of dementia in the Korean elderly. Health Welf Policy Forum. 2009;10:43–48. http://dx.doi.org/10.23062/2009.10.6
4. Risk reduction of cognitive decline and dementia [Internet]. WHO guidelines. Geneva: World Health Organization. 2019 [cited 2020 Nov 15]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK542796/
5. National Institute of Dementia. The rule for Dementia Prevention 3.3.3. [Internet], Seoul; National Institute of Dementia; 2014 Oct 21 [cited 2023 Nov 15]. Available from: https://www.nid.or.kr/info/dataroom_view.aspx?bid=116
6. Ministry of Health and Welfare. The 4th National Dementia Plan(2021–2025). Policy Report. Sejong: Ministry of Health and Welfare; 2020 September. https://www.korea.kr/archive/expDocView.do?docId=39215
7. Ha EH. Factors affecting dementia preventive behavior of the elderly in a local community: Application of information-motivation-behavioral skills model [master's thesis]. [Jinju]: Gyeongsang National University; 2020. 77 p.
8. Kim JH, Jung YM. A study on health status and quality of life in living alone elderly. Journal of Korean Gerontological Nursing. 2002;4(1):16–26.
9. Kang EN, Lee MH. Identifying the effect of living alone on life in later adulthood: Comparison between living alone and those living with others with a propensity score matching analysis. Health and Social Welfare Review. 2018;38(4):196–226. https://doi.org/10.15709/hswr.2018.38.4.196
10. Oh HK. Influencing factors on dementia preventive behavior in the elderly [master thesis]. [Gyeongsan]: Daegu Catholic University; 2017. 64 p.
11. Kang NG, Yoo MS, Song MS, You MA. The effect of knowledge on dementia and internal health locus of control on dementia preventive behaviors among the Korean older people living alone. Journal of Health Informatics and Statistics. 2015;40(3):9–19.
12. Han EG, Suh YJ. Factors affecting preventive behavior of dementia of the elderly living alone in the community. Journal of the Korean Applied Science and Technology. 2022;39(3):377–385. https://doi.org/10.12925/jkocs.2022.39.3.377
13. Kim YH, Kwon YC. The effect dementia knowledge and attitude on dementia preventive behavior of adults. The Journal of the Convergence on Culture Technology. 2020;6(3):9–17. http://doi.org/10.17703/JCCT.2020.6.3.9
14. Lee YW, Woo SM, Kim OR, Lee SY, Im HB. Relationships between dementia knowledge, attitude, self-efficacy, and preventive behavior among low income middle-aged women. Korean Journal of Adult Nursing. 2009;21(6):617–627.
15. Rosenstock IM. Historical origins of the health belief model. Health Education Monographs. 1974;2(4):328–335. https://doi.org/10.1177/109019817400200403
16. Becker MH. The health belief model and sick role behavior. Health Education Monographs. 1974;2(4):409–419. https://doi.org/10.1177/109019817400200407
17. Rosenstock IM, Strecher VJ, Becker MH. Social learning theory and the health belief model. Health Education Quarterly. 1988;15(2):175.–183. https://doi.org/10.1177/109019818

801500203

18. Jo SE, Shin HC, You SW, Roh HS. The study of factors affecting tuberculosis preventive behavior intentions: An extension of HBM with mediating effects of self-efficacy and fear. Journal of Public Relations. 2012;16(1):148–177. https://doi.org/10.15814/jpr.2012.16.1.148
19. Gillibrand R, Stevenson J. The extended health belief model applied to the experience of diabetes in young people. British Journal of Health Psychology. 2006;11(1):155–169. https://doi.org/10.1348/135910705X39485
20. Choi WH, Seo YM, Kim BR. Factors influencing dementia preventive behavior intention in the elderly people. Journal of East-West Nursing Research. 2019;25(2):138–146. https://doi.org/10.14370/jewnr.2019.25.2.138
21. Seo YM, Je NJ, Lee ES. The factors influencing intention of dementia prevention behavior in adults with hypertension or diabetes. Journal of Korean Academy of Community Health Nursing. 2020;31(4):481–490. https://doi.org/10.12799/JKACHN.2020.31.4.481
22. Kim BR, Chang HK. Factors influencing fear of dementia among middle-aged and older adults. Journal of Korean Academy of Community Health Nursing. 2020;31(2):156–165. https://doi.org/10.12799/jkachn.2020.31.2.156
23. Yoo R, Kim GS. Factors affecting the performance of the dementia screening test using the health belief model. Journal of Korean Public Health Nursing. 2017;31(3):464–477. https://doi.org/10.5932/JKPHN.2017.31.3.464
24. Chang SO, Lee YW, Kong ES, Kim CG, Kim HK, Cho MO, et al. Factors affecting the participation of the dementia screening in community-dwelling elderly. Korean Journal of Adult Nursing. 2020;32(2):134–144. https://doi.org/10.7475/kjan.2020.32.2.134
25. Faul F, Erdfelder E, Lang AG, Buchner A. G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. Behavior Research Methods. 2007;39(2):175–191. https://doi.org/10.3758/bf03193146
26. Lim KC, Kim JY, Kim MS. Development and verification of ‘the rules for dementia prevention enjoy, endure, take care’ scales for the elderly at home: Poster session presented at: The 2018 fall conference of Journal of Korean Academy of Nursing; 2018 Oct 22; Science and Technology Convention Center. Seoul.
27. Ministry of Health and Welfare. Second national dementia management comprehensive plan. Osong: Ministry of Health and Welfare; 2012. 202 p.
28. Kim S, Sargent-Cox K, Cherbuin N, Anstey KJ. Development of the motivation to change lifestyle and health behaviours for dementia risk reduction scale. Dementia and Geriatric Cognitive Disorders Extra. 2014;4(2):172–183. https://doi.org/10.1159/000362228
29. Bandura A. The explanatory and predictive scope of self-efficacy theory. Journal of Social and Clinical Psychology. 1986;4(3):359–373. https://doi.org/10.1521/jscp.1986.4.3.359
30. Gu MO. A structural model for selfcare behavior and metabolic control in diabetic patient [dissertation]. [Seoul]: Seoul National University; 1992. 135 p.
31. Oh HS. Health promoting behaviors and quality of life of Korean women with arthritis. Journal of Korean Academy of Nursing. 1993;23(4):617–630. https://doi.org/10.4040/jnas.1993.23.4.617
32. Werner P. Factors influencing intentions to seek a cognitive status examination: A study based on the health belief model. International Journal of Geriatric Psychiatry. 2003;18(9):787–794. https://doi.org/10.1002/gps.921
33. Zhang H, Park JS, Lee KS. A study of factors affecting preventive behavior intentions of overseas infectious disease based on health belief model: Focusing on the moderating effects of SNS eWOM. The Korean Journal of Advertising and Public Relations. 2020;22(2):265–302. https://doi.org/10.16914/kjapr.2020.22.2.265
34. Akyol MA, Zehirlioğlu L, Erünal M, Mert H, Hatipoğlu NŞ, Küçükgüçlü Ö. Determining middle-aged and older adults’ health beliefs to change lifestyle and health behavior for dementia risk reduction. American Journal of Alzheimer's Disease & Other Dementias®. 2020;35:1–7. https://doi.org/10.1177/1533317519898996
35. Park SH, Lee SH, Ham EM. The relationship between optimistic bias about health crisis and health behavior. Journal of Korean Academy of Nursing. 2008;38(3):403–409.

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Current Status and Associated Factors of Emotional Distress Due to COVID-19 Among People with Physical Disabilities Living in the Community: Secondary Data Analysis using the 2020 National Survey of Disabled Persons

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Purpose: This study aimed to assess the current situation and factors associated with emotional distress due to COVID-19 among people with physical disabilities living in the community, using a Social-Ecological Model.
Methods: A secondary data analysis was performed using data from the 2020 National Survey of Disabled Persons. The study participants were 1,654 participants aged 19 years or older with physical disabilities. For data analysis, complex sample logistic regression was conducted to identify factors associated with emotional distress due to COVID-19 in people with physical disabilities.
Results: The results showed that 55.7% of people with physical disabilities living in the community experienced emotional distress due to COVID-19. This emotional distress was influenced by various factors, including intrapersonal factors (activities of daily living, difficulty in getting information about COVID-19, difficulty in obtaining and using equipment related to COVID-19), interpersonal factors (satisfaction with the number of friends), and community/policy factor (support related to COVID-19 from national and local governments).
Conclusion: It is recommended to develop tailored interventions to prevent mental health issues among people with physical disabilities by considering the factors related to their emotional distress in the event of future infectious disease disasters.

Keywords: COVID-19; Disabled persons; Emotions

Introduction

1. Background

The outbreak of the novel coronavirus disease-19 (COVID-19) had spread rapidly across the world since the first cases of COVID-19 were detected in Wuhan, China in December 2019, and the World Health Organization (WHO) declared COVID-19 as a global pandemic, the highest level of infectious diseases in terms of the rate of spread of a disease, on March 11, 2020 [1]. In Korea, after the first case of COVID-19 was detected in January 2020 [2], a rapid spread of the infectious disease occurred, so the government recommended that people follow social distancing and guidelines for infection prevention and control for COVID-19 to prevent the occurrence and spread of COVID-19 infections. As a result, people experienced unprecedented social isolation, and this social isolation during the COVID-19 pandemic had negative social, psychological, and economic impacts. This disaster situation causes psychological trauma in people nationwide, and results in social and economic losses and mental health problems even after the disaster situation comes to an end. Consequently, there emerged a new word 'Corona Blue', which means depression and anxiety due to COVID-19, and more emphasis

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has been placed upon the importance of preventive measures and interventions for the psychological impact of COVID-19 [1,3].

COVID-19 is a crisis equally experienced by all people, but its impact may be different depending on each individual's situation and environment [3,4]. In particular, the vulnerable health conditions of people with disabilities put them at higher risk for infection, and in the absence of adequate welfare services, they experience more difficulties in daily life than people without disabilities, which may lead to a serious psychological impact [3,5]. In an early stage of the spread of COVID-19, there were not sufficient preventive measures against COVID-19 for people with disabilities, but the government strengthened the infection prevention and control system against the spread of COVID-19 after the occurrence of mass infections in residential facilities for people with disabilities [6]. Afterwards, the government provided support services such as emergency personal assistance support benefits and special benefits for the temporary absence of guardians not only to people with disabilities living in facilities but also to people with disabilities living in the community, but there was a lack of psychological support and services for the mental health of people with disabilities [6]. Therefore, there is a need to provide tailored psychological interventions by taking into account the special needs of people with disabilities in disaster situations such as the COVID-19 pandemic.

Previous studies showed that COVID-19 had a greater impact on mental health in people with disabilities than those without disabilities. According to prior studies conducted overseas, during the COVID-19 period, people with disabilities were found to have significantly greater amounts of symptoms of depression, anxiety, and loneliness, showed poorer sleep quality and poorer quality of life, and experienced a higher level of stress due to COVID-19, compared to those without disabilities [7,8]. In addition, a domestic study reported that after the COVID-19 pandemic, levels of loneliness, anxiety, and depression were 1.9 times higher, respectively, in people with disabilities, compared to those without disabilities, and there was a greater reduction in the level of satisfaction with life in people with disabilities (a 44.0% decrease) than those without disabilities (a 34.6% decrease) after the COVID-19 pandemic, compared to the pre-COVID-19 level of satisfaction with life [9]. Furthermore, previous studies have reported that gender, household income, disability grade, type of disability, chronic pain, social isolation, negative financial situations due to COVID-19, concerns about COVID-19, and increased loneliness were identified as factors affecting mental health in people with disabilities during the COVID-19 period, and that the level of depression was found to increase significantly over time in people with disabilities [3,10-13]. As described above, a review of domestic and foreign studies revealed that although many studies have been conducted to compare the impact of COVID-19 on mental health between people with disabilities and those without disabilities or to examine the effects of COVID-19 on mental health in people with disabilities as a whole, there has not been sufficient research to analyze the impact of COVID-19 on mental health in populations with each type of disability [3].

In particular, although people with physical disabilities account for the largest proportion of those with disabilities living in the community, there is a lack of research on the emotional impact of the COVID-19 pandemic on people with physical disabilities [14]. Persons with physical disabilities refer to people who have limitations on physical functions due to permanent impairment in the upper extremities, lower extremities, or body structure. As of 2020, among 15 types of disabilities, people with physical disabilities take up the largest proportion at 45.1% [15,16]. A previous study has revealed that elderly people with physical disabilities experience more emotional distress, including greater amounts of symptoms of depression and anxiety and a higher level of loneliness, compared to those without physical disabilities [7]. Under the circumstances of the COVID-19 pandemic, people with physical disabilities are more likely to experience increased levels of social isolation due to decreased access to healthcare services, changes in lifestyle habits, emotional changes, and reduced levels of physical activity, so it is necessary to provide adequate emotional support for them [6,14]. Therefore, in order to prevent the mental health problems of people with physical disabilities and reduce potential inequalities during disaster crises such as the COVID-19 pandemic, research should be conducted to systematically explore factors affecting mental health problems due to COVID-19 in such groups at higher risk for emotional distress in order to elucidate their psychological vulnerability and thereby contribute to the improvement of related policies and development of appropriate interventions.

Since mental health is influenced by various factors as well as individual factors, it is necessary to comprehensively consider environmental and social factors in addition to individual factors. The social-ecological model proposed by Mcleroy et al. [17] is one of the representative models widely used in the fields of public health and health promotion, and presents a theoretical framework that integrates individual and environmental dimensions that affect individuals' health status and health behavior [18]. This social-ecological model can be used to assess influencing factors for human behavior and explore appropriate interventions in terms of five types of factors centered on intrapersonal factors: intrapersonal, interpersonal, institutional, community, and policy factors [17-19]. In previous studies, a social-ecological model has been employed to analyze factors affecting health and health behavior among various groups of people, such as people living in tiny single-room residences (residents of jjokbang villages) [20], caregivers [19], elderly people in rural villages [18], elderly people [21], adults [22,23], and people with intellectual and/or developmental disabilities [24]. Thus, this study aimed to investigate factors associated with emotional distress due to COVID-19 in people with physical disabilities living in the community in terms of intrapersonal, interpersonal, community, and policy levels by applying a social-ecological model. Through this investigation, the present study sought to provide an increased understanding of the impact of a crisis situation such as COVID-19 on mental health in people with physical disabilities in the event of future disaster situations such as COVID-19, and to present research results that can serve as basic data for the development of nursing intervention programs for mental health prevention and psychological support.

2. Research Objectives

This study aimed to identify factors affecting emotional distress due to COVID-19 in people with physical disabilities living in the community, and the specific objectives are as follows:

1) To identify the current status of socio-ecological factors and emotional distress due to COVID-19 in people with physical disabilities living in the community;
2) to explore factors affecting emotional distress due to COVID-19 in people with physical disabilities living in the community, based on a social-ecological model.

Methods

1. Study design

This study is a cross-sectional descriptive study using data from the 2020 National Survey of Disabled Persons conducted by the Korea Institute for Health and Social Affairs, and the present study attempted to identify factors influencing emotional distress due to COVID-19 in people with physical disabilities living in the community by applying a social-ecological model. The theoretical framework of this study is shown in Figure 1.

2. Participants

This study used data from the 2020 National Survey of Disabled Persons carried out by the Ministry of Health and Welfare through the Korea Institute for Health and Social Affairs. The National Survey of Disabled Persons has been conducted among registered people with disabilities nationwide every three years

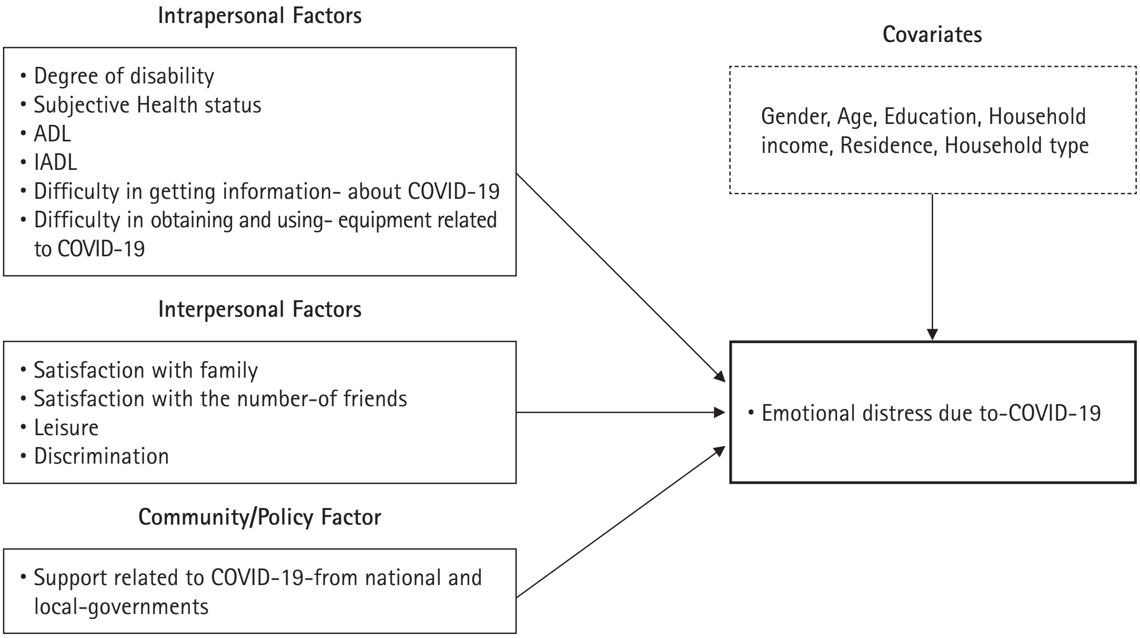

Figure 1. Research Framework of This Study

to examine the overall status of persons with disabilities since it was conducted for the first time in 1980, and the 2020 National Survey of Disabled Persons was the 11th survey [16]. This data was collected from a total of 7,025 people through interviews conducted by paying door-to-door visits to individual participants, and the survey participants were selected by the stratified cluster sampling method among registered people with disabilities in 17 cities and provinces in Korea [16]. The participants of this study were adults with physical disabilities, and a person with a physical disability refers to a person registered as physically disabled, a subcategory of the impairment of external physical functions among the types of disabilities stipulated in the Act on Welfare of Persons with Disabilities. Among a total of 7,025 people who participated in the survey, 1,785 adults with physical disabilities aged 19 or older were selected as the study participants, and a total of 1,654 people were finally included in the analysis excluding people with missing data (Figure 2).

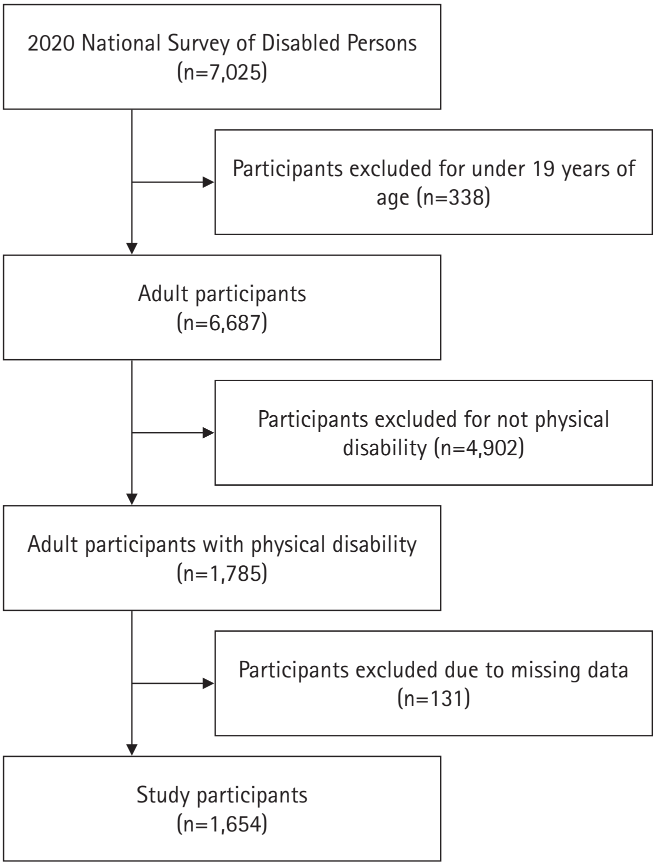

Figure 2. Participants Selection Flowchart

3. Measures

1) Dependent variables

According to WHO, mental health is more than the absence of mental disorders, such as depression, anxiety, and mental health conditions, and it is defined as a state of mental well-being that enables people to cope with stress, realize their abilities, and contribute to their community [25].

In this study, among the questions used in the 2020 Survey on Persons with Disabilities, the following item was operationally defined as emotional distress due to COVID-19: "During the recent spread of COVID-19 infections, how much difficulty did you experience in the following activities of daily living compared to usual? - regarding emotional stability (loneliness, depression, anxiety, stress, etc.)" The participants who answered that they experienced no difficulty were classified as having no emotional distress, and those who responded that they experienced somewhat or considerable difficulty were classified as having emotional distress.

2) Independent variables

This study posited factors affecting mental health reported in previous studies [3,7,12,26-28] as independent variables, based on a social-ecological model. The intrapersonal, interpersonal, and community/policy factors were defined as follows based on the survey items of the 2020 National Survey of Persons with Disabilities.

2-1) Intrapersonal factors

Intrapersonal factors are individual characteristics that affect mental health in people with disabilities, and the intrapersonal factors analyzed in this study were as follows: degree of disability, subjective health status, ADL (Activities of Daily Living), IADL (Instrumental Activities of Daily Living), difficulty in getting information related to COVID-19, and difficulty in obtaining and using equipment related to COVID-19. The degree of disability was classified as mild when it was assessed as not severe in the assessment of the level of disability or the existing grade of disability was 4-6. The degree of disability was classified as severe when it was assessed as severe or the existing grade of disability was 1-3. Subjective health status was measured using the question "How do you rate your usual health?", and it was rated on a 5-point scale ranging from 1 point (='Very good') to 5 points (='Very poor'). Higher scores indicate poorer subjective health status. ADL was categorized as not needing support (independent) when the respondent did not need assistance with any of the 12 items, and as needing support (dependent) when the respondent needed assistance with at least one of the 12 items. IADL was categorized as not needing support (independent) when the respondent did not need assistance with any of the eight items, and as needing support (dependent) when the respondent needed assistance with at least one of the eight items. Difficulty in getting information related to COVID-19 was assessed using the following question: "Have you experienced any difficulty related to infection prevention during the recent spread of COVID-19? - regarding the difficulty in getting information (status of the occurrence of infections, infection prevention and control guidelines, etc.)" People who answered that they had no difficulty in getting information were categorized as having no difficulty, and those who answered that they had some or considerable difficulty were classified as having difficulty. Difficulty in obtaining and using equipment related to COVID-19 was measured with the following question: "Have you experienced any difficulty related to infection prevention during the recent spread of COVID-19 (since February 2020)? - regarding obtaining and using infection prevention products related to COVID-19 (such as the purchase and use of masks and hand sanitizers, etc.)." People who answered that they had difficulty in obtaining and using equipment related to COVID-19 were classified as having no difficulty, and those who answered that they had some or considerable difficulty were classified as having difficulty.

2-2) Interpersonal factors

Interpersonal factors are related to social networks and social support systems. In this study, satisfaction with the family relationship, satisfaction with the number of friends, leisure activities, and experiences of social discrimination were selected as interpersonal variables. Satisfaction with the family relationship was rated on a 4-point scale ranging from 1 point (= 'Very satisfied') to 4 points (= 'Very dissatisfied') by using the question "How satisfied are you with your current life? -regarding the family relationship." This item was reverse-coded, and higher scores indicate higher levels of satisfaction with the family relationship. Satisfaction with the number of friends was assessed on a 4-point scale from 1 point (= 'Very satisfied') to 4 point (= 'Very dissatisfied') by using the question "How satisfied are you with your current life? -regarding the number of friends" This item was reverse-coded, and higher scores indicate higher levels of satisfaction with the number of friends. Regarding the presence or absence of leisure activities, the participants who had participated in at least one of the 15 leisure activities in the past week were categorized as having leisure activities, and those who had not participated in any of them were categorized as having no leisure activities. The experience of social discrimination was measured by using the question "Have you ever suffered any of the following social discrimination due to your current disability?" with respect to a total of 19 items. People with the experience of discrimination in at least one of the 19 items were classified as having the experience of discrimination. People without any experience of discrimination in all of the 19 items were classified as having no experience of discrimination.

2-3) Community/Policy factor

Community/policy factors refer to environmental assets and policies that can support individuals' behavior and improve individuals' health. In this study, support from national and local governments related to COVID-19 was selected as the community/policy factor. Among the survey items, the question "Have you received any additional support from national and local governments during the recent spread of COVID-19?" was used to examine the presence or absence of support from national and local governments related to COVID-19. In other words, participants who received support in at least one of the six items were categorized as receiving support, and those who did not receive support in any of the six items were categorized as not receiving support.

3) Covariates

Gender, age, education level, household income, residence, and household type were set as covariates, based on previous studies [3,7,12] that identified factors affecting mental health problems due to COVID-19 in people without disabilities. Gender was divided into male and female, and age was classified into four age groups: ages below 40 (≤39), ages 40-59, ages 60-79, and ages above 79 (≥80). Education level was classified into elementary school or lower, middle school, high school, and college or higher. Based on the quartiles of average monthly household income, average monthly household income was divided into four income groups: low (800,000 won or less), lower middle (more than 800,000 won and less than 1.5 million won), upper middle (more than 1.5 million won and less than 2.9 million won), and high (more than 2.9 million won). Residence was classified into metropolitan cities, small and middle cities, and rural areas, and household type was categorized into single-person households and non-single-person households.

4. Statistical analysis

This study conducted an analysis of survey data from a complex sample design by applying weights from the National Survey of

Persons with Disabilities to ensure that data of the sample was representative of the population, and the statistical significance level was set at less than .05. In a complex sample analysis, the standard error bias of estimates may occur when cases are deleted or selected, so data analysis is performed by generating cluster variables and using them to specify the parent population [29]. Specifically, statistical analysis was carried out as follows. First, to analyze the participants' sociodemographic characteristics, socio-ecological factors, and emotional distress due to COVID-19 by using descriptive statistics, unweighted frequencies were presented, and percentages, and all other statistical values were analyzed by applying weights. Second, to compare differences in the presence or absence of emotional distress due to COVID-19 according to the socio-demographic characteristics and socio-ecological factors of the participants, the Rao-Scott x^2 test, which is a complex samples cross-tabulation analysis, and the t-test of the complex samples general linear model were conducted. Third, a complex samples logistic regression analysis was conducted to analyze factors affecting emotional distress due to COVID-19 in the participants. All statistical analyses were conducted using the analysis methods for complex sample design data of SPSS 23.0.

5. Ethical considerations

This study received an exemption determination from the IRB of Seoul National University (IRB No. E2308/001-010). The researcher downloaded and used the raw data, questionnaire, and codebook of the 2020 National Survey of Disabled Persons from the health and welfare data portal of the Korea Institute for Health and Social Affairs after applying and receiving approval for the use of data from the National Survey of Disabled Persons through application for access to microdata of the above-mentioned data portal. The data provided was anonymized using unique numbers to make personal data unidentifiable.

Results

1. Distributions of sociodemographic characteristics, socio-ecological factors, and factors affecting emotional distress due to COVID-19 in participants

With respect to the sociodemographic characteristics of the participants, in gender, males (55.8%) took up the larger proportion of the participants than females. In age, the 60-79 age group (51.3%) made up the largest proportion of the participants. As for the average monthly household income, the low income group with an average monthly household income of ≤ 800,000 won (26.3%) made up the largest proportion, and for residence, people living in metropolitan cities (37.7%) accounted for the largest proportion. In terms of intrapersonal factors among the socio-ecological factors of the participants, 80.5% of the participants had mild disability. 23.7% of the participants needed support for ADL or were dependent on others in ADL, and 34.3% needed support for IADL. 55.1% of the participants had no difficulty in getting information related to COVID-19, and 54.0% had no difficulty in obtaining and using equipment related to COVID-19. With respect to interpersonal factors, the average score for satisfaction with family relationships was 3.08 ± 0.02 points out of 4, and the average score for satisfaction with the number of friends was 2.79 ± 0.02 points out of 4. As for the community/ policy factor, 58.8% of the participants received no support related to COVID-19 from national and local governments. Lastly, regarding emotional distress due to COVID-19, 55.7% of the participants responded that they experienced emotional distress (Table 1).

2. Differences in emotional distress due to COVID-19 according to the characteristics of participants

A comparative analysis of differences in emotional distress due to COVID-19 according to the characteristics of participants revealed that there were significant differences in emotional distress according to all the variables except the degree of disability (Table 2). With respect to the presence or absence of emotional distress due to COVID-19 according to intrapersonal factors, there were statistically significant differences according to subjective health status ($t = 6.36$, $p < .001$), ADL($x^2 = 48.27$, $p < .001$), IADL($x^2 = 34.41$, $p < .001$), difficulty in getting information related to COVID-19 ($x^2 = 333.74$, $p < .001$), and difficulty in obtaining and using equipment related to COVID-19 ($x^2 = 306.54$, $p < .001$), although the degree of disability was not significantly associated with emotional distress due to COVID-19. Regarding the presence or absence of emotional distress due to COVID-19 according to interpersonal factors, there were statistically significant differences according to satisfaction with family relationships ($t = -7.49$, $p < .001$), satisfaction with the number of friends ($t = -9.85$, $p < .001$), leisure activities ($x^2 = 12.19$, $p < .001$), and experience of social discrimination ($x^2 = 13.63$, $p < .001$). In the case of the presence or absence of emotional distress due to COVID-19 according to the community/policy factor, there was a statistically significant difference in emotional distress according to the presence or absence of support related to COVID-19 from the national and local governments ($x^2 = 10.35$, $p = .001$).

Table 1. Characteristics of Study Participants (*N*=1,654)

	Variables	Categories (Range)	n (%) or M ± SE
General characteristics	Gender	Female	702(44.2)
		Male	952(55.8)
	Age	19~39	58(4.1)
		40~59	474(29.2)
		60~79	888(51.3)
		≥ 80	234(15.4)
	Education	≤ Elementary school	635(37.6)
		Middle school	328(20.1)
		High school	448(27.7)
		≥ College	243(14.6)
	Household income	Low	426(26.3)
		Middle-low	421(23.7)
		Middle-high	396(24.7)
		High	411(25.4)
	Residence	Metropolitan cities	726(37.7)
		Middle and small cities	441(28.1)
		Rural area	487(34.2)
	Household type	Single	419(25.6)
		Not single	1235(74.4)
Intrapersonal factors	Degree of disability	Mild	1084(80.5)
		Severe	570(19.5)
	Subjective health status	1-5[†]	3.45 ± 0.02
	ADL	Dependent	465(23.7)
		Independent	1189(76.3)
	IADL	Dependent	643(34.3)
		Independent	1011(65.7)
	Difficulty in getting information about COVID-19	Yes	703(44.9)
		No	951(55.1)
	Difficulty in obtaining and using equipment related to COVID-19	Yes	739(46.0)
		No	915(54.0)
Interpersonal factors	Satisfaction with family	1-4[‡]	3.08 ± 0.02
	Satisfaction with the number of friends	1-4[‡]	2.79 ± 0.02
	Leisure	Yes	1545(93.8)
		No	109(6.2)
	Discrimination	Yes	562(31.1)
		No	1092(68.9)
Community/Policy factor	Support related to COVID-19 from national and local governments	Yes	673(41.2)
		No	981(58.8)
	Emotional distress due to COVID-19	Yes	909(55.7)
		No	745(44.3)

Unweighted N(weighted %); ADL=Activities of daily living; IADL=Instrumental activities of daily living
[†] Higher scores indicate worse subjective health status; [‡] Higher scores indicate greater satisfaction.

3. Factors affecting emotional distress due to COVID-19 in participants

Before identifying factors associated with emotional distress due to COVID-19 in the participants, a test for multicollinearity between independent variables was performed. The tolerance value was found to be greater than 0.1, ranging from 0.272 to 0.954, and the variance inflation index (VIF) was less than 10, ranging from 1.048 to 3.677. As a result, it was confirmed that there was

Table 2. Differences in Emotional Distress due to COVID-19 according to Variables (*N*=1,654)

Variables		Categories (Range)	Emotional distress due to COVID-19		Rao-Scott χ^2/t	*p*
			Yes (n=909)	No (n=745)		
			n (%) or M±SE	n (%) or M±SE		
General characteristics	Gender	Female	432(62.0)	270(38.0)	17.29	<.001
		male	477(50.7)	475(49.3)		
	Age	19~39	30(55.5)	28(44.5)	4.17	.006
		40~59	245(52.0)	229(48.0)		
		60~79	482(54.4)	406(45.6)		
		≥ 80	152(66.9)	82(33.1)		
	Education	≤ Elementary school	397(62.7)	238(37.3)	9.80	<.001
		Middle school	188(58.8)	140(41.2)		
		High school	218(51.0)	230(49.0)		
		≥ College	106(42.1)	137(57.9)		
	Household income	Low	279(67.4)	147(32.6)	16.10	<.001
		Middle-low	262(60.9)	159(39.1)		
		Middle-high	195(51.0)	201(49.0)		
		High	173(43.2)	238(56.8)		
	Residence	Metropolitan cities	378(52.1)	348(47.9)	3.01	.050
		Middle and small cities	266(60.3)	175(39.7)		
		Rural area	265(55.8)	222(44.2)		
	Household type	Single	269(64.1)	150(35.9)	13.27	<.001
		Not single	640(52.8)	595(47.2)		
Intrapersonal factors	Degree of disability	Mild	577(55.0)	507(45.0)	1.88	.170
		Severe	332(58.7)	238(41.3)		
	Subjective health status	1-5[†]	3.57±0.03	3.29±0.03	6.36	<.001
	ADL	Dependent	320(71.5)	145(28.5)	48.27	<.001
		Independent	589(50.8)	600(49.2)		
	IADL	Dependent	416(66.3)	227(33.7)	34.41	<.001
		Independent	493(50.1)	518(49.9)		
	Difficulty in getting information about COVID-19	Yes	584(83.1)	119(16.9)	333.74	<.001
		No	325(33.4)	626(66.6)		
	Difficulty in obtaining and using equipment related to COVID-19	Yes	590(81.0)	149(19.0)	306.54	<.001
		No	319(34.1)	596(65.9)		
Interpersonal factors	Satisfaction with family	1-4[‡]	2.97±0.03	3.22±0.02	-7.49	<.001
	Satisfaction with the number of friends	1-4[‡]	2.63±0.03	2.99±0.03	-9.85	<.001
	Leisure	Yes	830(54.5)	715(45.5)	12.19	<.001
		No	79(73.5)	30(26.5)		
	Discrimination	Yes	344(62.9)	218(37.1)	13.63	<.001
		No	565(52.4)	527(47.6)		
Community/ policy factor	Support related to COVID-19 from national and local governments	Yes	420(60.9)	253(39.1)	10.35	.001
		No	489(52.0)	492(48.0)		

Unweighted N(weighted %); ADL=Activities of daily living; IADL=Instrumental activities of daily living
[†] Higher scores indicate worse subjective health status; [‡] Higher scores indicate greater satisfaction.

no problem of multicollinearity between independent variables. Next, a complex samples logistic regression analysis was performed by including all socio-ecological factor variables and considering sociodemographic variables (Table 3). First, among sociodemographic variables, gender and residence showed a statistically significant relationship with emotional distress due to

Table 3. The Results of Complex Sample Logistic Regression (*N*=1,654)

Variables		Categories	Emotional Distress due to COVID-19				
			B	SE	OR	95% CI	*p*
Covariates	Gender	Male (ref. Female)	-0.32	.15	0.73	0.54-0.98	.036
	Age	19~39	0.69	.45	1.99	0.83-4.76	.123
		40~59	0.38	.28	1.46	0.85-2.52	.171
		60~79(ref. ≥80)	0.09	.22	1.10	0.72-1.68	.665
	Education	≤Elementary school	0.21	.25	1.23	0.75-2.02	.407
		Middle school	0.35	.26	1.42	0.86-2.36	.170
		High school (ref. ≥College)	0.18	.22	1.19	0.77-1.84	.431
	Household income	Low	0.43	.22	1.54	0.99-2.39	.053
		Middle-low	0.38	.21	1.46	0.97-2.19	.068
		Middle-high (ref. high)	0.20	.19	1.22	0.85-1.77	.278
	Residence	Metropolitan cities	0.15	.16	1.16	0.85-1.59	.347
		Middle and small cities (ref. rural area)	0.58	.17	1.78	1.27-2.50	.001
	Household type	Single (ref. Not single)	-0.04	.17	0.96	0.68-1.35	.817
Intrapersonal factors	Degree of disability	Severe (ref. Mild)	-0.24	.15	0.79	0.59-1.06	.116
	Subjective health status	1-5[†]	0.07	.09	1.08	0.90-1.28	.426
	ADL	Dependent (ref. Independent)	0.46	.23	1.58	1.01-2.47	.047
	IADL	Dependent (ref. Independent)	0.17	.20	1.18	0.80-1.74	.394
	Difficulty in getting information about COVID-19	Yes (ref. No)	1.33	.23	3.79	2.43-5.89	<.001
	Difficulty in obtaining and using equipment related to COVID-19	Yes (ref. No)	1.10	.22	3.02	1.97-4.62	<.001
Interpersonal factors	Satisfaction with family	1-4[‡]	-0.23	.12	0.79	0.63-1.00	.054
	Satisfaction with the number of friends	1-4[‡]	-0.44	.12	0.64	0.51-0.81	<.001
	Leisure	Yes (ref. No)	-0.45	.27	0.64	0.38-1.08	.092
	Discrimination	Yes (ref. No)	0.23	.15	1.26	0.95-1.68	.115
Community/Policy factor	Support related to COVID-19 from national and local governments	Yes (ref. No)	0.38	.14	1.47	1.11-1.94	.008
Cox & Snell					.31		
Nagelkerke R^2					.41		
McFadden					.27		

CI=Confidence interval; OR=Odds ratio; ref.=Reference group; ADL=Activities of daily living; IADL=Instrumental activities of daily living
[†]Higher scores indicate worse subjective health status; [‡]Higher scores indicate greater satisfaction.

COVID-19. Compared to women with physical disabilities, men with physical disabilities were found to be 0.73 times less likely to experience emotional distress due to COVID-19 (95% CI=0.54-0.98). People with physical disabilities living in small or middle cities were shown to be 1.78 times more likely to experience emotional distress due to COVID-19 than those living in rural areas (95% CI=1.27-2.50). Next, with respect to socio-ecological factors affecting emotional distress due to COVID-19, first, in the case of intrapersonal factors, ADL, difficulty in getting information related to COVID-19, and difficulty in obtaining and using equipment related to COVID-19 were identified as factors associated with emotional distress due to COVID-19. More specifically, people who needed support for ADL were 1.58 times more likely to experience emotional distress due to COVID-19 than those who did not need support for ADL (95% CI=1.01-2.47). People who had difficulty getting information related to COVID-19 were 3.79 times more likely to experience emotional distress due to COVID-19, compared to those who had no difficulty (95% CI=2.43-5.89). People who had difficulty obtaining or using related equipment were 3.02 times more likely to experience emotional distress due to COVID-19, compared to those who had no difficulty (95% CI=1.97-4.62). Second, among interpersonal factors, satisfaction with the number of friends was identified as a significant influencing factor for emotional distress due to COVID-19. The higher level of satisfaction with the number of friends was associated with 0.64 times lower likelihood to experience emotional distress due to COVID-19 (95% CI = 0.51-0.81). Lastly, regarding the community/policy factor, the presence or absence of support from national and local governments related to COVID-19 was found to affect emotional distress due to COVID-19. People who received support related to COVID-19 from the national and local governments were 1.47 times more likely to experience emotional distress due to COVID-19 (95% CI = 1.11-1.94).

Discussion

This study aimed to examine the current status of socio-ecological factors selected based on a socio-ecological model and emotional distress due to COVID-19 in people with physical disabilities living in the community by using data from the 2020 National Survey of Disabled Persons, and also attempted to identify factors affecting emotional distress due to COVID-19 in people with physical disabilities by using a complex samples logistic regression analysis. The analysis results of this study showed that 55.7% of people with physical disabilities living in the community experienced emotional distress due to COVID-19. In other words, more than half of the participants were found to have experienced more mental health problems such as loneliness, depression, anxiety, and stress during the COVID-19 period than usual. Previous domestic and foreign studies have reported negative impacts of COVID-19 on mental health among people with disabilities [3,8,12,13,30]. In particular, people with physical disabilities were shown to have experienced mental health problems such as depression, anxiety, and loneliness during the COVID-19 period [7,9]. Although these findings of prior studies are in agreement to the results of this study, the indicator of emotional distress due to COVID-19 was not specific in this study, so caution is needed in interpreting the results of this study. In disaster situations such as COVID-19, people with physical disabilities experience higher levels of perceived social isolation among because of restrictions on support for activities of people with physical disabilities due to concerns about infection as well as the suspension and reduction of the use of services, and also have financial problems due to reduced income, and these factors negatively affect mental health [3,5]. Therefore, it is essential to comprehensively examine and understand factors affecting mental health in people with physical disabilities in disaster situations such as the COVID-19 pandemic.

With respect to intrapersonal factors among the social-ecological factors, ADL was found to have a significant impact on emotional distress due to COVID-19 in people with physical disabilities. First, it was shown that a greater need for support in ADL was positively associated with a higher likelihood of emotional distress among people with physical disabilities. A number of previous studies [26,28,31] have reported similar findings regarding the relationship between the ability to perform ADLs and mental health problems such as depression. The results of this study are also consistent with a previous study showing that a higher level of dependence on others in ADL is associated with an increased level of depression among people with physical disabilities [31]. People who have a higher level of dependency in ADL need to receive more help from others, such as family members or disability support workers. During the COVID-19 period, people with disabilities who are highly dependent on others for ADLs find it difficult to maintain social distancing with others, and are at higher risk for infection through contact with others, and this situation would affect psychological factors such as anxiety, fear, and depression in people with disabilities [13]. Therefore, it is necessary to identify people with physical disabilities who need support for ADLs as a high-risk group for mental health, and to give priority to them when applying psychological interventions.

In this study, among the intrapersonal factors of people with physical disabilities, difficulty in getting information related to COVID-19 and difficulty in obtaining and using equipment related to COVID-19 were found to be significant influencing factors for emotional distress due to COVID-19. This finding is consistent with a previous study showing that obtaining more accurate information related to COVID-19 is linked to the reduction of negative impacts of COVID-19 on mental health [32]. A previous study by the National Rehabilitation Center reported that 15.0% of people with physical disabilities found it difficult to get information related to COVID-19 [9], and this proportion is lower than the result of this study (44.9%), but this difference may be attributed to differences in the sample size and research methods. Regarding the main reasons why people with physical disabilities have difficulty accessing information, a previous study reported that the most common reason given by more than half of the respondents (55.6%) was 'I don't know the methods', followed by 'a lack of guidance through easy-to-understand pictures and videos' (24.6%) [9]. The results of this study also showed that greater difficulty in obtaining and using equipment related to COVID-19 was associated with a higher likelihood of experiencing emotional distress due to COVID-19. A previous study reported that infection prevention and control measures such as wearing masks and using hand sanitizers reduce psychological impacts, depression, anxiety, and stress [32]. However, since people with physical disabilities have limitations on physical functioning, they experience more difficulty in complying with general infection prevention and control guidelines for COVID-19 than people without disabilities [9,33,34]. In disaster situations such as COVID-19, difficulty in accessing information related to infectious diseases as well as obtaining and using products for infection prevention and control are likely to be perceived as discrimination against disabled persons by people with physical disabilities [9,12], and this increases anxiety and fear about disease infections, leading a negative impact on mental health. Therefore, it is necessary to develop guidelines for infection prevention and control and information access and delivery methods by taking into account the characteristics of people with physical disabilities in order to keep difficulties related to infection prevention and control measures from negatively affecting mental health in people with physical disabilities, and prevent psychological distress among people with physical disabilities in the event of future infectious disease disasters.

In this study, regarding interpersonal factors among socio-ecological factors, satisfaction with the number of friends was found to be negatively correlated with emotional distress due to COVID-19. In other words, a higher level of satisfaction with the number of friends was associated with a lower likelihood of experiencing emotional distress due to COVID-19. In this connection, a previous study mentioned that COVID-19 had a negative impact on social interactions in elderly people with physical disabilities, and that less social interaction was associated with a greater degree of deterioration of mental health problems such as depression and loneliness in people with physical disabilities [7]. Satisfaction with the number of friends is a measure of social support and indicates satisfaction with social networks, and positive experiences from social support increase psychological well-being in people with disabilities [35]. During the COVID-19 period, people with disabilities are more likely to become socially isolated due to social distancing, self-quarantine, and disruption of the use of welfare services, so there arises a need to provide sufficient emotional support for them [6]. In an infectious disease outbreak situation such as COVID-19, people without disabilities can maintain social relationships online through social media, but people with disabilities may have limitations due to the constraints related to their disabilities [3]. Therefore, it is necessary to provide support through various media to ensure that people with physical disabilities will not be isolated from social relationships and can receive continuous emotional support through the social support system in an infectious disease disaster situation.

In this study, support related to COVID-19 from national and local governments was considered as a community/policy factor, and it was found that people with disabilities who received support related to COVID-19 from national and local governments were more likely to have emotional distress due to COVID-19. In general, support policies such as personal assistance services for people with disabilities were found to have a positive emotional impact on people with disabilities [36], and the results of this study are not consistent with such findings. In this study, the additional support items related to COVID-19 that people with physical disabilities received from national and local governments were found to be mostly products for infection prevention and control (Table 4). Thus, it seems that there was not sufficient support for mental health and psychological support, and simply providing supplies is thought to have no significant effect on mental health. A previous research reported that providing external support such as products for infection prevention and control and food to people with pre-existing depression prior to the COVID-19 period was associated with a decrease in the prevalence of anxiety and depression[37], but it is difficult to compare the findings of the prior study with the results of this study. This study is a cross-sectional study, and there is a need to conduct a longitudinal research to investigate the relationship of community-based and policy-based support services with mental health through in the future. The National Center for Disaster and Trauma and mental health centers of local governments provide counseling and psychological support services for mental health problems due to disasters such as COVID-19, but there are not services available that reflect the reality and characteristics of people with disabilities [1]. Therefore, there is a need to strengthen psychological support services for people with physical disabilities, and in particular, it is necessary to provide tailored psychological support

Table 4. Frequency of Support related to COVID-19 from National and Local Governments (*N*=673)

Item	n (%)
(1) Emergency care for social welfare facilities and special schools	20 (3.0)
(2) Special benefits for personal assistance services	30 (4.5)
(3) Food and supplies delivery	62 (9.2)
(4) Infection protection supplies	642 (95.4)
(5) Support for online lecture learning aids	22 (3.3)
(6) Others	23 (3.4)

Unweighted n (unweighted %); Multiple choices available.

services based on understanding of people with disabilities by considering measures such as utilization of peer counselors [5]. These efforts are expected to help detect emotional distress early in people with physical disabilities living in the community in disaster situations such as COVID-19 and provide effective support for them in the community.

This study has the following limitations. First, since this study was conducted using secondary data to identify influencing factors for emotional distress due to COVID-19, variables included in the analysis were not sufficient to measure various aspects of socio-ecological factors. In particular, this study had included only one variable related to community and policy factors in the analysis due to the limitation of data available, and there was some difficulty in interpreting variables such as satisfaction with the number of friends, which is an interpersonal factor. Therefore, in a follow-up research, it is necessary to conduct more comprehensive research by considering socio-ecological variables using valid tools. Additionally, since this study analyzed cross-sectional data, it had limitations in explaining causal relationships between variables. Moreover, because this study was conducted not with the entire population of people with physical disabilities but with a group of people with physical disabilities, there are limitations in generalizing and applying the results of this study to all people with physical disabilities. However, this study analyzed the current status and associated factors of emotional distress due to COVID-19 in people with physical disabilities living in the community for the first time in Korea by using a nationwide survey data by complex sample analysis methods. As a result, this research demonstrated that there is a need to develop an intervention program for providing psychological support in infectious disease disaster situations such as COVID-19. The results of this study showed that in the event of an infectious disease outbreak disaster in the future, it is necessary to give priority to people with physical disabilities who need support for ADLs when applying psychological interventions in order to prevent their psychological distress, and there is also a need for support services to provide appropriate information and help to use infection prevention control products. In addition, it is necessary to expand the provision of tailored psychological support services for people with physical disabilities instead of providing only some supplies and to strengthen the social support system to prevent their social isolation.

Conclusions

This study investigated socio-ecological factors and emotional distress due to COVID-19 in people with physical disabilities by using data from the 2020 National Survey of Disabled Persons, and attempted to identify factors associated with emotional distress due to COVID-19 by a complex samples logistic regression analysis. The analysis results of this study showed that more than half of adults with physical disabilities living in the community experienced emotional distress due to COVID-19. Factors associated with emotional distress due to COVID-19 were found to be gender and residence among sociodemographic factors, ADL, difficulty in getting information related to COVID-19, and difficulty in obtaining and using equipment related to COVID-19 among interpersonal factors, satisfaction with the number of friends as an interpersonal factor, and support from the national and local governments related to COVID-19 as a community/policy factor. Therefore, in order to provide adequate support for the mental health of people with physical disabilities in the event of future disaster situations due to the outbreak of infectious diseases such as COVID-19, it is necessary to pay more attention to people with physical disabilities living in the community with these characteristics, and identify mental health risk groups for early prevention and management. Additionally, it is required to improve support policies and systems for the promotion of mental health at the national and community levels by taking into consideration the characteristics of each type of disability.

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Conflict of interest

Ju Young Yoon has been editorial board member of the Research in Community and Public Health Nursing. She was not involve in the review process of this manuscript. No conflict of interest has been declared by authors.

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Authors' contributions

Bohye Kim contributed to conceptualization, data curation, formal analysis, methodology, visualization, and writing – original draft, review & editing. Ju Young Yoon contributed to conceptualization, methodology, writing – review & editing, supervision, and validation.

Data availability

The National Survey of Disabled Persons (2020) were obtained from the Korea Institute for Health and Social Affairs Health and Welfare Data Portal(https://data.kihasa.re.kr/kihasa/main.html).

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References

1. Lee E-W. COVID-19 generation, how is mental health?. Research Report. Gyeonggi: Gyeonggi Research Institute; 2020 May. Report No.: 414.
2. Kim NS. Current status and challenges of COVID-19. Health Welfare Issue & Focus. 2020;373:1–13.
3. Kim YR, Nam JH. The effects of COVID-19 on the mental health of the disabled. Health and Social Welfare Review. 2022;42(2):102–121. http://doi.org/10.15709/hswr.2022.42.2.102
4. Nam JH, Lee RH. Is the COVID-19's impact equal to all in South Korea? - Focusing on the effects on income and poverty by employment status-. Korean Journal of Social Welfare. 2020;72(4):215–241. http://doi.org/10.20970/kasw.2020.72.4.008
5. Lee SH, Lee BH. Current status of support for the disabled and policy tasks following the COVID-19 outbreak. Health & Welfare. 2020;22(3):7–34. http://doi.org/10.23948/kshw.2020.09.22.3.7
6. Kim KR, Cho SH. An analysis of status for support and strategies for people with disabilities in the COVID-19 crisis : Based on WHO recommendations. Health & Welfare. 2021;23(3):7–37. http://doi.org/10.23948/kshw.2021.9.23.3.7
7. Steptoe A, Di Gessa G. Mental health and social interactions of older people with physical disabilities in England during the COVID-19 pandemic: A longitudinal cohort study. The Lancet Public Health. 2021;6(6):e365–e373. https://doi.org/10.1016/s2468-2667(21)00069-4
8. Ciciurkaite G, Marquez-Velarde G, Brown RL. Stressors associated with the COVID-19 pandemic, disability, and mental health: Considerations from the Intermountain West. Stress and Health : Journal of the International Society for the Investigation of Stress. 2022;38(2):304–317. https://doi.org/10.1002/smi.3091
9. Ho SH, Choi HJ, Kim HY, Park JM, Kim MS, Park JH. Experiences and problems of people with disabilities on COVID-19. Research Report. Seoul: Korea National Rehabilitation Research Institute; 2021 Sep.
10. Pettinicchio D, Maroto M, Chai L, Lukk M. Findings from an online survey on the mental health effects of COVID-19 on Canadians with disabilities and chronic health conditions. Disability and Health Journal. 2021;14(3):101085. https://doi.org/10.1016/j.dhjo.2021.101085
11. Wang K, Manning III RB, Bogart KR, Adler JM, Nario-Redmond MR, Ostrove JM, et al. Predicting depression and anxiety among adults with disabilities during the COVID-19 pandemic. Rehabilitation Psychology. 2022;67(2):179.
12. Kim SH, Lee S, Chang EJ. Analyzing change trajectory and determinants of depression of disabled adults. Journal of Reinterpretation of Disability. 2022;3(1):309–327.
13. Park MJ, Lee JH, Shin SR, Lee TK, Jin JS, Kang MK, et al. The COVID-19 Impact on the life changes of the people with disability: Focused on the people with disability in Busan region. Journal of Disability and Welfare. 2022;56(56):119–148. http://doi.org/10.22779/kadw.2022.56.56.119
14. Lebrasseur A, Fortin-Bédard N, Lettre J, Bussières EL, Best K, Boucher N, et al. Impact of COVID-19 on people with physical disabilities: A rapid review. Disability and health journal. 2021;14(1):101014. https://doi.org/10.1016/j.dhjo.2020.101014
15. Employment Development Institute. Disability Statistics at a Glance 2022[Internet]. Seongnam: Korea Employment Agency for the Disabled; 2022 [cited 2023 Oct 24]. Available from: https://www.kead.or.kr/bbs/presearch/bbsView.do?pageIndex=1&bbsCode=presearch&bbsCnId=123951
16. Kim SH, Yi MG, Oh U, Oh DE, Hwang JH, Oh M, et al. 2020 National Survey of Disabled Persons. Sejong: Korea Institute For Health And Social Affairs; 2020. Report No.: 11-1352000-000568-12.
17. McLeroy KR, Bibeau D, Steckler A, Glanz K. An ecological perspective on health promotion programs. Health Education Quarterly. 1988;15(4):351–377. https://doi.org/10.1177/

109019818801500401
18. Yang JH, Park BH. Exploration on the health-related factors of the elderly in rural village based on the social ecological model. Journal of Korean Public Health Nursing. 2021;35(3):415–429. http://doi.org/10.5932/JKPHN.2021.35.3.415
19. Kim YA, Yoon HS. Factors associated with health promotion of caregivers based on a socio-ecological model. Journal of Korean Public Health Nursing. 2011;25(1):61–72. https://www.doi.org/10.5932/JKPHN.2011.25.1.061
20. Heo HH, Che XH, Chung HJ, Kim JS, Jo MJ, Moon DS, et al. Effects of socio-ecological factors on mental health of the residents in a single room occupancy (Jjok-bang) of South Korea. Korean Journal of Health Education and Promotion. 2015;32(2):39–52. http://doi.org/10.14367/kjhep.2015.32.2.39
21. So MH. Influencing factors on elderly's oral health level based on the social ecological model [dissertation]. [Seoul]: Ewha Womans Universiy; 2018. 85 p.
22. Kim YJ, Park JH. Factors influencing healthy living practice by socio-ecological model. The Journal of the Convergence on Culture Technology (JCCT). 2021;7(4):351–361. http://doi.org/10.17703/JCCT.2021.7.4.351
23. Bae SS, Jo HS, Kim DH, Choi YJ, Lee HJ, Lee TJ, et al. Factors associated with gastric cancer screening of Koreans based on a socio-ecological model. Journal of Preventive Medicine and Public Health. 2008;41(2):100–106.
24. Khan M, Brown HK, Lunsky Y, Welsh K, Havercamp SM, Proulx L, et al. A socio-ecological approach to understanding the perinatal care experiences of people with intellectual and/or developmental disabilities in Ontario, Canada. Women's Health Issues : Offical Publication of the Jacobs Institute of Women's Health. 2021;31(6):550–559. https://doi.org/10.1016/j.whi.2021.08.002
25. WHO. Mental health World Health Oragnization 2022 [Internet]. Geneva: World Health Organization. 2022 [cited 2023 Oct 24]. Available from: https://www.who.int/news-room/fact-sheets/detail/mental-health-strengthening-our-response
26. Lee EW, Song JY. Factors influencing mental health status of persons with physical disabilities. Journal of the Korea Entertainment Industry Association. 2019;13(6):287–295. http://doi.org/10.21184/jkeia.2019.8.13.6.287
27. Seo WS, Lee HS. A study of policy priorities for the promotion of mental health among people with disabilities. Health and Social Welfare Review. 2020;40(3):315–350. http://doi.org/10.15709/hswr.2020.40.3.315
28. Choi YS, Kim HL, Kim YH, Lim JR. The association among activity of daily living, instrumental activities of daily living, depression and isolation in disabled people. The Korean Journal of Rehabilitation Nursing. 2011;14(1):5–12.
29. Won YS, Choi CH, Oh HN. Risk factors of periodontal disease in Korean adults. Journal of Korean Academy of Oral Health. 2014;38(3):176–183. http://doi.org/10.11149/jkaoh.2014.38.3.176
30. Okoro CA, Strine TW, McKnight-Eily L, Verlenden J, Hollis ND. Indicators of poor mental health and stressors during the COVID-19 pandemic, by disability status: A cross-sectional analysis. Disability and Health Journal. 2021;14(4):101110. https://doi.org/10.1016/j.dhjo.2021.101110
31. Kwon Y. The relationship between activity of daily living and depression depending on types and degree of physical disability and psychological disorder [master's thesis]. [Seoul]: Yonsei University; 2014. 74 p.
32. Wang C, Pan R, Wan X, Tan Y, Xu L, Ho CS, et al. Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in China. International Journal of Environmental Research and Public Health. 2020;17(5):1729. https://doi.org/10.3390/ijerph17051729
33. Jeon GB. COVID-19 and the lives of disabled persons : The current status and countermeasures. Journal of Critical Social Welfare. 2020(68):173–207. http://doi.org/10.47042/ACSW.2020.08.68.173
34. Mörchen M, Kapoor H, Varughese S. Disability and COVID-19. Community Eye Health. 2020;33(109):10–11.
35. Kim CS, Shin YR, Roh SH. Factors of depression among the disabled in later life: Comparisons of middle age and old age. Studies in Humanities and Social Science. 2017(54):77–96. http://doi.org/10.17939/hushss.2017..54.005
36. Yoon D. The Effect of Personal Assistance Service on the Quality of Life of the Heavily Disabled [master's thesis]. [Seoul]: University of Seoul; 2007. 100 p.
37. Jung SJ, Jeon YJ, Yang JS, Park MS, Kim KH, Chibnik LB, et al. Impact of COVID-19 on mental health according to prior depression status: A mental health survey of community prospective cohort data. Journal of Psychosomatic Research. 2021;148:110552. https://doi.org/10.1016/j.jpsychores.2021.110552

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Urban-Rural Differences in Prevalence of Depressive Symptoms and Its Related Factors Among Older Adults: Findings from the Korean Longitudinal Study of Aging

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Purpose: Many studies exist on factors associated with depressive symptoms in urban and rural older adults; however, studies using a longitudinal design are scarce. This study aimed to determine whether there is a difference in the prevalence of depressive symptoms and their associated risk factors over time between urban and rural areas using a longitudinal sample of Korean older adults.
Methods: Data from the Korean Longitudinal Study of Aging (2006-2020) of older adult participants ≥65 years without depressive symptoms were analyzed. A generalized estimating equation model was employed for repeated measures analysis.
Results: As the time of living in the area increased, the prevalence risk of depressive symptoms in older adults increased in urban areas compared to rural areas in adjusted Model 2. In urban areas, less social contact with neighbors was significantly associated with a higher risk of depressive symptoms. In rural areas, occasional social contact with children was significantly associated with a lower risk of depressive symptoms. The prevalence of depressive symptoms was associated with five components of successful aging with some variations observed based on urban and rural residential areas.
Conclusions: Our findings suggest that understanding the longitudinal impact of residence on depressive symptoms provides valuable insights into the relationship between urban/rural areas and depressive symptoms. This study highlights the need for nursing intervention efforts aimed at promoting successful aging and increasing social contact with children or neighbors.

Keywords: Depression; Healthy aging; Aged; Residence; Urban/rural

Introduction

Depression in old age is a common mental disorder that affects health-related quality of life [1,2]. Due to rapid population aging, the prevalence of depressive symptoms among the older population is continuously increasing. Globally, approximately 5.7% of adults aged >60 years suffer from depression [3]. Moreover, 10-15% of older adults have clinically significant depressive symptoms [1]. The prevalence of depressive symptoms in older adults in Korea is estimated to be 13.5% in those aged >65 years and 24.0% in those >85 years [4]. Depression among older adults increases the risk of physical health problems, suicide, and mortality, and reduces cognitive functioning [5,6]; therefore, it has been widely recognized as a public health priority.

Depression in old age is primarily influenced by the features of neighborhoods or residential environments where older people live rather than individual-level characteristics [6-8]. In particular, because the place of residence varies greatly by socioeconomic status, urban/rural residential areas could be important contributors to health disparities [9]. Although the differences in the

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physical health of older adults between urban and rural areas have been studied extensively, relatively little attention has been paid to the differences in their mental health [6].

Previous studies have reported that urban and rural residential areas have different effects (positive or negative) on mental health aspects, such as depression and depressive symptoms [9,10]. A systematic review and meta-analysis study [6] found that depression prevalence was significantly higher among urban residents than among the rural ones in developed countries, whereas in developing countries, including China and Myanmar, depression prevalence was higher in most rural areas than in urban areas [6,11,12]. Previous studies in Korea have also reported a higher prevalence of depressive symptoms in urban older people [13] and a higher prevalence of depressive symptoms in rural areas [14-16]. In some studies, the prevalence of depressive symptoms in older adults was not significantly different between urban and rural areas [17,18]. The regional differences can be attributed to the fact that rural population generally have a relatively lower socioeconomic status and more limited access to healthcare resources, as well as social, and environmental resources, compared to the urban one [11,16]. Due to their differences in characteristics, it is necessary to distinguish between urban and rural areas when investigating the variations in depressive symptoms for effective nursing interventions.

Most of previous research has examined the association between residential areas and such symptoms in older adults using cross-sectional designs; thus, the findings have been limited in identifying consistent associations [6,11,12]. Therefore, it is of great necessity to study whether there are regional differences in the evolution of depressive symptoms using longitudinal data.

Recently, among the (individual) factors related to depressive symptoms in older adults, successful aging (SA) and social relationships have attracted attention as possible intervention factors. SA has become a crucial concept for describing the quality of aging and is a multidimensional concept encompassing physiological, social, and psychological health domains [19]. Prior studies have reported a relationship between SA and depression [20-22] and in a Korean study, unsuccessful aging predicted a higher risk of depressive symptoms [23]. Lack of or insufficient social contact with neighbors or children is related to depressive symptoms [24,25], and there are differences in access to essential social support resources between urban and rural areas. Although these studies provide important information on the predictors of depressive symptoms, studies using a longitudinal design are scarce.

Therefore, this study aimed to identify whether there is a difference in the urban/rural prevalence and risk factors of depressive symptoms over time using a longitudinal sample of Korean older adults. The findings provide evidence for the need of appropriate community-based nursing interventions to prevent depression in older adults living in residential areas with different characteristics.

Methods

1. Study Design and Participants

This was a secondary data analysis study using longitudinal data. Data were derived from the first to the eighth wave of the Korean Longitudinal Study of Aging (KLoSA) from 2006-2020, which is an ongoing, large-scale longitudinal study by the Korea Labor Institute that uses multistage stratified probability sampling of Korean residents aged ≥45 years. Nationally representative panel data were collected [26].

This study included a sample of adults aged ≥65 years. In the baseline data from 2006, 10,254 individuals were surveyed. We excluded those with missing data (n=1,262) and participants below 65 years of age (n=5,584). Among the 3,408 respondents, 617 were excluded because of depressive symptoms (n=461) or changes in residence (n=156). Our final baseline sample comprised 2,791 participants. To confirm the effect of residence over time, those who moved between urban and rural residential areas were excluded during the survey period. Figure 1 presents the flowchart of the participants and the selection process.

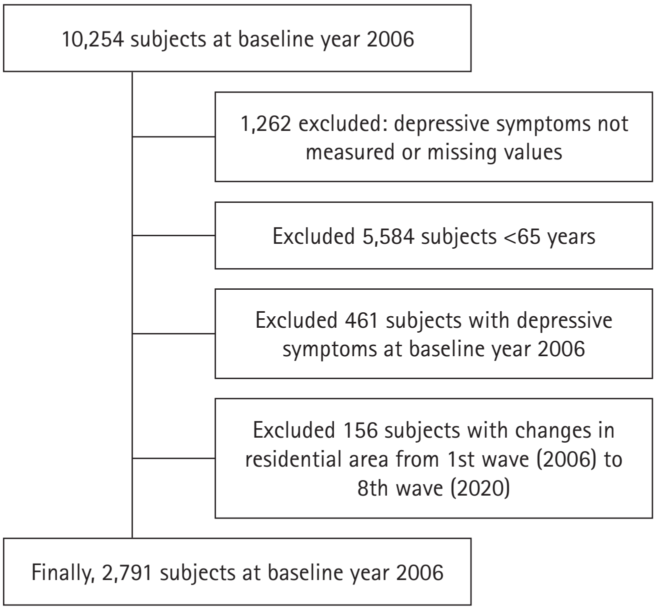

Figure 1. Flowchart of the study participants at baseline year

2. Measurements

Depressive symptoms

Depressive symptoms were assessed using the Korean version of the Center for Epidemiologic Studies Depression Scale (CES-D 10). The CES-D 10 comprises 10 items listed in the original 20-item version with scores ranging from 0-10, where higher scores indicate more severe depressive symptoms [27,28]. We used a recommended cutoff score of four points for older adults to indicate depressive symptoms at baseline, which is considered sufficient to diagnose clinically relevant depression in older adults [28,29]. Depressive symptoms were classified into two categories (1 = yes, 0 = no, meaning present and, respectively absent).

Residential areas

Urban and rural areas were identified according to the administrative divisions of South Korea. Urban areas were defined as metropolitan cities and small and medium cities with "dong" (neighborhood) unit districts, while rural areas were defined as provinces made up of "eup" (township) and "myeon" (town) unit districts.

Social contact

Social contact was measured by the frequency of meetings with own children and neighbors. Social contact with children was categorized as "frequently meets at least one child," "frequently meets all the children," "occasionally meets all the children," or "rarely meets all the children." Social contact with neighbors was categorized as "meets with neighbors more than once a week" or "meets with neighbors less than once a week."

Successful aging

The following five components were used to assess SA: 1) absence of chronic disease, 2) no disability, 3) high cognitive function, 4) active social engagement, and 5) satisfaction with life [30,31]. The first component refers to chronic diseases that are the primary causes of death in Korea (cancer, heart disease, chronic lung disease, diabetes mellitus, and cerebrovascular disease), with a total count ranging between 0-5. Based on respondents' self-reports of previously diagnosed diseases, SA was defined as the absence of all these five diseases [32]. Disability was evaluated by reference to activities of daily living (ADL) and instrumental activities of daily living (IADL) [23,32]. Successful agers included respondents without difficulties in ADL and with no more than one disability in IADL. Cognitive function was evaluated using the Korean version of the Mini-Mental State Examination (MMSE-K). The MMSE-K scores range between 0-30, and respondents with a score of ≥24 were classified as achieving SA [23,32]. Active social engagement was assessed by participation in social activities, including religious, leisure/sports, alumni, volunteering, and political and nongovernmental organizations [23,32]. Successful agers had to participate in at least one of these activities. Satisfaction with life was measured as satisfaction with health, economic status, marital status, relationships with children, and general satisfaction in later life on a scale of 0-100 [32].

Respondents with a mean score of ≥60 were classified as achieving SA [33]. Overall, participants who satisfied all five conditions were classified under SA.

Control variables

Control variables included sex, age (65-74, 75-84, or ≥85 years), marital status (married or unmarried), education level (elementary or lower, middle school, high school, college, or higher), household income level (low, low-middle, middle-high, high), medical insurance type (national, medical aid), economic activity (active or inactive), health behaviors, vision (good or poor), and hearing ability (good or poor). Health behaviors included smoking (current/past/never), alcohol consumption (yes/no), physical activity (yes/no), regular diet (yes/no), and body mass index (BMI), which was calculated using a person's height and weight, and accordingly, participants were categorized as underweight (<18.5 g/m^2), normal weight (18.5-25 g/m^2), or obese (>25 g/m^2). Relevant physical activity was considered at least once a week and was assessed with response options of "yes" and "no."

3. Statistical analysis

Baseline differences between the characteristics of the respondents by residential area (urban or rural) were determined using a chi-square test. Eight waves (2006-2020) were used for the analysis and repeated measurements were performed for each individual up to seven times. We determined the prevalence of depressive symptoms by residence from 2008 to 2020. Considering the longitudinal nature of our data, a generalized estimating equation (GEE) model was employed for repeated-measures analysis, and a lag function was applied to determine whether depressive symptoms were present or absent in the previous and following years.

Using GEE logistic regression, we examined the combined effects of changes in time and other covariates on depressive symptoms. In Model 1 (unadjusted), independent and other variables were not included, and the prevalence of depressive symptoms according to residence and time change was identified. In Model 2, the adjusted effect was identified by adding SA, social contact with children and neighbors, and the control variables to Model 2. The effects of residential area and time on depressive symptoms were identified using an interaction term. In Model 2, the effects of time change, residential area, and time change × r esidential area on the prevalence of depressive symptoms were analyzed after controlling for the control variables. A subgroup analysis (rural versus urban) was performed to identify differences in factors related to depressive symptoms by residential area. All statistical analyses were performed using SAS version 9.4 (SAS Institute Inc., Cary, NC, USA), and a *p*-value <0.05 was considered statistically significant.

4. Ethical statement

The original data are publicly available free of charge from the KLoSA website, published by the Korea Employment Information Service. This study used a deidentified secondary dataset. Therefore, it was exempted from review by Institutional Review Board of Cheongju University (No. 1040621-202202-HR-E001).

Results

1. Baseline characteristics of the study population by urban and rural areas

Table 1 presents the descriptive statistics and differences in the distribution of the study variables by urban and rural areas at baseline. A total of 2,791 older adults without depressive symptoms were included (urban=1,961, rural=830). Of the participants, 46.43% were men and 53.57% were women. The percentage of participants aged 65-74 was 67.97%. Approximately 68.94% of all participants had an education level below elementary school, 42.06% had a high household income, and 80.08% were economically inactive. There were significant differences between urban and rural areas in all variables except for sex, age, medical insurance type, hearing, and vision.

2. Changes in the prevalence of depressive symptoms according to survey periods

Figure 2 shows the differences in the prevalence of depressive symptoms between urban and rural areas from the second (2008) to the eighth wave (2020). In 2008, the prevalence of depressive symptoms was higher in rural areas (17.10%) than in the urban ones (15.64%). Over the following decade, there have been some shifts in prevalence rates. In urban areas, the prevalence of depressive symptoms increased from 17.16% in 2010 to 19.30% in 2020. Contrastingly, the prevalence of depressive symptoms in rural areas decreased from 18.19% in 2010 to 10.89% in 2020 (Appendix Table 1).

3. Urban-rural differences in the prevalence risk of depressive symptoms over time

Table 2 and Figure 3 show the effects of residential area on the prevalence of depressive symptoms over time in Model 1 (unadjusted) and Model 2 (adjusted) using a GEE analysis. Considering only the residential area, the risk of depressive symptoms was significantly lower in urban areas compared to rurality in Model 1 (OR=0.64, 95% CI:0.48-0.85) and Model 2 (OR=0.60, 95% CI:0.44-0.82). Models 1 and 2 showed a significant interaction effect on the risk of depressive symptoms between the survey period and residential area. As the duration of living in an area increased, the prevalence risk in older adults rose in urban areas compared to the rural ones in Model 1 (OR=1.17, 95% CI:1.11-1.23) and Model 2 (OR=1.19, 95% CI:1.12-1.26). Model 2 included additional control variables related to depressive symptoms. Despite this adjustment, the significant interaction effect between time and residential area on the risk of depressive symptoms persisted. Figure 3 displays the interaction effect between the survey period and residential area in Model 1 (unadjusted Model 1A) and Model 2 (adjusted Model 2B).

4. Factors related to the prevalence of depressive symptoms by urban and rural areas

Table 3 presents the urban/rural differences in the associations between the prevalence of depressive symptoms and two factors: SA and social contact. In urban areas, having meetings with neighbors less than once a week (OR=1.33, 95% CI: 1.15-1.54) was significantly associated with a higher risk of depressive symptoms. Contrastingly, in rural areas, occasional meetings with all children (OR=0.69, 95% CI:0.52-0.92) was significantly associated with a lower risk of depressive symptoms. Regarding the five components of SA, in urban areas, older individuals who had one or more chronic diseases were found to have a higher likelihood of experiencing depressive symptoms (OR=1.37, 95% CI:1.17-1.59) compared to those who had no such diseases. Contrastingly, no association was found between the presence of chronic diseases and risk of depressive symptoms in rural areas. In all areas, older people who had a limitation of daily activity (urban OR=1.94, 95% CI:1.66-2.26; rural OR=2.48, 95% CI:1.94-3.18), a cognitive dysfunction (urban OR=1.66, 95% CI:1.42-1.94; rural OR=1.80, 95% CI:1.36-2.38), and low life satisfac-

Table 1. Baseline Characteristics of the Participants

Variables	Categories	Total (*N* = 2,791)	Urban (n = 1,961)	Rural (n = 830)	*p*
			n (%)		
Sex	Men	1296 (46.43)	906 (46.20)	390 (46.99)	.703
	Women	1495 (53.57)	1055 (53.80)	440 (53.01)	
Age (years)	65–74	1897 (67.97)	1349 (68.79)	548 (66.02)	.164
	75–84	776 (27.80)	537 (27.38)	239 (28.80)	
	≥ 85	118 (4.23)	75 (3.82)	43 (5.18)	
Education	Elementary school or less	1924 (68.94)	1234 (62.93)	690 (83.13)	< .001
	Middle school	306 (10.96)	251 (12.80)	55 (6.63)	
	High school	388 (13.90)	319 (16.27)	69 (8.31)	
	College or more	173 (6.20)	157 (8.01)	16 (1.93)	
Marital status	Married	1914 (68.58)	1318 (67.21)	596 (71.81)	.017
	Unmarried	877 (31.42)	643 (32.79)	234 (28.19)	
Household income	High	1174 (42.06)	823 (41.97)	351 (42.29)	< .001
	High-middle	413 (14.80)	259 (13.21)	154 (18.55)	
	Middle-low	659 (23.61)	436 (22.23)	223 (26.87)	
	Low	545 (19.53)	443 (22.59)	102 (12.29)	
Medical insurance type	National health insurance	2723 (97.56)	1913 (97.55)	810 (97.59)	.952
	Medical aid	68 (2.44)	48 (2.45)	20 (2.41)	
Economic activity	Active	556 (19.92)	271 (13.82)	285 (34.34)	< .001
	Inactive	2235 (80.08)	1690 (86.18)	545 (65.66)	
Smoking	Never	2000 (71.66)	1424 (72.62)	576 (69.40)	.023
	Past	354 (12.68)	254 (12.95)	100 (12.05)	
	Current	437 (15.66)	283 (14.43)	154 (18.55)	
Physical activity	Yes	955 (34.22)	824 (42.02)	131 (15.78)	< .001
	No	1836 (65.78)	1137 (57.98)	699 (84.22)	
Alcohol consumption	Yes	829 (29.70)	555 (28.30)	274 (33.01)	.013
	No	1962 (70.30)	1406 (71.70)	556 (66.99)	
Regular diet	Yes	2610 (93.51)	1818 (92.71)	792 (95.42)	.008
	No	181 (6.49)	143 (7.29)	38 (4.58)	
BMI	Under weight	177 (6.34)	108 (5.51)	69 (8.31)	.005
	Normal	2614 (93.66)	1853 (94.49)	761 (91.69)	
	Overweight	0 (0.00)	0 (0.00)	0 (0.00)	
Hearing ability	Poor	1290 (46.22)	907 (46.25)	383 (46.14)	.716
	Good	1501 (53.78)	1054 (53.75)	447 (53.86)	
Vision/eyesight	Poor	2222 (79.61)	1557 (79.40)	665 (80.12)	.959
	Good	569 (20.39)	404 (20.60)	165 (19.88)	
Social contact with children	Frequently meets at least one child	1200 (43.00)	876 (44.67)	324 (39.04)	< .001
	Frequently meets all children	109 (3.91)	94 (4.79)	15 (1.81)	
	Occasionally meets all children	853 (30.56)	571 (29.12)	282 (33.98)	
	Rarely meets all children	629 (22.54)	420 (21.42)	209 (25.18)	
Social contact with neighbors	< 1/week	891 (31.92)	700 (35.70)	191 (23.01)	< .001
	≥ 1/week	1900 (68.08)	1261 (64.30)	639 (76.99)	
Components of SA					
Absence of chronic disease	Number of chronic diseases				
	0	2153 (77.14)	1482(75.57)	671 (80.84)	.002
	≥ 1	638 (22.86)	479 (24.43)	159 (19.16)	
No disability	Sum of ADL and IADL				.042
	0-1	2366 (84.77)	1680 (85.67)	686 (82.65)	
	≥ 2	425 (15.23)	281 (14.33)	144 (17.35)	
High cognitive function	MMSE-K ≥ 24	1660 (59.48)	1231 (62.77)	429 (51.69)	< .001
	MMSE-K < 24	1131 (40.52)	730 (37.23)	401 (48.31)	
Active social engagement	Number of participations in activities				.007
	≥ 1	1790 (64.13)	1289 (65.73)	501 (60.36)	
	0	1001 (35.87)	672 (34.27)	329 (39.64)	
Satisfaction with one's life	Scores of life satisfaction				.009
	≥ 60	1545 (55.36)	1054 (53.75)	491 (59.16)	
	< 60	1246 (44.64)	907 (46.25)	339 (40.84)	

BMI=body mass index; ADL=activities of daily living; IADL=instrumental ADL; MMSE-K=Mini Mental State Examination; SA=Successful Aging tion (urban OR = 2.80, 95% CI:2.37-3.31; rural OR = 1.91, 95% CI:1.43-2.54) were found to be significantly associated with a higher risk of depressive symptoms compared to those who achieved each component of SA. There were no significant urban/rural differences in the association between the prevalence of depressive symptoms and active social engagement.

Discussion

This study investigated urban and rural differences in depressive symptoms over time and identified factors associated with the prevalence of depressive symptoms among older adults using data from the KLoSA (2006-2020). Our primary finding was that residential areas affect this prevalence over time after adjusting for control variables, and that there were differences between urban and rural areas. Since the baseline with no depressive symptoms at the first follow-up survey in 2008, the prevalence of depressive symptoms in rural older adults was higher than in the urban ones. However, as the duration of residence increased, the trend reversed, and older adults in urban areas showed an increased risk of depressive symptoms compared with those in rural areas.

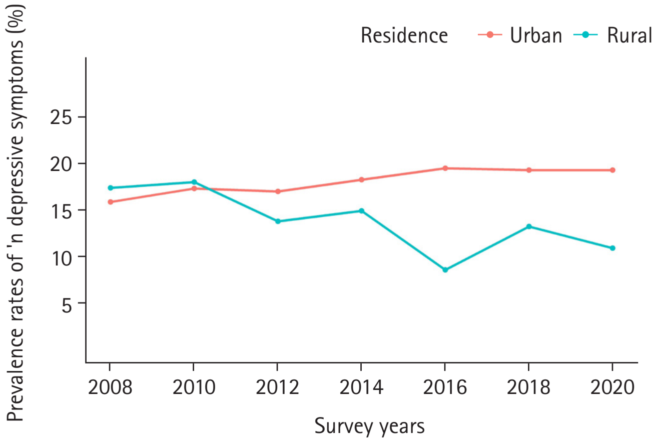

Figure 2. Prevalence of depressive symptoms from 2008 to 2020

While previous cross-sectional studies among Koreans or other Asian populations have reported no urban/rural differences in depressive symptoms [13,14] or were higher in rural areas [11,12,16], our longitudinal study revealed significant such differences, with higher rates in urban areas. Our finding is aligned with previous research results indicating that depressive symptoms are higher in urban than in rural residences in developed countries [6]. This suggests that longitudinal data may provide a better understanding of the impact of residency on depressive symptoms over time. Longitudinal studies may be valuable for gaining further insights into the mechanisms through which various neighborhood characteristics influence the differences in depressive symptoms between urban and rural residents, especially among older adults.

Furthermore, our findings suggest that the place of residence or neighborhood can influence depressive symptoms in older adults [9,10,34]. Previous studies have reported that prolonged exposure to urban environments may have a negative impact on depression in older populations, whereas rural environments may have protective factors or provide a supportive social context that mitigates mental health risks in older adults [6,35]. A Chinese longitudinal study that investigated differences in neigh-

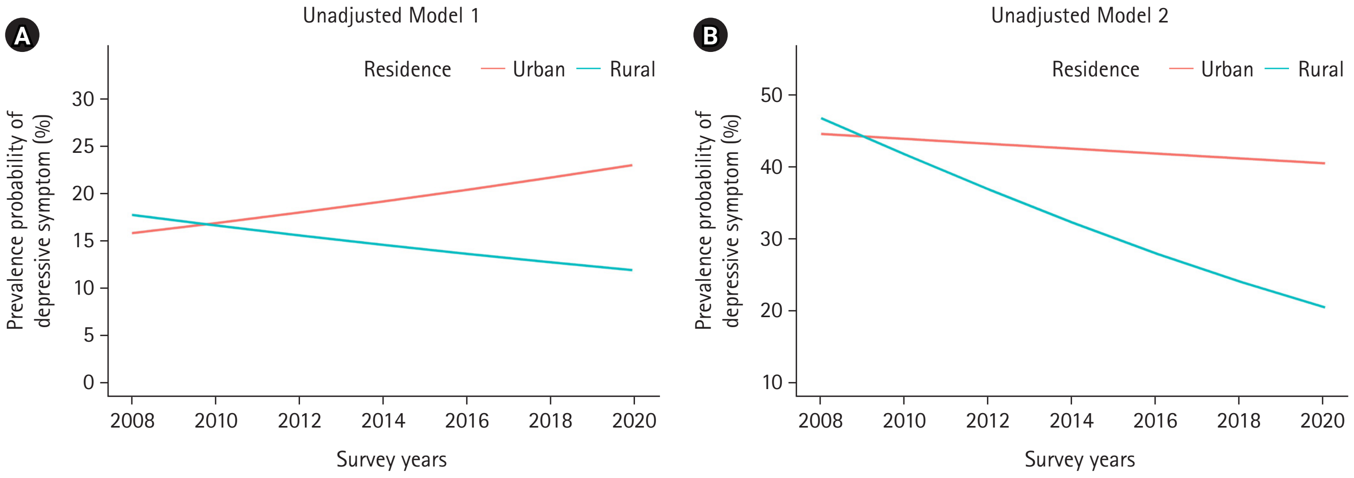

Figure 3. Effect plot of residential area on depressive symptoms (unadjusted Model 1A). Effect plot of residential area in depressive symptoms (adjusted Model 2B)

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Table 2. Effects of Residential Area on Prevalence of Depressive Symptoms: GEE Model

Variables		Model 1			Model 2		
		OR	95% CI	*p*	OR	95% CI	*p*
Time (wave)	2–8 wave	0.93	0.88–0.97	.002	0.81	0.77–0.86	< .001
Residential area	Urban	0.64	0.48–0.85	.002	0.60	0.44–0.82	.001
	Rural	1.00			1.00		
Time × Residential area	Urban	1.17	1.11–0.23	< .001	1.19	1.12–1.27	< .001
	Rural	1.00			1.00		
Sex	Men				1.09	0.88–1.35	.430
	Women				1.00		
Age (years)	≥ 85				0.69	0.45–1.03	.068
	75–84				1.02	0.87–1.20	.793
	65-74				1.00		
Education attainment	≥ Elementary				1.13	0.79–1.62	.506
	Middle school				1.03	0.69–1.52	.898
	High school				1.28	0.87–1.89	.208
	College or higher				1.00		
Marital status	Married				0.93	0.78–1.11	.440
	Unmarried				1.00		
Household income	High				1.32	1.09–1.61	.004
	High-middle				1.29	1.01–1.64	.042
	Middle-low				1.07	0.85–1.34	.572
	Low				1.00		
Medical insurance type	National health insurance				0.87	0.61–1.22	.414
	Medical aid				1.00		
Economic activity	Inactive				1.47	1.20–1.80	< .001
	Active				1.00		
Smoking	Never				1.02	0.78–1.34	.875
	Past				1.14	0.90–1.45	.286
	Current				1.00		
Alcohol consumption	No				1.47	1.21–1.78	< .001
	Yes				1.00		
Physical activity	No				1.22	1.06–1.39	.005
	Yes				1.00		
Regular diet	No				1.67	1.41–1.99	< .001
	Yes				1.00		
BMI	Underweight				1.31	1.07–1.59	.009
	Normal weight				1.00		
Hearing ability	Poor				1.06	0.94–1.20	.319
	Good				1.00		
Vision	Poor				1.30	1.07–1.58	.007
	Good				1.00		
Social contact with children	Frequently meets at least one child				1.07	0.93–1.24	.334
	Frequently meets all children				1.06	0.80–1.41	.672
	Occasionally meets all children				0.98	0.86–1.12	.768
	Rarely meets all children				1.00		
Social contact with neighbors	< 1/week				1.29	1.15–1.45	< .001
	≥ 1/week				1.00		
Presence of chronic diseases	Number of chronic diseases ≥ 1				1.36	1.20–1.55	< .001
	Number of chronic diseases = 0				1.00		
Disability	Sum of ADL and IADL ≥ 2				2.06	1.82–2.33	< .001
	Sum of ADL and IADL = 0-1				1.00		
High cognitive function	MMSE-K < 24				1.78	1.57–2.02	< .001
	MMSE-K ≥ 24				1.00		
Active social engagement	Participations in activities = 0				1.18	1.05–1.33	.007
	Participations in activities ≥ 1				1.00		
Satisfaction with own life	< 60				2.40	2.11–2.72	< .001
	≥ 60				1.00		

GEE=generalized estimating equation; BMI=body mass index.

Table 3. Factors Related to Depressive Symptoms by Urban and Rural Areas

Variables	Categories	Depressive symptoms (CES-D10 ≥ 4)					
		Urban			Rural		
		OR	95% CI	*p*	OR	95% CI	*p*
Sex	Women	1.16	0.90–1.49	.247	0.83	0.59–1.16	.281
	Men	1.00			1.00		
Age (years)	≥ 85	0.68	0.43–1.07	.099	0.70	0.36–1.35	.288
	75–84	1.10	0.92–1.32	.315	0.98	0.75–1.28	.882
	65–74	1.00			1.00		
Education attainment	Elementary school or lower	0.99	0.67–1.44	.942	1.12	0.40–3.14	.822
	Middle school	0.89	0.59–1.35	.593	1.41	0.46–4.29	.544
	High school	1.21	0.81–1.79	.358	1.57	0.52–4.71	.423
	College or higher	1.00			1.00		
Marital status	Married	0.89	0.74–1.08	.246	0.91	0.66–1.25	.552
	Unmarried	1.00			1.00		
Household income	High	1.25	1.01–1.54	.041	1.21	0.85–1.70	.287
	High-middle	1.38	1.05–1.81	.021	1.01	0.66–1.55	.949
	Middle-low	1.21	0.94–1.55	.132	0.62	0.42–0.91	.016
	Low	1.00			1.00		
Medical insurance type	National health insurance	0.87	0.61–1.25	.463	0.97	0.54–1.74	.918
	Medical aid	1.00			1.00		
Economic activity	Inactive	1.49	1.09–2.03	.013	1.21	0.89–1.65	.225
	Active	1.00			1.00		.
Smoking	Never	0.94	0.69–1.28	.698	1.37	0.87–2.17	.174
	Past	1.09	0.82–1.45	.571	1.37	0.84–2.24	.203
	Current	1.00			1.00		.
Alcohol consumption	No	1.44	1.14–1.81	.002	1.48	1.01–2.16	.042
	Yes	1.00			1.00		.
Physical activity	No	1.28	1.09–1.51	.003	1.01	0.72–1.42	.938
	Yes	1.00			1.00		
Regular diet	No	1.59	1.28–1.98	< .001	0.94	0.60–1.49	.792
	Yes	1.00			1.00		.
BMI	Underweight	1.33	1.02–1.72	.032	1.28	0.89–1.84	.184
	Normal weight	1.00			1.00		.
Hearing ability	Poor	1.05	0.90–1.23	.545	1.03	0.79–1.34	.829
	Good	1.00			1.00		.
Vision/eyesight	Poor	1.13	0.89–1.45	.314	2.13	1.25–3.61	.005
	Good	1.00			1.00		.
Social contact with children	Frequently meets at least one child	1.09	0.91–1.30	.379	0.90	0.67–1.20	.453
	Frequently meets all children	1.06	0.75–1.48	.755	1.05	0.54–2.06	.881
	Occasionally meets all children	1.08	0.91–1.29	.374	0.69	0.52–0.92	.011
	Rarely meets all children	1.00			1.00		
Social contact with neighbors	< 1/week	1.33	1.15–1.54	< .001	0.91	0.69–1.19	.483
	≥ 1/week	1.00			1.00		
Presence of chronic disease	≥ 1	1.37	1.17–1.59	< .001	1.26	0.98–1.62	.070
	0	1.00			1.00		
Disability	≥ 2	1.94	1.66–2.26	< .001	2.48	1.94–3.18	< .001
	0-1	1.00			1.00		
High cognitive function	< 24	1.66	1.42–1.94	< .001	1.80	1.36–2.38	< .001
	≥ 24	1.00			1.00		
Active social engagement	0	1.15	0.98–1.34	.082	1.03	0.81–1.31	.803
	≥ 1	1.00			1.00		
Satisfaction with own life	< 60	2.80	2.37–3.31	< .001	1.91	1.43–2.54	< .001
	≥ 60	1.00			1.00		

BMI=body mass index.

borhood stressors associated with depressive symptoms among older adults in rural and urban settings found that, for the former, neighborhood stressors were primarily linked to the physical environment, while among the latter, these were associated with the social environment [36]. As such, depressive symptoms in older adults may be particularly influenced by the social environment in their living area [10,37]. However, there are currently no measurements of residential environmental variables in Korea's aging panel data, preventing the analysis of residential characteristics that may affect depressive symptoms. In Korea, studies on neighborhood effects have been relatively scarce compared to those on various individual level causes of depression [7,16,34]. Therefore, future research in this area is warranted.

In this study, the prevalence of depressive symptoms is associated with SA and social contact in both urban and rural areas. SA has become essential for describing the quality of aging and promoting health in older adults [38]. Here, a low risk of depressive symptoms in older adults was associated with all five SA components, which supports previous findings [22,23]. Some subdomains of SA and the risk of depressive symptoms differed slightly between urban and rural older adults. Those with one or more chronic diseases living in urban areas had a higher risk than their rural counterparts. Meanwhile, in urban areas, the likelihood (OR = 2.80) of low life satisfaction was higher than in rural areas, where the OR for the presence of disability was 2.48, which was relatively higher than in urban areas. These findings imply that, unlike in urban-dwelling older adults, the presence or absence of a daily living disability has a greater effect on the prevalence of depressive symptoms in rural older adults than the number of chronic diseases. Depressive symptoms are common among older people with chronic diseases, cognitive impairment, or disabilities [1,39]. The mental health of older adults can be improved through nursing interventions that enhance the key components of SA tailored to the characteristics of urban and rural residential areas.

Less social contact with neighbors was associated with a higher risk of depressive symptoms in urban areas, whereas in the rural ones, occasional social contact with all children was associated with a lower risk of developing depressive symptoms. This finding is consistent with the results of previous studies showing differences in crucial social support resources between urban and rural areas [15,24,25]. In a systematic review of research on older adults living in Asian communities, those with a good overall degree of social support—including living with their families, having a wide social network, and having more contact with family and friends—were = more likely to have fewer depressive symptoms [24]. Family support has a greater influence on depression among community-dwelling older adults in Asian than in Western populations. This indicates that family institutions should be incorporated into programs and interventions designed to address depression in the Asian context [24]. Encouraging rural older adults to form social support networks with their children and urban older adults with their neighbors may help prevent depressive symptoms among those living in the community.

One limitation of this study is that it did not explore the potential mechanisms accounting for changes and differences in rural/urban depressive symptoms due to the use of KLoSA data. Cross-sectional studies have found significant associations between the physical and social environments of a community and depression or depressive symptoms. In future research, incorporating environmental data into the study design can help investigate the longitudinal social and physical environments that contribute to rural/urban mental health disparities. Another limitation is related to the follow-up period, which extended from 2008 to 2020 after the 2006 baseline. Unfortunately, we were unable to analyze the urban and rural older adults who were excluded from the survey due to death during this time frame. This exclusion could have potentially introduced selection bias.

Conclusions

This study utilized a longitudinal sample of Korean older adults to identify changes in the prevalence of depressive symptoms between urban and rural residential areas over time. Unlike previous cross-sectional studies, our findings reveal that the urban prevalence increased over time compared to the rural one, highlighting the influence of residential areas. Furthermore, our study confirmed that this prevalence is associated with components of SA and social contact with neighbors or children, with some variations observed based on pertaining to urban or rural residential areas.

These findings not only offer valuable insights into the relationship between residential areas and depressive symptoms but also highlight the necessity of nursing approaches that consider the characteristics of the living environments for reducing health disparities between regions. It highlights the need to accordingly tailor nursing interventions to ensure SA as well as social support from children and neighbors to prevent depression.

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Conflict of interest

The authors declared no conflict of interest.

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None.

Authors' contributions

Bongjeong Kim contributed to conceptualization, methodology, and writing - original draft, review & editing. Jinseub Hwang, Dohyang Kim contributed to data curation, formal anlaysis, and visualization. Soo Jin Kang contributed to methodology, and writing - original draft, review & editing.

Data availability

Publicly available datasets were analyzed in this study. These data are here: (https://survey.keis.or.kr/eng/klosa/klosa01.jsp).

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References

1. Kok RM, Reynolds III CF. Management of depression in older adults: A review. Journal of American Medical Association. 2017;317(20):2114–2122. https://doi.org/10.1001/jama.2017.5706
2. Shin J, Cho E. Trajectories of depressive symptoms among community-dwelling Korean older adults: Findings from the Korean longitudinal study of aging (2006-2016). BMC Psychiatry. 2022;22(1):246. https://doi.org/10.1186/s12888-022-03905-3
3. World Health Organization. Depression [Internet]. Geneva: World Health Organization. 2022 [Cited 2023 Nov 9]. Available from: https://www.who.int/health-topics/depression#tab=tab_2
4. Lee YK, Kim SJ, Hwang NH, Yim JM, Chu BH, Nam EH, et al. The survey on the actual conditions of older persons in Korea. Policy Report. Sejong: Ministry of Health and Welfare; 2020 November. Report No.: 11-1352000-000672-12.
5. Murphy RA, Hagaman AK, Reinders I, Steeves JA, Newman AB, Rubin SM, et al. Depressive trajectories and risk of disability and mortality in older adults: Longitudinal findings from the health, aging, and body composition study. Journals of Gerontology: Series A, Biological Sciences and Medical Sciences. 2016;71(2):228–235. https://doi.org/10.1093/gerona/glv139
6. Purtle J, Nelson KL, Yang Y, Langellier B, Stankov I, Diez Roux AV. Urban-rural differences in older adult depression: A systematic review and meta-analysis of comparative studies. American Journal of Preventative Medicine. 2019;56(4):603–613. doi: 10.1016/j.amepre.2018.11.008. Epub 2019 Feb 16. PMID: 30777704.
7. Kim BJ. Individual and community-level factors affecting depressive symptoms among Korean older adults. Journal of Wellness. 2020;15(4):695–706. https://doi.org/10.21097/ksw.2020.11.15.4.695
8. Leggett A, Zarit SH. Prevention of mental disorder in older adults: Recent innovations and future directions. Generations. 2014;8(3):45–52.
9. Diez Roux AV, Mair C. Neighborhoods and health. Annals of the New York Academy of Sciences. 2010;1186:125–145. https://doi.org/10.1111/j.1749-6632.2009.05333.x
10. Kim D. Blues from the neighborhood? Neighborhood characteristics and depression. Epidemiologic Reviews. 2008;30:101–117. https://doi.org/10.1093/epirev/mxn009
11. Li LW, Liu J, Xu H, Zhang Z. Understanding rural-urban differences in depressive symptoms among older adults in China. Journal of Aging and Health. 2016;28(2):341–362. https://doi.org/10.1177/0898264315591003
12. Sasaki Y, Shobugawa Y, Nozaki I, Takagi D, Nagamine Y, Funato M, et al. Rural-urban differences in the factors affecting depressive symptoms among older adults of two regions in Myanmar. International Journal of Environmental Research and Public Health. 2021;18(6):2818. https://doi.org/10.3390/ijerph18062818
13. Kim JM, Stewart R, Shin IS, Yoon JS, Lee HY. Lifetime urban/rural residence, social support and late-life depression in Korea. International Journal of Geriatric Psychiatry. 2004;19(9):843–851. https://doi.org/10.1002/gps.1175
14. Kang HW, Park KM. Comparison of correlation of depression in late-life between urban and rural areas. Journal of Korean Gerontological Society. 2012;32(1):129–143.
15. Kim C, Chang EJ, Kim CY. Regional differences in the effects

of social relations on depression among Korean elderly and the moderating effect of living alone. Journal of Preventative Medicine and Public Health. 2021;54(6):441–450. https://doi.org/10.3961/jpmph.21.337

16. Kim S, Cho S, Morgan MR. Neighborhood and depressive symptoms in older adults living in rural and urban regions in South Korea. Healthcare (Basel, Switzerland). 2023;11(4):476. https://doi.org/10.3390/healthcare11040476
17. Kim KM, Kim JH, Rhee HS. A study on depression levels and influencing factors in the elderly: A comparison between low-income and ordinary-income households. Health and Social Welfare Review. 2020;40(3):286–314. https://doi.org/10.15709/hswr.2020.40.3.286
18. Kim JH, Park EC, Lee SG, Lee Y, Jang SI. Effects of social integration on depressive symptoms in Korea: Analysis from the Korean Longitudinal Study of Aging (2006-12). Australian Health Review : A Publication of the Australian Hospital Association. 2017;41(2):222–230. https://doi.org/10.1071/AH16029
19. Fernández-Ballesteros R. The concept of successful aging and related terms. In: Fernández-Ballesteros R, Benetos A, Robine J-M, editors. The Cambridge Handbook of Successful Aging. Cambridge: Cambridge University Press; 2019. p. 6–22.
20. Choi HJ, Han CK. Impact of successful aging in old age on trajectories of depression. Journal of the Korean Gerontological Society. 2021;41(6):1037–1054. https://doi.org/10.31888/JKGS.2021.41.6.1037
21. Jeste DV, Savla GN, Thompson WK, Vahia IV, Glorioso DK, Martin AS, et al. Association between older age and more successful aging: Critical role of resilience and depression. The American Journal of Psychiatry. 2013;170(2):188–196. https://doi.org/10.1176/appi.ajp.2012.12030386
22. Kim M. Cross-age networks, successful aging, and depression among middle-aged South Koreans living in Seoul. Journal of Intergenerational Relationships. 2021;19(1):35–55. https://doi.org/10.1080/15350770.2021.1868220
23. Nari F, Jang BN, Kim S, Jeong W, Jang SI, Park EC. Association between successful aging transitions and depressive symptoms among older Korean adults: Findings from the Korean Longitudinal Study of Aging (2006-2018). BMC Geriatrics. 2021;21(1):352. https://doi.org/10.1186/s12877-021-02250-6
24. Tengku Mohd TAM, Yunus RM, Hairi F, Hairi NN, Choo WY. Social support and depression among community dwelling older adults in Asia: A systematic review. BMJ Open. 2019;9(7):e026667. https://doi.org/10.1136/bmjopen-2018-026667
25. Green MJ, Whitley E, Niedzwiedz CL, Shaw RJ, Katikireddi SV. Social contact and inequalities in depressive symptoms and loneliness among older adults: A mediation analysis of the English Longitudinal Study of Ageing. SSM - Population Health. 2021;13:100726. https://doi.org/10.1016/j.ssmph.2021.100726
26. Boo KC, Chang JY. Korean longitudinal study of ageing: Research design for international comparative studies. Survey Research. 2006;7(2):97–122.
27. Anderson EM, Malmgren JA, Carter WB, Patrick DL. Screening for depression in well older adults: Evaluation of short form of the CES-D (Center for Epidemiologic Studies Depression Scale). American Journal of Preventative Medicine. 1994;10(2):77–84. https://doi.org/10.1016/S0749-3797(18)30622-6
28. Kohout FJ, Berkman LF, Evans DA, Cornoni-Huntley J. Two shorter forms of the CES-D (Center for Epidemiological Studies Depression) depression symptoms index. Journal of Aging and Health. 1993;5(2):179–193. https://doi.org/10.1177/089826439300500202
29. Irwin M, Artin KH, Oxman MN. Screening for depression in the older adult: Criterion validity of the 10-item Center for Epidemiological Studies Depression Scale (CES-D). Archives of Internal Medicine. 1999;159(15):1701–1704. https://doi.org/10.1001/archinte.159.15.1701
30. Lu W, Pikhart H, Sacker A. Domains and measurements of healthy aging in epidemiological studies: A review. The Gerontologist. 2019;59(4):e294–e310. https://doi.org/10.1093/geront/gny029
31. Teater B, Chonody JM. What attributes of successful aging are important to older adults? The development of a multidimensional definition of successful aging. Social Work in Health Care. 2020;59(3):161–179. https://doi.org/10.1080/00981389.2020.1731049
32. Kim HJ, Min JY, Min KB. Successful aging and mortality risk: The Korean longitudinal study of aging (2006-2014). Journal of the American Medical Directors Association. 2019;20(8):1013–1020. https://doi.org/10.1016/j.jamda.2018.12.010
33. Feng Q, Son J, Zeng Y. Prevalence and correlates of successful ageing: A comparative study between China and South Korea. European Journal of Ageing. 2015;12(2):83–94.
34. Hwang JH, Kim YJ. Neighborhood effect on elderly depression in Republic of Korea. International Journal of Environmental Research and Public Health. 2023;20(6):5200. https://doi.org/10.3390/ijerph20065200

35. Bonnell LN, Clifton J, Rose GL, Waddell EN, Littenberg B. Urban-rural differences in mental and physical health among primary care patients with multiple chronic conditions: A secondary analysis from a randomized clinical trial. International Journal of Environmental Research and Public Health. 2022;19(23):15580. https://doi.org/10.3390/ijerph192315580

36. Wang Y, Chen YC, Shen HW, Morrow-Howell N. Neighborhood and depressive symptoms: A comparison of rural and urban Chinese older adults. The Gerontologist. 2018;58(1):68–78. https://doi.org/10.1093/geront/gnx063

37. Barnett A, Zhang CJP, Johnston JM, Cerin E. Relationships between the neighborhood environment and depression in older adults: A systematic review and meta-analysis. International Psychogeriatrics. 2018;30(8):1153–1176. https://doi.org/10.1017/S104161021700271X

38. Kim BJ. Individual and environmental factors associated with successful aging among Korean older adults: Multilevel analysis of cross-sectional nationwide survey data. Archives of Gerontology and Geriatrics. 2023;113:105062. https://doi.org/10.1016/j.archger.2023.105062

39. Pocklington C. Depression in older adults. British Journal of Medical Practitioners. 2017;10(1):a1007.

Appendix Table 1. Changes of Prevalence of Depressive Symptoms over the Survey Years

Survey Year	Total			Urban		Rural	
	N	No	Yes	No	Yes	No	Yes
		n (%)		n (%)		n (%)	
2008	2403	2016 (83.90)	387 (16.10)	1381 (84.36)	256 (15.64)	635 (82.90)	131 (17.10)
2010	2172	1792 82.50)	380 (17.50)	1221 (82.84)	253 (17.16)	571 (81.81)	127 (18.19)
2012	1963	1651 (84.11)	312 (15.89)	1108 (83.06)	226 (16.94)	543 (86.33)	86 (13.67)
2014	1778	1477 (83.07)	301 (16.93)	989 (82.07)	216 (17.93)	488 (85.17)	85 (14.83)
2016	1563	1313 (84.01)	250 (15.99)	848 (80.53)	205 (19.47)	465 (91.18)	45 (8.82)
2018	1361	1126 (82.73)	235 (17.27)	744 (80.69)	178 (19.31)	382 (87.02)	57 (12.98)
2020	1125	938 (83.38)	187 (16.62)	619 (80.70)	148 (19.30)	319 (89.11)	39 (10.89)

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Influencing Factors for Work Engagement of COVID-19 Response Workers in Public Health Centers: Based on the Job Demands-Resources Model

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Purpose: This study aimed to identify the influencing factors for work engagement of COVID-19 response workers in public health centers based on the JD-R model.
Methods: The participants were 119 civil servants and professionals of 20 public health centers with at least 6 months of work experience and have experience of COVID-19 response tasks in cities, districts and counties. The collected data were analyzed by descriptive statistics, t-test, ANOVA, Pearson's correlation coefficient and multiple regression using IBM SPSS 27.0.
Results: The factors influencing work engagement were age, career development opportunity, and person-job fit. The explanatory power of these variables was 61%.
Conclusion: In order to enhance the work engagement of public health center workers in responding to future infectious disease outbreaks, it is necessary to develop various strategies such as assigning job roles that aligned with individual characteristics, providing career growth opportunities even during infectious disease outbreaks, and designing tasks by taking into account age.

Keywords: Work Engagement; Public Health Practice; COVID-19; Occupational Stress; Burnout

Introduction

1. Background

As the coronavirus disease (COVID-19) spread rapidly around the world in 2020, each community in Korea focused on infection control in response to COVID-19 centered on public health centers for responding to COVID-19 infections simultaneously occurring and spreading across the country on a large-scale [1]. During the COVID-19, public health centers completely suspended or partially adjusted most health services, including various health promotion programs such as chronic disease management programs, screenings, tests, and focused on responding to the spread of COVID-19. In Korea, public health centers played a pivotal role in infection prevention and control against COVID-19 that rapidly spread to communities, and the dedication and passion of COVID-19 response workers at public health centers served as the main impetus for Korea' effective responses to COVID-19 [2].

Work engagement enables individuals to perform their job duties with enthusiastic attitude and to willingly take on even challenging tasks [3]. Persons with a high level of work engagement occupy themselves with their duties sufficiently energetically despite the job stress and work engagement enables them to immerse themselves in their tasks and carry them out completely [4]. In a previous study on work engagement among public health workers during the COVID-19, it was found that a high

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level of work engagement not only has a positive impact on individuals' growth and development, but it can also improve organizational performance [5]. In light of these findings, to effectively respond to future outbreaks of new and re-emerging infectious diseases, there is a need to examine work engagement among the COVID-19 response workers of public health centers in Korea.

Theories on nursing practice perform the roles of explaining, exploring, and predicting phenomena in nursing, so it is necessary to use an appropriate theoretical framework to effectively explore factors influencing work engagement among the COVID-19 response workers of public health centers. The Job Demands-Resources model (JD-R model) is well known as a theory that proposes job demands and job resources explain organizational performance through strain and motivation [6]. The JD-R model includes dual processes: the job demands process, which is the energy depletion process, and the job resources process, which is the motivational process [6]. According to a previous study, job demands such as job stress increase burnout and consequently reduce work engagement, while job resources such as resilience and career development opportunities generate motivation and have a positive effect on work engagement [6].

COVID-19 response workers at public health centers had to struggle with overwhelming workloads in a situation where they were not sufficiently prepared to prevent the spread of an emerging infectious disease, endured poor working conditions due to a severe shortage of workers, and were not guaranteed regular work hours or holidays during a very long period. A number of studies reported that the continuous heavy workloads of healthcare workers during the COVID-19 in their burnout, posing a major threat to their jobs and health [7]. Meanwhile, few studies have been conducted on the effects of a high level of job stress and burnout on work engagement among COVID-19 response workers of public health centers in Korea, so there is a need to examine the relationship between the factors.

According to the JD-R model, job resources such as resilience and career development opportunities increase motivation and thereby improve work engagement even in situations involving excessive job demands [6]. Career development opportunities are defined as members' perception of various learning and development opportunities provided by the organization. It has been reported that members who have a greater degree of career development opportunities through the performance of job duties or tasks in the organization show a higher level of work engagement because they perceive that they are able to continuously develop their capabilities and grow professionally through the capability development process [8]. Such findings suggest there is a need to analyze whether resilience and career development opportunities had a positive impact on COVID-19 response workers even in unpredictable and various situations such as the COVID-19 situation.

In recent years, there has been growing interest in the impact of person-job fit on organizational performance. Person-job fit refers to the degree to which an individual's responsibilities and tasks required by his or her specific job position match his or her interests and capabilities [9]. In several previous studies, person-job fit has been shown to be positively associated with individuals' job satisfaction, work engagement, and organizational immersion, and a study of public health center nurses also found that person-job fit has a positive effect on work engagement [10]. However, few studies have so far been conducted on the relationship between person-job fit and work engagement among healthcare workers in the COVID-19, so it is necessary to investigate the relationship between the two factors.

The WHO has announced its prediction that recurrent epidemic outbreaks caused by new infectious diseases such as COVID-19 may occur at any time in the future, as currently observed in the COVID-19 [11]. In this situation, it is important to systematically support healthcare workers so that they can engage in their work with enthusiasm even in infectious disease outbreak by identifying factors influencing work engagement among the workers of public health centers, the frontline organizations responding to the outbreaks of emerging and re-emerging infectious diseases. Therefore, this study aimed to identify explore factors affecting work engagement. To provide basic data for establishing effective policy in the event of an emerging infectious disease outbreak crisis in the future.

2. Conceptual framework

According to the JD-R model, job demands have been shown to increase strain and thereby reduce motivation, and job resources have been found to have a positive effect on motivation [6]. Based on the JD-R model, this study defined job demands as job stress, strain as burnout, job resources as resilience and career development opportunities, and motivation as work engagement. In addition, based on a previous research [10] reporting that person-job fit has a positive effect on work engagement, this study also posited the relationship to examine how person-job fit affects work engagement.

Methods

1. Study design

This study is a descriptive survey research to identify factors affecting work engagement among civil servants and professionals working at public health centers during the COVID-19.

2. Participants

The target population of this study was civil servants and professionals working at public health centers in 20 areas including cities, counties, and districts in G Province. The inclusion criteria were as follows: 1) person with minimum 6 months of working experience at a public health center; 2) person with working experience of as a COVID-19 response worker during the period from January 2020 to June 2022. Part-time workers and medical staff were excluded from the study because their work characteristics were different from those of public health centers.

The sample size of this study was calculated using G*power 3.1.9.7 by applying a significance level (α) of .05, a medium effect size of .15, a power (1-β) of .80, 10 predictor variables, and the statistical technique of regression analysis. As a result, the minimum sample size was calculated to be 118 people, but considering the dropout rate of 10%, a total of 130 copies were distributed. All the 130 copies were collected, and a total of 119 copies were used in the final analysis, excluding 11 copies with insincere responses.

3. Measures

The general characteristics of the participants were examined using a total of 6 items about gender, age, marital status, location of the public health center, work period, and position. In addition, the participants' work-related characteristics about COVID-19 response tasks were examined using a total of 7 items about experience of abrupt task, time of notification about abrupt task, satisfaction with compensation related to COVID-19, satisfaction with work assignment related to COVID-19, satisfaction with the working support system related to COVID-19, satisfaction with the current job, and requirements to prepare for a future infectious disease disaster.

1) Job stress

Job stress was measured using the Korean Occupational Scale Short Form (KOSS-SF) developed by Jang et al. [12], which is a tool for assessing occupational stress among workers in Korea. The instrument was used excluding some items. In particular, this study did not use four items on workplace culture among the sub-domains because they were suitable for the COVID-19. In addition, two items on job insecurity were also excluded because they were not related to the characteristics of civil servants working at public health centers. The instrument used consists of a total of 18 items in the following five subdomains: job demands (4 items), insufficient job control (4 items), interpersonal conflict (3 items), organizational system (items), and lack of reward (3 items). Each item is rated on a 4-point Likert scale ranging from 1 point (='Strongly disagree') to 4 points (='Strongly agree'). Higher scores indicate higher levels of job stress. As for the reliability of the tool, the value of Cronbach's α was .92 for the original tool, and it was calculated as .86 in this study.

2) Burnout

Burnout was measured using a Korean adapted version of the Burnout Measure Short Version (BMS) developed by Malach-Pine [13], and the Korean version used was developed by Cho [14]. This scale consists of a total of 10 items in the following three subdomains: physical exhaustion (3 items), emotional exhaustion (3 items), and mental exhaustion (4 items). Each item is rated on a 7-point Likert scale ranging from 1 point (='Never') to 7 points (='Always'), and higher scores indicate higher levels of burnout. Regarding the reliability of the tool, the value of Cronbach's α was reported as .86 for the original tool and as .89 in Cho [14], and it was calculated as .93 in this study.

3) Resilience

Resilience was assessed using a Korean version of the resilience scale from the Psychological Capital Questionnaire (PCQ) developed by Luthans et al. [15]. The resilience scale used was the Korean version presented on the website of Mind Garden (https://www.mindgarden.com), and it was used after receiving approval for use from Mind Garden. The tool contains 6 items in total, each item is rated on a 6-point Likert scale ranging from 1 point (='Strongly disagree') to 6 points (='Strongly agree'), and higher scores indicate higher levels of resilience. The value of Cronbach's α was reported as .87 for the original tool, and it was calculated as .92 in this study.

4) Career development opportunities

Career development opportunities were measured using a Korean version of the scale for career development opportunity included in the Questionnaire on the Experience and Evaluation of Work (QEEW 2.0) developed by Van Veldhoven [16]. The Korean version used in this study was presented by Im [17], who developed it by translating and adapting the original scale. This assessment tool contains 6 questions in total. Each item is rated on a 5-point Likert scale ranging from 0 points (= 'Strongly disagree') to 4 points (= 'Strongly agree'), and a higher score indicates a greater degree of career development opportunities. The value of Cronbach's α was reported as .87 for the original tool and as .87 in Im [17], and it was calculated as .83 in this study.

5) Person-job fit

Person-job fit was measured using the six-item tool developed by Yang [18]. This tool is designed to measure the degree of match between an individual' abilities, aptitude, and values and the demands and rewards of a specific job. Each item is rated on a 5-point Likert scale ranging from 1 point (= 'Strongly disagree') to 5 points (= 'Strongly agree'), and higher scores indicates higher levels of person-job fit. The value of Cronbach's α was reported as .98 in Yang [18] and calculated as .93 in this study.

6) Work engagement

Work engagement was assessed using a Korean version of the Utrecht Work Engagement Scale (UWES) developed by Schaufeli & Bakker [19], and the Korean version of the UWES was developed by Yi et al. [20]. This scale contains a total of 17 items in the following three subdomains: vigor (6 items), dedication (5 items), and absorption (6 items). Each item is rated on a 5-point Likert scale from 1 point (= 'Never') to 5 point (= 'Always'), and higher scores indicate higher levels of work engagement. The value of Cronbach's α was reported as .98 for the original scale and as .86~.87 in Yi et al. [20], and it was calculated as .93 in this study.

4. Data collection

After receiving approval from the IRB of Gyeongsang National University (IRB No.: GIRB-A22-Y-0075), data was collected from the participants of the job training for civil servants and professionals of the integrated health promotion program of G Province in July 2022. The researcher gave the participants explanations about the purpose and methods of the study, confidentiality of personal information, voluntary consent to participate in the study, and participants' right to refuse to participate. A questionnaire survey was conducted only with people who understood the purpose and content of the study and gave written informed consent to participate in the study after receiving sufficient explanations about the study. It took approximately 10 to 15 minutes to complete the questionnaire, and the completed questionnaires were collected after the respondents put them in sealed envelopes. The participants who completed the survey were given a small gift as a token of appreciation for their participation.

5. Statistical analysis

The statistical analysis of the collected data was conducted using IBM SPSS/WIN Ver. 27.0 as follows. First, the general and work-related characteristics of the participants were analyzed by using the frequency, percentage, mean, and standard deviation. Second, the frequency, percentage, mean, and standard deviation were calculated to analyze the levels of job stress, burnout, resilience, career development opportunities, person-job fit, and work engagement. Third, the t-test and ANOVA were used to investigate differences in work engagement according to general and work-related characteristics, and the post-hoc test was conducted using Scheffé test to determine the significance of differences between groups. Fourth, Pearson's correlation coefficient was used to examine the correlations between job stress, burnout, resilience, career development opportunities, person-job fit, and work engagement. Fifth, multiple regression analysis was performed to identify factors affecting work engagement.

Results

1. General characteristics and characteristics related to COVID-19 response tasks

The participants were mostly married women with a mean age of 44.8 years. Locations of public health centers that were workplaces, the proportion of city/district areas was similar to that of county areas. The average period of working was 9.98 ± 8.53 years and 53.8% was nurses as job position, 49.6% of the participants had experience of handling an abrupt task, and 33.8% received notification about abrupt tasks on the day of task assignment or the day before. 77.3% responded that they were dissatisfied or very dissatisfied with compensation for COVID-19 response tasks. As to work assignment related to COVID-19, 63.1% responded that they were dissatisfied or very dissatisfied. Regarding the working support system, 62.2% were dissatisfied or very dissatisfied. As for satisfaction with the current job, 81.5% were moderately satisfied or very satisfied. Requirements to prepare for future disasters, 57.1% responded that sufficient reward is needed, 53.8% answered that employment of flexible workforce is required, and 47.9% expressed the view that it is necessary to create an organizational support system (Table 1).

2. Degrees of job stress, burnout, resilience, career development opportunity, person-job fit, and work engagement

Among the participants of this study, the mean score for job stress was 2.46 ± 0.30 points, the mean score for burnout was

Table 1. General Characteristics and Experience related to COVID-19 Response Work (*N*=119)

Characteristics	Categories	n (%) or M ± SD
Gender	Male	10 (8.4)
	Female	109 (91.6)
Age (yr)	≤ 30	34 (28.6)
	40~49	41 (34.5)
	≤ 50	44 (37.0)
		44.8 ± 9.04
Marital status	Married	97 (81.5)
	Single	22 (18.5)
Location of public health center	City, District	64 (53.8)
	County	55 (46.2)
Work period(yr)	0.5~5	35 (29.4)
	> 5	84 (70.6)
		9.98 ± 8.53
Position	Nurse	64 (53.8)
	Non-nurse	55 (46.2)
Experiences of abrupt task	Yes	59 (49.6)
	No	60 (50.4)
Time of notification about abrupt task (n = 59)	0~1 day ago	20 (33.8)
	A few days ago	39 (66.2)
Requirements to prepare for future disasters[†]	Sufficient reward	68 (57.1)
	Employment of flexible workforce	64 (53.8)
	Construction of organizational support system	57 (47.9)
	Sufficient cooperation	41 (34.5)
	Education of disaster preparedness	36 (30.3)
	Flexible working system	35 (29.4)
	Proper budget	15 (12.6)
Satisfaction with compensation related to COVID-19	Very dissatisfied	37 (31.1)
	Dissatisfied	55 (46.2)
	Moderate	27 (22.7)
	Satisfied	0 (0.0)
	Very satisfied	0 (0.0)
Satisfaction with work assignment related to COVID-19	Very dissatisfied	19 (16.0)
	Dissatisfied	56 (47.1)
	Moderate	43 (36.4)
	Satisfied	1 (0.5)
	Very satisfied	0 (0.0)
Satisfaction with working support system related to COVID-19	Very dissatisfied	20 (16.8)
	Dissatisfied	54 (45.4)
	Moderate	42 (35.3)
	Satisfied	3 (2.5)
	Very satisfied	0 (0.0)
Satisfaction with current job	Very dissatisfied	3 (2.5)
	Dissatisfied	17 (4.3)
	Moderate	67 (56.3)
	Satisfied	30 (25.2)
	Very satisfied	2 (1.7)

[†] Multiple choice.

3.24 ± 1.12 points, the mean score for resilience was 4.35 ± 0.71 points, the mean score for career development opportunities was 1.88 ± 0.67 points, the mean score for person-job fit was 3.36 ± 0.70 points, and the mean score for work engagement was 3.24 ± 0.62 points (Table 2).

3. Differences in work engagement according to the general characteristics and work-related characteristics regarding COVID-19 response tasks

Among the general characteristics and work-related characteristics regarding COVID-19 response tasks of the participants, age (F = 5.45, p = .002), marital status (t = 2.94, p = .004), location of the public health center (t = 2.12, p = .036), and satisfaction with work assignment related to COVID-19 (F = 5.33, p = .006) had a significant effect on work engagement (Table 3). As a result of post-hoc analysis, the level of work engagement was higher in the 40-49 age group and the ≥ 50 age group than the ≤ 30 age group, and the married group showed a higher level of work engagement than the unmarried group. Also, the level of work engagement was higher in the group working at public health centers in a city or district than the group working at public health centers in counties. Additionally, the level of work engagement was higher in the group satisfied with work assignment related to COVID-19 than the group dissatisfied with it.

4. Correlations between job stress, burnout, resilience, career development opportunities, person-job fit, and work engagement

Work engagement was negatively correlated with job stress (r = -.40, p < .001) and burnout (r = -.38, p < .001), but it was positively correlated with resilience (r = .52, p < .001), career development opportunity (r = .48, p < .001), and person-job fit (r = .74, p < .001) (Table 4).

5. Factors affecting work engagement among the participants

In the multiple regression analysis, age, among the general characteristics, marital status, workplace, and satisfaction with work division, which were found to have a significant effect on work engagement, were converted into dummy variables and included as control variables. After controlling for these variables, multiple regression analysis was conducted job stress, burnout, resilience, career development opportunities, and person-job fit, which showed a significant correlation with work engagement. To check the basic assumptions of the regression model, the test for multicollinearity between independent variables was performed.

Table 2. Degrees of Job stress, Burnout, Resilience, Career Development Opportunity, Person-Job Fit, Work Engagement (*N*=119)

JD-R model concept	Variables	Categories	Range	Mean ± SD
Job demands	Job stress	Job demand	1~4	2.65 ± 0.56
		Insufficient job control		2.47 ± 0.31
		Interpersonal conflict		2.27 ± 0.58
		Organizational system		2.40 ± 0.50
		Lack of reward		2.49 ± 0.53
		Total		2.46 ± 0.30
Strain	Burnout	Physical exhaustion	1~7	3.80 ± 1.22
		Emotional exhaustion		2.93 ± 1.32
		Mental exhaustion		3.06 ± 1.20
		Total		3.24 ± 1.12
Job resources	Resilience		1~6	4.35 ± 0.71
	Career development opportunity		0~4	1.88 ± 0.67
	Person-job fit		1~5	3.36 ± 0.70
Motivation	Work engagement	Vigor	1~5	3.25 ± 0.67
		Dedication		3.42 ± 0.72
		Absorption		3.10 ± 0.68
		Total		3.24 ± 0.62

The tolerance values were all greater than 0.1, ranging from .398 to .675, and the Variance Inflation Factor (VIF) values were less than 10, ranging 1.416 to 2.473, indicating that there was no multicollinearity problem. The Durbin-Watson statistic was 1.70, which is close to 2, so it was confirmed that there was no autocorrelation in the residuals. The results of regression analysis showed that the regression model was statistically significant (F = 17.83, $p < .001$). Among the control variables, age was identified as an influencing factor for work engagement among the participants. Among the independent variables, the factor that had the greatest impact on work engagement was personal-job fit ($\beta = 0.49$, $p < .001$), followed by career development opportunities ($\beta = 0.16$, $p = .035$). These variables explained 61% of the total variance (Table 5).

Discussion

Based on the JD-R model and previous studies, this study aimed to investigate the relationships between job stress, burnout, resilience, career development opportunities, person-job fit, and work engagement, and identify factors affecting work engagement among healthcare workers at public health centers during the COVID-19. It is expected to contribute to the response to future emerging infectious disease outbreaks. In this study, 49.6% of the participants had the experience of unexpected abrupt tasks due to COVID-19 response tasks, and regarding the time of receiving notification about such abrupt tasks, 33.8% were notified on the day of task assignment or the day before, and 66.2% were informed a few days ago. During the COVID-19 period, public health centers were required to handle heavy job demands due to a sudden surge in workloads due to frequently changing infection control policies and urgently issued emergency orders [21]. It has been shown that unexpected abrupt tasks cause job stress due to its unpredictable nature and low control over one's work, and consequently, they greatly interfere with work as well as household and social activities, resulting in depression and decreased quality of life among workers [22]. Therefore, there is a need to consider appropriate strategies against abrupt tasks and their negative impact. In this study, the proportion of people dissatisfied with work assignment related to COVID-19 was 63.1%, and the proportion of people dissatisfied with the working support system was 62.2%. These results may be attributed to the fact that infection control measures taken in response to COVID-19 resulted in workload surges for the workers of public health centers, COVID-19 response tasks were not properly divided but concentrated in particular job positions [21], and the support system was also insufficient, leading to increased confusion. Therefore, it is necessary to prepare systems for appropriately responding to infectious disease outbreaks, such as adequate staffing for essential areas and an infectious disease response system, and these strategies require close cooperation with related government agencies.

Table 3. Differences in Work Engagement according to General Characteristics, Job Characteristics Experience related to COVID-19 (*N*=119)

Characteristics	Categories	Work engagement	
		Mean ± SD	t/F (*p*)
Gender	Male	2.91 ± 0.91	2.65 (.082)
	Female	3.27 ± 0.58	
†Age (yr)	≤ 30^{a}	2.90 ± 0.60	10.51 (< .001)
	40~49^{b}	3.25 ± 0.61	a < b
	≥ 50^{b}	3.49 ± 0.50	
Marital status	Married	3.32 ± 0.32	2.94 (.004)
	Single	2.91 ± 0.55	
Location of public health center	City, District	3.34 ± .0.64	2.12 (.036)
	County	3.11 ± 0.57	
Work period(yr)	0.5~5	2.97 ± 0.64	0.53 (.464)
	> 5	3.35 ± 0.57	
Position	Nurse	3.27 ± 0.65	0.85 (.358)
	None-nurse	3.20 ± 0.57	
Experiences of abrupt task	Yes	3.13 ± 0.61	-1.97 (.052)
	No	3.35 ± 0.60	
Time of notification about abrupt task (n = 59)	0~1 day ago	2.82 ± 0.70	3.48 (.067)
	A few days ago	3.27 ± 0.52	
Satisfaction with compensation related to COVID-19	Very dissatisfied	3.32 ± 0.75	0.46 (.631)
	Dissatisfied	3.21 ± 0.56	
	Neutral & Satisfied	3.20 ± 0.62	
†Satisfaction with work assignment related to COVID-19	Very dissatisfied^{a}	2.83 ± 0.83	5.33 (.006)
	Dissatisfied^{b}	3.28 ± 0.53	a < b
	Neutral & Satisfied^{b}	3.34 ± 0.52	
Satisfaction with working support system related to COVID-19	Very dissatisfied	3.09 ± 0.97	1.18 (.311)
	Dissatisfied	3.23 ± 0.52	
	Neutral & Satisfied	3.33 ± 0.52	
Satisfaction with Current job	Very dissatisfied	2.55 ± 1.14	2.49 (.086)
	Dissatisfied	3.13 ± 0.80	
	Neutral & Satisfied	3.28 ± 0.62	

†Scheffé test

Table 4. Correlation among Job stress, Burnout, Resilience, Career Development Opportunity, Person-Job Fit and Work Engagement (*N*=119)

Variables	1	2	3	4	5	6	7	8	9
	r (*p*)								
1. Job stress	1								
2. Physical exhaustion	.29 (.001)	1							
3. Emotional exhaustion	.31 (< .001)	.73 (< .001)	1						
4. Mental exhaustion	.39 (< .001)	.62 (< .001)	.81 (< .001)	1					
5. Burnout	.37 (< .001)	.85 (< .001)	.94 (< .001)	.91 (< .001)	1				
6. Resilience	-.28 (< .001)	-.32 (< .001)	-.46 (< .001)	-.43 (< .001)	-.45 (< .001)	1			
7. Career development opportunity	-.36 (< .001)	-.22 (.016)	-.25 (.006)	-.30 (.001)	-.29 (.001)	.31 (.001)	1		
8. Person-job fit	-.39 (< .001)	-.28 (.002)	-.33 (< .001)	-.45 (< .001)	-.40 (< .001)	.52 (< .001)	.48 (< .001)	1	
9. Work engagement	-.40 (< .001)	-.33 (< .001)	-.31 (.001)	-.38 (< .001)	-.38 (< .001)	.52 (< .001)	.48 (< .001)	.74 (< .001)	1

Table 5. Factors influencing of Work Engagement (*N*=119)

Variables	B	SE	β	t	*p*
Age (ref.=over 50)					
≤30	-0.29	0.11	-0.22	-2.50	.014
40~49	-0.19	0.08	-0.15	-2.28	.024
Marital status (ref.=single)	0.01	0.13	0.01	0.02	.893
Location of public health center (ref.=city)	-0.02	0.07	-0.02	-0.40	.583
Satisfaction with work assignment related to COVID-19 (ref. very dissatisfied)					
Dissatisfied	0.17	0.1	0.14	1.96	.108
Neutral & satisfied	0.18	0.11	0.15	1.80	.105
Job stress	-0.16	0.14	-0.08	-1.11	.588
Burnout	-0.01	0.04	-0.01	0.13	.983
Resilience	0.12	0.07	0.13	1.81	.073
Career development opportunities	0.16	0.06	0.16	2.19	.035
Person-job fit	0.43	0.07	0.49	6.03	<.001
Adj-R^2			.61		
R^2			.65		
F (*p*)			17.83 (<.001)		

The mean score for work engagement was found to be 3.24 points (range: 1 to 7 points). There are no previous studies to investigate work engagement among the workers of public health centers, work engagement in this study was slightly higher, compared to 3.06-3.17 points reported in previous studies of hospital nurses [23]. The results of this study seem to show that COVID-19 response workers at public health centers showed a relatively higher level of work engagement through personal sacrifice and passion with a sense of mission to prevent the spread of COVID-19 infections to the local communities in the context of the COVID-19 as a national disaster [2,21]. It is thought that follow-up research is needed to determine whether a high level of work engagement among public health center workers can be attributed to the special situation of COVID-19.

The mean score for job stress was 2.46 points (range: 1 to 4 points), which is a similar level to 2.47 points in a previous study among clinical nurses during the COVID-19 [24]. Among the sub-domains of job stress, job demands had the highest mean score at 2.65 points. In this regard, a previous study reported that response workers experienced a severe shortage of workforce due to the spread of COVID-19 and various changes related to COVID-19 [21], and unexpected abrupt tasks due to insufficient staffing levels as a result of the frequently changing COVID-19 situation are also presumed to have contributed to increased job stress. The mean score of burnout was found to be at a risk level with a mean score of 3.24 (range: 1 to 7 points). Since the first confirmed case of COVID-19 in Korea was detected in January 2020, Korea suffered five times of COVID-19 pandemics and many healthcare workers showed a high level of burnout as a result of emotional exhaustion and chronic fatigue [24-26]. Among the sub-domains of burnout, physical exhaustion showed the highest mean score of 3.80 points, and it is thought that the participants showed a serious level of physical exhaustion due to heavy workloads and insufficient rest. The negative consequences of job stress and burnout have been found to have a negative impact not only on the individual but also on organizational performance [27], so there is a need to pay attention to and improve job stress and burnout among healthcare workers of public health centers.

The mean score for resilience was 4.35 points (range: 1 to 6 points). This score is higher than 3.76 points among clinical nurses during COVID-19 [28]. Resilience helps individuals to overcome adverse situations and adapt to changing environments, and help them to perform their jobs properly [29]. Especially in a disease outbreak involving various and rapidly changings such as the COVID-19, importance of resilience more emphasized for response workers [30], so it is necessary to continuously maintain a high level of resilience. In particular, mindfulness-based programs have been effective in promoting resilience in infectious disease outbreak. [31], organization-level efforts are needed to improve resilience among public health workers at public health centers during the recovery phase of the COVID-19 as a disaster.

The mean score for career development opportunities was 1.88 points (range: 0-4 points), and this is lower than 2.31 points of tertiary general hospital nurses [17]. These results are presumed to suggest that the workers of public health centers did not perceive that their COVID-19 response tasks were helpful for the growth and development of their careers. According to a previous study, career development opportunities as a job resource are a factor that stimulates personal growth and development, and contribute to carrying out job tasks by increasing work engagement [32]. In this respect, career development opportunities in an infectious disease outbreak situation are very important, and organization-level attention and effort are needed to promote this factor. To this end, expansion of various forms of career development opportunities, including rewards and promotions, work guidelines that distinguish between the work system for disaster periods and the one for ordinary times, and online job training on infectious diseases by the Health and Welfare Human Resources Institute can be employed as strategies to provide career growth opportunities for response workers of public health centers.

The mean score for person-job fit was 3.36 points (range: 1 to 5 points), which is relatively higher than 3.21 points of nursing public officials [10], and 3.07 points of general civil servants [33]. According to a previous study, individuals are likely to perceive a good person-job fit when they feel comfortable about the jobs they pursue and get motivated by them, when they learn specific skills needed for their tasks at work and use them to perform their tasks, and when they acquire or exert capabilities, and a good person-job fit contributes to performance improvement [10]. It has also been reported that when individuals deem their jobs suitable for themselves, their morale is increased due to their pride in their job, and this perception gives them motivation for work, and has a positive impact on work performance [10]. In view of these findings, it is suggested that public health centers should explore strategies to improve person-job fit. If the organizational system is reorganized by considering the characteristics of each department as well as the characteristics of individual workers to ensure appropriate staffing and efficient task assignment in the event of emerging infectious disease outbreaks, it can be a useful strategy to improve person-job fit among response workers at public health centers.

In this study, factors affecting work engagement among COVID-19 response workers of public health centers were identified as age, career development opportunity, and person-job fit, and the total explanatory power of these variables for work engagement was 65%. Person-job fit was found to be the factor that has the greatest impact on work engagement among COVID-19 response workers of public health centers. The results of this study is consistent with a meta-analysis study on factors affecting work engagement among the members of domestic companies, and the meta-analysis reported that person-job fit was found to be the most important factor among job resources [33,34]. Person-job fit refers to the degree of match between a person's degree of knowledge, skills, and abilities required for a given job and the job demands of a job [9], and it is widely known as a variable influencing positive job performance such as job satisfaction and work engagement in public health center nurses and clinical nurses [10]. In an infectious disease outbreak situation, if the characteristics and personality traits of response workers of public health centers are well suited to job duties that they are currently performing, this good person-job fit will positively affect COVID-19 response tasks, thereby leading to the increase of work engagement and improvement of organizational performance, and it will also have a positive impact on public health and safety. In this respect, it is important to improve person-job fit among healthcare workers of public health centers. In the COVID-19, the response workers of public health centers experienced more difficulties due to increased confusion resulting from unsatisfactory work assignment and unfamiliar tasks [21]. The directors and officials of public health centers should make effort to allocate tasks based on the assessment of person-job fit even at ordinary times to ensure that task assignment will appropriately reflect individuals' interests, understanding, behaviors, skills, and needs. As a strategy for efficient task assignment based on person-job fit, it is necessary to provide education focused on practice training that is helpful for the actual performance of job duties rather than education focused on theoretical knowledge. Since civil servants in public health centers are required to have the ability to develop and plan health projects and manage cases even in infectious disease outbreak situations, customized job training for each job position is required for them. On the other hand, professional personnel in public health centers should be provided with practical education programs that will be helpful in the field of nursing practice. Appropriate staffing is also expected to contribute to improving person-job fit among professionals working at public health centers.

In this study, second impact factor on work engagement was career development opportunities. These results are consistent with a previous study of nurses reporting that it is a significant variable positively affecting work engagement [17]. Career development opportunities, which are one component of job resources [6], represent an individual's assessment of the degree to which the organization and job duties are useful for the growth and development of his or her career, and this factor can increase work engagement through individuals' perception that they can continuously develop and grow their capabilities at work through education and training [17,35]. Therefore, there is a need to consider establishing a system that can make people confident that their tasks in special situations such as an infectious disease outbreak will also be helpful for their career development. In particular, in the case of civil servants of public health centers, their promotion system usually requires a long period of time between promotions, so it may be difficult for them to recognize their work as a career development opportunity. In this regard, the introduction of a system such as the career development system for clinical nurses that is currently being implemented in domestic tertiary general hospitals may promote self-development of nursing personnel at public health centers, and thereby create career development opportunities.

In this study, among the general characteristics, age was found to be the only variable affecting work engagement. More specifically, among COVID-19 response workers of public health centers, the 30-49 age group showed a higher level of work engagement than the ≥50 age group. But almost studies of nurses reported that age was identified as a factor affecting work engagement, and the level of work engagement was found to increase with aging [29]. The results of this study are partially different from these findings. Generally, work engagement has been reported to increase with aging increased job flexibility and loyalty to the organization [29]. The different result from previous study is presumed to be due to the fact that the participants of this study included both civil servants and healthcare professionals, who can be divided into two groups in charge of different tasks. Thus, in a follow-up study, there is a need to examine the relationship between age and work engagement by distinguishing between civil servants and healthcare professionals in public health centers.

In short, based on the JD-R model, this study identified factors affecting work engagement among response workers at public health centers who experienced severe job stress and burnout due to unexpected abrupt tasks during COVID-19. It is a significant aspect that this is the first research attempt to examine the influences of resilience, career development opportunities, and person-job fit on work engagement during COVID-19, based on the JD-R model. However, it should be pointed out that this study has several limitations. First, because the participants of this study were workers of public health centers or branch offices of public health centers in 20 areas including cities, counties and districts in one province, it is difficult to generalize study findings to all public health centers in Korea. Second, because this study is a cross-sectional research, the present study could not clarify causal relationships between the factors influencing work engagement among COVID-19 response workers of public health centers. Third, the participants consisted of civil servants and professionals, and since these two groups are distinct from each other in terms of types of tasks, so there may be a limitation in the discussion of their work engagement.

Conclusions

Based on the JD-R model, this study attempted to examine the relationships between job stress, burnout, resilience, career development opportunities, person-job fit, and work engagement among COVID-19 response workers of public health centers, and identify factors influencing work engagement. As a result of multiple regression analysis, person-job fit, career development opportunities, and age were found to be significant influencing factors for work engagement, and the explanatory power of the variables was 61%. The results of this study suggest that for increase work engagement among healthcare workers of a future infectious disease outbreak, it is necessary to align tasks with individuals' characteristics in the process of work assignment, develop various strategies for providing career development opportunities even in infectious disease outbreak situations, and design work assignment by taking age into account.

Based on the results of this study, the following suggestions are presented. First, it was found that there were differences in the job demands for healthcare workers at public health centers among areas such as cities, counties, and districts depending on the situations of small-scale COVID-19 mass infections during the past three years. Therefore, in follow-up research, a replication study should be conducted by expanding the scope of research to public health centers including public health clinics in the cities, counties, and districts of different provinces. Second, although the JD-R model suggested that there are significant relationships between job stress, burnout, and work engagement, the results of this study did not show any significant association between them. Thus, a follow-up research should undertake a replication study to investigate relationships between the variables. Third, it is required to explore various strategies for increasing work engagement by distinguishing between civil servants and healthcare professionals at public health centers as two groups in charge of disparate tasks.

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Conflict of interest

Yeongmi Ha has been editorial board member of the Research in Community and Public Health Nursing. She was not involved in the review process of this manuscript. The authors declared no conflict of interest.

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Authors' contributions

Songran Park contributed to conceptualization, data curation, formal analysis, visualization, writing-original draft, review&editing, investigation, resources, software, and validation. Yeongmi Ha contributed to conceptualization, methodology, project administration, visualization, writing-original draft, review&editing, investigation, resources, software, supervision, and validation.

Data availability

The datasets generated and/or analyzed during the current study are not publicly available due to privacy concerns, but select data are available from the corresponding author upon reasonable request.

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References

1. Korea Center for Disease Control and Prevention. COVID-19 response guidelines (9-2 ed) [internet]. Chungju: Korea Center for Disease Control and Prevention; 2020 [cited 2022 Jan 10]. Available from: http://ncov.mohw.go.kr/
2. Lee MH, Park GH, Lee DE, Choi YI, Oh YH, Chang YS. South Korea's responses to COVID-19: Factors behind. Sejong: Science and Technology Policy Institute; 2020. 87 p.
3. Schaufeli WB, Bakker AB. Job demands, job resources, and their relationship with burnout and engagement: A multi-sample study. Journal of Organizational Behavior. 2004;25:295–315. https://doi.org/10.1002/job.248
4. García-Sierra R, Fernández-Castro J, Martínez-Zaragoza F. Work engagement in nursing: An integrative review of the literature. Journal of Nursing Management. 2016;24(2):101–111. https://doi.org/10.1111/jonm.12312
5. Fietta V, Bertoldo F, Gasperi L, Mazza C, Roma P, Monaro M. The role of work engagement in facing the COVID-19 pandemic among mental healthcare workers: An Italian study to improve work sustainability during emergency situations. Sustainability. 2023;15(4):3214. https://doi.org/10.3390/su15043214
6. Bakker AB, Demerouti E. The job demands-resources model: State of the art. Journal of Managerial Psychology. 2007;22(3):309–328. https://doi.org/10.1108/02683940710733115
7. Zerbini G, Ebigbo A, Reicherts P, Kunz M, Messman H. Psychosocial burden of healthcare professionals in times of COVID-19–a survey conducted at the University Hospital Augsburg. Germa Medical Science: GMS e-Journal. 2020;18:Doc05. https://doi.org/10.3205/000281
8. Bedeian AG, Kemery ER, Pizzolatto AB. Career commitment and expected utility of present job as predictors of turnover intentions and turnover behavior. Journal of Vocational Behavior. 1991;39(3):331–343. https://doi.org/10.1016/0001-8791(91)90042-K
9. Edwards JR. Person-job fit: A conceptual integration, literature review, and methodological critique. International review of Industrial and Organizational Psychology. 1991;6:287–357.
10. Park SH, Gwon DY, Nam HK. The effect of person-job fit and perceived organizational support on job satisfaction on the public health center nurses: Moderating effect of full-time public servants and temporary public servants. Journal of Korean Public Health Nursing. 2019;33(2):188–198. http://dx.doi.org/10.5932/JKPHN.2019.33.2.188
11. Chae SM. COVID-19 and Challenges for Future Disease Response. Health and Welfare Issue & Focus. 2020;5(374):1–8.
12. Chang SJ, Kang DM, Kim SA, Lee CG, Son DK, Kim HS, et al. Developing an occupational stress scale for Korean employees. Annals of Occupational and Environmental Medicine. 2005;17(4):297–317. https://doi.org/10.35371/kjoem.2005.17.4.297
13. Maslach-Pines A. The burnout measure short version. International Journal of Stress Management. 2005;12(1):78–88.

https://doi.org/10.1037/1072-5245.12.1.78

14. Cho YK. A structural equation model on new graduate nurses' turnover intentions and turnover [dissertation]. [Seoul]: Ewha Womans University; 2013. 128 p.
15. Luthans F, Avolio BJ, Avey JB. Psychological capital questionnaire [Internet]. Menlo Park, CA: Mind Garden Inc.; 2019 [cited 2019 Aug 15]. Available from: http://www.mindgarden.com/products/alqconsult.htm.
16. Van Veldhoven M, Prins J, Van der Laken P, Dijkstra L. QEEW2.0, 42 short scales for surveys research on work, well-being and performance. Amsterdam: SKB; 2015. 89 p.
17. Im YI. Nurses' intention to leave and organizational citizenship behavior: verification of the Job Demands-Job Resources model [dissertation]. [Seoul]: Yonsei University; 2018. 70 p.
18. Yang YJ. Hotel employees' person-environment fit influencing proactive behavior: focused on the mediating effect of perceived organizational support [master's thesis]. [Seoul]: Sejong University; 2009. 98 p.
19. Schaufeli WB, Salanova M, González-Romá V, Bakker AB. The measurement of engagement and burnout: A two sample confirmatory factor analytic approach. Journal of Happiness Studies. 2002;3:71–92. https://doi.org/10.1023/A:1015630930326
20. Yi R, Kim WS, Shin KH. The role of emotional labor strategies in the job demand-resource model with burnout and engagement - call centre employees case -. Korean Journal of Industrial and Organizational Psychology. 2006;19(4):573–596.
21. Son HM, Yang HR, Park B. Experiences of public officials for the COVID-19 response in the community health center. Journal of Korean Academy of Community Health nursing. 2021;32(4):578–592. https://doi.org/10.12799/jkachn.2021.32.4.578
22. Bamberg E, Dettmers J, Funck H, Krähe B, Vahle-Hinz T. Effects of on-call work on well-being: Results of a daily survey. Applied Psychology: Health and Well-Being. 2012;4(3):299–320. https://doi.org/10.1111/j.1758-0854.2012.01075.x
23. Ko MS, Lee HZ, Ko MS. Effects of nurses' social capital and job engagement on nursing performance: Focused on the mediating effects of organizational citizenship behavior. Journal of Korean Academy of Nursing Administration. 2017;23(1):42–51. http://doi.org/10.11111/jkana.2017.23.1.42
24. Park YJ. Cha KS, Lee KL. A study of the factors influencing burnout in clinical nurses throughout the COVID-19-A focus on physical symptoms, depression, infection stress, and occupational stress-. The Journal of Korean Nursing Research. 2021;5(3):11–23. https://doi.org/10.34089/jknr.2021.5.3.11
25. Yun SY, Ahn SB, Correlation between COVID-19 and nurses' job stress and burnout. HIRA Research. 2022;2(2):202–218. https://doi.org/10.52937/hira.22.2.2.e5
26. Hwang SY, Kwon KT. Burnout among healthcare workers during COVID-19 pandemic. Korean Journal of Healthcare-Associated Infection Control and Prevention. 2022;27(1):28–34. https://doi.org/10.14192/kjicp.2022.27.1.28
27. Lee JH. Effects of COVID-19 related peritraumatic distress and job stress on the nursing performance of clinical nurses. Journal of Korean Public Health Nursing. 2022;36(3):334–346. https://doi.org/10.5932/JKPHN.2022.36.3.334
28. Jeon KJ, Park MJ. The influence of emotional labor, positive psychological, capital, and rewards on the retention intention among coronavirus disease 2019 ward nurses in regional public hospitals. Journal of Korean Academic of Fundamental of Nursing. 2022;29(2):181–190. http://doi.org/10.7739/jkafn.2022.29.2.181
29. Moon IO, Park SK, Jung JM. Effects of resilience on work engagement and burnout of clinical nurses. Journal of Korean Academy of Nursing Administration. 2013;19(4):525–535. http://doi.org/10.11111/jkana.2013.19.4.525
30. Labrague LJ. Psychological resilience, coping behaviours and social support among health care workers during the COVID-19: A systematic review of quantitative studies. Journal of Nursing Management. 2020;29(7):1893–1905. https://doi.org/10.1111/jonm.13336
31. Kim AN, Kang H. The effects of mindfulness-based course delivered live online due to COVID 19 on college student's resilience. The journal of Learner-Centered Curriculum and Instruction. 2021;21(10):153–166. https://doi.org/10.22251/jlcci.2021.21.10.153
32. Demerouti E, Bakker AB. Schaufeli WB. The job demands-resources model of burnout. Journal of Applied Psychology. 2001;86(3):499–512. https://doi.org/10.1037/0021-9010.86.3.499
33. Rho SB, Kim JR. The individual-organizational suitability and individual-job suitability of front-line public officials effect on job enthusiasm: Mediating effect of self-efficacy. Journal of Digital Convergence. 2021;19(12):79–89. https://doi.org/10.14400/JDC.2021.19.12.079
34. Yoon SK. A meta-analysis of factors affecting work engagement of employees in Korea's corporate organizations. The Korean Journal of Human Resource Development Quarterly. 2022;24(3):167–210. https://doi.org/10.18211/kjhrdq.2022.24.3.006
35. Jawahar IM, Liu Y. Why are proactive people more satisfied with their job, career, and life? An examination of the role of work engagement. Journal of Career Development. 2016;44(4):344–358. https://doi.org/10.1177/0894845316656070

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Validity and Reliability of the Korean Version of the Diabetes Acceptance and Action Scale (DAAS-K)

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Purpose: The purpose of this study was to evaluate the validity and reliability of the Korean version of the Diabetes Acceptance and Action Scale-Revised (DAAS-R) for Korean patients with type 2 diabetes.
Methods: The survey was conducted from September 1, 2021, to September 30, 2021, through a survey institution for patients diagnosed with diabetes who understood the purpose of the study and voluntarily agreed to participate. A total of 231 individuals with type 2 diabetes participated in this study. After performing forward and backward translations of the original version of the Diabetes Acceptance and Action Scale-Revised (DAAS-R) into Korean, its constructive validity (confirmatory factor analysis), concurrent validity and reliability were assessed. Concurrent validity was confirmed through the correlation between acceptance and action, quality of life, diabetes self-stigma, and experiential avoidance.
Results: Construct validity, measured using confirmatory factor analysis, showed a good fit. The DAAS-K was positively correlated with acceptance and action, quality of life, and negatively correlated with diabetes self-stigma and experiential avoidance. As for internal reliability, the Cronbach's α of the DAAS-K was .95.
Conclusion: The DAAS-K can be applied to assess diabetes acceptance and action in Korean patients with type 2 diabetes and to compare the levels of psychological flexibility of patients with diabetes internationally.

Keywords: Acceptance and commitment therapy; Diabetes mellitus; Factor analysis, statistical; Psychometrics; Validation study

Introduction

Diabetes affects 537 million of the global population aged 20 to 79 years as of 2021, and is expected to increase to 783 million by 2045 [1]. Therefore, the economic and social burden required to manage diabetes is expected to increase [2]. Diabetes requires self-care, including a proper diet, exercising, and medical treatment [3]. It is very important for patients to practice self-care especially when visits to hospitals, clinics, or public health centers may be limited due to certain restraining factors, as during the coronavirus disease 2019 (COVID-19) pandemic. However, several psychosocial factors act as obstacles to self-care in patients with diabetes, such as disease-related stress and self-stigma [4]. Acceptance and commitment therapy (ACT) has recently received attention as an intervention method to reduce negative emotions, such as disease-related stress in patients with diabetes and to increase their self-care practices [5,6].

ACT is a cognitive-behavioral therapy, and an acceptance-centered approach that allows one to accept facts rather than judge them [7]. ACT emphasizes that recognizing thoughts, sensations, or emotions about an event and stopping those thoughts can reduce the restrictions on behavior [3]. This technique is called psychological flexibility [3]. Psychological flexibility is the active acceptance of current personal experiences through a flexible cognitive process [8]. It means accepting even if an individual experiences negative and harmful consequences and adopting a positive attitude [9,10].

For patients to be diagnosed with diabetes and subsequently

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self-care successfully, they must go through a process of re-recognition of having a healthy self to a self with disease [11]. Acceptance is the most important factor in this re-awareness process [11]. Acceptance and action is an active acceptance of experiences, such as thoughts, emotions, and sensations, with a non-judgmental attitude of self-perception [12]. A qualitative study on the experiences of patients with diabetes found that when these patients accept that they have diabetes, they readjust their lives, manage their illness and lead a better life [13]. In other words, patients need to accept diabetes non-judgmentally and take action to manage it. This willingness to accept thoughts and feelings while acting in a way that is consistent with one's values and goals is called acceptance and action [12]. When individuals with diabetes do not accept diabetes, they develop negative perceptions of themselves, which in turn results in self-stigma [4]. Self-stigma reduces self-efficacy and self-esteem, and acts as an obstacle to self-care, reducing the quality of life of patients with diabetes [14]. In this process, acceptance and action were found to improve the quality of life by acting as a mediating factor in the relationship between self-stigma and quality of life [15]. As such, the acceptance action of diabetes patients is very important; therefore, a tool is needed to adequately measure, manage, and improve acceptance.

In Korea, the Acceptance and Action Questionnaire (AAQ) and the Acceptance and Action Questionnaire-Stigma (AAQ-S) are used as acceptance and action tools. The AAQ measures aspects related to acceptance and action in assessing psychological flexibility; Moon translated the tool developed by Hayes et al. to measure general acceptance and action and its validity and reliability have been verified [12,16]. Levin et al. developed the AAQ-S to measure the psychological flexibility of stigmatizing thinking. This tool was translated by Lee et al. to verify the validity and reliability of patients with diabetes [17,18]. The validity and reliability of these two tools have been confirmed in Korean samples. However, because the AAQ measures acceptance and action in the general population, a limitation is that it does not reflect the characteristics of acceptance and action of diabetes patients in particular. In addition, the AAQ-S has been used for diabetes patients; however, a limitation is that it is difficult to measure the diabetes acceptance and action of diabetes patients because the tool measures these variables in response to stigma.

The Diabetes Acceptance and Action Scale (DAAS), developed by Greco and Hart [19], measures the degree of acceptance and action when faced with diabetes-related problems in adolescents with type 1 diabetes. Gillanders and Barker [3] evaluated the validity and reliability of the Diabetes Acceptance and Action Scale-Revised (DAAS-R), a shortened scale consisting of nine items based on 42 items of the DAAS. At the time, both type 1 and type 2 diabetes patients were included, and validity was confirmed in a sample comprising adults as well as teenagers; thus, the acceptance and action of diabetes patients across different age groups can be measured with the tool [3]. To use this tool, which consists of a single factor and nine items, it is necessary to evaluate whether it is appropriate to measure the acceptance and action of Korean people with type 2 diabetes. Therefore, in this study, we tried to evaluate the construct and concurrent validity and reliability of the tool by translating it into Korean and applying it to Korean people with type 2 diabetes.

Methods

1. Design and Participants

This was a descriptive, cross-sectional study. The survey was conducted from September 1, 2021 to September 30, 2021, through a survey institution (PMI Co., Ltd.) for patients diagnosed with diabetes who understood the purpose of the study and voluntarily agreed to participate in it. The inclusion criteria for the study participants were as follows: 1) adults diagnosed with type 2 diabetes by a doctor, 2) people who are able to practice self-care to manage the condition, and 3) people who are able to fill out the questionnaire. The exclusion criteria were as follows: 1) people who have not been diagnosed with diabetes by a doctor, 2) people who face difficulties in self-care, and 3) people experiencing difficulty in filling out the questionnaire. A self-report questionnaire consisting of general characteristics, DAAS-R, acceptance and action, quality of life, diabetes self-stigma, and experiential avoidance was prepared as an online questionnaire and distributed to 4,800 panelists at the survey institution (PMI). The sample size required to perform confirmatory factor analysis (CFA) was at least 150 participants for verifying the tool's construct validity [20]; considering the response rate of the survey and accounting for missing responses, the survey was conducted with 250 patients with diabetes. The questionnaire was administered to those who answered that they had diabetes to both questions about current health problems and diseases diagnosed by a doctor, among 15 chronic diseases. For participants who did not select diabetes for either of the two questions, the questionnaire was designed to end automatically. Thereafter, the accepted participants were asked to answer four questions about diabetes-related characteristics, and after answering these, the rest of the questionnaire was compiled. After 250 responses were collected sequentially based on those that were completed first, the survey ended. The final analysis included 231 participants, excluding data from 19 with insufficient responses.

This study was conducted, with data analysis using the abovementioned raw data, after obtaining approval from the Institution Review Board of Joongbu University (IRB No: JIRB-2022050301-01-220509).

2. Measures

The questionnaire used in this study consisted of 10 items on general characteristics, 9 on DAAS-R, 16 on acceptance and action, 26 on quality of life, 16 on the diabetes self-stigma scale, and 24 on the experiential avoidance questions.

1) Diabetes Acceptance and Action

Diabetes acceptance and action is the outcome of the translation-reverse translation process of the DAAS-R developed by Gillanders and Barker [3] with the permission of the original developer, and then translated into the Korean version, followed by facial validation. It was used after the correction was completed. This tool is a measure to estimate the degree of acceptance and adaptation when faced with diabetes-related problems. It consists of nine items evaluated on a 5-point Likert scale that ranges from 1 point for "not at all" to 5 points for "always." The higher the total score, the higher was the acceptance action. The reliability of the tool at the time of development was, Cronbach's α = .90.

2) Acceptance and action

The Korean version of the Acceptance and Action Questionnaire, which was originally developed by Hayes et al. [12] and adapted to Korean by Moon [16], was used. It measures the degree to which one is willing to accept a thought or emotion, acting in a way that is consistent with one's values and goals. The scale consists of 16 items rated on a 7-point Likert scale ranging from 1 = "not at all" to 7 = "always." A higher total score indicated a higher degree of acceptance. Cronbach's α was . 82 in Moon [16] and .90 in this study.

3) Quality of life

Based on the World Health Organization Quality of Life assessment instrument-100 (WHOQOL-100), the Korean version of the World Health Organization quality of life simple scale developed by Min et al. [21] was used. This tool consists of 26 questions in four domains: physical health (7 questions), psychological domain (6 questions), social domain (3 questions), living environment domain (8 questions), and overall quality of life (2 questions), which are constituted on a 5-point Likert scale, with higher scores indicating a higher quality of life. Negative questions (Numbers 3, 4, and 26) were reverse-coded. The Cronbach's α was .89 in Min et al. [21], and the reliability of the tool in this study had a Cronbach's α = .93.

4) Diabetes self-stigma

The Diabetes Self-Stigma Scale developed by Seo and Song [22] to measure self-stigma. The tool consists of 16 items in four sub-domains: comparative inability, social withdrawal, self-devaluation, and apprehensive feeling. All items are measured on a 5-point Likert scale (1 = "not at all," 2 = "not," 3 = "average," 4 = "yes," 5 = "very much"). The Cronbach's α was .89 in the original study [22] and .95 in this study.

5) Experiential avoidance

For experiential avoidance, the Korean version of the Multidimensional Experiential Avoidance Scale (MEAQ) developed by Gamez et al. [23] was translated into Korean by Lee and You [23], and its validity was tested (K-MEAQ-24). This tool consists of six factors: avoidance behavior, pain aversion, procrastination behavior, distraction/inhibition, repression/denial, and pain tolerance. It is measured on a 6-point Likert scale (1 point: totally disagree, 6 points: completely agree), with a higher score indicating higher experience avoidance. In the study by Lee and Yoo [24], Cronbach's α = .93, and the reliability of the tool in this study was Cronbach's α = .88.

3. Procedure

The double translation method suggested by Waltz et al. [25] was used to translate the DAAS-R into Korean. One nursing professor and a professional who holds a PhD in nursing, who were bilingual speakers of Korean and English, translated the DAAS-R into Korean, and revised and supplemented the translated version while comparing the results. Another doctor who had English as his mother tongue and who was also fluent in Korean, translated the Korean version back into English. After the reverse translation, a person with a nursing major fluent in English and Korean performed a comparative analysis and verified whether there were any items with differences in meaning from the original tool. To check the content validity of the translated tool, two nursing professors and three diabetes experts verified the validity of the questionnaire. They also checked whether the contents of the questionnaire were applicable to Korean culture. The content validity index (CVI) evaluates the degree to which the tool is appropriate to measure diabetes acceptance and action on a 4-point

Likert scale ranging from 4 (strongly agree) to 1 (strongly disagree)." All items were confirmed to be valid with a CVI of 0.8 or higher [26]. In addition, it was judged that the contents of the questionnaire could be applied to Korean culture.

Before the validity test, the translated questionnaire was administered to 10 patients with diabetes, and the time taken to complete the questionnaire and the responses of the participants were observed. Additionally, the participants were asked to present their opinions when the meaning was unclear or when they did not understand vocabulary or sentences while filling out the questionnaire. The time to respond to the questionnaire ranged from three to five min. The final translation of the tool was completed without any modifications, as there were no complaints about difficulty in responding.

Thereafter, the construct and concurrent validity of the DAAS-K was verified. The DAAS-R was reduced to a nine-item instrument with a single factor by repeatedly performing exploratory factor analysis (EFA) on the 42 items of the DAAS (original version of the instrument) according to strict standards [3]. The DAAS-R was later confirmed to have construct validity as a single scale through CFA [3]. In this study, CFA was performed to test the single attribute identified at the time of tool development [27]. To evaluate the concurrent validity, a Pearson correlation analysis was performed by simultaneously applying the acceptance and action, quality of life, diabetes self-stigma, and experiential avoidance, which previous studies found to be related to diabetes acceptance and action. The reliability of the tool was verified by calculating Cronbach's α, which represents internal consistency.

4. Statistical Analysis

The data were analyzed using SPSS/WIN version 24.0 and Amos version 22.0. The general characteristics of the participants were analyzed using descriptive statistics, and CFA was performed to verify the model suitability structures of the existing items to verify construct validity. Goodness of fit index (GFI), root mean square residual (RMR), and root mean square error of approximation (RMSEA) were used as model fit indices. The comparative fit index (CFI), Tucker-Lewis index (TLI), and incremental fit index (IFI) were identified as incremental fit indices. Concurrent validity was verified using Pearson's correlation analysis, and reliability was calculated using Cronbach's α.

Results

1. Participants' Characteristics

The general characteristics of the participants are listed in Table 1. Of the participants, 49.8% (n = 115) were male and 50.2% (116) were female. The mean age was 56.06 (± 12.12) years, and 69.7% (n = 161) had spouses. Those who had a job accounted for 61.9% (n = 143), and those who graduated from university accounted for the majority (61.5%, n = 142). The number of participants receiving treatment at the clinic was 54.1% (n = 125), and 71.4% (n = 165) were taking oral drugs only, and 12.1% (n = 28) were on insulin therapy. Only 31.6% (n = 73) of the participants answered that they had experience in education related to diabetes.

2. Item Analysis

For item analysis, the mean and standard deviation of each item and each factor were measured, and normality was evaluated by

Table 1. Participants' General Characteristics (*N*=231)

Characteristics	Categories	M ± SD or n (%)	MIN-MAX
Gender	Male	115 (49.8)	
	Female	116 (50.2)	
Age (yr)		55.99 ± 12.12	23.00-85.00
Educational level	Middle school or lower	16 (6.9)	
	High school	73 (31.6)	
	≥ University or higher	142 (61.5)	
Having spouse	Yes	161 (69.7)	
	No	70 (30.3)	
Having a job	Yes	143 (61.9)	
	No	88 (38.1)	
Perceived health status	Bad	66 (28.5)	
	Moderate	123 (53.2)	
	Good	42 (18.3)	
Duration of diabetes (yr)		7.57 ± 7.87	1.00-42.00
Type of hospital being treated	Clinic	125 (54.1)	
	General hospital	57 (24.7)	
	University hospital	46 (19.9)	
	Public health	3 (1.3)	
Type of medication	Diet therapy	38 (16.5)	
	PO	165 (71.4)	
	Insulin	12 (5.2)	
	PO+Insulin	16 (6.9)	
Experience of diabetes education	Yes	73 (31.6)	
	No	158 (68.4)	

checking skewness and kurtosis. As a result, the average score of the questions was 3.13-3.63, the standard deviation was 0.95-1.07, and the average score and standard deviation of the total score were 3.36 ± 0.90. Skewness and kurtosis were evaluated as criteria [28] that normality was satisfied when the value was less than ± 1.97 at the 5% significance level. The correlation coefficient value between the revised item-total score to evaluate the correlation between individual items and the total score can be interpreted as showing a low correlation when the value is less than .30 [29], and the result of this study is .63 to .87. Therefore, it met these criteria (Table 2).

3. Confirmatory Factor Analysis

The construct validity of the DAAS-K was verified using CFA. The standardization coefficients of the items corresponding to each factor were all above .50, confirming the validity of the items. Accordingly, the suitability of the DAAS-K, consisting of two factors and nine items, was confirmed. The absolute fit index of $\chi^2 = 61.06$ ($p < .001$), the degree of freedom (df) = 27, and Normed χ^2 (χ^2 /df) = 2.26. RMR = .08, and RMSEA = .07. Referring to Roh [30], Normed χ^2 should be less than 3, and RMR and RMSEA should range from .05 to .08 or are less in value. All incremental fit indices above .90 are accepted as a good fit [30]. The results of this study showed that GFI, CFI, TLI, and IFI had a good fit at .90 or higher (Tables 3).

4. Concurrent Validity

The DAAS-K showed a positive correlation with acceptance and action ($r = .48$, $p < .001$) and quality of life ($r = .43$, $p < .001$), and was negatively correlated with diabetes self-stigma ($r = -.73$, $p < .001$) and experiential avoidance ($r = -.51$, $p < .001$) (Table 4).

5. Reliability

As a result of the reliability test, the Cronbach's α value of the nine questions of the DAAS-K was .95, indicating a high level of internal consistency (Table 2).

Table 2. Item analysis and reliability (*N*=231)

	Items	Mean ± SD	Skewness	Kurtosis	Corrected item total correlation
Q1	My life can't be good because I have diabetes	3.30 ± 1.00	-0.08	-0.74	.84
Q2	I do things to forget about my diabetes.	3.25 ± 0.95	-0.2	-0.16	.78
Q3	Diabetes keeps me from working on my goals.	3.26 ± 1.04	-0.05	-0.77	.84
Q4	I stopped doing fun things because I have diabetes.	3.62 ± 1.10	-0.71	-0.03	.76
Q5	My diabetes gets in the way of living a good and meaningful life.	3.30 ± 1.06	-0.09	-0.78	.85
Q6	Diabetes stops me from doing what I want to do.	3.46 ± 1.04	-0.28	-0.59	.82
Q7	Diabetes stops me from socializing with my friends.	3.49 ± 1.05	-0.35	-0.57	.80
Q8	Diabetes stops me from doing well in life.	3.35 ± 1.04	-0.14	-0.62	.87
Q9	I try hard to forget the fact that I have diabetes.	3.13 ± 1.05	0.08	-0.61	.81
	Cronbach's α			0.95	

Table 3. Goodness-of-fit indicators of confirmatory factor analysis(*N*=231)

Variables	χ^2/DF	GFI	RMR	RMSEA	CFI	TLI	IFI
Evaluation criteria	≤ 3	≥ .90	≤ .05~.08	≤ .05~.08	≥ .90	≥ .90	≥ .90
DAAS-K	2.26	.94	.08	.07	.98	.97	.98

DF = degree of freedom; RMR = root mean-square residual; RMSEA = root mean square error of approximation; GFI = goodness of fit Index; CFI = comparative fit index; TLI = Tucker-Lewis index; IFI = incremental fit index; DAAS-K = Korean version of the Diabetes Acceptance and Action Scale.

Table 4. Concurrent validity (*N*=231)

	Acceptance and action	Quality of life	Diabetes self-stigma	Experiential avoidance
	r (*p*)	r (*p*)	r (*p*)	r (*p*)
Diabetes Acceptance and Action Scale	.48 (< .001)	.43 (< .001)	-.73 (< .001)	.51(< .001)

Discussion

In this study, the DAAS-R developed by Gillanders and Barker [3] was translated into Korean to evaluate the diabetes acceptance and action levels of Korean patients with diabetes objectively, and was applied to verify its validity and reliability. For reliability verification, Cronbach's α, which indicates internal consistency, was used. As a result, the reliability of the DAAS-K was .95, similar to the .90 obtained in the study of Gillanders and Barker [3], and was higher than .70, criterion suggested by DeVellis [31], for patients with diabetes. It has been demonstrated that there is stability in measuring diabetes receptive behavior. However, in this study, stability tests, such as assessing test-retest reliability, were not conducted; therefore, it is suggested that a test-retest assessment be conducted in further studies.

For construct validity, CFA was performed. As factor analysis was confirmed with one factor with nine questions, the standardization coefficients for each question were all higher than .50, confirming that all questions were valid for one factor. Since the factor structure of the tool and the model fit for the item was evaluated, the CMIN/df was 2.25, which was less than 3.0, and all fit indices met the criteria, indicating that the fit was excellent. This concurs as all the model fit indices met the criteria in the original tool [3]. Rajaeiramsheh et al. [32] verified the validity and reliability of the Persian versions of the DAAS and the acceptance and action diabetes questionnaire (AADQ). Accordingly, the DAAS-R selected nine items from the DAAS consisting of three sub-areas and verified its validity and reliability, and presented it as a single area for easier measurement. When compared with the AAQ developed by Hayes et al. [12] and the AAQ-S developed by Levin et al. [17], the degree of fusion with diabetes-related thoughts, and avoidance of diabetes-related thoughts or distorted values, amongst others, the DAAS-K has the advantage of being able to measure acceptance and action that reflects the characteristics of diabetes.

To test concurrent validity, a positive correlation was found between acceptance and action and quality of life, and a negative correlation was found between diabetes self-stigma and experiential avoidance. This is similar to the findings of Gillanders and Barker [3], in which higher DAAS was associated with lower diabetes distress and experiential avoidance, and higher standards of self-care and worthwhile lives. When patients with diabetes accept their thoughts and feelings while acting according to their values and goals for diabetes, experience avoidance is lowered because unpleasant feelings about the experience or avoidance of images or thoughts are reduced [32]. This naturally lowers the stigma on oneself because negative emotions related to diabetes are not generated [22], which is consistent with previous studies showing that it leads to an improvement in one's quality of life [15]. Therefore, it can be said that the concurrent validity of the DAAS-K has been proven. Hence, the DAAS-K is considered a reliable tool to measure diabetes acceptance and action in diabetic patients.

However, this study has some limitations. First, since it was a self-reported measurement, it may have been influenced by subjective bias or a desire for exemplary answers. This can be improved through a later test-retest reliability verification. Second, since this study only included few Type 2 diabetes patients in Korea, it may be biased; therefore, a follow-up study with a larger sample should be conducted in the future. Third, since the patients with type 1 diabetes have a disease pathogenesis that differs from patients with type 2 diabetes, a separate validation is required in applying this tool for type 1. However, this study is meaningful in that it is possible to measure acceptance action objectively by reflecting the characteristics of patients with diabetes by translating DAAS into Korean and verifying its reliability and validity. The clinical application of ACT to improve self-care and quality of life of patients with diabetes using this tool is necessary.

Conclusions

Through this study, the validity and reliability of the 9-item DAAS-K consisting of one factor was verified. Through exploratory factor analysis, it was confirmed that it consisted of one factor, and it was confirmed that there was simultaneous validity due to its high correlation with related concepts. In addition, the reliability of the tool was ensured owing to the high internal consistency of the items. Through this study, it is expected that the DAAS-K can be used to measure the diabetes acceptance action of patients with type 2 diabetes.

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Conflict of interest

The authors declared no conflict of interest.

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Authors' contributions

Seo, Kawoun contributed to conceptualization, supervision, data curation, formal analysis, and writing-original draft, review & editing.

Data availability

Please contact the corresponding author for data availability.

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References

1. International Diabetes Federation. IDF Diabetes Atlas 10th edition. Brussels: International Diabetes Federation; 2021 [cited 25 Apr 2022]. Available online: https://diabetesatlas.org
2. Tandon N, Anjana RM, Mohan V, Kaur T, Afshin A, Ong K, et al. The increasing burden of diabetes and variations among the states of India: The global burden of disease study 1990-2016. The Lancet. Global Health. 2018;6(12):e1352–e1362. https://doi.org/10.1016/s2214-109x(18)30387-5
3. Gillanders DT, Barker E. Development and initial validation of a short form of the diabetes acceptance and action scale: The DAAS-revised (DAAS-R). Journal of Contextual Behavioral Science. 2019;14:20–28. https://doi.org/10.1016/j.jcbs.2019.08.005
4. Seo K, Song YS. Self-stigma among Korean patients with diabetes: a concept analysis. Journal of Clinical Nursing. 2019;28(9-10):1794–1807. https://doi.org/10.1111/jocn.14789
5. Hadlandsmyth K, White KS, Nesin AE, Greco LA. Proposing an acceptance and commitment therapy intervention to promote improved diabetes management in adolescents: A treatment conceptualization. International Journal of Behavioral Consultation and Therapy. 2013;7(4):12–15. https://doi.org/10.1037/h0100960
6. Khashouei MM, Ghorbani M, Tabatabaei F. The effectiveness of acceptance and commitment therapy (ACT) on self-efficacy, perceived stress and resiliency in type II diabetes patients. Global Journal of Health Science. 2017;9(5):18–26. http://doi.org/10.5539/gjhs.v9n5p18
7. Hayes SC. Acceptance and commitment therapy, relational frame theory, and the third wave of behavioral and cognitive therapies - Republished article. Behavior Therapy. 2004;35(4):639–665. https://doi.org/10.1016/S0005-7894(04)80013-3
8. McCracken LM, Morley S. The psychological flexibility model: A basis for integration and progress in psychological approaches to chronic pain management. The Journal of Pain. 2014;15(3):221–234. https://doi.org/10.1016/j.jpain.2013.10.014
9. Hayes SC, Niccolls R, Masuda A, Rye AK. Prejudice, terrorism and behavior therapy. Cognitive and Behavioral Practice. 2002;9(4):296–301. https://doi.org/10.1016/S1077-7229(02)80023-2
10. Lillis J, Hayes SC. Applying acceptance, mindfulness, and values to the reduction of prejudice: A pilot study. Behavior Modification. 2007;31(4):389–411. https://doi.org/10.1177/0145445506298413
11. Larsen PD. Lubkin's chronic illness: impact and intervention. 10th ed. Burlington, VT: Jones & Barlett Learning; 2017. 600 p.
12. Hayes SC, Strosahl K, Wilson KG, Bissett RT, Pistorello J, Toarmino D, et al. Measuring experiential avoidance: A preliminary test of a working model. The Psychological Record. 2004;54:553–578. https://doi.org/10.1007/BF03395492
13. Yoo B. A review of qualitative research in Korea: The life experiences of diabetes patients. The Journal of Korean Diabetes. 2017;18(4):270–274. https://doi.org/10.4093/jkd.2017.18.4.270
14. Farhangi MA, Emam-Alizadeh M, Hamedi F, Jahangiry L. Weight self-stigma and its association with quality of life and psychological distress among overweight and obese women. Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity. 2017;22:451–456. https://doi.org/10.1007/s40519-016-0288-2
15. Seo KW. Mediating effect of acceptance action in relationship between diabetes self-stigma and quality of life in people with diabetes in Korea. Journal of Korean Academy of Fundamentals of Nursing. 2021;28(3):384–394. https://doi.org/10.7739/jkafn.2021.28.3.384
16. Moon HM. Development and Validation of the Program for Facilitation of Psychological Acceptance Based on Acceptance & Commitment Therapy Model [dissertation]. [Seoul]: The Catholic University; 2006. 116 p.
17. Levin ME, Luoma JB, Lillis J, Hayes SC, Vilardaga R. The acceptance and action questionnaire-stigma (AAQ-S): Developing a measure of psychological flexibility with stigmatizing thoughts. Journal of Contextual Behavioral Science. 2014;3

(1):21–26. https://doi.org/10.1016/j.jcbs.2013.11.003

18. Lee H, Kwon M, Seo K. Validity and reliability of the Korean version of the acceptance and action questionnaire-Stigma (AAQ-SK). Healthcare. 2021;9(10):1355. https://doi.org/10.3390/healthcare9101355
19. Greco LA, Hart TA. Diabetes acceptance and action scale for children and adolescents (DAAS). Michigan USA: Association for Contextual Behavioral Science. 2005 [cited 25 Apr 2022]. Available from: https://contextualscience.org/diabetes_acceptance_and_action_scale_for_children_and_adolescents_daas
20. Gerbing DW, Anderson JC. An updated paradigm for scale development incorporating unidimensionality and its assessment. Journal of Marketing Research. 1988;25(2):186–192. https://doi.org/10.2307/3172650
21. Min SK, Kim KI, Suh SY, Kim DK. Development of the Korean version of the world health organization quality of life scale (WHOQOL). Journal of Korean Neuropsychiatric Association. 2000;39(1):78–88.
22. Seo K, Song Y. Development and validation of the self-stigma scale in people with diabetes. Nursing Open. 2021;8(3):1089–1097. https://doi.org/10.1002/nop2.719
23. Gámez W, Chmielewski M, Kotov R, Ruggero C, Watson D. Development of a measure of experiential avoidance: The multidimensional experiential avoidance questionnaire.
24. Lee J, You SE. Validation of the Korean version of the multidimensional experiential avoidance questionnaire (K-MEAQ) and development of a brief form (K-MEAQ-24). Cognitive Behavior Therapy in Korea. 2017;17(2):181–208.
25. Waltz CF, Strickland OL, Lenz ER. Measurement in nursing and health research. 5th ed. New York (NY): Springer Publishing Company; 2017. 58 p.
26. Polit DF, Beck CT, Owen SV. Is the CVI an acceptable indicator of content validity? Appraisal and recommendations. Research in Nursing & Health. 2007;30(4):459–467. https://doi.org/10.1002/nur.20199
27. Geldhof GJ, Preacher KJ, Zyphur MJ. Reliability estimation in a multilevel confirmatory factor analysis framework. Psychological Methods. 2014;19(1):72–91. https://doi.org/10.1037/a0032138
28. Woo JP. Normality. In Woo JP. The Concept and Understanding of Structural Equation Modeling. 1st ed. Seoul: Hannarae Publishing Company; 2012. pp. 309-310.
29. Field A. Discovering Statistics Using IBM SPSS Statistics: And Sex and Drugs and Rock 'n' Roll. 4th ed. London: Sage; 2013. 915 p.
30. Roh GS. The Proper Methods of Statistical Analysis for Dissertation: SPSS & AMOS. Rev. 2nd ed. Seoul: Hanbit Academy Incoporated; 2019. 459 p.
31. DeVellis RF. Scale development: theory and applications. 4th ed. Thousand Oaks (CA): SAGA Publications; 2016. 216 p.
32. Rajaeiramsheh F, Rezaie Z, Davoudi M, Ahmadi SM, Qorbani-Vanajemi M. Psychometric properties of the Persian versions of acceptance and action diabetes questionnaire (AADQ) and the diabetes acceptance and action scale (DAAS), in Iranian youth with type 1 diabetes. Journal of Diabetes & Metabolic Disorders. 2021;20(1):655–663. https://doi.org/10.1007/s40200-021-00796-1

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Smartphone dependency latent profile classification and association with emotional and behavioral difficulties among high school students in Korea

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Purpose: The pervasive integration of smartphones into adolescents' daily lives has resulted in a concerning upsurge in smartphone dependency among high school students. Due to the diverse types and severity levels of smartphone dependency, there is a critical need for research to explore its heterogeneity. This study aimed to identify latent profile of smartphone dependency in high school students based on the four subdomains of smartphone dependency: disturbance of adaptive functions, virtual life orientation, withdrawal, and tolerance. In addition, we explored how emotional and behavioral difficulties differ according to the profiles.
Methods: We used data from 2,195 Korean high school students from the Korean Children and Youth Panel Survey 2018. Latent profile analysis (LPA) was performed to identify smartphone dependency latent profile. Statistical analysis including chi-square test, Analysis of Variance (ANOVA), and ranked Analysis of Covariance (ANCOVA) confirmed differences in smartphone use characteristics and emotional-behavioral difficulties according to the classified latent profile.
Results: LPA identified four distinct latent profiles of smartphone dependency among high school students; 1) Underdependent type, 2) Moderate type, 3) Habitual user type, and 4) Virtual space dependent type. The results of ranked ANCOVA, controlling for gender, geographical location, economic status, parental smartphone dependency, and relational variables, revealed that habitual user type exhibited significantly higher rates of attention deficit hyperactivity disorder, social withdrawal, and depressive symptoms compared to other types.
Conclusion: The identification of these profiles provides a foundation for developing tailored intervention programs for adolescents with different levels and patterns of smartphone dependency.

Keywords: Smartphone; Dependency, Psychological; Mental health; Latent class analysis; Adolescent

Introduction

1. Background

These days, for adolescents who have had easy access to digital devices and have been using them in their daily lives since childhood, the smartphone has become part of their lives and a primary means of social communication. According to the results of the '2022 Survey on Smartphone Overdependence', the proportion of the risk group for smartphone overdependence among children and adolescents aged 10 to 19 was 40.1%. In this case, the risk group for smartphone overdependence includes the high-risk group and the potential risk group among smartphone users. The proportion of the risk group for smartphone overdependence was increased by approximately 10% in 2022, compared to 2019, indicating that the proportion and increase of the risk group for smartphone overdependence are the most serious levels in the 10-19 age group among all age groups [1]. This surge underscores the urgency of addressing smartphone overde-

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pendence.

Smartphones are distinct from mobile phones in that they are mobile devices with expanded and advance features based on the use of the Internet. As a mobile device characterized by digital convergence, the smartphone enables not only the acquisition of information but also the immediate production of information through functions such as the simultaneous use of cameras, videos, and various applications, and these capabilities of smartphones can promote the use of social media [2]. In addition, smartphones provide users with more convenient access to desired programs, including the Internet, compared to PCs. They are conveniently portable at any time and are frequently used because information or messages are provided along with a notification sound for incoming messages [3]. The National Information Society Agency considered disturbance of adaptive functions, withdrawal, and tolerance as the common attributes of smartphone addiction and mobile phone addiction. Additionally, to reflect the characteristics of the smartphone itself, virtual life orientation was included as another attribute of smartphone addiction, resulting in the development of a standardized self-report smartphone addiction proneness scale for youth, consisting of four subdomains [3]. This scale is currently the most widely used tool in status surveys and studies on smartphone addiction in Korea. Disturbance of adaptive functions refers to a condition in which smartphone use becomes a very important part of a person's daily life and dominates his or her thinking, emotions, and behaviors to such a degree that the smartphone user has difficulty living a normal life. Virtual life orientation means that a person much more prefers using a smartphone over spending time with the family or friends and places more value on online life than offline life. Withdrawal refers to the phenomenon of becoming anxious, nervous, and irritable when a person cannot use the smartphone, and tolerance refers to the phenomenon in which a person spends more and more time on smartphone use as he or she increasingly uses the smartphone [4]. This tool was developed in 2011 and named the standardized self-report smartphone addiction proneness scale for youth. However, due to the excessively negative connotations associated with the concept of 'smartphone addiction' and the criticism that it tends to consider the majority of smartphone users as potential addicts, 'smartphone overdependence' is increasingly being used instead of the term 'smartphone addiction' [4]. Nationwide panel surveys such as the Korean Children and Youth Panel Survey (KCYPS) also use this scale to measure smartphone overdependence. Therefore, this study also intended to use this scale to investigate smartphone overdependence.

However, although the cut-off point of this scale allows us to classify the severity of smartphone overdependence, it has limitations in providing insight about the leverage point that can make changes in smartphone usage patterns for adolescents showing a high degree of smartphone overdependence. Therefore, in order to develop an intervention program for adolescents showing smartphone overdependence, there is a need to closely examine each domain or each attribute of smartphone overdependence. In the study by Bae [4], it was found that 60.8% of adolescents experienced disturbance of adaptive functions, due to smartphone overdependence, 44.6% showed virtual life orientation, 50.7% had the experience of withdrawal symptoms, and 68.3% had the experience of tolerance. In particular, the proportion of people experiencing difficulties due to tolerance was found to be significantly higher among adolescents than children or adults, suggesting that adolescents are unable to have control over their time due to smartphones and spend too much time on smartphone use. However, this previous study simply investigated the current status of smartphone overdependence among adolescents, and such research has limitations in identifying the patterns of each domain among individual adolescents showing smartphone overdependence.

Latent profile analysis (LPA) is a person-centered statistical approach that focuses on analyzing similarities and differences between individuals rather than relationships between variables, and is a research method to identify unobserved subtypes or latent subgroups within a group [5,6]. These identified subgroups allow us to understand the characteristics of each group and examine distinctive associations between these characteristics and outcome variables. Considering that the concept of smartphone overdependence consists of four domains (disturbance of adaptive functions, virtual life orientation, withdrawal, and tolerance), there is a possibility that all adolescents do not show the same patterns for each domain. Therefore, by identifying subgroups with different patterns within the relevant population, we can understand differences among subgroups and develop more appropriate customized intervention strategies. In addition, if we identify differences in emotional and behavioral difficulties among the subgroups of smartphone overdependence of adolescents, it will allow us to develop customized interventions by taking into account the characteristics of each subgroup. Therefore, this study aimed to identify latent profiles of smartphone overdependence among high school students in Korea, based on responses regarding each domain of smartphone overdependence by using KCYPS data.

Several studies have shown that smartphone dependency is closely associated with emotional and behavioral difficulties among adolescents, such as attention deficit hyperactivity disorder (ADHD) [7,8], aggression [9,10], social withdrawal [11,12], and depressive symptoms [13]. In general, previous studies assumed that all adolescents have the same characteristics rather than dividing them into subtypes of smartphone overdependence [7-13]. However, this study aimed to explore whether these emotional and behavioral difficulties differ according to classified latent profiles of smartphone dependency. In addition, this study also intended to examine whether there are differences in the domains reported to be associated with smartphone dependency such as gender [14,15], geographic location of the residence area [16,17], subjective household economic status [18,19], peer relationships [14,20,21], teacher relationships [20], parenting attitude [9,14,20], time spent with parents [22], and smartphone-use characteristics [14,15] according to the latent profiles of smartphone dependency. Through this, we aim to provide foundational data for development of smartphone overdependence prevention program and intervention programs for high-risk groups.

2. Objectives

The specific objectives of this study are as follows:

1) To identify the latent profiles of smartphone dependency according to its attributes among high school students;
2) to investigate the differences in general characteristics and smartphone use characteristics of the participants according to the latent profiles of smartphone dependency among high school students;
3) to examine emotional and behavioral difficulties according to the latent profiles of smartphone dependency among high school students.

Methods

1. Study design

This study is a secondary data analysis research using data from the Korean Children and Youth Panel Survey 2018 (KCYPS 2018) to identify the latent profiles of smartphone dependency among high school students and investigate the emotional and behavioral difficulties according to the latent profiles.

2. Participants and data collection

This study used data from the 4th Wave of the KCYPS 2018 (2021) conducted by the National Youth Policy Institute. The survey panel was established using a multistage stratified cluster sampling method, with adolescents who were in their first year of middle school in 2018 as the target population. The original panel consisted of 2,590 people, and follow-up surveys are conducted annually. The data of the original panel respondents and their guardians from the 4th Wave KCYPS 2018 conducted in 2021, which are the most recent data currently available, were used in the analysis of this study. The 4th Wave KCYPS 2018 was conducted in 2021, when the original panel of the middle school cohort became first-year high school students, and the retention rate of the original panel and the survey participation rate of the guardians of the original panel were 87.5% and 87.2%, respectively.

In this study, the variables pertaining to the father or mother as the primary caregiver (e.g., the primary caregiver's smartphone dependency) were included as independent variables. Data from both students and guardians were merged for analysis purposes. The main variable in this study was smartphone dependency, and respondents with missing data for the questions on smartphone dependency were excluded (n = 21). In addition, when the survey respondent was not the primary caregiver, the participant was excluded from the study (n = 49). The samples provided were 2,265 people, and 2,195 people were included in the final analysis.

3. Measures

1) Smartphone dependency

In KCYPS 2018, smartphone dependency was investigated using the 15-item scale constructed based on the self-report smartphone addiction proneness scale developed by Kim et al. [2]. This 15-item scale includes 5 items about disturbance of adaptive functions, 2 items about virtual life orientation, 4 items about withdrawal, and 4 items about tolerance. Each item was rated on a 4-point Likert scale ranging from 1 point (= 'Not at all') to 4 points (= 'Very much'). Higher total scores indicate higher levels of smartphone dependence of adolescents. Based on the total score and the scores of the three subdomains (disturbance of adaptive functions, withdrawal, and tolerance), the respondents are classified into three groups: the 'high-risk user group', 'potential risk user group', and 'normal user group' [3]. According to this scale [3], people with a total score of 45 points or more based on a standardized score of 70 points, or those with 16 points or more in disturbance of adaptive functions, 13 points or more in withdrawal, and 14 points or more in tolerance are categorized as the high-risk user group. People who meet one of the following four conditions are categorized as the potential risk user group: 1) a total score of 42 to 44 points; 2) 14 points or more in disturbance of adaptive functions; 3) 12 points or more in withdrawal; or 4) 13 points or more in tolerance. Lastly, the normal user group are people who meet the following conditions: 1) a total score of 41 points or less; 2) 13 points or less in disturbance of adaptive functions; 3) 11 points or less in withdrawal; and 4) 12 points or less in tolerance. To identify the latent subgroups based on smartphone dependency, this study used the mean values of each of the following four subdomains: disturbance of adaptive functions, virtual life orientation, withdrawal, and tolerance. The value of Cronbach's α was .81 in the study by Kim et al. [2] and it was .86 in this study.

2) Emotional and behavioral difficulties

In KCYPS 2018, a modified version of the self-report emotional or behavioral problems scale for children developed by Cho & Lim [23] was used to assess attention deficit hyperactivity disorder (ADHD) and aggression. The scale contains 7 items about ADHD and 6 items about aggression. Each item was rated on a 4-point Likert scale ranging from 1 point (= 'Not at all') to 4 points (= 'Very much'). The level of each variable was analyzed using the total score of the items in each subdomain, and higher total scores indicates higher levels of ADHD and aggression. The values of Cronbach's α for ADHD and aggression were .78 and .76, respectively, in the study by Cho and Lim [23], and they were .84 and .85, respectively in this study.

In KCYPS 2018, social withdrawal was measured by a modified and supplemented version of a behavior problem scale for children and adolescents developed by Kim and Kim [24]. The scale consists of a total of 5 items rated on a 4-point Likert scale ranging from 1 point (= 'Not at all') to 4 points (= 'Very much'), and a higher total score indicates a higher level of social withdrawal. The value of Cronbach's α was reported as .79 in the study by Kim and Kim [24], and it was .88 in this study.

In KCYPS 2018, depressive symptoms were measured by a modified 10-item version of the 13-item depression scale from a short-form mental health symptom checklist presented by Kim et al. [25]. Each item was rated on a 4-point Likert scale ranging from 1 point (= 'Not at all') to 4 points (= 'Very much'), and higher total scores indicate more depressive symptoms. The value of Cronbach's α was reported as .86 in the study by Yeom et al. [26], and it was .90 in this study.

3) General characteristics and smartphone use characteristics of the participants

General characteristics examined in this study are as follows: gender, geographical location, subjective household economic status, relationship with peers, relationship with teachers, parenting attitude, and time spent with parents. Smartphone use characteristics analyzed in this study are the frequency of smartphone use by purpose, average daily time spent using smartphones during leisure time, and parental smartphone dependency.

In the KCYPS 2018, the geographical location of the residence area was divided into metropolis, urban (small and medium-sized cities), and rural (eup/myeon) areas. The subjective household economic status was classified based on the guardian's response on a 5-point Likert scale, ranging from the highest to the lowest, which was condensed into three categories: good (very good, good), fair, poor (poor, very poor).

For relationship with peers, in the KCYPS 2018, it was measured using the peer relationship quality scale for adolescents developed by Bae et al. [27]. This scale contains 8 items about positive relationships and 5 items about negative relationships. Each item was rated on a 4-point Likert scale ranging from 1 point (= 'Not at all') to 4 points (= 'Very much'). The total score for positive relationships and the total score for negative relationships are calculated, respectively, and higher total scores indicate stronger perceptions of positive or negative peer relationships. In the study by Lee [28], the value of Cronbach's α was reported as .87 for positive relationship with peers and .80 for negative relationship with peers. In this study, the value of Cronbach's α was .86 for positive relationship with peers and .85 for negative relationship with peers.

In the KCYPS 2018, relationship with teachers was measured using the 14-item student-teacher attachment relationship scale developed by Kim and Kim [29]. Each item was assessed on a 4-point Likert scale ranging from 1 point (= 'Not at all') to 4 points (= 'Very much'), and a higher total score indicates the student's more positive perception of the relationship with teachers. The value of Cronbach's α was .88 in Kim et al. [29], and it was .91 in this study.

For parenting attitude, in the KCYPS 2018, it was measured using the 24-item parenting attitude scale for adolescents validated by Kim and Lee [30]. It consists of 12 items on positive parenting attitudes and 12 items on negative parenting attitudes. Each item was assessed on a 4-point Likert scale ranging from 1 point (= 'Not at all') to 4 points (= 'Very much'). The total scores for positive and negative parenting attitudes are calculated respectively, and higher total scores indicate higher levels of positive and negative parenting attitudes. The value of Cronbach's α ranged from .75 to .88 in the study by Kim and Lee [30], and the value of Cronbach's α was .92 for positive parenting attitudes, and .87 for negative parenting attitudes in the study by Kim and Ahn

[31]. In this study, the value of Cronbach's α was .91 for positive parenting attitudes, and .88 for negative parenting attitudes. In KCYPS 2018, time spent with parents was divided into weekdays and weekends, and the average hours and minutes spent with parents per day were examined. In this study, average time spent with parents per week was calculated by adding 'average time spent with parents per day during weekdays' × 5 days and 'average time spent with parents per day during a weekend' × 2 days.

As for smartphone usage type, in the KCYPS 2018, this variable was examined using a modified and supplemented version of the 2013 youth media use survey questionnaire developed by Bai et al. [32]. Smartphone usage type was divided into 13 categories: calls with the family, messaging with the family, calls with friends, messaging with friends, social networking services (SNS), playing games, taking photos/videos, watching TV and videos, listening to music, information search, viewing documents, learning or work, and others. Each item was rated on a 4-point Likert scale ranging from 1 point (= 'Never use it') to 4 points (= 'Frequently use it.'). In this study, smartphone usage type was reclassified into 8 categories by grouping together some categories into a single category as follows: 'calls with family', 'messaging with family', 'calls with friends', and 'messaging with friends' were grouped together as 'calls/messaging', 'watching TV and videos' and 'listening to music' were grouped together as 'multimedia use', and 'viewing documents' and 'others' were also grouped together as 'others.' In the case of reclassified items, the mean score of the items grouped together was used, and a higher score indicates the more frequent use of the smartphone for that purpose.

Regarding the duration of daily smartphone use, in KCYPS 2018, average daily time spent using smartphones during leisure time was divided into the duration of smartphone use on weekdays and on weekends. It was classified into 'Never use it', 'Less than 30 minutes', '30 minutes to less than 1 hour', '1 hour to less than 2 hours', '2 hours to less than 3 hours', and '3 hours to less than 4 hours', and 'more than 4 hours.' In this connection, according to the '2021 National Leisure Activity Survey', adolescents' average leisure time using smart devices was found to be 2.6 hours on weekdays and 3.4 hours on weekends [33]. In this study, based on the results of the '2021 National Leisure Activity Survey', average daily time spent using smartphones during leisure time was divided into 'less than 1 hour', '1 hour to less than 3 hours', and '3 hours or more.'

As for parental smartphone dependency, in the KCYPS 2018, it was examined using the 15-item scale constructed based on the self-report smartphone addiction proneness scale developed by Kim et al. [2]. The scale contains 5 items on disturbance of adaptive functions, 2 items on virtual life orientation, 4 items on withdrawal, and 4 items on tolerance. Each item was rated on a 4-point scale ranging from 'Not at all (1 point)' to 'Very much (4 points),' and a higher total score indicates the primary caregiver' greater degree of smartphone dependency. Cronbach' α was .81 in the study by Kim et al. [2], and it was . 84 in this study.

4. Data collection and analysis

In order to identify the latent profiles according to the subdomains of smartphone dependency among high school students, the four indicators were selected: disturbance of adaptive functions, virtual life orientation, tolerance, and withdrawal. In the LPA, model estimation is performed by increasing the number of latent groups, and through the processes of model fit analysis and comparison of models, the number of latent groups is finally determined based on the best-fit model. When determining the number of latent groups, information criterion indices such as the sample-size adjusted BIC (saBIC) and the Bayesian information criterion (BIC), the results of the likelihood ratio test method using the Lo-Mendell-Rubin likelihood ratio test (LMR) and the bootstrap likelihood ratio test (BLRT), and entropy values are checked, and the distribution rate for each latent profile is also comprehensively considered [34]. For the information criterion indices, a better model shows a smaller value, and in the likelihood ratio tests, if the likelihood ratio is $<.05$, it means that the k latent group model is better than the k-1 group model in terms of model fit [34,35]. For entropy values, a value closer to 1 indicates a higher level of classification accuracy [36].

Descriptive statistics, chi-square test, and Analysis of Variance (ANOVA) were used to compare the general characteristics and smartphone use characteristics of the participants between the identified latent profiles of smartphone dependency, and a post-hoc test was performed using the Sheffé test. In order to examine differences in emotional and behavioral difficulties between the latent profiles of smartphone dependency among high school students, ranked Analysis of Covariance (ANCOVA) was conducted after controlling for general characteristics, parental smartphone dependency, and relational variables, which showed a statistically significant relationship with each latent profile. A post-hoc test was performed using the Tukey-Kramer test, and the statistical significance level was adjusted to .0083 using the Bonferroni correction to control the overall probability of the type 1 error [37]. Statistical analysis was performed using Mplus 8.0 (Muthen & Muthen, Los Angeles, CA, USA) and SPSS 29.0 (IBM Corp., Armonk, NY, USA).

5. Ethical considerations

This study was conducted after receiving an exempt determination from the institutional review board of Jeju National University (IRB No. JJNU-IRB-2023-052). The data of the Korean Children and Youth Panel Survey (KCYPS) is publicly available through the KCYPS data archive (https://www.nypi.re.kr/archive/contents/siteMain.do), and individuals can obtain the data by submitting a data use agreement form. The KCYPS 2018 data provided to researchers does not contain any personally identifiable information and has been anonymized.

Results

In this study, latent profile analysis was performed to determine the number of latent subgroups according to the subdomains of smartphone dependency (disturbance of adaptive functions, virtual life orientation, withdrawal, and tolerance) among high school students. To determine the best-fit model, this study examined the model fits by increasing the number of latent profiles from two-profile model to five-profile model (Table 1). BIC and saBIC values were decreased as the number of classes increased, and these indices were lowest in the 5-profile model. An entropy value [36] closer to 1 indicates a higher level of classification accuracy, and the entropy value was highest in the 4-profile model. LMR and BLRT values were found to be statistically significant in 2-, 3-, and 4-profile models ($p < .001$), confirming the existence of distinct heterogeneous groups in terms of smartphone dependency. LMR was not statistically significant in the 5-profile model.

The 4-profile model had lower BIC and saBIC values than 2- and 3-profile models, and LMR and BLRT indicated that both models supported the alternative hypothesis ($p < .001$). The 4-profile model was found to have more information than the 3-profile model, and the distribution rate ranged from 11.8% to 47.0%, indicating a high level of practicality. The 4-profile model was selected because it had low model fit indices, its entropy value was closest to 1, more than 5.0% of the total samples were present in all groups, and sufficiently meaningful and distinct characteristics for each group were found. The average posterior probability value of the finally determined 4-profile model was close to 1, ranging from .79 to .90, which indicated a high level of classification accuracy.

1. Latent profiles of smartphone dependency among high school students

The results of identifying the latent classes of smartphone dependency among high school students are shown in Figure 1 and Table 2. Class 1 (n = 410, 18.7%) has low scores in all the four domains of disturbance of adaptive functions, virtual life orientation, withdrawal, and tolerance. This group showing a low level of smartphone dependence and healthy usage patterns, and the group was named the 'underdependent type.' Class 2 (n = 1,033, 47.0%) is a group showing a medium level of smartphone dependency in all four domains and was referred to as 'the moderate type.' Class 3 (n = 259, 11.8%) is characterized by high levels of disturbance of adaptive functions and tolerance but a low level of virtual life orientation. This group shows a significant negative impact of excessive smartphone use on daily life, including activities at home and at school, and this group needs increasingly more stimulations for the same degree of satisfaction. In consideration of these characteristics, Class 3 was named the 'habitual user type.' Class 4 (n = 493, 22.5%) is characterized by high levels of virtual life orientation and withdrawal and was termed as the 'virtual space dependent type.'

2. General characteristics and smartphone use characteristics of the participants according to the latent profiles of smartphone dependency

The general characteristics and smartphone use characteristics of the high school students included in this study are shown in Table 3. The gender proportion difference among the latent classes of smartphone dependency was statistically significant, and the

Table 1. Model Fit Indices of Latent Profile Analysis and Distribution Rate of Smartphone Dependency (*N*=2,195)

Model	Model fit indices					Latent class distribution rate (%)				
	BIC	saBIC	LMR	BLRT	Entropy	1	2	3	4	5
2-profile	14281.57	14240.27	< .001	< .001	.68	54.4	45.6			
3-profile	13657.96	13600.77	< .001	< .001	.75	15.8	61.0	21.2		
4-profile	13218.27	13145.20	< .001	< .001	.76	18.7	47.0	11.8	22.5	
5-profile	13052.28	12963.32	0.1431	< .001	.73	26.3	7.7	13.1	35.8	17.1

BIC = Bayesian Information Criteria; saBIC = Sample-size Adjusted BIC; LMR = Lo-Mendell-Rubin adjusted Likelihood Ratio Test; BLRT = Parametric Bootstrapped Likelihood Ratio Test.

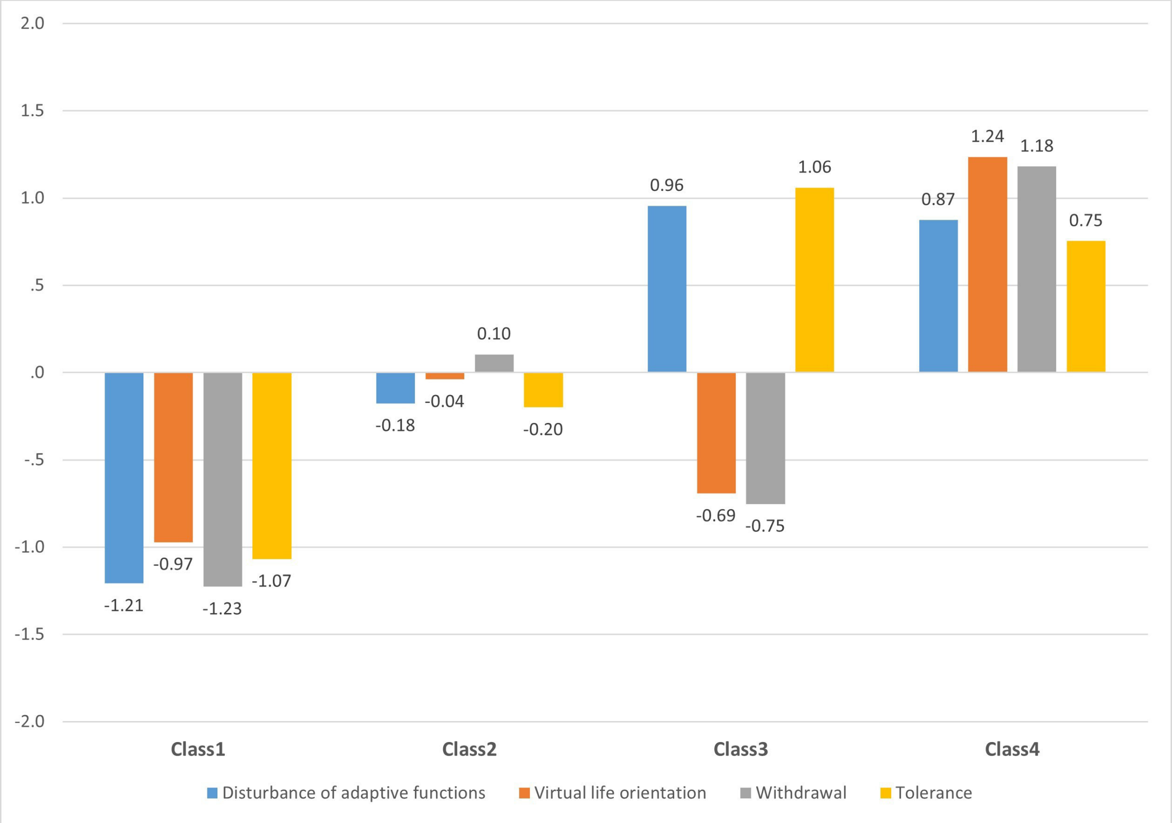

Figure 1. Illustration of z-score distribution of smartphone dependency in the four profiles defined in the latent profile analysis
Class 1=Underdependent type; Class 2=Moderate type; Class 3=Habitual user type; Class 4=Virtual space dependent type

Table 2. Differences of Indices of Smartphone Dependency among Latent Classes (*N*=2,195)

Group indices	Total (n=2,195) M±SD	Class 1 (n=410) M±SD	Class 2 (n=1,033) M±SD	Class 3 (n=259) M±SD	Class 4 (n=493) M±SD	F (*p*)
Disturbance of adaptive functions	2.27±0.57	1.58±0.40	2.16±0.36	2.84±0.42	2.76±0.36	967.86 (<.001)
Virtual life orientation	1.78±0.64	1.15±0.30	1.76±0.43	1.34±0.40	2.57±0.50	967.96 (<.001)
Withdrawal	2.00±0.56	1.32±0.30	2.06±0.30	1.61±0.38	2.67±0.34	1469.12 (<.001)
Tolerance	2.37±0.61	1.71±0.50	2.24±0.41	3.03±0.44	2.82±0.42	719.55 (<.001)

Class 1=Underdependent type; Class 2=Moderate type; Class 3=Habitual user type; Class 4=Virtual space dependent type.

proportion of female students was higher in the habitual user type and virtual space dependent type ($\chi^2=10.34$, $p=.016$). Also, the proportion of people living in urban areas ($\chi^2=22.75$, $p=.001$) and the proportion of people who rated subjective household economic status as poor ($\chi^2=33.20$, $p<.001$) were also higher in the habitual user type and virtual space dependent type.

Regarding the differences in relationships with peers, teachers, and parents according to latent profiles, the score for positive relationship with peers was higher in the underdependent type and the habitual user type than other types (F=21.36, $p<.001$), and the virtual space dependent type showed a higher score for negative relationship with peers than other types (F=85.14, $p<.001$). The score for relationship with teachers was highest in the underdependent type and lowest in the virtual space dependent type (F=33.37, $p<.001$). For positive parenting attitude, the underdependent type had the highest score (F=63.24, $p<.001$), and for negative parenting attitude, the virtual space dependent type had the highest score (F=124.49, $p<.001$). As for time spent with parents, the underdependent type and habitual user type spent more time with their parents than the other types, while

Table 3. Differences in the Characteristics of Participants according to the Profile Group (*N*=2,195)

Characteristics	Categories	Total (n=2,195) n (%) or M±SD	Class 1 (n=410) n (%) or M±SD	Class 2 (n=1,033) n (%) or M±SD	Class 3 (n=259) n (%) or M±SD	Class 4 (n=493) n (%) or M±SD	χ^2 or F (*p*) Sheffé
Gender	Boy	1172 (53.4)	234 (57.1)	571 (55.3)	123 (47.5)	244 (49.5)	10.34 (.016)
	Girl	1023 (46.6)	176 (42.9)	462 (44.7)	136 (52.5)	249 (50.5)	
Geographic location	Metropolis	975 (44.6)	186 (45.4)	496 (48.3)	97 (37.6)	196 (39.9)	22.75 (.001)
	Urban	866 (39.6)	175 (42.7)	365 (35.5)	111 (43.0)	215 (43.8)	
	Rural	345 (15.8)	49 (12.0)	166 (16.2)	50 (19.4)	80 (16.3)	
Subjective household economic status	Good	220 (10.0)	58 (14.1)	79 (7.6)	28 (10.8)	55 (11.2)	33.20 (<.001)
	Fair	1669 (76.0)	316 (77.1)	815 (78.9)	192 (74.1)	346 (70.2)	
	Poor	306 (13.9)	36 (8.8)	139 (13.5)	39 (15.1)	92 (18.7)	
Relationship with peers	Positive	24.57±3.74	25.38±4.22	24.51±3.53	25.34±4.00	23.62±3.35	21.36 (<.001) 1,3>2>4
	Negative	8.96±2.89	7.47±2.73	9.00±2.78	8.54±2.52	10.36±2.76	85.14 (<.001) 4>2,3>1
Relationship with teachers		38.45±6.56	40.91±6.91	38.24±6.23	38.79±6.81	36.67±6.20	33.37 (<.001) 1>3,2>4
Parenting attitude	Positive	37.39±5.41	40.05±5.34	36.85±5.14	38.68±5.54	35.66±4.99	63.24 (<.001) 1>3>2>4
	Negative	23.60±5.88	19.88±5.36	23.94±5.46	22.24±5.92	26.71±5.20	124.49 (<.001) 4>2>3>1
Time spent with parents (hours/week)		23.98±17.02	27.70±17.98	22.97±16.44	28.77±18.51	20.49±15.41	22.13 (<.001) 3,1>2>4
Smartphone usage type	Calls and messaging	3.44±0.50	3.38±0.53	3.45±0.50	3.45±0.51	3.47±0.45	2.43 (.064)
	Social networking service	3.16±0.94	3.04±1.00	3.10±0.94	3.35±1.00	3.30±0.84	11.05 (<.001) 4,3>2,1
	Game	2.74±1.02	2.43±1.06	2.70±1.01	2.90±1.05	2.98±0.94	24.60 (<.001) 4>2>1 3>1
	Use multimedia	3.49±0.61	3.45±0.69	3.45±0.58	3.67±0.52	3.51±0.60	10.07 (<.001) 3>4,2,1
	Take photos/videos	3.16±0.80	2.93±0.83	3.15±0.77	3.12±0.86	3.36±0.74	22.54 (<.001) 4>2,3>1
	Information search	3.30±0.75	3.35±0.79	3.25±0.74	3.37±0.80	3.32±0.72	2.84 (.037)
	Learning	2.88±0.92	2.84±1.07	2.82±0.93	2.95±0.88	3.02±0.78	6.09 (<.001) 4>1,2
	Others†	2.91±1.00	2.74±1.12	2.87±0.95	3.05±1.09	3.08±0.89	11.25 (<.001) 4>2,1 3>1
Average daily time spent using smartphones during leisure time (weekdays)	<1 hr	576 (26.2)	155 (37.8)	294 (28.5)	25 (9.7)	102 (20.7)	105.81 (<.001)
	1~<3 hrs	1200 (54.7)	197 (48.0)	585 (56.6)	155 (59.8)	263 (53.3)	
	≥3 hrs	419 (19.1)	58 (14.1)	154 (14.9)	79 (30.5)	128 (26.0)	
Average daily time spent using smartphones during leisure time (weekend)	<1 hr	300 (13.7)	94 (22.9)	126 (12.2)	7 (2.7)	73 (14.8)	185.25 (<.001)
	1~<3 hrs	1056 (48.1)	185 (45.1)	597 (57.8)	76 (29.3)	198 (40.2)	
	≥3 hrs	839 (38.2)	131 (32.0)	310 (30.0)	176 (68.0)	222 (45.0)	
Students' smartphone dependency		32.37±6.93	22.30±3.60	31.53±3.04	35.42±3.98	40.91±3.43	2382.47 (<.001) 4>3>2>1
High-risk user group		79 (3.6)	0 (0.0)	0 (0.0)	5 (1.9)	74 (15.0)	1094.24 (<.001)
Potential risk user group		544 (24.8)	3 (0.7)	94 (9.1)	183 (70.7)	264 (53.5)	
General user group		1572 (71.6)	407 (99.3)	939 (90.9)	71 (27.4)	155 (31.4)	
Parental smartphone dependency		28.90±6.04	26.31±6.48	29.14±5.24	26.96±6.01	31.58±6.01	73.33 (<.001) 4>2>3,1

Class 1=Underdependent type; Class 2=Moderate type; Class 3=Habitual user type; Class 4=Virtual space dependent type
†View documents, take notes, draw pictures, set alarms

the virtual space dependent type spent the least time with their parents (F = 22.13, p < .001).

As a result of examining differences in the smartphone usage type among latent profiles, the frequency of using the smartphone for multimedia use was higher in the habitual user type than in other types (F = 10.07, $p < .001$), and the frequency of using the smartphone for SNS was statistically significantly higher in the habitual user type and virtual space dependent type, compared to the underdependent and moderate types (F = 11.05, $p < .001$). In addition, compared to other types, the virtual space dependent type showed higher rates of smartphone use for playing games (F = 24.60, $p < .001$), taking photos or videos (F = 22.54, $p < .001$), learning (F = 6.09, $p < .001$), and others (F = 11.25, $p < .001$). Regarding average daily time spent using smartphones during leisure time, the proportion of adolescents spending more than 3 hours a day on smartphones was highest in the habitual user type with 30.5% for weekdays and 68.0% for weekends.

With respect to smartphone dependency among high school students, the virtual space dependent type showed the highest score for smartphone dependency (40.91 ± 3.43 points), and also showed the highest proportion of the high-risk user group for smartphone overdependence at 15.0%. The habitual user type had the second highest score for smartphone dependence at 35.42 ± 3.98 points. In the habitual user type, the proportion of the potential risk user group was a high level of 70.7%, but the proportion of the high-risk user group was 1.9%. 99.3% of adolescents in the underdependent type were categorized as the normal user group according to the criteria of the smartphone overdependence proneness scale, and only 0.7% belonged to the potential risk user group. For the moderate type, 9.1% of this group belonged to the potential risk user group. There were no high-risk user group in the underdependent type and moderate type. For parental smartphone dependency, the virtual space dependent type showed the highest score (31.58 ± 6.01points) (F = 73.33, $p < .001$).

3. Emotional and behavioral difficulties according to latent profiles of smartphone dependency

The results of descriptive statistical analysis of emotional and behavioral difficulties showed that the levels of ADHD, aggression, and depressive symptoms were highest in the virtual space dependent type, and the level of social withdrawal was highest in the habitual user type. After controlling for gender, geographic location, economic status, parental smartphone dependency, and relational variables, the ranked ANCOVA results showed that there were significant differences in ADHD (F = 49.70, $p < .001$), aggression (F = 17.29, $p < .001$), social withdrawal (F = 34.01, $p < .001$), and depressive symptoms (F = 38.24, $p < .001$) according to the latent profiles of smartphone dependency among high school students (Table 4). The underdependent type had the lowest scores for all the four categories of emotional and behavioral difficulties, and the habitual user type showed the highest scores for all the four categories. The level of aggression was the high in both the habitual user type and the virtual space dependent type. As for ADHD and depressive symptoms, the habitual user type had the highest scores, followed by the virtual space dependent type, moderate type, and underdependent type in descending order.

Discussion

This study was conducted using data from the 4th Wave KCYPS 2018 to classify the latent profiles of smartphone dependency according to the subdomains of smartphone dependency among high school students and to identify differences in general characteristics, smartphone use characteristics and emotional and behavioral difficulties according to the latent profiles.

The classification of latent profiles according to the subdomains of high school smartphone dependency revealed four latent profiles. The underdependent type showed low levels of all four subdomains, and the moderate type showed medium levels of all four subdomains. The habitual user type showed high levels of disturbance of adaptive functions and tolerance but a low level of virtual life orientation. Lastly, the virtual space dependent type exhibited particularly high levels of virtual life orientation and withdrawal, compared to other types. Some cases of the habitual use type or virtual space dependent type in this study were classified as the general user group according to the criteria of the smartphone overdependence scale. This is due to the fact that in terms of the criteria of the scale, the domain of virtual life orientation is not included in the specific criteria for classification but is included only in the criteria of the total score [3]. According to the classification criteria of the scale, the criteria for the high-risk user group are somewhat strict because the high-risk user group only includes cases that satisfy both the total score criterion and the cut-off point for each domain. On the other hand, the potential risk user group encompasses a broader range because this group is regarded as a union of the group satisfying the total score criterion and groups satisfying the cut-off point for each domain.

Considering the relationship between each latent profile and

Table 4. Comparison of Emotional and Behavioral Difficulties Between the 4 Classes (*N*=2,195)

Variables	Total (n = 2,195) M ± SD	Class 1 (n = 410) M ± SD	Class 2 (n = 1,033) M ± SD	Class 3 (n = 259) M ± SD	Class 4 (n = 493) M ± SD	F (*p*) Tukey-Kramer
Attention deficit hyperactivity disorder	14.76 ± 3.93	12.3 ± 4.20	14.52 ± 3.54	16.08 ± 3.89	16.64 ± 3.23	49.70(< .001) 3 > 4 > 2 > 1
Aggression	11.08 ± 3.39	9.04 ± 3.06	11.01 ± 3.08	11.24 ± 3.58	12.83 ± 3.20	17.29(< .001) 4,3 > 2 > 1
Social withdrawal	10.43 ± 3.42	9.06 ± 3.82	10.17 ± 3.01	11.94 ± 3.78	11.33 ± 3.12	34.01(< .001) 3 > 4 > 2,1
Depressive symptoms	17.83 ± 5.50	14.57 ± 5.26	17.47 ± 4.91	19.20 ± 5.72	20.58 ± 5.17	38.24(< .001) 3 > 4 > 2 > 1

Class 1 = Underdependent type; Class 2 = Moderate type; Class 3 = Habitual user type; Class 4 = Virtual space dependent type. Covariates (gender, geographical location, economic status, parental smartphone dependency, and relational variables) were included in ranked ANCOVA.

emotional and behavioral difficulties shown in the results of this study, even when individuals are categorized as the general user group according to the criteria of the smartphone overdependence scale, it is necessary to closely examine whether they are categorized as the habitual user type or the virtual space dependent type in terms of detailed aspects of smartphone dependency. The scores for ADHD, aggression, and depressive symptoms were highest in the virtual space dependent type, followed by the habitual user type. For social withdrawal, the habitual user type had the highest score for this domain and the virtual space dependent type had the second highest score. In agreement with the findings of previous studies, the results of this study also showed that adolescents exhibiting a high level of smartphone dependency, such as the habitual user type or the virtual space dependent type, showed high levels of ADHD [7,8], aggression [9,10], social withdrawal [11,12], and depressive symptoms [13]. However, considering that the proportion of the general user group is about 30% in both types, the results of this study suggest that when screening adolescents for smartphone dependency, simply considering the severity of smartphone dependency based on the criteria of the smartphone overdependence scale may have some problems. In other words, this means that among the general user group, some smartphone users who can prevent the transition to smartphone overdependence may be overlooked. In this study, compared to other types, the habitual use type and virtual space dependent type showed relatively higher proportions of female adolescents, adolescents living in urban areas, and those with poor subjective household economic status, and these results are consistent with the findings of previous studies [15,17,19]. However, since this study investigated differences in general characteristics according to latent profiles only using descriptive statistics, further research is needed to investigate how these differences in general characteristics affect the distinct latent profiles.

With respect to smartphone use characteristics, in terms of average daily time spent using smartphones during leisure time on weekdays, the proportion of less than 1 hour was significantly lower in the habitual user type compared to other types. In particular, the proportion of adolescents spending more than 3 hours on smartphone use on weekends was 68.0% in the habitual user type, and this percentage is more than two times higher than in the underdependent type (32.0%) or the moderate type (30.0%) and it is about 1.5 times higher than in the virtual space-dependent type (45.0%). In terms of the types of smartphone usage, the habitual user type had a higher score for the use of multimedia such as TV, video, and music than other types. The habitual user type and virtual space dependent type showed higher scores for SNS than the underdependent and moderate types. In particular, the virtual space dependent type was found to use smartphones more for other types of smartphone usage, including games, compared to other latent profiles. In this study, it is difficult to accurately examine the total duration of daily smartphone use because the KCYPS 2018 only investigated average daily time spent using smartphones during leisure time, not the total duration of daily smartphone usage. However, since there was no statistically significant difference in the use of the smartphone for calls/messaging or information search according to the latent profiles, differences in usage pattern between latent profiles are thought to be primarily influenced by differences in smartphone use during leisure activities. According to a previous research [38], the use of smartphones for information seeking, SNS, and games was found to have a positive impact on smartphone overdependence among adolescents. In particular, games are highly likely to cause smartphone overdependence because they provide vicarious satisfaction or rewards of immediate pleasure [39]. Furthermore, nowadays among adolescents, capturing photos or videos not only serves the purpose of personal possession but also significantly involves utilizing SNS to share them in virtual spaces and engage in communication within them [40,41]. Moreover, such behaviors are closely associated with their identity formation as well [42]. The types of smartphone usage among adolescents are interconnected rather than fragmented, so intervening with smartphone-dependent adolescents should prioritize understanding the underlying motivations that reinforce smartphone usage. Therefore, it is important to simultaneously emphasize awareness of smartphone use and cultivation of healthy usage habits so that adolescents can self-regulate their smartphone use patterns. In addition, efforts are needed to promote physical activities and encourage participation in art and cultural events, and expand infrastructure for adolescents' leisure activities to support these endeavors so that their leisure activities are not limited to sedentary activities using smartphones.

An interesting finding is that descriptive statistical analysis showed that the scores for all the domains of emotional and behavioral difficulties were highest in the virtual space dependent type, but when ranked ANCOVA was performed after controlling for covariates (gender, geographic location, subjective economic status, parental smartphone dependency, and relationship variables), the results of ranked ANCOVA showed that the levels of ADHD, social withdrawal, and depressive symptoms were statistically significantly higher in the habitual user type than in the virtual space dependent type. In the additional analysis, covariates were entered in a stepwise manner, and the above results were obtained when relational variables were entered. In this study, the habitual user type showed a better level of relational variables, compared to the virtual space dependent type. The virtual space dependent type had a higher score for negative relationship with peers than other types, but the habitual user type showed a high level of positive relationship with peers, which was a similar level to that of the underdependent type. In addition, the virtual space dependent type had a high score for the negative parenting attitude, and was found to spend the least time with their parents, while the habitual user type had the highest score for time spent with parents, which was a similar level to that of the underdependent type. These results are presumed to show that since adolescents in the habitual user type have positive relationships with people around them, and these relational factors are performing the role of partially buffering emotional and behavioral difficulties [43-45]. In addition, adolescents with relatively negative perceptions in terms of relationships with people around them were highly likely to belong to the virtual space dependent type and experienced more emotional and behavioral difficulties. However, this study had limitations in determining whether these adolescents' dissatisfaction with real-life relationships led to their increased dependence on virtual space [46,47], or whether their high dependence on virtual space had a negative impact on relationships in real life [48,49]. Further research is needed to investigate the causal relationship. Therefore, intervention programs designed to reduce emotional and behavioral difficulties resulting from smartphone dependence should take into account the complex interactions of relationships with parents and peers, and should focus on improving these relationships and addressing adolescents' psychological needs.

In addition, there is a need to vary intervention approach depending on the latent profiles identified in this study. First, in the case of the habitual user type, it is necessary to provide an intervention to reduce daily smartphone usage time itself. For the habitual user type, this method may be effective because this group does not show withdrawal symptoms even if they stop using smartphones temporarily. For example, it is necessary to provide an intervention to block unconscious smartphone uses due to SNS algorithms and the infinite scroll function and to break a chain of habits, and such interventions may utilize digital detox training, such as providing feedback to check one's smartphone usage patterns, utilizing apps that limit smartphone usage time, turning off app notification settings, and deleting non-essential apps if possible, and using a smartphone timer box with a lock [50,51]. In addition, to utilize the positive relationships with peers and parents shown by the habitual user type, peers and parents can be actively utilized as part of an intervention program [52,53]. On the other hand, in the case of the virtual space dependent type, this group has high levels of virtual life orientation and withdrawal, so an attempt to drastically restrict their smartphone use may result in increased symptoms of emotional and behavioral difficulties [54]. Therefore, rather than suddenly restricting their smartphone use, it is necessary to provide training to gradually develop their control over smartphone use in conjunction with expert counseling.

The results of this study showed that 1 out of 10 adolescents belongs to the habitual user type and 1 out of 5 adolescents belongs to the virtual space dependent type. When combining the habitual use type and the virtual space dependence type among all adolescents, they account for a significant proportion of approximately one third. This means that adolescents at high-risk of mental health problems associated with smartphone overdependence account for a considerable proportion of the adolescent population. Therefore, these subgroups should be emphasized as groups that deserve more attention in terms of the mental health of adolescents. In addition, when determining the scale of an intervention program in the field of nursing practice, the distributions of the habitual use type and virtual space dependent type in the total population of adolescents can be used as reference data. The proportion of each latent profile can be used as an important indicator in determining the target population of an intervention program and adjusting the scale and resource allocation of the intervention program.

This study has some limitations. First, this study is a secondary data analysis and used the limited variables included in the panel data. In particular, in the case of the variable of average daily time spent on smartphones, it was measured using a question about average daily time spent using smartphones during leisure time, so it was not possible to examine the total duration of daily smartphone usage. Also, since the responses about the type of smartphone usage were also categorical, there were limitations on the investigation of smartphone usage types. Second, because this study was a cross-sectional study using the most recent data of the KCYPS 2018, only first-year high school students were included as the participants in the study. Thus, further research is needed to examine whether the latent profiles are classified into similar types in other age groups of adolescents.

Conclusions

This study used data from the Korean Children and Youth Panel Survey (KCYPS) conducted in 2021 to identify the latent profiles of smartphone dependency among first-year high school students in Korea. The latent profiles of smartphone dependency were classified based on four domains: disturbance of adaptive functions, virtual life orientation, withdrawal, and tolerance. As a result, four latent profiles were identified. The 'underdependent type' showed low levels of all the four domains, and the 'moderate type' showed medium levels of all the four domains. The 'habitual user type' showed high levels of disturbance of adaptive functions and tolerance, and the 'virtual space dependent type' showed high levels of all domains but especially high levels of virtual life orientation and withdrawal. Since the identified four latent profiles of smartphone dependency respectively represents groups with different characteristics of smartphone dependency, various intervention strategies for each latent profile are needed based on the results of this study.

The comparison of emotional and behavioral difficulties between the latent profiles showed that the levels of attention deficit hyperactivity disorder, aggression, social withdrawal, and depressive symptoms were highest in the virtual space dependent type. However, the results of ranked ANCOVA performed after controlling for covariates revealed that the habitual user type with positive relationships with parents and peers showed statistically significantly higher levels of attention deficit hyperactivity disorder, social withdrawal, and depressive symptoms, compared to the virtual space dependent type. Considering that the habitual user type was found to have positive relationships with parents and peers, the results suggest that the relational variables may play the role of buffering the impact of smartphone dependency on emotional and behavioral difficulties. Therefore, it is necessary to consider relational aspects in intervention strategies for smartphone dependency among adolescents. These research results can be used as basic data for early detection of emotional and behavioral difficulties related to smartphone overdependence among adolescents and provision of appropriate support in the field of nursing practice in school.

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Conflict of interest

The authors declared no conflict of interest.

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Authors' contributions

Eunjoo Kim contributed to conceptualization, funding acquisition, project administration, writing – original draft, review & editing, resources, supervision, and validation. Min Kyung Song contributed to data curation, formal analysis, methodology, visualization, writing – original draft, review & editing, and software.

Data availability

Please contact the corresponding author for data availability.

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References

1. National Information Society Agency. The survey on smartphone overdependence. Daegu: Ministry of Science and ICT, 2022. Report No.: NIA Ⅷ-RSE-C-22052.
2. Kim DI, Chung YJ, Lee JY, Kim MC, Lee YH, Kang EB, et al. Development of smartphone addiction proneness scale for adults: Self-report. Korea Journal of Counseling. 2012;13(2):629–644. https://doi.org/10.15703/kjc.13.2.201204.629
3. Shin KW, Kim DI, Jeong Y, Lee J, Lee Y, Kim M, et al. Development of Korean smartphone addiction proneness scale for youth and adults. Seoul: Korean National Information Society Agency, 2011. Report No.: NIA Ⅳ-RER-11051.
4. Bae Y. The Reality and Issues of Smartphone Overdependence [Internet]. Daejeon: Statistics Research Institute; 2016 [cited 2023 May 13]. Available from: https://kostat.go.kr/board.es?mid = a90104010301&bid = 12309&tag = &act = view&list_no = 370220&ref_bid = .
5. Berlin KS, Williams NA, Parra GR. An introduction to latent variable mixture modeling (part 1): Overview and cross-sectional latent class and latent profile analyses. Journal of Pediatric Psychology. 2014;39(2):174–187. https://doi.org/10.1093/jpepsy/jst084
6. Mathew A, Doorenbos AZ. Latent profile analysis - An emerging advanced statistical approach to subgroup identification. Indian Journal of Continuing Nursing Education. 2022;23(2):127–133. https://doi.org/10.4103/ijcn.ijcn_24_22
7. Kocyigit S, Guzel HS, Acikel B, Cetinkaya M. Comparison of smartphone addiction level, temperament and character and parental attitudes of adolescents with and without attention deficit hyperactivity disorder. International Journal of Mental Health and Addiction. 2021;19:1372–1384. https://doi.org/10.1007/s11469-021-00494-2
8. Kwon SJ, Kim YJ, Kwak YH. Influence of smartphone addiction and poor sleep quality on attention-deficit hyperactivity disorder symptoms in university students: A cross-sectional study. Journal of American College Health. 2022;70(1):209–215. https://doi.org/10.1080/07448481.2020.1740228
9. Doo EY, Kim JH. Parental smartphone addiction and adolescent smartphone addiction by negative parenting attitude and adolescent aggression: A cross-sectional study. Frontiers in Public Health. 2022;10:981245. https://doi.org/10.3389/fpubh.2022.981245
10. Kim MO, Kim HJ, Kim KS, Ju SJ, Choi JH, Yu M. Smartphone addiction: (Focused depression, aggression and impulsion) among college students. Indian Journal of Science and Technology. 2015;8(25):1–8. https://doi.org/10.17485/IJST/2015/V8I25/80215
11. Lim SA. Longitudinal effect of social withdrawal on negative peer relations mediated by smartphone dependence among Korean early adolescents. International Journal of Mental Health and Addiction. 2023;21(5):3061–3075. https://doi.org/10.1007/s11469-022-00774-5
12. Park JH, Choi JM. Smartphone overdependence and quality of life in college students: Focusing on the mediating effect of social withdrawal. Frontiers in Public Health. 2022;10:997682. https://doi.org/10.3389/fpubh.2022.997682
13. Elhai JD, Dvorak RD, Levine JC, Hall BJ. Problematic smartphone use: A conceptual overview and systematic review of relations with anxiety and depression psychopathology. Journal of Affective Disorders. 2017;207(1):251–259. https://doi.org/10.1016/j.jad.2016.08.030
14. Kim EJ, Jo JH, Song MK. Latent classes of smartphone dependency trajectories and predictors of classes among middle school students in South Korea. Journal of Pediatric Nursing. 2023;73:44–52. https://doi.org/10.1016/j.pedn.2023.08.013
15. Lee EJ, Kim YK, Lim SJ. Factors influencing smartphone addiction in adolescents. Child Health Nursing Research. 2017;23(4):525–533. https://doi.org/10.4094/chnr.2017.23.4.525
16. Daoud O, Abdo JB, Demerjian J. Implications of smartphone addiction on university students in urban, suburban and rural areas. International Journal of Education Economics and Development. 2021;12(1):17–26. https://doi.org/10.1504/ijeed.2021.10033131
17. Kim JO. Factors and health behaviors affecting smartphone over-dependency among adolescents: Focus on 2020 adolescents' health behavior survey. The Korean Society of Health Service Management. 2021;15(2):91–105. https://doi.org/10.12811/kshsm.2021.15.2.091
18. Lee EJ. Comparison of factors related to smartphone dependency among middle school, high school, and college students based on the seventh Korean children and youth panel survey. Child Health Nursing Research. 2019;25(2):165–174. https://doi.org/10.4094/chnr.2019.25.2.165
19. Tsetsi E, Rains SA. Smartphone internet access and use: Extending the digital divide fand usage gap. Mobile Media & Communication. 2017;5(3):239–255. https://doi.org/10.1177/2050157917708329
20. Kwak JY, Kim JY, Yoon YW. Effect of parental neglect on smartphone addiction in adolescents in South Korea. Child

Abuse & Neglect. 2018;77:75–84. https://doi.org/10.1016/j.chiabu.2017.12.008

21. Sun R, Gao Q, Xiang Y, Chen T, Liu T, Chen Q. Parent–child relationships and mobile phone addiction tendency among Chinese adolescents: The mediating role of psychological needs satisfaction and the moderating role of peer relationships. Children and Youth Services Review. 2020;116:105113. https://doi.org/10.1016/j.childyouth.2020.105113
22. Kwon HM, Kim BR. A comparative study of the influencing factors of smartphone dependence between elementary and middle school students. The Journal of The Korea Contents Association. 2022;22(10):827–839. https://doi.org/10.5392/JKCA.2022.22.10.827
23. Cho BH, Lim KH. Development and validation of emotional or behavioral problems scale. The Korean Journal of Counseling and Psychotherapy. 2003;15(4):729–746.
24. Kim KY. Development of behavior problem scale for children and adolescence. Journal of Families and Better Life. 1998; 16(4):155–166.
25. Kim KI, Kim JH, Won HT. Symptom Checklist-90-Revision - Depression. In: Jung Ang Juk Sung Publisher. Korean manual of symptom checklist-90-revision. 1st ed. Seoul: Jung Ang Juk Sung Publisher; 1984. p. 8–10.
26. Yeom YO, Hong YP, Kim KM, Lee YL, Lim MH. The relationships between academic burnout, mental health, parental achievement pressure, and academic demand in high school students. Stress. 2020;28(2):61–67. https://doi.org/10.17547/kjsr.2020.28.2.61
27. Bae SM, Hong JY, Hyun MH. A validation study of the peer relationship quality scale for adolescents. Korean Journal of Youth Studies. 2015;22(5):325–344.
28. Lee MY. Effects of parenting attitudes on smartphone addiction of adolescents: Mediator effects of peer & teacher relationship. Forum for Youth Culture. 2022;70:69–98. https://doi.org/10.17854/ffyc.2022.04.70.69
29. Kim JB, Kim NH. Validation of student-teacher attachment relationship scale (STARS) as a basis for evaluating teachers` educational competencies. The Korean Journal of Educational Psychology. 2009;23(4):697–714.
30. Kim TM, Lee EJ. Validation of the Korean version of parents as social context questionnaire for adolescents: PSCQ_KA. Korean Journal of Youth Studies. 2017;24(3):313–333. https://doi.org/10.21509/KJYS.2017.03.24.3.313
31. Kim S, Ahn DH. Influences of parenting styles on middle school students' depression: Mediating effects of academic helplessness and social withdrawal. Korean Education Inquiry. 2021;39(3):177–203. https://doi.org/10.22327/kei.2021.39.3.177
32. Bai SY, Kim H, Sung E. 2013 youth media use survey report. Seoul: Ministry of Gender Equality and Family, 2013. Report No.: 2013-R28.
33. Ministry of Culture, Sports and Tourism. 2021 National Leisure Activities Survey [Internet]. Seoul: Ministry of Culture, Sports and Tourism, 2022 [cited 2023 Jun 12]. Available from: http://www.mcst.go.kr/kor/s_policy/dept/deptView.jsp? pSeq=1898&pDataCD=0406000000
34. Nylund KL, Asparouhov T, Muthén BO. Deciding on the number of classes in latent class analysis and growth mixture modeling: A Monte Carlo simulation study. Structural Equation Modeling: A Multidisciplinary Journal. 2007;14(4):535–569. https://doi.org/10.1080/10705510701575396
35. Pastor DA, Barron KE, Miller BJ, Davis SL. A latent profile analysis of college students' achievement goal orientation. Contemporary Educational Psychology. 2007;32(1):8–47. https://doi.org/10.1016/j.cedpsych.2006.10.003
36. Clark SL, Muthén B. Relating latent class analysis results to variables not included in the analysis: the analysis. 2009 [cited 2023 Jun 16]. Available from: http://www.statmodel.com/download/relatinglca.pdf
37. Armstrong RA. When to use the Bonferroni correction. Ophthalmic and Physiological Optics. 2014;34(5):502–508. https://doi.org/10.1111/opo.12131
38. Resnikoff AW, Nugent NR. Social media use: What are adolescents communicating? The Brown University Child and Adolescent Behavior Letter. 2021;37(6):1–6. https://doi.org/10.1002/cbl.30546
39. Bae SM. Influence of smartphone usage types and excessive expectation for smartphone on adolescents' smartphone overdependence. Informatization Policy. 2018;25(4):65–83. http://doi.org/10.22693/NIAIP.2018.25.4.065
40. Min JS, Kim ES. A study on game usage motivation affecting game addiction: Focusing on mediation effect of future maturity. Korean Journal of Social Science. 2018;37(1):55–80. https://doi.org/10.18284/jss.2018.04.37.1.55
41. Throuvala MA, Griffiths MD, Rennoldson M, Kuss DJ. Motivational processes and dysfunctional mechanisms of social media use among adolescents: A qualitative focus group study. Computers in Human Behavior. 2019;93:164–175. https://doi.org/10.1016/j.chb.2018.12.012
42. Miranti A. Visual hyper reality of teenagers in social media with photographs as communication media. KnE Social Sciences. 2017;2(4):329–333. https://doi.org/10.18502/kss.v2i4.904
43. Becker SP, Fite PJ, Luebbe AM, Stoppelbein L, Greening L.

Friendship intimacy exchange buffers the relation between ADHD symptoms and later social problems among children attending an after-school care program. Journal of Psychopathology and Behavioral Assessment. 2013;35:142–152. https://doi.org/10.1007/S10862-012-9334-1

44. Maurizi LK, Grogan-Kaylor A, Granillo MT, Delva J. The role of social relationships in the association between adolescents' depressive symptoms and academic achievement. Children and Youth Services Review. 2013;35(4):618–625. https://doi.org/10.1016/J.CHILDYOUTH.2013.01.006
45. Rubin KH, Bowker J, Gazelle H. Social withdrawal in childhood and adolescence: Peer relationships and social competence. In: Rubin KH, Coplan RJ, editors. The development of shyness and social withdrawal. NY: The Guilford Press; 2010. p. 131–156.
46. Jassogne C, Zdanowicz N. Real or virtual relationships: Does it matter to teens? Psychiatria Danubina. 2020;32(suppl. 1):172– 175.
47. Jensen M, George MJ, Russell MA, Lippold MA, Odgers CL. Does adolescent digital technology use detract from the parent-adolescent relationship? Journal of Research on Adolescence. 2021;31(2):469–481. https://doi.org/10.1111/jora.12618
48. Asghari BA. Relationship between internet addiction and dependency virtual social networks with loneliness in adolescents. Journal of Research and Health. 2018;8(5):442–450. https://doi.org/10.29252/JRH.8.5.442
49. Lo SK, Wang CC, Fang W. Physical interpersonal relationships and social anxiety among online game players. Cyberpsychology & Behavior. 2005;8(1):15–20. https://doi.org/10.1089/cpb.2005.8.15
50. Hari J. Stolen Focus: Why You Can't Pay Attention. London, UK: Bloomsbury Publishing; 2022. 368 p.
51. Kent S, Masterson C, Ali R, Parsons CE, Bewick BM. Digital intervention for problematic smartphone use. International Journal of Environmental Research and Public Health. 2021;18(24):13165. https://doi.org/10.3390/ijerph182413165
52. Kim E, Son HD, Choi MO, Jeong B. Development of a smartphone overdependence prevention group program in adolescents. Asia-Pacific Journal of Convergent Research Interchange. 2019;5(4):123–137. https://doi.org/10.21742/apjcri.2019.12.13
53. Marini L, Hendriani W, Wulandari PY. Optimizing the role of the family in prevention teen smartphone addiction through psychoeducation smartphone addiction to parents. Dinamisia: Jurnal Pengabdian Kepada Masyarakat. 2023;7(4):930–941. https://doi.org/10.31849/dinamisia.v7i4.15217
54. Eide TA, Aarestad SH, Andreassen CS, Bilder RM, Pallesen S. Smartphone restriction and its effect on subjective withdrawal related scores. Frontiers in Psychology. 2018;9:1444. https://doi.org/10.3389/fpsyg.2018.01444

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Illness Experience of Glaucoma Patients

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Purpose: The purpose of this study was to understand and describe the experiences of patients with glaucoma.
Methods: Data were collected from March to April in 2023, through individual in-depth interviews with 10 glaucoma patients. Verbatim transcripts were analyzed using Colaizzi's phenomenological analysis.
Results: Six theme clusters were extracted that described patients' experiences: 1) The frightening disease unexpectedly discovered; 2) A dismal life gradually trapped in darkness; 3) Fear of the unseen; 4) Following treatment without any other options; 5) Grateful for the help but feeling miserable; 6) Realizing the importance of eyes and health.
Conclusion: The results of this study provide a deep understanding and insight into the experience of Glaucoma patients. Glaucoma patients experienced physical, mental, and social pain through the disease process. Therefore, psychological nursing interventions are needed to understand and reduce mental pain along with medical treatment to relieve physical symptoms in glaucoma patients. Furthermore, it will be necessary to prepare institutional support measures to minimize various social restrictions.

Keywords: Glaucoma; Patients; Qualitative research

Introduction

1. Background

In Korea, the number of glaucoma patients has been increasing at an average annual increase rate of 4.5% from 870,000 people in 2017 to 1.08 million people in 2021 [1]. Glaucoma is one of the three leading causes of blindness worldwide. In early stages, there are usually no symptoms since the optic nerve damage occurs gradually, but as the disease progresses, in later stages, severe visual field loss occurs and it may even cause complete vision loss. In particular, since optic nerve damage caused by glaucoma does not improve even with treatment, glaucoma does not currently have a cure [2].

The main goals of glaucoma treatment are to detect the disease early through regular eye exams, prevent the progression of optic nerve damage and visual field defect, and improve quality of life in patients [3]. Chronic progressive diseases such as glaucoma require patients' self-management and a continuous and comprehensive medical intervention [4].

Glaucoma patients have been shown to have high levels of depression and anxiety and a low level of quality of life [5,6]. In addition, they experience great mental and psychological difficulties due to visual field defects and visual impairment during the treatment process, so nursing care for glaucoma patients requires not only approaches for management of physical symptoms but also psychological understanding and support [7].

Therefore, nursing care based on the needs of glaucoma patients should be provided to help them adjust to the disease and increase therapy adherence rates. The provision of nursing care based on the needs of patients can help reduce irreversible dam-

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age caused by glaucoma by positively improving patients' treatment adherence. In this regard, it is believed that qualitative research to understand and reveal phenomena experienced by patients can provide practical help for nursing based on the needs of patients. In other words, a better understanding of the experience of patients can be provided by qualitative research rather than objective quantitative research carried out by selecting some interesting concepts from researchers' perspective and identifying associated variables or influencing factors.

A review of previous studies on glaucoma patients showed that previous quantitative researches were mainly conducted centered on ophthalmological societies, and the majority of them were focused on physical problems such as risk factors for glaucoma [8] and treatment methods [9,10].

With respect to qualitative research on glaucoma patients, there are a small number of qualitative studies on glaucoma patients conducted in foreign countries, and these prior studies include studies limited to glaucoma treatment experiences, such as a research on barriers to glaucoma medication adherence [11] and an investigation of patients' experience of a glaucoma virtual clinic [12], and a study of quality of life in children with glaucoma [13]. In the case of domestic qualitative studies on glaucoma patients, a study in the field of special education investigated the experience of the visual environment and support needs among four glaucoma patients with visual impairment in their 40s [14], and a phenomenological study explored the illness experience of patients with visual field defects in their 20s and 40s [7]. As described above, a review of domestic and foreign previous studies revealed that there have been few qualitative researches on the illness experience of glaucoma patients in their 50s or older.

However, there is a clear need to qualitatively explore the illness experience of glaucoma patients in their 50s or older, considering that 76.4% of glaucoma patients in Korea in 2021 are in their 50s or older [1], Also, according to a survey by Statistics Korea, people aged 50 or older account for 44.16% of the total population [15], and these age groups often suffer from various chronic diseases and physical dysfunction, and experience various difficulties due to such health problems [16]. In particular, considering that glaucoma is a chronic progressive disease that most commonly occur in people aged 50 or older, there is a need for qualitative research to understand and reveal the experiences of glaucoma patients in their 50s or older.

Phenomenological research is an approach of qualitative research that describes an individual's lived experiences, and allows the researcher to take a holistic approach of contacting the reality of the subject and thereby explain the essential nature of human behaviors based on the understanding of human beings [17]. Among phenomenological research methods, the method proposed by Colaizzi [18] focuses on deriving the common attributes of all research participants and is appropriate for describing the essential structure of the illness experience of glaucoma patients. Therefore, this study attempted to conduct an in-depth analysis of the experiences of glaucoma patients aged 50 or older and gain a deeper understanding of their illness experience by applying the phenomenological research method of Colaizzi [18]. Based on the research results, this study sought to provide nursing knowledge for glaucoma patients and provide basic data for nursing interventions and the development of intervention programs.

2. Purpose

The purpose of this study was to conduct a comprehensive, in-depth inquiry of the illness experience of glaucoma patients and describe its meanings by applying a phenomenological method. The main research question of this study is as follows: 'What is the essential nature of the illness experience of glaucoma patients?'

Methods

1. Study design

This study was an inductive research conducted according to the phenomenological procedures of Colaizzi [18] to comprehensively understand and explore the disease experience of glaucoma patients through in-depth interviews.

2. Participant selection

The participants of this study were patients aged 50 or older who were diagnosed with glaucoma (diagnosis code: H40, H42) at the outpatient clinic of the Department of Ophthalmology at a university hospital in Busan, and participants were selected without restrictions on the duration of disease or whether the patient underwent surgery for glaucoma. Glaucoma is a chronic progressive disease that does not have a cure, and glaucoma surgery is performed with the goal of slowing down the progression of the disease. Therefore, it was thought that it would be difficult to comprehensively understand the overall characteristics of the disease if participants were limited by applying the inclusion criteria about disease duration and previous history of glaucoma surgery, so the criteria for selecting subjects were determined through agreement among researchers. To ensure the homogeneity of participants, participants were selected among patients without cognitive impairment and with visual field defects diagnosed through visual field testing, and patients with other ophthalmological diseases that may affect visual field defects were excluded. Study participants were selected by the purposive sampling method. This researcher gave detailed explanations about the purpose and methods of this study to the fellow doctors in the department of ophthalmology and outpatient nurses of the hospital to form a trust relationship with them. The hospital staff recommended participants who experienced the disease and had no difficulty communicating among patients who were diagnosed with glaucoma and had visual field defects. Among the patients recommended by the medical staff, ten patients who met the inclusion criteria and gave informed consent to participate in the study were finally recruited as the participants of this study.

3. Data collection

Data collection was conducted from March to April 2023, and face-to-face individual interviews with the participants were conducted by the researcher. Individual interviews were conducted 1 to 2 times for each participant, and each interview session took 1 to 2 hours. Considering the accessibility and convenience of the participants, interviews were conducted in a quiet place such as a consultation room in a hospital, the participant's home, or a café. After collecting and analyzing data from eight people, the researcher recognized that the collected data included repeated contents. As a result of conducting interviews with two additional participants, it was determined that data saturation was reached because no additional new facts were found and the same information was repeatedly found. Therefore, data collection was completed.

During the interview, the researcher first asked about the participant's general characteristics, and the main interview was started with the following unstructured and open-ended question: "Please tell me about your illness experience about being diagnosed with glaucoma." Regarding the parts that the researcher considered important among the participant's statements, follow-up questions were asked to conduct an in-depth inquiry of them. The main interview questions were as follows: 1) How did you feel when you were diagnosed with glaucoma?; 2) What did you experience due to the symptoms of glaucoma?; 3) What difficulties do you have due to glaucoma?; 4) While you were experiencing the illness process after glaucoma diagnosis, what impact did the illness process have on you?; 5) What has changed in your life as a result of your illness experience? Throughout the entire process of an interview from the beginning to the end of the interview, the researcher excluded the researcher's subjective viewpoint or prejudice through 'suspending judgment.' In addition, the researcher made continuous efforts to understand the essential nature of the participants' experiences through open-ended questions.

In order to describe the phenomena experienced by the study participants as they are, the purpose and procedures of the study were fully explained to the participants, and after their consent was obtained, the interviews with them were recorded. After interviews with the participants, the researcher listened to the recordings repeatedly and made verbatim transcripts of them. In addition to the participants' verbal expressions, their gazes, gestures, laughter, crying, weeping, and changes of facial expression were also observed and recorded in the interview notes. The researcher read the transcripts of interviews repeatedly several times to understand the meanings of what the participants said. When omitted questions or parts with unclear meanings were found in the process of reading the transcripts of interviews, supplementary questions were asked during the next interview. After completing the interviews, the researcher gave her contact information to the participants and informed them that they could make inquiries related to the study at any time.

4. Data analysis

To analyze research data, the researcher directly carried out the coding process and derived results according to the procedures of the phenomenological method presented by Colaizzi [18]. The data analysis process was carried out in the following order. 1) Glaucoma patients' illness experiences were recorded through individual in-depth interviews and then the recordings of interviews were transcribed. The researcher listened to and read the participants' statements repeatedly to get feelings about them. 2) Meaningful statements were found and underlined from sentences containing phenomena representing the illness experience of glaucoma patients, and statements with similar meanings and overlapping statements were extracted and systematically described. 3) The statements in the extracted sentences were restated in the researcher's language to derive meaning units. 4) The derived meaning units were classified based on common themes. 5) Similar themes were grouped together to derive more general and abstract theme clusters. 6) In order to validate the theme clusters, they were checked by comparing them with the raw data. 7) After integrating the analyzed contents into one description, the essential meanings of the research phenomenon were comprehensively described.

5. Ensuring the quality of research and the researcher's preparations

This study attempted to ensure the rigor of qualitative research, based on the following four criteria for rigor in qualitative research suggested by Guba and Lincoln [19]: credibility, transferability, dependability, and confirmability. First, to ensure credibility, the interviews with the participants were recorded after obtaining the consent of each participant to prevent the omission of any part of the interview data. The researcher refrained from expressing her emotions during each interview to minimize the researcher's influence on the participant, and the transcription of recordings was conducted immediately after each interview to minimize the distortion and omission of data. In addition, in the data analysis process, to ensure consistency in data analysis and increase the credibility of analysis results, the researcher derived analysis results based on consensus through discussion with two other researchers with abundant experience in qualitative research. Second, to ensure transferability, study participants in various environments were selected by the purposive sampling method, and data were collected until saturation was reached. Third, to increase dependability, the researchers faithfully applied the analysis procedures presented by Colaizzi [18], and asked one participant to verify whether the content of the transcript and analysis results were consistent with what he or she had stated. In addition, the researchers made a detailed description of the research method and the processes of data collection and analysis in detail, and tried to describe the participants' vivid experiences by quoting their statements in the research results. Lastly, confirmability can be ensured when the above-mentioned three criteria have been secured. Throughout the entire research process, efforts were made to exclude the researcher's viewpoint or preconceptions by suspending judgment in order to minimize the distortion of the research phenomenon. The pre-understandings and assumptions recognized by the researcher are as follows. Patients with glaucoma may not be aware of the seriousness of the illness and are likely to think it is not a serious disease. Since it is not a life-threatening disease, they would not worry much about it, although it is an unfamiliar disease. When they begin to recognize the illness that gradually gets worse with time, and their anxiety and despair will increase. Because the researcher presumed that elderly patients with glaucoma would complain of not only physical symptoms but also mental problems such as higher levels of anxiety and depression, the researcher became curious about their perceptions and experiences of the disease.

The researcher completed two courses (6 credits) on qualitative research as part of a doctoral program to have a theoretical foundation for qualitative research. In addition, the researcher regularly participated in qualitative research seminars and workshops to get opportunities for training in data collection and analysis as a qualitative researcher.

The final research results were reviewed by two persons with a PhD in nursing and an MD-PhD.

6. Ethical considerations

The data for this study was collected after receiving approval from the IRB of Kosin University (IRB No. KU IRB 2022-0077). Participants were given explanations about the purpose and methods of the study before data collection, and were informed about their right to withdraw from this study at any time. They were also informed that the interview data would be anonymous, confidentiality would be guaranteed, and the interview data would be discarded after the completion of the study. The participants of this study fully understood these facts and signed a written consent form. The collected data were coded to ensure anonymity, written or printed data were stored in a locked filing cabinet, and electronic data files were stored on the researcher's personal computer locked with a password. The participants were given a small gift certificate as a token of gratitude after interviews were completed.

Results

The participants consisted of three women and seven men. The average age of the participants was 68 years, and the participants included two people in their 50s, five people in their 60s, one person in their 70s, and two people in their 80s. Regarding their occupations, the participants consisted of two unemployed people, two housewives, a bus driver, a person engaged in construction equipment business, a person engaged in financial business, a person engaged in the fishing industry, a person engaged in agriculture, and a business representative. The duration of disease ranged from 2 weeks to 35 years. Regarding the eyes diagnosed with glaucoma, six people were diagnosed with glaucoma in both eyes, two people in the right eye, and two people in the left eye. The transcript data obtained from 10 participants were 107 pages of A4 paper, and a total of 39 meaning units were extracted from the data. Based on the results, while rechecking the relatedness of derived meaning units to the raw data, the meaning units were classified and grouped together into 16 themes, and common themes were grouped together again to derive six theme clusters (Table 1).

Table 1. Theme Clusters and Themes of the Experience of Patients with Glaucoma

theme clusters	theme	meaning unit
The frightening disease unexpectedly discovered	Stunned by the Unexpected Diagnosis	Diagnosed while treating another condition.
		Suddenly appeared unexpectedly.
		Realized the true meaning of glaucoma for the first time.
	Feeling overwhelmed about the future	Different from common illnesses and treatment methods.
		An incurable disease.
		Ultimately, a dreadful disease that causes blindness.
A dismal life gradually trapped in darkness	Eyes filled with welling tears and pain	Blurred and hazy vision.
		Severe eye pain.
		Excessive tear production.
	Feeling discomfort and frustration from disrupted daily life	Difficulty in performing household activities.
		Fear of dark places.
		Restricted to familiar places due to poor vision.
	Sorrowful for the loss of identity	Wanting to work but unable to due to eye problems.
		Struggling with household roles.
Fear of the unseen	Becoming progressively worse, feeling exhausted and drained	Managing the condition is not easy.
		Despite treatment, the condition does not improve.
	Fear of blindness, feeling like the end of life	Inability to do anything without sight, leading to unhappiness.
		Losing health means losing everything.
	Emotionally crumbling	Despair at the complete destruction of the body.
		Anxiety due to recurrent episodes and no full recovery.
		Overwhelmed by the inability to perform even simple daily tasks alone.
Following treatment without any other options	Feeling disappointed and loss of energy due to the lack of treatment options	Unclear cause of deteriorating eyesight.
		Unable to find answers in search of treatment methods.
	The best treatment is following medical guidance	Limited to following doctors' instructions.
		Regular check-ups are essential.
Grateful for the help but feeling miserable	Feeling pathetic without help	Forced to accept help.
		Unwillingness to burden others.
	Thankful for the support of loved ones	Thankfulness towards people in my life.
		Mixed feelings of gratitude and guilt towards family.
		Finding strength through faith.
Realizing the importance of eyes and health	Realizing the importance of eyes and health	Recognizing the eyes as the most vital sensory organ.
		Developing a greater interest in eye health.
		Reconsidering the significance of overall health.
	Accepting and adapting to the disease, living on	Embracing the illness with no alternative solution.
		Managing the symptoms independently.
	Managing eyes to the best of one's ability	Continuously protecting and taking precautions for the eyes.
		Committing to regular eye drops for a lifetime.
	Hoping it doesn't progress further	Desiring to remain in the current state without further deterioration.
		Vaguely hoping for the invention of a curative medicine to achieve recovery.

1. The frightening disease unexpectedly discovered

This theme cluster depicts participants' feelings and perceptions when they were first diagnosed with glaucoma. Most of the participants were unexpectedly diagnosed with glaucoma as the disease was discovered by chance while receiving treatment for other diseases, and when they were first diagnosed, they were surprised by the expected diagnosis, but they supposed it was an easily curable disease. However, after they learned that glaucoma, unlike other diseases, needs different treatment methods and is a progressive disease that cannot be completely cured, they were living every day with anxiety and the feeling of helplessness.

Actually, when I didn't know about glaucoma, I didn't think much *of it. When I were healthy, anyway, at that time, I didn't even recognize that the risk of blindness from glaucoma is high. Now, I feel afraid to learn that glaucoma, macular degeneration, and retinopathy are three major diseases causing blindness. (Participant 2).*

1) Stunned by the unexpected diagnosis

Most of the participants were unexpectedly diagnosed with glaucoma while receiving treatment for another disease. As in most cases of glaucoma, which typically does not show obvious symptoms in early stages, most of the participants didn't feel any particular symptoms of glaucoma at the time of diagnosis, and the disease was discovered by chance at a hospital. Because the participants did not know the accurate meaning of glaucoma and the seriousness of the disease, glaucoma was a strange unfamiliar disease to them, and they felt bewildered and confused when they were unexpectedly diagnosed with this disease.

2) Feeling overwhelmed about the future

Unlike common diseases, glaucoma is a progressive disease that cannot be cured or improved by surgery or treatment. The participants gradually realized that it is a disease that cannot be cured by modern medicine, and they continued treatment by applying eye drops every day to prevent the disease from getting worse. However, they felt at a loss and helpless to learn that there is no specific medical treatment that can cure the disease. Because the symptoms of glaucoma alternately get better and worse and this disease cannot be cured, the participants were living every day with anxiety and would do so during the remaining years of their life.

2. A dismal life gradually trapped in darkness

This theme cluster represents the participants' experience of physical pain and difficulties in daily life due to the various symptoms caused by glaucoma. Due to the symptom of blurry and dim vision, they had difficulty performing daily activities at home they had done easily before, so they felt frustrated. The range of their activities was further reduced due to a gradual narrowing of their visual field and their fear of dark places. In addition, the participants were experiencing many inconveniences due to poor eyesight in various areas of their lives, including working life and daily tasks at home, and were also facing restrictions on various activities that glaucoma brought.

If I had good eyesight and saw things clearly, I would have done various things, but since two years ago, I haven't even been able to prepare meals and don't cook anymore .... I can see the shapes of things, but I can't even see the people on TV ... They look blurry and I cannot know what they are doing. I can hear sounds, but I can't see their faces. It's really frustrating because I can only see the blurry shapes of people. (Participant 6)

1) Eyes filled with welling tears and pain

All the participants complained of blurry and dim vision. More specifically, they experienced symptoms such as feeling like looking at blurry clouds or something like the moon floating in front of eyes, cloudy vision like looking at things through fog or haze, and lights appearing like a rainbow or looking blurry. These symptoms sometimes caused letters to look blurry, and caused objects to appear or disappear, or caused things to appear larger and then smaller repeatedly. Some participants complained of severe eye pain. Meanwhile, some participants said that they experienced discomfort because they shed more tears than usual after being diagnosed with glaucoma.

2) Feeling discomfort and frustration from disrupted daily life

The participants experienced many changes in their daily lives due to the discomfort caused by various eye symptoms. For example, they felt frustrated when they had difficulty doing daily activities at home that they had done very easily, such as cutting nails, putting on and taking off shoes, eating, or watching television, due to their poor eyesight.

3) Sorrowful for the loss of identity

The participants said that they could continue to work if their eyes got better, but their damaged eyesight made it difficult for them to work or do any activities. In particular, the participants in the younger age group felt devastated about their uncertain future as they experienced many limitations on various activities due to their poor eyesight. Among the participants, a woman who had performed housekeeping duties as a housewife felt sorry and guilty for not being able to fulfill her roles at home.

3. Fear of the unseen

This theme cluster reveals the participants' psychological pain due to the characteristics of glaucoma, which did not improve despite continuous treatment and disease management even in a difficult situation. They were living with fear and anxiety about the possibility of complete vision loss every day, and they felt so anxious that they thought that if they became blind in the end, they would feel despair as if their life was over, and that even though it is not a fatal disease, it would be better to die.

(If I go blind), it's like my life is completely over. Even though I am not young, I am still active, exercise a lot and try to live an active life

like I did when I was young. If that happens, my life will be completely over. I will just breathe and live and won't be able to do any activities … My life will probably be shortened, and that is very psychologically … My biggest worry is that I might go blind. … If you lose your health, you lose everything, and if your eyes get worse, you won't be able to do anything. You won't be able to do any activities at all. Diabetes is not so bad since it is manageable as long as you exercise, but they say that glaucoma may cause blindness if not managed, so that's scary. I fear that I may go blind. (Participant 10)

1) Feeling more exhausted with the progression of illness

Although the participants diligently applied eye drops and received regular medical treatment, their conditions did not improve, but rather got worse, so they felt despondent about their illness and became more and more disappointed. As participants recognized the absence of a cure for glaucoma symptoms, their skepticism and sense of despair about medical treatment were increased.

2) Fear of blindness, feeling like the end of life

The participants said that if they became blind, they would not be able to do anything and it would be like their life was over. Although it was not a fatal disease, their fear of blindness was so great that they thought it would be better to die. In a situation where it was difficult to expect improvement and it was unclear how far the situation would worsen, most of the participants suffered extreme psychological pain due to anxiety about losing their eyesight.

3) Emotionally crumbling

When participants were diagnosed with glaucoma, they felt despair that their bodies were completely destroyed. They didn't realize it at first, but as they suffered from pain through the treatment process, they gradually collapsed psychologically. They thought that these small eyes were controlling their entire body, and as their vision gradually became dimmer, they found themselves unable to do even small things on their own, and they felt more frustrated and depressed.

4. Following treatment without any other options

This theme cluster is related to participants' feelings, perceptions, and attitudes throughout their never-ending glaucoma treatment. Even though they tried to look for a treatment, they felt frustrated when they realized that there was no cure for glaucoma and that there was nothing they could do. In such a desperate situation, the best thing they could do was to follow the medical staff's instructions. However, they could not find the cause of their illness, and their skepticism about medical treatment was increased in a situation where their illness did not improve despite treatment.

I had eye surgery, but I couldn't feel any difference. My eyes didn't get any better, and the symptoms remained the same. Now, when they got worse, I went to the hospital for an eye exam and also went to the ophthalmology clinic, but they didn't say it would get better or I would recover my eyesight. Instead, the doctors only said what's happening to my eyes is that the eye nerves are dying. The doctor just said that my eyes were getting worse for that reason and didn't cure them, so I even went to Seoul and also went to a large hospital. Even in a large hospital, they had no special treatment for it, and there was nothing I could do about it, so I just stopped trying to find a cure and now just keep applying eye drops every day." (Participant 6)

1) Feeling disappointed and loss of energy due to the lack of treatment options

The participants said that even though they tried to find out the cause of their eyesight deterioration, they could not find definite causes, and that their eyesight had gradually worsened even while they were realizing it. Since the exact cause was not known, there was no cure even though they searched for a treatment method, and even though they went to various hospitals and received treatment, the only answer they got was, 'If you don't treat it, you will go blind.' The participants gradually realized that there was nothing they could do to treat glaucoma.

2) The best treatment is following medical guidance

In this hopeless situation, the participants had no choice but to follow the doctor's medical guidance and instructions. The best thing they could do was to receive regular medical treatment and apply prescribed eye drops. One participant felt tired of this endless treatment process, and thus even thought about stopping applying the eye drops.

5. Grateful for the help but feeling miserable

This theme cluster is about the perception of the reality that it is difficult for them to live independently due to visual impairment, and the feelings toward family members and people around them who provide help. The participants felt grateful for their family and people around them who helped them, but at the same time, they felt miserable about themselves for not being able to do anything alone. Some participants were living getting psychological stability by relying on faith in these difficult situations.

Even at a crosswalk, I cross the road with others when they cross, *but I don't cross alone … When I considering crossing alone, a young married woman said to me, "Grandmother, we can cross the road now," and she held my hand and helped me cross the road. Yes, after I did it, my heart... (weeping) I felt like that … So, I held her hand and said thank you … Saying thank you … and at that time, I really, I really felt that way … I feel grateful when I meet people who help me like that … I'm so grateful … I feel grateful and thankful … (Participant 7)*

1) Feeling pathetic about myself who cannot live without others' help

Due to the progression of visual field defects in the eyes, the participants found it increasingly more difficult to perform daily activities independently. They thought it was pathetic when they found themselves having a hard time living without anyone's help. Due to visual impairment, they were having a difficult time perceiving their physical limitations of not being able to do activities as they wanted to and not being able to do anything without help.

2) Thankful for the support of loved ones

Although the participants lost their energy and motivation for life and experienced frustration and despair due to visual field defects, they felt grateful for the help of their family and people around them who always helped and supported them. They felt both sorry for and thankful to their families who experienced various difficulties because of them, and they also felt very grateful even for the small help they received from strangers they met on the street.

6. Realizing the importance of eyes and health

This theme cluster depicts new perceptions, acceptance, and coping about eyes and health gained through experiencing glaucoma. The participant stated that although the eyes are a very small body organ, they are so important that people would think that losing eyesight virtually means the end of life. The participants keenly realized the importance of their eyes as they experienced the disease, and in the lifelong treatment process for glaucoma, they reluctantly accepted the illness as part of their lives and tried to overcome psychological pain such as despair, frustration, and anxiety. They were also making their best effort to manage and treat the symptoms, and hoped that their illness would not progress any further and they could live without losing eyesight until they die.

Because of eyes … these small things dominates the whole thing like this? This thought occurred to me … I used to drink too much and overwork without thinking about my body, but it made me think again about what is important, and I think it served as an opportunity to think about health. (Participant 5)

1) Realizing the importance of eyes and health

The participants said that although the eyes are a very small part of the body, they are important enough to dominate the entire body. They said that eyes are the most important of the sense organs, and it is so important that it would be better to be unable to speak than to become blind, and that becoming blind virtually means that your life is over. In this way, the participants keenly realized the importance of their eyes through the experience of the disease. They came to pay more attention to their eyes, and had an opportunity to think again about their health.

2) Accepting and adjusting to illness, living on

Due to the disease characteristics of glaucoma, the participants were having a hard time coping with an uncertain, prolonged treatment process to maintain the current condition rather than cure the illness. However, they were trying to live a life while accepting and adjusting to the treatment process of glaucoma, which is like going through an endless dark tunnel.

3) Doing their utmost to manage their eyes

The participants were constantly taking care and trying to protect their eyes and prevent them from getting worse. To maintain eye health, they were making every effort they could to take care of their eyes, including refraining from drinking alcohol, eating regular meals, and taking nutritional supplements.

4) Hoping it doesn't progress further

The participants hoped that they would be able to continue to live in their current condition without the further progression of their visual field defects. Since people had to continue to live even in a helpless, distressful, situation without any hope, they were trying to have a positive attitude in their daily life. Meanwhile, some of the participants vaguely hoped that a cure for their disease would be developed in the near future.

As described above, patients with glaucoma was accidentally diagnosed with an unfamiliar disease. At first, they thought it was a minor disease, but they learned that it was a dreadful disease with no cure. However, as the disease progressed, they experienced difficulties in daily activities and limitations on their roles, and they began to experience feelings of frustration. In addition, as they gradually lost their eyesight, their fear and despair about the possibility of blindness increased. They realized that there was no other special treatment and that all they could do was follow the medical staff's instructions, and they were trying their best to receive the treatment they could to prevent their eyesight from getting worse. Although they thought themselves pitiful about the fact that they were forced to receive others' help, they also felt grateful to the people around them. As they experienced the disease, they realized the importance of their eyes and health, and they lived their lives taking care of their eyes and adjusting to their condition so that they would not lose their eyesight completely until the day they would die. Through this study, it was found that glaucoma patients suffer not only physical pain but also severe psychological pain. Therefore, it is necessary to provide specific nursing interventions and support policies that can empathize with their pain and provide psychological support for them.

Discussion

This study attempted to gain an in-depth understanding of the nature of glaucoma patients' illness experience and explore its meaning by apply phenomenological research methods. The illness experience of glaucoma patients are discussed below, focusing on the theme clusters derived from this study The first theme cluster named 'The frightening disease unexpectedly discovered' is related to the process in which the participants were diagnosed with a disease and the shock they felt when they faced the disease for the first time. This theme can be viewed as a unique characteristic observed in qualitative research on glaucoma, since it represents experience usually not observed in the illness experience of ordinary diseases. In the case of most diseases, such as Parkinson's disease [20] and spinal disease [21], patients first feel symptoms and then go through the process of finding about the diagnosis at the hospital, but glaucoma generally has no symptoms in early stages, so patients are thought to perceive it as a sudden illness and feel at a loss and confused. As described above, glaucoma is a chronic progressive disease that often has no symptoms in early stages, so early detection of the disease is very important [3]. The Korean Glaucoma Society recommends that people in their 20s and 30s receive regular eye exams if they have diseases such as high myopia, high blood pressure, and diabetes, and that people aged 40 or older receive an eye exam once every six months or once a year. However, the participants were accidentally diagnosed with glaucoma while receiving treatment for other eye diseases without having ever received a test for glaucoma before. In addition, although they had heard of glaucoma, they were not clearly aware of what kind of disease it was. In a related previous study, 97.4% of respondents reported that they had heard of glaucoma, but only 32% knew that glaucoma is a disease difficult to cure [22]. In Korea, the rate of the glaucoma screening test is a very low level of 2.5%, and 74.2% of glaucoma patients are accidentally diagnosed at an ophthalmology clinic without feeling symptoms [22]. Taken together, these facts show that because the general public does not accurately know the disease characteristics of glaucoma, most of them do not recognize glaucoma, which is typically asymptomatic in early stages, and do not receive the glaucoma screening test, leading to a delayed diagnosis for many patients. Therefore, more efforts should be made to provide accurate information about glaucoma through various media and to emphasize the importance of an early glaucoma screening test. In addition, a method for increasing the rate of early glaucoma screening is thought to include an eye examination in the national general health screening program for the general public, like tests for high blood pressure and diabetes, considering the fact that high blood pressure and diabetes are asymptomatic chronic diseases like glaucoma, and tests for these diseases are included in the national general health screening program.

The second theme cluster named 'A dismal life gradually trapped in darkness' is related to the difficulties that the participants experienced in daily activities and working life due to various symptoms occurring with the progression of glaucoma. The participants in this study included people in middle adulthood according to Erikson's theory of developmental tasks according to stages of psychosocial development, and middle adulthood is a period when people generally engage in active social activities based on their pride in their achievements [23]. However, during the course of the disease, the participants felt devastated when they could not carry out the roles they normally had performed at work and at home due to physical symptoms such as pain and visual field defects. A previous study also reported that if the progression of glaucoma leads to the rapid elevation of the intraocular pressure, various symptoms occur, including severe eye pain, visual loss, and headache, and even vomiting occurs in severe cases [24]. In addition, the participants were also found to come to lose vigor in life as they were no longer able to engage in hobbies they enjoyed, such as drinking and smoking. Another previous study also found that glaucoma patients feared that their social life would be restricted due to the disease [5]. Similarly, in this study, a participant engaged in the transportation industry reported that even though he recognized his visual impairment, for fear of losing his job, he hesitated to tell others about his symptoms for a long time. In the case of transportation or manufacturing workers, if they continue to work hiding their disease, it may lead to more serious accidents, so it is necessary to provide national-level support such as an employment policy to create jobs for glaucoma patients so that they can receive treatment comfortably without hiding their disease.

The third theme cluster named 'Fear of the unseen' revealed that the participants were living in pain every day, feeling fearful and anxious about the possibility that they might become blind due to symptoms that did not improve despite treatment. As apparent in the statement 'If I become blind, it is like my life is completely over,' the participants suffered from so severe psychological pain due to anxiety about blindness that they thought that if they became blind, they would not be able to do anything and it would be better to die. These results are consistent with the findings of a previous study [25], which reported that glaucoma patients suffer from psychological pain due to the possibility of complete vision loss, the absence of a cure, and the fact that the goal of treatment is to maintain the current state of the disease. These mental health problems increase stress levels, which may reduce medication adherence, accelerate the progression of glaucoma, and ultimately result in a vicious cycle [26]. Therefore, glaucoma patients should be provided with not only medical treatment but also nursing interventions and psychological intervention programs that can help them to cope with psychological problems. Unlike people with congenital blindness, people who lose their eyesight later in life have great difficulty adjusting to daily life, so a rehabilitation program for visual impairment is also required from the time when patients have partial vision loss in order to help glaucoma patients to cope with daily tasks, such as learning how to eat alone, before complete vision loss occurs [27].

The fourth theme cluster named 'Following treatment without any other options' reveals the helplessness felt by the patients who had difficulty actively participating in the treatment process due to the characteristic of glaucoma that it currently has no cure. As participants recognized the absence of a cure for glaucoma, their skepticism and sense of helplessness about medical treatment were increased. Although the participants faithfully participated in medical treatment to prevent blindness, they were performing the role of a traditional passive patient, and their scope of participation in treatment was mostly limited to administering eye drops as instructed and making regular outpatient visits since they had no other options. In a previous study, factors positively influencing patient participation were shown to include factors such as the characteristics of disease, the patient's health status, and the patient's experience, and the most important factors promoting patient participation were found to be 'the attentive and kind attitude of the medical staff' and 'the medical staff's description of negative health outcomes that may happen if the patient does not follow the medical staff's instructions' [28]. Therefore, if patients are sufficiently aware of the possibility of blindness due to the illness, medical staff should have an attentive and friendly attitude toward glaucoma patients to encourage their participation in medical treatment

The fifth theme cluster of this study was named 'Grateful for the help but feeling miserable.' This theme cluster showed the participants' mixed feelings in that they found it pitiful and disheartening about the fact that they needed others' help due to their dim vision, but they also felt grateful for the support of people around them. This finding suggests that it is necessary to provide national-level support to understand such feelings of glaucoma patients and help them. First, it is necessary to create an environment to ensure that glaucoma patients can consistently receive treatment. Since the intraocular pressure of glaucoma patients cannot be measured at home unlike blood pressure or blood sugar, outpatient visits are needed for glaucoma patients. However, the results of this study showed that as a glaucoma patient's symptoms got worse, it became difficult for the patient to visit the outpatient clinic alone, and they required the help of a guardian even in daily activities. Therefore, there is a need to provide them with people who can give assistance necessary for them such as caregivers and social workers who can help glaucoma patients with visual impairment in their daily activities and hospital visits and provide them with psychological support. A similar system is the long-term care insurance system. The long-term care insurance system is available for individuals who are determined to have functional disability in activities of daily living for at least six months among people aged 65 or older or those under 65 with geriatric diseases such as dementia or cerebrovascular disease [29]. The results of this study also demonstrated that patients with visual field defects had difficulty performing daily activities on their own. Therefore, there is a need to supplement the existing long-term care insurance system and expand services to provide support for patients who have difficulty in performing activities of daily living due to visual field defects.

The sixth theme cluster of this study named 'Realizing the importance of eyes and health' showed that the participants fully realized the importance of their eyes and health, came to accept their disease in the end, and were trying to live on adjusting to the illness. Glaucoma is a chronic disease that requires lifelong treatment and management, and self- management is especially important [4]. In order for patients to live without losing their eyesight until they die, patients' own efforts are needed, but it is also required to create a system in which society and medical institutions can consistently manage patients with chronic diseases. In Korea, chronic disease management fees are paid to medical institutions that have established a management system to help patients with chronic diseases who continuously visit medical institutions to understand their disease and prevent complications through educational counseling [30]. Currently, diseases that are recognized for chronic disease management fees include high blood pressure, diabetes, mental disorder, tuberculosis, heart disease, cerebrovascular disease, nervous system disorder, malignant neoplasm, thyroid disease, liver disease, and chronic renal failure. Therefore, it is necessary to include glaucoma in the chronic disease management fee codes as a method for establishing a management system to prevent complications through the introduction of the chronic disease management fee for glaucoma, and providing individualized education and counseling to patients to prevent patients from neglecting to receive treatment.

Conclusions

This study attempted to explore the essential nature and meanings of the illness experience of glaucoma patients by applying phenomenological research methods. The participants of this study were 10 people aged 50 or older who were diagnosed with glaucoma and had visual field defects. The analysis of the illness experience of glaucoma patients yielded 6 theme clusters, 16 themes, and 39 meaning units.

This study explored glaucoma patients' perceptions, attitudes, and feelings regarding how glaucoma, which is called the silent thief of eyesight, affected patients' lives and how glaucoma patients experienced the illness process. Through this inquiry, the present study presented the directions of nursing interventions for glaucoma patients. Based on an in-depth understanding of glaucoma patients, the results of this study are expected to help demonstrate the need for education on the nature of disease and proper use of drugs for glaucoma patients, the importance of the early glaucoma screening test, and the need for psychological and social support intervention programs.

In conclusion, this study showed that the participants as glaucoma patients experienced physical, mental, and social pain while going through the disease process. Therefore, along with medical treatment to relieve the physical symptoms of glaucoma patients, a psychological nursing intervention to understand and reduce their psychological pain should be provided. Additionally, policy measures for support are needed to minimize various social limitations that glaucoma patients may experience. In the future, based on the results of this study, further research should be conducted on the development and effectiveness verification of an education program and a psychological counseling program for glaucoma patients.

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Authors' contributions

Hyeon ae Lee contributed to conceptualization, data curation, formal analysis, methodology, visualization, writing-original draft, review & editing, investigation, and software. Seon Nyeo Kim contributed to data curation, formal analysis, methodology, visualization, writing-review & editing, resources, software, and validation. Hwa Young Kim contributed to investigation, resources, and validation. Sue Kyung Sohn contributed to formal analysis, methodology, project administration, writing – review & editing, supervision, and validation.

Data availability

Please contact the corresponding author for data availability.

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References

1. Health Insurance Review & Assessment Service. Healthcare Bigdata Hub [Internet]. Wonju: Health Insurance Review & Assessment Service. 2022 [cited 2022 Dec 1]. Available from: https://opendata.hira.or.kr/op/opc/olapMfrnIntrsIlnsInfo-

Tab1.do
2. The Korean Glaucoma Society. Glaucoma definition [Internet]. Seoul: The Korean Glaucoma Society. 2022 [cited 2023 August 17]. Available from: https://koreanglaucoma.org/info/sub01.html
3. Biggerstaff KS, Lin A. Glaucoma and quality of life. International Ophthalmology Clinics. 2018;58(3):11–22. https://doi.org/10.1097/IIO.0000000000000230
4. Jung YH, Go SJ, Kim EJ. Research on effective management of chronic diseases [Internet]. Seoul: Korea Institute for Health and Social Appairs; 2013 [cited 2023 Aug 17]. Available from: https://www.kihasa.re.kr/publish/report/view?type=research&seq=27593
5. Hwang MW, Kim JL. Depression and anxiety in patients with glaucoma or glaucoma suspect. Journal of The Korean Ophthalmological Society. 2015;56(7):1089–1095. https://doi.org/10.3341/jkos.2015.56.7.1089
6. Yoon HR, Park JS, Yoon HS, Hwang YY, Chun JH. Anxiety, depression, quality of life in glaucoma patients. Asia-pacific Journal of Multimedia Services Convergent with Art, Humanities, and Sociology. 2017;7(3):617–630. https://doi.org/10.35873/ajmahs.2017.7.3.060
7. Son SJ. A study of experiences in visual field defect patient. The Journal of Learner-Centered Curriculum and Instruction. 2019;19(22):417–422. https://doi.org/10.22251/jlcci.2019.19.22.407
8. Jung DH, Hong KE, Park HY. Risk factors for requiring glaucoma surgery in steroid-induced glaucoma. Journal of Korean Ophthalmological Society. 2021;62(1):91–99. https://doi.org/10.3341/jkos.2021.62.1.91
9. Kim IH, Gu WM, Jung AR, Cha SC. Long-term longitudinal changes in choroidal thickness with intraocular pressure reduction after glaucoma surgery. Journal of Korean Ophthalmological Society. 2020;61(1):69–77. https://doi.org/10.3341/jkos.2020.61.1.69
10. Patel KD, Silva LB, Park Y, Shakouri T, Keskin-Erdogan Z, Sawadkar P, et al. Recent advances in drug delivery systems for glaucoma treatment. Materials Today Nano. 2022;18:100178. https://doi.org/10.1016/j.mtnano.2022.100178
11. Lacey J, Cate H, Broadway DC. Barriers to adherence with glaucoma medications: A qualitative research study. Eye. 2009;23(4):924–932. https://doi.org/10.1038/eye.2008.103
12. Kotecha A, Bonstein K, Cable R, Cammack J, Clipston J, Foster P. Qualitative investigation of patients' experience of a glaucoma virtual clinic in a specialist ophthalmic hospital in London, UK. BMJ Open. 2015;5(12):e009463. https://doi.org/10.1136/bmjopen-2015-009463
13. Knight LS, Ridge B, Staffieri SE, Craig JE, Senthil MP, Souzeau E. Quality of life in children with glaucoma: A qualitative interview study in Australia. BMJ Open. 2022;12(7):e062754. http://doi.org/10.1136/bmjopen-2022-062754
14. Han DI. The visual impairments experienced by people with glaucoma and needed supports. Journal of Special Education & Rehabilitation Science. 2020;59(4):47–64. https://doi.org/10.23944/Jsers.2020.12.59.4.2
15. Statistics Korea. Statistics Korea's future population projections [Internet]. Daejeon: Statistics Korea. 2023 [cited 2024 Mar 9]. Available from: https://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_1BPA001&conn_path=I2
16. Choi MJ, Kim SY. Relationship between multimorbidity and osteoporosis in Korean adults aged 50 years and older. The Korean Journal of Health Service Management. 2023;17(2):65–73. https://doi.org/10.12811/kshsm.2023.17.2.065
17. Omery A. Phenomenology: A method for nursing research. Advances in Nursing Science. 1983;5(2):49–64. https://doi.org/10.1097/00012272-198301000-00010
18. Kim SY, Choi MO, Han JT. Analysis of the elderly with Parkinson's disease. Korean Journal of Gerontological Social Welfare. 2015;68:217–250. https://doi.org/10.21194/KJGSW..68.201506.217
19. Jeong HJ, Sohn SK. Illness experiences of patients following spinal surgery. Journal of Muscle and Joint Health. 2022;29(3):151–164. https://doi.org/10.5953/JMJH.2022.29.3.151
20. Colaizzi PF. Psychological research as the phenomenologist views it. In: Ronald SV, Mark K, editors. Existential-Phenomenological Alternatives for Psychology. UK: Oxford University Press; 1978. p. 6.
21. Guba EG, Lincoln YS. Fourth gener ation evaluation. 1st ed. Newbury Park CA: Sage Publications; 1989. 296 p.
22. Hwang YH, Park JH, Lee EJ. Results of the glaucoma awareness and knowledge survey: Performed for the world glaucoma week event. Journal of the Korean Glaucoma Society. 2021;10(2):31–36. https://doi.org/10.36299/jkgs.2021.10.2.31
23. Park AC. A review of Erikson's developmental frame-works on human development. The Journal of Social Sciences. 2007;26(2):143–163.
24. Jung YH. Glaucoma pathogenesis and lifestyle modification. Journal of the Korean Medical Association. 2017;60(12):978–982. https://doi.org/10.5124/jkma.2017.60.12.978
25. Jung IS. A study of mechanism to induce frustration of person with lately visual impairments. Journal of Social Science Research. 2015;24(1):61–83.
26. Groff ML, Choi B, Lin T, Mcllraith I, Hutnik C, Malvankar-Me-

hta MS. Anxiety, depression, and sleep-related outcomes of glaucoma patients: Systematic review and meta-analysis. Canadian Journal of Ophthalmology. 2023;58(4):346–355. https://doi.org/10.1016/j.jcjo.2022.02.010

27. Jo SJ, Huh CD. A review of peer counseling for people who are adventitiously blind or visually impaired. The Korean Journal of Visual Impairment. 2012;28(1):149–179.
28. Chung SJ, Hwang JI. Patients' experience of participation in hospital care. The Journal of Korean Academy of Nursing Administration. 2017;23(5):504–515. https://doi.org/10.11111/jkana.2017.23.5.504
29. National Health Insurance. Introduction of long-term care insurance system for the elderly [Internet]. Seoul: National Health Insurance. 2023 [cited 2023 Aug 17]. Available from: https://www.longtermcare.or.kr/npbs/e/b/101/npeb101m01.web?menuId=npe0000000030
30. Health Insurance Review & Assessment Service. Health insurance treatment benefit cost [Internet]. WonJu: Medical Veterinary Service Department Medical Veterinary Development Department. 2023 [cited 2023 Aug 1] Available from: https://repository.hira.or.kr/handle/2019.oak/3076

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Optimistic bias: Concept analysis

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Purpose: The purpose of this study was to analyze and clarify the concept of 'optimistic bias.'

Methods: A review of the literature was conducted using several databases. The databases were searched using the following keywords: optimistic bias, optimism bias, and concept analysis. The literature on optimistic bias was reviewed using the framework of Walker and Avant's conceptual analysis process.

Results: Optimistic bias can be defined by the following attributes: 1) underestimation of personal risk, 2) vague confidence, 3) positive future prediction and 4) lack of risk recognition. The antecedents of optimistic bias are as follows: 1) risk perception, 2) self-efficacy, and 3) risk controllability. The consequences of optimistic bias are as follows: 1) reduced anxiety, 2) providing emotional stability, 3) negative consequences for preventive health behavior, 4) lack of attention to risk-related information, and 5) negative consequences for self-protection behavior.

Conclusion: The definition and attributes of optimistic bias identified by this study can provide a common understanding of this concept and help to develop a nursing intervention program effective in preventing, protecting, and improving health of subjects in the field of nursing practice.

Keywords: Optimism; Bias; Concept Formation; Health behavior

Introduction

1. Background

Chronic diseases are illnesses with a very high disease burden, and they are reported to account for 80% of all deaths and 41% of medical expenses in Korea [1]. Chronic diseases are one of the leading causes of death worldwide [2], and in Korea, the prevalence rates of chronic conditions such as diabetes, hypertension, obesity, and hyperlipidemia have been gradually increasing [3]. In addition, mortality rates due to chronic diseases have been continuously increasing, and this problem has become one of the important considerations in national health management and establishment of public health policies [4]. As such, chronic diseases are currently the most difficult task in healthcare, and both individual and societal efforts are needed to prevent chronic diseases [5].

In terms of the concept of disease prevention, the concept of optimistic bias acts as an important factor [6]. Optimism bias means the psychological tendency for individuals to underestimate their risks or likelihood to experience negative future events but overestimate their likelihood to experience positive future events, and it generally refers to the tendency to underestimate one's chances of experiencing unfortunate events or diseases and overestimate one's probability of experiencing positive events [7]. When individuals have optimistic bias, they tend to make more optimistic judgements about their own situations than others' situations [8]. Optimism bias may cause people to think lightly of health-related risks and may also affect the way patients follow treatment plans [7]. Optimism bias is also related to mental health. An optimistic attitude may be helpful for stress management, but unrealistic positive expectations may lead to disappointment or anxiety [8].

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In relation to disease prevention, optimistic bias has a significant impact on disease prevention. This bias has been shown to affect the way individuals perceive and respond to health-related risks [6]. In addition, optimistic bias is an important factor in the design and implementation of various public disease prevention campaigns and health promotion programs. A prior study reported that optimistic bias enhances motivation for taking preventive measures against the coronavirus disease (COVID-19), and the study suggested that it is important to emphasize actual risks in order to reduce optimistic bias and promote participation in preventive behaviors [9]. In addition, a study on the relationship between optimistic bias and smoking found that smokers tend to overestimate the effectiveness of their preventive behaviors [10].

With respect to disease management, optimistic bias has also been shown to influence the occurrence, spread, and management of diseases, and thus in terms of disease management, it is important to consider optimistic bias in order to change individuals' behaviors and promote preventive measures [7]. A survey study on the perception of chronic obstructive pulmonary disease (COPD) and optimistic bias among male smokers suggested that it is important to change the perception and attitudes of the target group for the prevention and management of COPD, and that customized education programs and public health campaigns are needed to induce such changes [11]. If optimistic bias is not taken into account, in terms of the development and implementation of strategies for disease prevention and management, unrealistic expectations and inaccurate evaluations may hinder adequate implementation of effective preventive and management measures, and unpredictable problems may arise in disease transmission and management [12].

The above findings show that it is very important to understand how optimistic bias affects disease management and prevention. If individuals underestimate the risks of their behaviors that may have a harmful effect on their health, this underestimation of risks may hinder their adoption and maintenance of healthy lifestyle habits, which in turn may have a negative impact on the prevention and management of diseases [7].

This concept of optimistic bias has been considered in diverse health areas such as HIV, smoking, heart disease, skin cancer, and chronic diseases [13]. A review of previous studies showed that research on optimistic bias has been conducted in various health-related fields such as cancer [14,15], AIDS [16-18], stroke [19], and COVID-19 [20-22]. A number of previous studies have demonstrated that optimistic bias affects health behaviors in relation to the perception of health risks. In connection with disease prevention, research findings suggest that there is a need to consider the degree to which individuals with optimistic bias will perform desirable disease prevention behaviors actively.

Therefore, an accurate understanding of optimistic bias will make an important contribution to improving strategies for disease prevention and management. In this respect, the present study is expected to contribute to providing a deeper understanding of this phenomenon and exploring more effective approaches to disease prevention and management. In addition, it is thought that effective disease-related nursing interventions in nursing practice necessitates an accurate understanding of the concept of optimistic bias held by the recipients of nursing care. Therefore, this study aimed to identify and define the attributes of optimistic bias through a conceptual analysis of optimistic bias about illness that has been studied in various fields.

2. Purpose

The purpose of this study was to present a theoretical basis for the concept of optimistic bias in nursing care recipients by clearly identifying the attributes of optimistic bias. In other words, this study aimed to conduct the concept analysis of optimistic bias based on the conceptual analysis framework presented by Walker & Avant [23], understand the optimistic bias of nursing care recipients, and provide basic data for the development of effective nursing interventions in nursing practice. The specific objectives of this study are as follows:

1) To define the concept of optimism bias;
2) to understand the uses of the concept of optimistic bias through a literature review;
3) to identify the attributes of optimistic bias and describe a model case based on the identified attributes;
4) to identify the antecedents and consequences of optimistic bias.

Methods

1. Study design

This study is a concept analysis research that applied the method of concept analysis proposed by Walker & Avant [23] to derive the attributes, antecedents, and consequences of the concept of optimistic bias. The specific procedures of concept analysis are as follows:

1) Select a concept; 2) Set the purpose of concept analysis; 3) Identify all the uses of the concept; 4) Determine the defining attributes; 5) Present a model case; 6) Present additional cases (borderline cases, contrary cases, and related cases); 7) Identify the antecedents and consequences of the concept; 8) Define em-

pirical referents.

2. Subjects

Through literature search using domestic and foreign electronic databases and the review of papers retrieved through the search, 19 papers were finally selected for analysis (Figure 1).

3. Ethical considerations and preparations of the researcher

This study aimed to investigate the attributes, causes, and consequences of optimistic bias through text data analysis using previously published research papers available through academic databases. It was confirmed prior to this research that this study was exempt from IRB review because personally identifiable information, such as personal ID, was not collected or used in the process of text data analysis.

The researcher is a doctoral student who has completed a course on nursing theory development related to concept analysis, and the researcher continuously reviewed related academic professional books and research papers from various perspectives during the research process. In addition, in order to apply the method of concept analysis proposed by Walker & Avant [16], the researcher meticulously reviewed previous studies that applied the analysis method, and conducted this study through continuous discussions with the professor in charge of the relevant course.

4. Data collection and analysis

The literature search for this study was carried out from March 15 to May 17, 2023, and it was conducted using domestic and international electronic academic databases. No search limit about the publication date was set in order to use abundant data. The keywords used in the literature search using electronic databases were as follows (Table 1).

The search of foreign studies was conducted using Publisher MEDline (Pubmed) and Cumulative Index of Nursing and Allied Health Literature (CINAHL). The search terms used were 'optimism bias' and 'optimistic bias', and a total of 618 articles were retrieved. Out of the 618 articles, 128 duplicate articles were removed. In addition, 17 papers whose full texts were not available, a retracted article, and two other articles were excluded. Additionally, 354 papers not related to the concept of optimistic bias were also excluded. As a result, the full texts of a total of 116

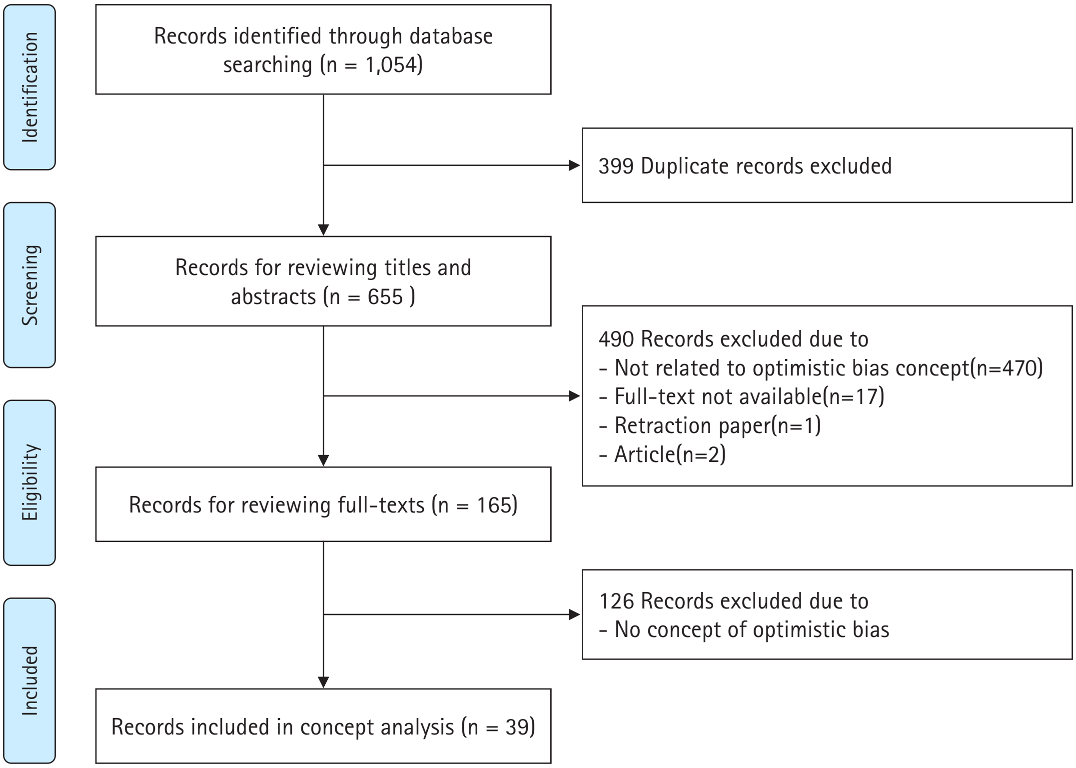

Figure 1. Flowchart of study selection.

Table 1. Searching Strategies Applied to Internet Database

Database	Search engine	The number of items	search formula
CINAHL	EBSCO	178	TI "optimism bias" OR AB "optimism bias" OR TI "optimistic bias" OR AB "optimistic bias"
MEDLINE	Pubmed	440	("optimism bias"[Title/Abstract]) OR ("optimistic bias"[Title/Abstract])
RISS	RISS	272	"낙관적 편향"OR"낙관 편향"OR"낙관적 편견"OR"낙관 편견"
KISS	KISS	164	"낙관적 편향"OR"낙관 편향"OR"낙관적 편견"OR"낙관 편견"

articles were reviewed.

The search of domestic studies was conducted through the Korean Studies Information Service System (KISS) and Research Information Sharing Service (RISS), and the used search terms were Korean words for 'optimism bias', 'optimistic bias', 'optimism prejudice', and 'optimistic prejudice.' A total of 436 articles were retrieved, and among them, 271 duplicate articles were excluded. 116 articles not related to the concept of optimistic bias were initially excluded, and the full texts of a total of 49 articles were reviewed.

In short, a total of 165 articles including domestic and foreign studies were initially selected, and after reviewing their full texts, 146 papers that did not deal with the concept of optimistic bias were excluded, and a total of 19 articles were selected for final analysis (Figure 1).

Results

1. Literature review on the concept of optimistic bias

1) Dictionary definition

The National Institute of the Korean Language defines 'optimistic' as viewing one's life or things from a bright and hopeful perspective and 'bias' as the quality of being biased toward or against a certain side. Therefore, since optimistic bias is a term made by combining the word 'optimistic', which means viewing things from a bright and hopeful viewpoint, and the word 'bias', which means being biased to one side, it can be defined as the tendency to view things from a perspective biased toward the bright and hopeful side of things [24].

2) Scope of the uses of the concept of optimistic bias

(1) Use of the concept in other fields of study: Use of the concept in various fields

The concept of optimistic bias was first described and demonstrated by psychologist Neil Weinstein in 1980, and various studies on the concept have since been conducted in the field of psychology. In psychological research, the concept of optimistic bias has been studied as a moderator variable for specific behaviors [25]. Factors affecting optimistic bias presented in literature are generally not demographic characteristics but psychological factors related to perception or disposition, such as individuals' general positivity bias, individuals' risk perception, egocentric way of thinking, self-efficacy, involvement based on experience, inspiration, illusion of control, social distance, and risk recognition [26]. This concept has also been studied from a perspective related to media, and it has been suggested that the concept of optimistic bias can be viewed as a result of media use [8]. In addition, optimistic bias in the field of tourism has been analyzed in relation to tourist behaviors. More specifically, it has been reported that an individual's perception of risk may have a relative nature in relationships with others, and people generally tend to perceive that others are at higher risk than themselves, and most tourists are likely to judge their home country to be safer than others' home countries [27].

(2) Uses of the concept in nursing research

In health-related fields, the concept of optimistic bias has been used in domestic studies on HIV [16-18], cancer [14,15], general health problems [28], and COVID-19 [20-22], and in a foreign study on diseases and smoking [29]. A previous study reported that optimistic bias in health-related fields was found to be a variable that negatively affects risk preventive behaviors [7]. In addition, a previous research on COVID-19 recently found a negative association between optimistic bias and infection prevention behavior [21]. While there are positive evaluations of this concept regarding the fact that it can provide a sense of safety in daily life and have a positive effect on mental health [30], optimistic bias has also been shown to have negative aspects such as leading people to neglect the management of their health and not to perform preventive behaviors or adhere to medical prescriptions [12].

2. Identification of the attributes of optimistic bias

1) List of tentative criteria

The attributes of optimistic bias were examined through the review of 19 articles (Appendix 1). The list of the tentative attributes of optimism bias is presented below (Table 2).

① To tend to underestimate personal risks [A01, A19].

② To believe without specific grounds that negative events will not happen [A02, A12].

③ To consider oneself less susceptible to risks than others [A02, A05, A09].

④ To perceive that negative events will happen not to oneself but to others [A02].

⑤ To underestimate the likelihood of negative events [A16].

⑥ To perceive that society-level risk is higher than individual-level risk [A08].

⑦ To view oneself from a more advantageous viewpoint than others [A02, A09, A17].

⑧ To tend to overestimate the likelihood of positive events [A16].

⑨ To perceive that there is no individualized risk [A12].

Table 2. Literature regarding Attributes of Optimistic bias

Authors	Attributes
Blair et al. [A01]	individuals underestimate their probability of experiencing negative life events and overestimate their probability of experiencing positive life events
Caponecchia et al. [A02]	people's perception that bad things won't happen to them has been frequently investigated, chiefly regarding health beliefs and behavior. Optimism bias is the tendency to think that negative events are less likely to happen to oneself than to one's peers
Cho and Kim [A05]	usually a tendency for people to judge that they are less exposed to risk than others
Kim [A08]	risk perception at the social level is higher than risk at the individual level
Klaczynski [A09]	people predict that they are more likely to attain important goals—and less likely to experience adverse life events—than others
Lee et al. [A12]	lack of the idea that a health crisis would happen to oneself, which means that there is no personalizing risk perception
Sharot [A16]	pervasive pattern in future projections that refers to our tendency to overestimate the likelihood of positive events in our future while underestimating the likelihood of negative events
Strombotne et al. [A17]	individuals want to view themselves in a more favorable light
White et al. [A19]	the tendency to systematically underestimate personal risk.

2) List of defining attributes

As a result of comprehensively reviewing the list of tentative attributes, the defining attributes of optimistic bias were identified as follows (Figure 2).

(1) Underestimation of personal risks ① ⑤ ⑥

(2) Vague confidence ② ③ ④ ⑦

(3) Positive future prediction ⑧

(4) Lack of risk recognition ⑨

3. Construction of a model case of the concept

A model case is constructed as a real case that contains all the identified attributes of a concept but does not include the attributes of any other concept [23].

Ms. A, a 35-year-old woman, went to the public health center for medical tests due to symptoms of severe dryness, polyuria, and polyphagia a while ago. After she underwent blood and urine tests, her HbA1C level was found to be 12%, and she was diagnosed with diabetes and prescribed diabetes medications. Although she heard about diabetes, she was not well aware of dia-

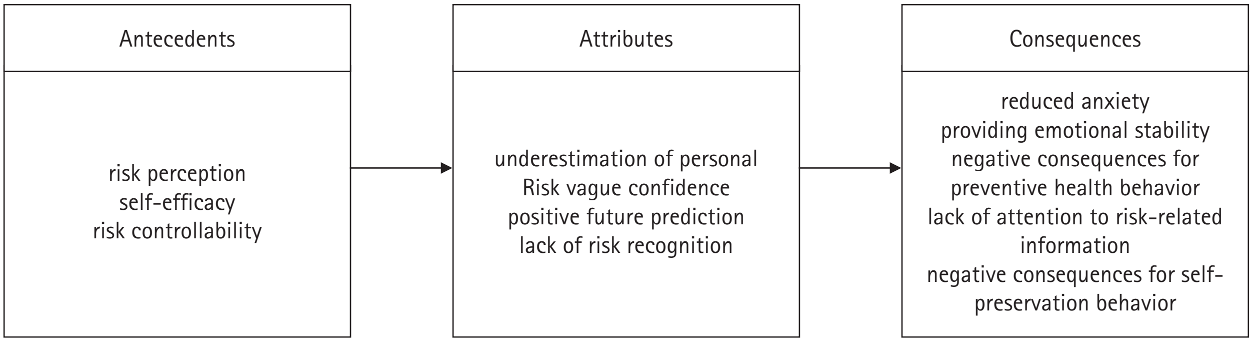

Figure 2. Conceptual structure of Optimistic bias.

betes, so she thought, "If I just take medications for a few days, I will get better," and she continued to have an irregular lifestyle, lived with severe stress, and did not eat properly (attributes 1 and 2). Although she had heard from people around her that people with diabetes may need to have their legs amputated or many of them suffer from complications of diabetes, but she dismissed such serious complications of diabetes as irrelevant to her (attribute 2). Thus, while taking diabetes medications, she consumed alcohol and instant foods, and drank 5 cups of instant coffee mix a day, not accurately recognizing her disease and thinking vaguely, "How could anything bad happen to me?" (attributes 1 and 4) Some days, she found herself constantly looking for and drinking water like a hippopotamus, and there were a few times when she felt dizzy at dawn, but she dismissed it as nothing serious (attribute 4). Then one day, she passed out and was rushed to the emergency room. Immediately after she was admitted to the hospital, she underwent a blood sugar test and found that her self-monitoring blood glucose (SMBG) level was over 600 mg/dl. The cause of her fainting was shock due to high blood sugar, and the endocrinologist recommended that she should be hospitalized and undergo detailed medical tests. However, Ms. A said that she just passed out temporarily due to dizziness and thought positively that she would get better soon as she had done before, and after refusing hospitalization, she signed a self-discharge against medical advice form and was discharged (attributes 1, 3, and 4).

This model can be seen as an example of a model that includes all the attributes of optimistic bias: vague confidence in oneself, positive future prediction, underestimation of personal risks, and lack of risk recognition.

4. Development of additional cases of the concept

1) Borderline case

A borderline case is a case that does not include all the attributes presented in the model case, but includes only some of the important attributes of the concept [23].

Ms. B is a 48-year-old woman who usually has a mild cough and occasionally suffers from shortness of breath. Although she had smoked intermittently since she was young, she did not think of her symptoms as a direct result of smoking. When her symptoms got slightly worse recently, she thought that she would get better only by paying a little more attention to her health (attribute 3). She underwent a pulmonary function test during a free health checkup at a local public health center, and the test results showed low levels of respiratory function that were close to the normal ranges. The doctor warned Ms. B that the test results could indicate an early sign of COPD, but she did not think that her condition was serious enough to be diagnosed with COPD (attribute 1).

Although the doctor recommended that she quit smoking and exercise regularly, she did not attempt to make any major lifestyle changes. She continued to smoke casually if not heavily every weekend at gatherings with friends, and did not seriously consider her health condition due to the lack of proper recognition of the risks she felt in her daily life (attribute 4). One day, while taking a long walk with her family, she unexpectedly experienced severe shortness of breath. This incident was a very shocking experience to her, and made her think again about COPD. Afterwards, she decided to manage his health more actively, participated in a smoking cessation program, and began to perform regular exercise.

This borderline case shows the process in which Ms. B, who exhibited only some of the key attributes of optimistic bias, came to realize the importance of changing lifestyle habits through early recognition of the risk of disease. This case emphasizes the importance of recognition of the early signs of COPD and an early intervention for the disease, and clearly demonstrates the importance of individuals' recognition and behavioral changes in disease management.

This model is a case that does not include 'vague confidence', a major attribute of optimistic bias. This borderline case accentuates the importance of recognition of early signs and an early intervention for COPD. The case of Ms. B highlights the importance of individuals' recognition and behavioral changes in disease management, and in particular, it should be noted that this case does not include 'vague confidence' among the attributes of optimistic bias. This case includes some of the major attributes of optimistic bias associated with COPD, and it also illustrates early disease recognition and the process in which the recognition leads to the active modification of lifestyle habits.

2) Contrary case

A contrary case is a case that exhibits none of the attributes of the concept and includes the opposite characteristics of the identified attributes of the concept [23].

Ms. C is a 60-year-old woman and was diagnosed with diabetes 10 years ago, and the only method she used to treat diabetes was to take prescribed medications. She got a minor injury by accidentally cutting her finger with a knife while working at the factory. Because it was not a serious injury, she sterilized the wound at home. After about a week, she suddenly developed a fever, suffered from severe abdominal pain, and felt dizzy, so she hurriedly went to the emergency department of a hospital. Because COVID-19 was rapidly spreading in Korea, the emergency departments of hospitals were reluctant to admit or treat patients with fever, so she had to visit several emergency departments before getting treatment. While moving from hospital to hospital, she felt scared, thinking about even the possibility of death in the car (opposite of attribute 3). Finally, she received tests at one hospital and was diagnosed with sepsis, so she received treatment for sepsis, but she felt anxious that her health would not recover easily due to diabetes complications (opposite of attribute 3). However, fortunately, she was able to regain her strength after surgery. After she almost died of sepsis, she lived a new life again with changes in her attitude toward health. During her hospitalization, she saw many patients around her. She saw many patients with diabetes, including a young 25-year-old patient who was receiving treatments to manage blood sugar levels and on medical nutrition therapy due to uncontrolled blood sugar levels, and a patient who had suffered from diabetes for a long time and was on dialysis due to chronic renal failure. Watching the patients, she thought to herself, “Diabetes is a scary disease. If I don’t actively receive treatment, I will probably suffer like the patients here during the remaining years of my life! (opposites of attributes 1, 3, and 4) I need to be aware of the risks, properly manage my health, and try to control my blood sugar levels from now on (opposite of attribute 4).” She also started to change lifestyle habits beginning with minor ones. She actively participated in dietary education throughout her hospitalization, and even after she got discharged from the hospital, she tried to maintain a healthy life by adjusting her diet and performing therapeutic exercise to control her blood sugar levels at home.

This model is a case that includes the opposites of the attributes of optimistic bias. The case of Ms. C includes the characteristics contrary to the defining attributes of optimistic bias and emphasizes the importance of realistic perception of risk and active management of one’s health.

3) Related case

A related case is a case that is related to the concept analyzed but does not contain its important attributes. In other words, it is a case similar to the concept analyzed in some aspects, but careful observation reveals that it has a different meaning from that of the concept analyzed [23].

Mr. P is a 30-year-old man who was recently diagnosed with hypercholesterolemia. His total cholesterol level was significantly higher than the recommended level. The doctor recommended improving lifestyle habits through changes in eating habits and regular exercise, and advised him to consider drug therapy if necessary. Although he was diagnosed with hypercholesterolemia, he did not make any efforts to improve his eating habits. He continued to maintain unhealthy eating habits, saying, “I can’t give up eating foods I like.” Moreover, although he was aware of the importance of regular exercise, he did not try to start performing exercise using his busy daily life as an excuse. He didn’t make any active effort to perform exercise, thinking, “Even if I start exercise later, there wouldn’t be any problems.” In addition, when the doctor mentioned the possibility of pharmacotherapy, he showed a skeptical attitude toward drug therapy, saying, “I don't want to depend on medications.” He wanted to resolve health problems only in natural ways. Rather than carefully considering his health condition, he made light of his current health problems with an optimistic attitude, and thought, “I am young, so I would not have any serious health problems.”

The case of Mr. P is not a direct example of optimistic bias but a related case that shows an attitude of indifference and avoidance toward health problems. This case shows that even if an individual does not have optimistic bias toward diseases, he or she may ignore health problems rather than actively dealing with them.

5. Antecedents and consequences of the concept of optimistic bias

1) The antecedents of optimistic bias identified in this study are as follows (Figure 2).

(1) Risk perception [A03, A05, A10]

Risk perception is an individual’s subjective judgment about the characteristics of risk or risk itself, and is formed by an individual’s experience or social influence. These characteristics of risk perception are related to the fact that optimistic bias is formed through differences in perceptions of risks to oneself, to the society, and to the third party.

(2) Self-efficacy [A06, A07]

As an individual’s subjective psychological factor, self-efficacy is an individual’s belief in their ability to escape from a particular risk, and acts as a psychological mechanism for oneself. In other words, self-efficacy decreases one’s perception of risk to oneself rather than to others, and consequently increases the difference between the perception of risk to oneself and the perception of risk to others, which may lead to the increase of optimistic bias.

(3) Risk controllability [A06, A15, A18]

Risk controllability refers to the degree to which an individual can control a particular risk that he or she encounters through his or her efforts. While individuals perceive a relatively low risk in situations where they can control risks on their own or with the help of others (e.g., driver accidents), they tend to perceive a higher risk in situations where they have little or no control over risks (e.g., passenger accidents). Previous studies have reported that risk controllability reduces optimistic bias mainly by decreasing the impact of optimistic bias on the individual's own risk perception. Risk controllability and self-efficacy have been investigated as important concepts that can influence behaviors such as behaviors to avoid physical health risks, health-promoting behaviors, and effort to restore poor health status to a healthy state.

2) The consequences of optimistic bias identified in this study are as follows (Figure 2).

(1) Anxiety reduction [A16]
(2) Provision of psychological stability [A14]
(3) Negative consequences for preventive health behaviors [A12]
(4) Lack of attention to risk-related information [A11]
(5) Negative consequences for self-protection behaviors [A04]

6. Empirical referents

Empirical referents are the measurable aspects of a concept by which you can recognize the defining attributes of the concept, and they indicate the occurrence of the concept in the field. Based on the identified attributes of optimistic bias, the empirical referents of optimistic bias were identified as follows.

(1) Underestimation of personal risks: poor health behaviors and accepting objective information in a distorted way
(2) Vague confidence: increased motivation, anxiety reduction, and increased self-esteem
(3) Positive future prediction: psychological stability, stress reduction, and positive attitudes
(4) Lack of risk recognition: overlooking risks, lack of self-protection behaviors, and lack of attention to risk-related information

Discussion

A literature review showed that the concept of optimistic bias is closely related to health behaviors. However, in several previous studies, slightly different terms for the concept, including 'optimism bias' and 'optimistic bias', were used, and a clear conceptual analysis of optimistic bias toward disease has not yet been conducted. Thus, this study attempted to identify the attributes of optimistic bias and define the concept through the steps of concept analysis proposed by Walker & Avant. More specifically, this study sought to understand optimistic bias by clarifying the concept of optimistic bias, and present basic data for nursing interventions through a clear understanding of the optimistic bias held by nursing care recipients. The attributes of optimistic bias identified in this study are expected to contribute to understanding the optimistic bias of nursing care recipients in the field of community nursing practice and performing health behavior interventions for them. The results of concept analysis through a literature review revealed that underestimation of personal risks, vague confidence, positive future prediction, and lack of risk recognition are the defining attributes of optimistic bias. As for the antecedents and consequences of optimistic bias, risk perception, self-efficacy, and risk controllability were identified as the antecedents of optimistic bias, and based on the identified antecedents, anxiety reduction, providing emotional stability, negative consequences for preventive health behaviors, lack of attention to risk-related information, and negative consequences for self-protective behaviors were identified as the consequences of optimistic bias.

Optimistic bias has been found to serve as an internal reference point when an individual makes a decision on whether to adopt health behaviors [22]. A previous study reported that individuals evaluate health information and decide whether to adopt health behaviors through optimistic bias [A06]. As shown in several previous studies, optimistic bias has a significant impact on health promotion, prevention, and behavioral change programs [31]. Previous studies have demonstrated that optimistic bias influences the practice of health-promoting behaviors. In particular, Weinstein [7] claimed that optimistic bias acts as a variable that hinders risk prevention behaviors. In addition, according to a previous study, a higher level of optimistic bias is linked to lower levels of lifestyle habits, self-actualization, and health-promoting lifestyle habits [32]. Optimistic bias has also been shown to have a negative association with infection prevention behaviors [21]. Moreover, the concept of optimistic bias has been reported to act as an important obstacle to the recognition of personal risk not only for healthy people but also for patients with diseases [33]. As described above, it has been confirmed that optimistic bias affect the practice of health-promoting behaviors [34]. In addition, a prior study [35] focused on optimistic bias as an internal psychological variable that hinders adherence to health behaviors, and found that stronger optimistic bias was associated with a lower likelihood to adhere to or practice health behaviors. These research results are consistent with the claim of Weinstein [36], who conceptualized optimistic bias as a psychological factor that hinders individuals from deciding to practice health behaviors, as well as the results of previous studies that support Weinstein's argument. Therefore, there is a need for interventions to correct this optimistic bias to promote adherence to health behaviors needed for disease prevention and treatment. Interventions to reduce optimistic bias are expected to help nursing care recipients to understand their optimistic bias in the field of nursing practice and improve their health behaviors through an education program on the risk of diseases [35].

It has been shown that optimistic bias is closely related to health-related behaviors and affects the health belief model (HBM) [37]. In light of such research findings, it is thought that understanding optimistic bias will help to effectively understand and apply the health belief model of patients in the field of nursing practice, and thereby it will contribute to promoting individuals' behavioral changes for healthy behaviors and maintaining healthy lifestyle habits for a long-term period.

The attributes, antecedents, and consequences of optimistic bias identified in this study as well as other research results are expected to contribute to a more realistic understanding and improvement of the health behaviors of nursing care recipients in the field of nursing practice, and help to encourage individuals to adopt healthy lifestyle habits. Based on research results, the specific suggestions of this study are as follows. First, it is necessary to assess the level of optimistic bias of individual nursing care recipients through personalized health counseling, and offer counseling based on the assessment results of their optimistic bias. In addition, there is a need to eliminate optimistic bias associated with the lack of risk recognition by designing and implementing a risk recognition promotion program. Additionally, it is also necessary to develop strategies for promoting preventive health behaviors. These strategies should include activities that minimize the negative effects of optimistic bias and promote positive behavioral changes, and it is important to raise awareness of the importance of self-protective behaviors and the benefits of adopting healthy lifestyle habits. In clinical practice, these recommendations are expected to help nurses to more effectively understand and manage the optimistic bias of nursing care recipients, which will eventually help nursing care recipients to evaluate their health more realistically and adopt healthy lifestyle habits.

Regarding the limitations of this research, the present study conducted a literature review based on accessible research papers, excluding theses and dissertations, so it is difficult to say that this work has comprehensively analyzed all researches on optimistic bias. In particular, there is a possibility that important papers dealing with the defining characteristics of optimistic bias were not included in this study. Therefore, these limitations should be taken into consideration in generalizing or interpreting the results of this study. Nevertheless, this work is believed to be a meaning research attempt in that this study has contributed to increasing the understanding of optimistic bias and providing a theoretical basis for it.

Conclusions

This study is expected to contribute to gaining a better understanding of optimistic bias. Since optimistic bias causes people to underestimate the risks of behaviors that may have harmful effects on their health, it may hinder individuals' adoption and maintenance of healthy lifestyle habits, which may have a negative impact on the prevention and management of diseases. Therefore, interventions based on an accurate understanding of optimistic bias can play an important role in improving strategies for the prevention and management of diseases. This research is expected to contribute to exploring more effective approaches to disease prevention and management, and is expected to help to prevent diseases and protect and promote public health in nursing practice and in the community.

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Conflict of interest

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Authors' contributions

Miseon Shin contributed to conceptualization, data curation, formal analysis, project administration, visualization, writing-original draft, review & editing, investigation, resources, and validation. Juae Jeong contributed to conceptualization, data curation, formal analysis, project administration, visualization, writing-original draft, review & editing, investigation, and resources.

Data availability

Please contact the corresponding author for data availability.

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References

1. Cho KS. Current status of non-communicable diseases in the Republic of Korea. Public Health Weekly Report. 2021;14(4):166–177.
2. World Health Organization. The top 10 cause of death [Internet]. Geneva: World Health Organization; 2023 [cited 2023 Jul 13]. Available from: https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death
3. Korea Disease Control and Prevention Agency. National Health Survey Results Presentation 2022 [Internet]. Seoul: Statistics Korea. 2022 [cited 2023 Dec 28]. Available from: http://knhanes.kdca.go.kr/knhanes/sub04/sub04_04_03.do
4. Korea Disease Control and Prevention Agency. 280,000 deaths from chronic diseases in 2022, with medical expenses amounting to 83 trillion won [Internet]. Seoul: Korea Disease Control and Prevention Agency; 2023 [cited 2023 Dec 11]. Available from: https://www.kdca.go.kr/board/board.es?mid=a20501010000&bid=0015&act=view&list_no=724036#
5. Korea Disease Control and Prevention Agency. Status and issues of chronic diseases in 2021 [Internet]. Korea Disease Control and Prevention Agency; 2021 Nov 19 [cited 2023 Dec 11]. Available from: https://www.kdca.go.kr/board/board.es?mid=a20501010000&bid=0015&list_no=717581&cg_code=&act=view&nPage=1
6. Weinstein ND. Unrealistic optimism about susceptibility to health-problems. Journal of Behavioral Medicine. 1982;5(4):441–460. https://doi.org/10.1007/Bf00845372
7. Weinstein ND. Unrealistic optimism about future life events. Journal of Personality and Social Psychology. 1980;39(5):806–820. https://doi.org/10.1037/0022-3514.39.5.806
8. Tyler TR, Cook FL. The mass media and judgments of risk: Distinguishing impact on personal and societal level judgments. Journal of Personality and Social Psychology. 1984;47(4):693–708. https://doi.org/10.1037/0022-3514.47.4.693
9. Park T, Ju I, Ohs JE, Hinsley A. Optimistic bias and preventive behavioral engagement in the context of COVID-19. Research in Social and Administrative Pharmacy. 2021;17(1):1859–1866. https://doi.org/10.1016/j.sapharm.2020.06.004
10. Masiero M, Lucchiari C, Pravettoni G. Personal fable: optimistic bias in cigarette smokers. International Journal of High Risk Behaviors and Addiction. 2015;4(1):e20939. https://doi.org/10.5812/ijhrba.20939
11. Hwang YI, Park YB, Yoon HK, Kim TH, Yoo KH, Rhee CK, et al. Male current smokers have low awareness and optimistic bias about COPD: Field survey results about COPD in Korea. International Journal of Chronic Obstructive Pulmonary Disease. 2019;14:271–277. https://doi.org/10.2147/copd.s189859
12. Weinstein ND, Marcus SE, Moser RP. Smokers' unrealistic optimism about their risk. Tobacco Control. 2005;14(1):55–59. https://doi.org/10.1136/tc.2004.008375
13. Bae BJ. Effect of health news consumption on unrealistic optimism toward cancer risk. American Communication Journal. 2015;17(2):38–52.
14. Sohn YK, Lee JW, Jang JY. A study on the persuasive effects of cervical cancer screening prevention campaign - Focusing on mediating and moderating effect of optimistic bias. Advertising Research. 2011;(90):99–131.
15. Aiken LS, Fenaughty AM, West SG, Johnson JJ, Luckett TL. Perceived determinants of risk for breast cancer and the relations among objective risk, perceived risk, and screening behavior over time. Women's Health (Hillsdale, NJ). 1995;1(1):27–50.
16. Seo MH. A study on the effectiveness and sustainability of an HIV/AIDS human rights education of nursing students: Focusing on knowledge, fear, personal stigma related HIV/AIDS, and stigma communication. Journal of the Korea Academia-Industrial Cooperation Society. 2023;24(6):196–205. http://doi.org/10.5762/KAIS.2023.24.6.196
17. Cha DP. Self-serving bias for HIV/AIDS infection among college students. Journal of Public Relations. 2004;8(1):137–160.
18. Kim BC, Choi MI, Choi YH, James M. Cultural difference study on optimistic bias of AIDS : Comparison between Korea and Kenya. The Korean Journal of Advertising. 2007;18(1):111–130.
19. Jeong YJ, Park JH. The effects of the stroke on the health knowledge, optimistic bias and health-promoting lifestyle in middle-aged adults. Journal of the Korea Academia-Industrial Cooperation Society. 2016;17(9):141–155. http://doi.org/10.5762/KAIS.2016.17.9.141
20. Jo SA. Effects of optimistic bias in risk perception of COVID 19 on tourism intentions of potential tourists: Focusing on moderating effects of optimistic bias. Journal of Tourism

Management Research. 2021;25(3):523–542.
21. Wise T, Zbozinek TD, Michelini G, Hagan CC, Mobbs D. Changes in risk perception and self-reported protective behaviour during the first week of the COVID-19 pandemic in the United States. Royal Society Open Science. 2020;7(9):200742. https://doi.org/10.1098/rsos.200742
22. Chen S, Liu J, Hu H. A norm-based conditional process model of the negative impact of optimistic bias on self-protection behaviors during the COVID-19 pandemic in three Chinese cities. Forntiers in Psychology. 2021;12:659218. https://doi.org/10.3389/fpsyg.2021.659218
23. Walker LO, Avant KC. Strategies for theory construction in nursing. Upper Saddle River, New Jersey: Pearson/Prentice Hall; 2005. 249 p.
24. NAVER. Naver dictionary [Internet]. Seongnam: NAVER. 2023 [cited 2023 Jun 10]. Available from: https://ko.dict.naver.com/#/search?query=%EB%82%99%EA%B4%80%EC%A0%81%20%ED%8E%B8%ED%96%A5
25. Suh MS, Suh KH, Kim IK. Relationships between factors from the theory of planned behavior, optimistic bias, and fruit and vegetable intake among college students. Korean Journal of Health Psychology. 2019;24(1):191–208. https://doi.org/10.17315/kjhp.2019.24.1.009
26. Chapin J, de las Alas S, Coleman G. Optimistic bias among potential perpetrators and victims of youth violence. Adolescence. 2005;40(160):749–760.
27. Larsen S, Brun W. 'I am not at risk-typical tourists are'! Social comparison of risk in tourists. Perspectives in Public Health. 2011;131(6):275–279. https://doi.org/10.1177/1757913911419898
28. Hoorens V, Buunk BP. Social comparison of health risks: Locus of control, the person-positivity bias, and unrealistic optimism1. Journal of Applied Social Psychology. 1993;23(4):291–302. https://doi.org/10.1111/j.1559-1816.1993.tb01088.x
29. Arnett JJ. Optimistic bias in adolescent and adult smokers and nonsmokers. Addictive Behaviors. 2000;25(4):625–632. https://doi.org/10.1016/s0306-4603(99)00072-6
30. Perloff LS. Social comparison and illusions of invulnerability to negative life events. Coping with Negative Life Events: Clinical and Social Psychological Perspectives. 1987;217–242. https://doi.org/10.1007/978-1-4757-9865-4_9
31. Avis NE, Smith KW, McKinlay JB. Accuracy of perceptions of heart attack risk: What influences perceptions and can they be changed? American Journal of Public Health. 1989;79(12):1608–1612. https://doi.org/10.2105/ajph.79.12.1608
32. Kim SI, Yang SJ. Effect of optimistic bias on perceived health risk and health promotion lifestyle of middle-aged physical activity participants. The Korean Journal of Physical Education. 2019;58(4):87–99. https://doi.org/10.23949/kjpe.2019.07.58.4.6
33. Masiero M, Riva S, Oliveri S, Fioretti C, Pravettoni G. Optimistic bias in young adults for cancer, cardiovascular and respiratory diseases: A pilot study on smokers and drinkers. Journal of Health Psychology. 2018;23(5):645–656. https://doi.org/10.1177/1359105316667796
34. Chu YR, Park JY, An HS, Bae KE. Influence of cognition and optimistic bias on the intention to visiting obstetrics and gynecology of women college students. Korean parent-child health journal. 2019;22(1):22–29.
35. Suh KH. Verification of a theory of planned behavior model of medication adherence in Korean adults: Focused on mederating effects of optimistic or present bias. BMC Public Health. 2021;21(1):1391. https://doi.org/10.21203/rs.3.rs-39206/v1
36. Weinstein ND. Why it won't happen to me: Perceptions of risk factors and susceptibility. Health Psychology : Official Journal of the Division of Health Psychology. 1984;3(5):431–457. https://doi.org/10.1037/0278-6133.3.5.431
37. Ku YH, Noh GY. A study of the effects of self-efficacy and optimistic bias on breast cancer screening intention : Focusing on the Health Belief Model(HBM). Ewha Journal of Social Sciences. 2018;34(2):73–109. http://doi.org/10.16935/ejss.2018.34.2.003

Appendix 1. References Used for Concept Analysis in This Study

A01. Blair KS, Otero M, Teng C, Jacobs M, Odenheimer S, Pine DS, et al. Dissociable roles of ventromedial prefrontal cortex (vmPFC) and rostral anterior cingulate cortex (rACC) in value representation and optimistic bias. NeuroImage. 2013;78:103-110. https://doi.org/10.1016/j.neuroimage.2013.03.063

A02. Caponecchia C, Sheils I. Perceptions of personal vulnerability to workplace hazards in the Australian construction industry. Journal of Safety Research. 2011;42(4):253-258. https://doi.org/10.1016/j.jsr.2011.06.006

A03. Chapin J, de las Alas S, Coleman G. Optimistic bias among potential perpetrators and victims of youth violence. Adolescence. 2005;40(160):749-760.

A04. Chen S, Liu J, Hu H. A norm-based conditional process model of the negative impact of optimistic bias on self-protection behaviors during the COVID-19 pandemic in three Chinese cities. Forntiers in Psychology. 2021;12:659218. https://doi.org/10.3389/fpsyg.2021.659218

A05. Cho SA, Kim SW. The Influence of Optimistic Bias on Risk Perception, Tourist Destination Switching Intention, and Risk Reduction Behavior. Journal of Tourism Sciences. 2018;42(10):175-190. https://doi.org/10.17086/jts.2018.42.10.175.190

A06. Dongsuk L, Yeon Jeong H, Joo Young O, Jae Seo L, Hee Young J, Se Ah J, et al. COVID-19 Vaccination experience of nursing students. Journal of Korean Association for Qualitative Research. 2022;7(1):12-25. https://doi.org/10.48000/KAQRKR.2022.7.12

A07. Helweg-Larsen M, Shepperd JA. Do moderators of the optimistic bias affect personal or target risk estimates? A review of the literature. Personality and social psychology review. 2001;5(1):74-95. https://doi.org/10.1207/s15327957pspr0501_5

A08. Hoorens V, Buunk BP. Social Comparison of Health Risks: Locus of Control, the Person-Positivity Bias, and Unrealistic Optimism 1. Journal of Applied Social Psychology. 1993;23(4):291-302. https://doi.org/10.1111/j.1559-1816.1993.tb01088.x

A09. Kim IS. The impact of risk perception of nuclear power, perception of knowledge, the use of communication channels, the third-person effect about nuclear accident on optimistic bias -Fukushima nuclear accident. Journal of Communication Science. 2012;12(3):79-106.

A10. Klaczynski PA. Age differences in optimism bias are mediated by reliance on intuition and religiosity. Journal of Experimental Child Psychology. 2017;163:126-139. https://doi.org/10.1016/j.jecp.2017.06.007

A11. Knox B. Consumer perception and understanding of risk from food. British medical bulletin. 2000;56(1):97-109. https://doi.org/10.1258/0007142001903003

A12. Kos JM, Clarke VA. Is optimistic bias influenced by control or delay? Health Education Research. 2001;16(5):533-540. https://doi.org/10.1093/her/16.5.533

A13. Lee SH, Ham EM. The Relationship between the optimistic bias about cancer and cancer preventive behavior of the Korean, Chinese, American, and Japanese adult residing in Korea. Journal of Korean Academy of Nursing. 2010;40(1):52-59. https://doi.org/10.4040/jkan.2010.40.1.52

A14. McColl K, Debin M, Souty C, Guerrisi C, Turbelin C, Falchi A, et al. Are People Optimistically Biased about the Risk of COVID-19 Infection? Lessons from the First Wave of the Pandemic in Europe. International Journal of Environmental Research and Public Health. 2022;19(1):436. https://doi.org/10.3390/ijerph19010436

A15. Schwarzer R, Fuchs R. Changing risk behaviors and adopting health behaviors: The role of self-efficacy beliefs. In: Bandura A, editor. Self-Efficacy in Changing Societies. Cambridge: Cambridge University Press; 1995. p. 259-288. https://doi.org/10.1017/CBO9780511527692.011

A16. Sharot T. The optimism bias. Current Biology. 2011;21(23):R941-R945. https://doi.org/10.1016/j.cub.2011.10.030

A17. Strombotne K, Sindelar J, Buckell J. Who, me? Optimism bias about US teenagers' ability to quit vaping. Addiction. 2021;116(11):3180-3187. https://doi.org/10.1111/add.15525

A18. Thompson SC. Will it hurt less if I can control it? a complex answer to a simple question. Psychological bulletin. 1981;90(1):89. https://doi.org/10.1037/0033-2909.90.1.89

A19. White MP, Eiser JR, Harris PR. Risk Perceptions of Mobile Phone Use While Driving. Risk Analysis. 2004;24(2):323-334. https://doi.org/10.1111/j.0272-4332.2004.00434.x

RCPHN
Research in Community and Public Health Nursing

한국지역사회간호학회 회칙

2006년 12월 12일 전면 개정
2011년 12월 10일 개정
2017년 01월 16일 개정
2017년 12월 14일 개정
2018년 12월 20일 개정
2022년 02월 21일 개정

제1장 총칙

제1조 (명칭) 본 회는 한국지역사회간호학회라 칭한다.

제2조 (목적) 본 회는 지역사회 간호학의 학문적 발전을 위해 교육과 연구에 관한 학술과 정책 활동을 도모하고 회원간 학술적 교류를 목적으로 한다.

제3조 (사무소 소재지) 본 회 사무소는 본회 학회장 소속 기관에 둔다.

제4조 (사업) 제1장 제2조의 목적을 달성하기 위하여 다음의 사업을 행한다.

1. 연구 활동
2. 국내외 학술활동 및 교류
3. 학술 및 홍보활동
4. 학회지 발간 및 출판사업
5. 간호교육 발전을 위한 활동
6. 기타사업

제2장 회원

제5조 (회원자격)

① 본 학회의 회원은 본 법인에 등록을 마친 자로 한다.

② 본 학회의 회원은 다음과 같이 구분한다.

1. 정회원은 간호학을 전공한 자로서 학사학위 이상의 소지자로 한다.
2. 준회원은 본 학회의 목적에 동의하는 자로 한다.
3. 명예회원은 간호학 발전에 공헌이 있는 개인 혹은 기관으로서 실행이사회에서 추대된 자로 한다.

제6조 (회원의 권리와 의무)

① 본 학회의 회원은 정관을 준수하고 다음과 같이 소정의 회비 납부와 본 학회의 사업에 적극 참여할 의무를 갖는다.

1. 정회원과 준회원은 입회비 및 회비를 본 학회에 납부하여야 한다.
2. 정회원은 선거권과 피선거권을 갖는다. 단, 선거예정일로부터 1년 이상 정회원 자격을 유지한 자로 한다.
3. 회원은 본 학회가 제공하는 학회지, 학술정보 등 각종혜택을 받을 권리를 갖는다.

② 본 학회의 회원은 1개 이상의 회원 학회에 가입할 수 있으며 회원이 회원 학회에 복수가입을 원할 경우에는 온라인 가입 후 복수회비를 본 법인에 납부하여야 한다.

제7조 (회원의 탈퇴)

① 회원은 회장에게 탈퇴의사를 서면으로 통고함으로써 본 법인을 임의로 탈퇴할 수 있다.

② 회원이 탈퇴해도 이미 납부한 회비는 반환되지 않는다.

제8조 (회원의 제명)

본 학회의 회원으로서 본 법인의 목적에 배치되는 행위 또는 명예·위신 등의 손상을 가져오는 행위를 하였을 때에는 이사회의 의결로써 회장이 제명할 수 있다.

제3장 조직 및 임원

제9조 (임원) 본회에는 다음과 같은 임원을 둔다.

1. 회장 1명
2. 부회장 1명
3. 총무이사 1명
4. 서기이사 1명
5. 재정이사 1명
6. 학술이사 1명
7. 교육이사 1명
8. 편집이사 1명
9. 출판이사 2명
10. 홍보이사 1명
11. 국제교류이사 2명
12. 정책이사 1명
13. 감사 2명
14. 당연직 이사

제10조 (임원의 직무)

1. 회장은 본회를 대표하고 회무를 정리하며, 본회의의 의장이 된다.
2. 부회장은 회장과 협력하여 본회의 제반 사업 활동을 처리한다.

3. 총무이사는 본회의 일반 제질 활동을 총괄한다.
4. 서기이사는 본회의 회의록을 기록하고, 보고하며, 제반 서류를 보관한다.
5. 재정이사는 본회의 재정을 담당한다.
6. 학술이사는 본회의 학술활동을 총괄한다.
7. 교육이사는 본회의 교육활동을 총괄한다.
8. 편집이사는 본회의 학술활동을 위한 출판을 총괄한다.
9. 출판이사는 본회의 문제은행 관리, 출판활동을 총괄한다.
10. 홍보이사는 본회의 홍보활동을 담당한다.
11. 국제교류이사는 본회의 국제교류활동을 담당한다.
12. 정책이사는 본회 관련된 정책 활동을 담당한다.
13. 감사는 본회 회무 및 재정을 담당한다.
14. 당연직이사는 분야별 학회장과 단체의 장, 지역 지부장으로 한다.

제11조(위원회, 지부, 분야별 학회와 분야별 단체)

1. 본회의 조직과 활동을 위해 별도의 위원회를 둘 수 있다. 위원회의 운영에 관해서는 별도의 규정을 둔다.
2. 본회는 지부, 분야별 학회, 분야별 단체를 둘 수 있다.
3. 지부, 분야별 학회 및 분야별 단체의 운영을 위하여 별도의 규정을 둔다.

제12조(임원의 선임)

1. 회장은 총회에서 출석인원 과반수의 득표로 선출한다.
2. 부회장은 차기 회장 지역의 지역사회 간호학 교수 중 추대된 자로 한다.
3. 감사는 총회에서 선출하되 다수득표자로 정한다.
4. 임원(총무, 학술, 정책, 교육, 편집, 출판, 서기, 재정, 홍보, 국제교류)은 회장이 정하고 재적 총투표자의 다수결에 의한다.

제13조 (임원의 임기)

1. 임원의 임기는 2년이다.
2. 임원의 동일한 직에 1회에 한하여 중임할 수 있다. 임원 중 결원이 있을 때에 회장을 제외하고는 임원회에 서 이를 보선하며 임기는 잔여기간으로 한다.

제4장 회의

제17조 (구성) 본회는 정기총회, 임시총회, 이사회를 둔다.

제18조 (총회의 소집)

정기총회는 매년 12월, 임시총회는 회장이 필요하다고 인정하였을 때 또는 회원 3분의 1이상의 요구가 있을 때 회장이 이를 소집한다.

제19조(총회의 기능)

정기총회는 다음사항을 관장한다.

1. 회칙개정
2. 예산, 결산
3. 임원선거
4. 사업계획
5. 기타 안건 토의

제5장 재정

제21조(재정) 본회의 재정은 다음과 같이 충당 한다.

한국간호과학회로부터 본회에 등록된 회원의 연회비 중일정액을 지급받는다. 지급받은 회비와 찬조금, 기타 사업조성금으로 재정을 충당한다.

제22조(회계연도) 본회의 회계연도는 12월 1일부터 11월 30일로 한다.

부칙

제1조 본회 회칙은 총회 재적 3분의 2이상의 결의로서 수정할 수 있다.

제2조 본회 회칙은 정기총회에서 개정통과일로부터 시행한다.

제3조 기타 본 회칙에 규정되지 아니한 사항은 일반 관례에 따른다.

제4조 한국간호과학회의 인준을 받은 후 2018년 1월 1일부터 시행한다.

부칙 < 2018.12.20. >

제1조 (시행일)

본 회칙은 한국간호과학회의 인준을 받은 날로부터 시행한다.

RCPHN
Research in Community and Public Health Nursing

Instructions for authors

Aims and scope

1. The Research in Community and Public Health Nursing (RCPHN) is the official journal of the Korean Academy of Community Health Nursing. The RCPHN coverage includes theoretical, practical, and educational issues related to community and public health nursing. Articles include original research articles, reviews, and editorials. This journal aims to provide worldwide access to timely research and practice features of use to community and public health nurses, educators, school health teachers, occupational nurses, and administrators in the field of community and public health nursing.
2. The RCPHN is a peer-reviewed journal published quarterly at the end of the month (March, June, September, and December) by the Korean Academy of Community Health Nursing.
3. RCPHN is an open-access journal, and articles are made freely available online to read, download, and share, immediately upon publication. The RCPHN endorses the Equator Network (http://www.equator-network.org). This international initiative seeks to improve the reliability and value of research literature in health care by promoting transparent and accurate reporting of studies. Authors are asked to make use of appropriate reporting guidelines to ensure excellence in scientific reporting.

Research and Publication ethics

1. Research ethics

1) The policies on the research and publication ethics of the journal follow the guidelines set by the Korean Association of Medical Journal Editors, the Committee on Publication Ethics (COPE, http://publicationethics.org/), the Ministry of Education, and the National Research Foundation of Korea with respect to the settlement of any misconduct.

2) All manuscripts should be prepared in strict application of the research and publication ethics guidelines recommended by the Council of Science Editors (CSE, http://www.councilscienceeditors.org/), the International Committee of Medical Journal Editors (ICMJE, http://www.icmje.org/), and the Korean Association of Medical Journal Editors (KAMJE, http://www.kamje.or.kr/).

3) The author(s) must be able to state that the research involving humans or animals has been approved by a responsible IRB and conducted in accordance with accepted national and international standards. RCPHN will follow the guidelines set by the Committee on Publication Ethics (COPE, http://publicationethics.org/) to settle any misconduct. All studies involving human subjects or human data must be reviewed and approved by a responsible research ethics board or institutional review board (IRB). Please refer to the principles embodied in the Declaration of Helsinki (https://www.wma.net/policies-post/wma-declaration-of-helsinki-ethical-principles-for-medical-research-involving-human-subjects/) for all investigations involving human subjects and materials. The editor of the journal may request the submission of copies of the informed consent received from human subjects in clinical studies or IRB approval documents. Animal experiments should also be reviewed by an appropriate committee (e.g., the Institutional Animal Care and Use Committee) for the care and use of animals. If the study was exempt from such approval, the basis of such exemption and the regulatory framework should be described.

4) Submission Declaration: When submitting a manuscript, authors should include a letter informing the Editor of any potential overlap with other already published material or material being evaluated for publication and should also state how the manuscript submitted to the RCPHN differs substantially from the previously published paper(s). If all or part of the participants were previously reported, this should be mentioned in the Methods section, along with a citation of the appropriate reference(s).

5) Permissions: Authors should obtain permission to use measurement tools for their studies from the copyright owners. Permission to reproduce previously published material must also be obtained in writing from the copyright holder (usually the publisher) and acknowledged in the manuscript.

2. Conflict of interest

1) The corresponding author of an article is asked to inform the Editor of any potential conflicts of interest that may have influenced the research or interpretation of data. A potential conflict of interest should be disclosed on the title page, even when the authors are confident that their respective judgments

have not been influenced when preparing the manuscript. Such conflicts may include financial support or private connections to pharmaceutical companies, political pressure from special interest groups, or academic problems.

2) The disclosure form should be the same as the ICMJE Uniform Disclosure Form for Potential Conflicts of Interest (http://www.icmje.org/disclosure-of-interest/).
3) The Editor will decide whether the information provided about any conflict of interest should be included in the published paper. In particular, all funding sources for a study should be explicitly stated. The RCPHN asks referees to inform the Editor of any conflict of interest before reviewing a particular manuscript.

3. Authorship

1) The RCPHN follows the recommendations for authorship set out by the ICMJE, 2019 (http://www.icmje.org/icmje-recommendations.pdf) and the Good Publication Practice Guidelines for Medical Journals 3rd Edition (KAMJE, 2019, https://www.kamje.or.kr/board/view?b_name=bo_publication&bo_id=13&per_page=).
2) Any designated author should meet all four criteria for authorship, and anyone who meets the four criteria should be identified as an author. Authors should have confidence in the integrity of the contributions of their co-authors. All other contributors not listed as authors should be mentioned in the acknowledgments section.
3) When a master's thesis or doctoral dissertation is submitted for publication, the first author should be the person awarded the degree, and they should declare that content is from a thesis/dissertation.
4) The corresponding author has primary responsibility for addressing all issues with the Editor and the readership. Any comment by the corresponding author is regarded as the opinion of all co-authors. The corresponding author should confirm that all appropriate persons are listed as authors in the manuscript, and all co-authors should approve the final version to be published.
5) When a large, multicenter group has conducted the work, the group should identify the individuals who accept direct responsibility for the manuscript. When submitting a manuscript authored by a group, the corresponding author should indicate the preferred citation and identify all individual authors and the group name. Journals generally list other members of the group not included as authors in the Acknowledgments section. Acquisition of funding, collection of data, or general supervision of the research group alone does not constitute authorship.
6) These authorship criteria are intended to keep the status of authorship to those who deserve credit and can take responsibility for the work. Authors are expected to carefully consider the list and order of authors before submitting their manuscript and provide the definitive list of authors at the time of the original submission. All authors, including the order and list of author names, should be confirmed at the time of submission. When submitting the article, all authors are requested to list the ORCID. This ID can be obtained through https://orcid.org.
7) Any addition, deletion, or rearrangement of author names in the authorship list should only be made prior to acceptance of the manuscript and only if approved by the Editor. To request such a change, the Editor must receive the following from the corresponding author: (a) the reason(s) for the change in the author list; (b) written confirmation (e-mail, letter) from all authors that they agree with any addition, removal, or rearrangement. In the case of the addition or removal of authors, this includes a requirement for confirmation from the author being added or removed. Only in exceptional circumstances will the Editor consider the addition, deletion, or rearrangement of authors after the manuscript has been accepted. While the Editor considers the request, the publication of the manuscript will be suspended. If the manuscript has already been published in an online issue, any requests approved by the Editor will result in a corrigendum.

4. Redundant publication and plagiarism

1) Redundant publication (duplication) is defined as "reporting (publishing or attempting to publish) substantially the same work more than once, without attribution of the original source(s)." Characteristics of reports that are substantially similar include the following: (a) "At least one of the authors must be common to all reports (if there are no common authors, it is more likely plagiarism than redundant publication);" (b) "The subjects or study populations are the same or overlapped;" (c) "The methodology is typically identical or nearly so;" (d) "The results and their interpretation generally vary little, if at all."
2) Authors should not submit the same research to more than one journal and should not publish the manuscript in different languages. If authors wish to pursue a secondary publication of

the manuscript in another language, they should obtain approval from the editor-in-chief of both related journals. The editorial board will determine the nature and degree of duplicate publication or duplicate submission for the manuscript.

3) Plagiarism means the appropriation of another person's ideas, research processes, results, or text as one's own. This includes using previously published material of oneself or any other author without citing the reference. Authors are required to submit original manuscripts and confirm that they have cited or quoted others' ideas and texts appropriately and accurately.

5. Process for managing publication malpractice

1) When reviewers or readers suspect publication malpractice, such as fabrication, falsification, salami slicing, plagiarism, or simultaneous/ duplicate publication, inappropriate changes in authorship, an undisclosed conflict of interest, ethical problems with a submitted manuscript, a reviewer who has appropriated an author's idea or data, and complaints against editors, the process of resolution will be initiated according to the flowchart provided by the Committee on Publication Ethics (COPE, http://publicationethics.org/resources/flowcharts).
2) The ethics committee will discuss and adjudicate cases of suspected publication malpractice, as well as complaints and appeals against editors.
3) If an author violates the aforementioned research and publication ethics, the editorial board will decide specific penalty, including the prohibition of making contributions for two years.

Manuscript submission

1. The first author and corresponding author should be a member, with the exception of non-Korean authors. The Society permits both members and nonmembers to submit manuscripts, but nonmembers shall only be allowed to submit in the following cases:
   1) When a nonmember is in joint research with a member of the Society,
   2) When a nonmember has received a recommendation from the director of this Society.
2. Only research papers, reviews, and editorials are considered for review and manuscripts that do not adhere to the submission regulations shall not be accepted.

3. All manuscripts shall be submitted online.

1) All manuscripts may be submitted at any time through the Korean Academy of Community Health Nursing website. Reviews shall be processed on a first-come-first-served basis.
2) For any questions regarding the use of the online submission system, please contact the publication director of the Society via e-mail (rcphnoffice@gmail.com).

4. Types of Publication

1) Research Papers: The RCPHN publishes original research that matches the aims and scope of the journal. These include full papers reporting original research. These are reports of empirical findings from the highest quality basic and clinical research studies within the scope of focus of the RCPHN. The findings from studies utilizing diverse approaches are relevant. These include the following: qualitative methods; measurement, such as the development and evaluation of instrumentation; observational, quasi-experimental, and experimental studies; e-science, information-based studies; mixed-method designs. Research papers should adhere to recognized standards. Analysis by gender is recommended. Instrument development or validation papers are only considered if accompanied by a copy of the full instrument, included as a supplementary file at the submission stage, so it can be published as an appendix online if accepted.
2) Reviews: These include critical presentations of topics of interest and relevance to nursing theory, practice, and education. The body of a review article should be a comprehensive, scholarly, evidence-based review of the literature, accompanied by critical analysis, and leading to reasonable conclusions. The journal publishes systematic reviews (addressing focused research questions) and broader literature reviews (such as scoping reviews). We also publish discussion papers, which are scholarly articles of a debating or discursive nature. In all cases, there must be engagement with and critical analysis of a substantive body of research or other scholarship. Systematic reviews should adhere to recognized standards for reporting.
3) Editorials: These include comments by organizations or individuals on topics of current interest and are by invitation only. Authors with ideas for editorials that address issues of substantive concern to the discipline, particularly those of a controversial nature or linked directly to current/forthcoming content in the journal, should contact the editorial office.
4) Letters to the Editor: These include responses to previous articles and editorials. Designed to stimulate academic debate and discussion, the Editor invites readers to submit letters that refer to and comment on recent content in the journal, introduce

new comments and discussion of clear and direct relevance to the journal's aims and scope, or briefly report data or research findings that may not warrant a full paper.

Manuscript preparation

General guideline

1. The first author and co-author shall be addressed separately, and the affiliations and positions of the authors shall be indicated. The author addressed first becomes the first author, followed by the co-authors. The corresponding author shall be explicitly indicated. If the author is an elementary, junior, high school, or college student, it should be indicated that the author is a student and the school to which the author belongs. In the case of a minor who does not belong to a school, their last school, position, and school year shall be indicated.
2. Manuscripts shall be proofread by the author(s), and publication charges, special composing frames and supplementary documents shall also be prepared by the author (s) according to the regulations of the Society. The publication charges are 60,000 won (50 USD) per page.
3. Authors will be required to complete the Checklist during the submission process to assist them in ensuring that the basic requirements of manuscript submission are met, including details of the contribution of authors, funding sources, and any conflicts of interest. The Checklist is designed to be a self-assessment checklist to assist authors in preparing their manuscripts. A completed form must be submitted to show that have been included all the necessary parts in the submission have been included.

4. The procedures of manuscript submission are as follows.
   1) The title page and manuscript should be submitted in separate files.
   2) The authors' names can be omitted in the main text, and all pages shall be numbered.
   3) The manuscript shall be prepared in an A4 size page in word file, with a 1-inch margin on all sides. The font size shall be 12-point batang or 12-point Times New Roman. The line spacing shall be double-spaced or 200% for the title page, abstract, text, and references. The line spacing should be single-spaced or 100% for the tables, table titles and notes, and figure captions. The manuscript shall be within 20 pages, excluding the title page, abstract, references, and any supplemental digital contents.
   4) All manuscripts shall be written in Korean or English with correct spelling. The abstract, acknowledgments and references should be written in English. The abstract shall not exceed 250 words.
   5) English abbreviations should be placed in parenthesis after writing the full name, e.g., magnetic resonance imaging (MRI).
   6) Standard abbreviations and units must be used in accordance with the Citing Medicine: The NLM (National Library of Medicine) Style Guide for Authors Editors, and Publishers 2nd ed (2007).
   7) Even when submitted through the online submission system, only the manuscripts that fit the guidelines regarding the number of pages, order of contents, and organization shall be accepted.

Composition of manuscripts

1. The composition of manuscripts shall be in the following order: title page, title, abstract and keywords, main text (introduction, methods, results, discussion, and conclusion), references, tables, figures, appendix, and finally, a literature review if necessary. The composition may be different for special papers. The order of each section shall be I - 1 - 1) – or (1). In the main text (including references, figures, tables, and acknowledgments), the author's name or identification, such as the name of the institution or IRB, should not be written for anonymous peer review.

2. Title page

On the title page include 1) title and running title, 2) type of manuscript, 3) authors' names and affiliations (department, location, and ORCID (visit https://orcid.org)), 4) corresponding author's name and complete address, including e-mail, phone number, ORCID, and fax number, 5) keywords (English and Korean), 6) contributor roles of each author, 7) any acknowledgments, credits, or disclaimers, including funding sources and conflicts of interest, Institutional Review Board statement, data-sharing statements, and registration of study.

1) Copyright Transfer Agreement

All authors will be required to sign a Copyright Transfer Agreement conferring the manuscript copyright to the Research in Community and Public Health Nursing. Copyright Transfer

Agreement form and form of Conflicts of interest should be submitted online at submission. Articles are published under the terms of the Creative Commons Attribution-No Derivatives 4.0 International Public License, which allows readers to disseminate and reuse the article, as well as share and reuse the scientific material. It does not permit the creation of derivative works without specific permission. To view a copy of this license, please visit https://creativecommons.org/licenses/by-nc/4.0/.

2) Conflict of interest statement

Authors are required to disclose any possible conflicts of interest when submitting a paper. These can include financial conflicts of interest, e.g., patent ownership, stock ownership, consultancies, speaker's fee. All conflicts of interest (or information specifying the absence of conflict of interest) should be included at the end of the article under 'Conflicts of Interest'. This information will be included in the published article.

If the author does not have any conflicts of interest, the following statement should be included: "No conflict of interest has been declared by the author(s)."

3) Funding statement

RCPHN requires authors to specify any funding sources (institutional, private, and corporate financial support) for the work reported in their paper. This information, in the form of the name of the funding organization(s) and the grant number or should be included at the end of the article under the heading 'Funding' and provided at the time of submitting the paper. If there was no funding, the following wording should be used: "This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors." Any materials suppliers should be named, and their location (town, state/county, country) included if appropriate. This information will be included in the published article.

3. Title

The title should be concise. In the case of a paper written in Korean, the exact meaning of the English and Korean titles must correspond.

4. Abstract and keywords

1) An abstract of up to 250 words should be typed double-spaced on a separate page. The purpose, methods, results, and conclusion shall be provided sequentially in subheadings without any partitions between paragraphs. When using abbreviations, explanations for those abbreviations must be given.

2) Below the abstract, three to five keywords shall be given in English. Keywords shall not exceed five words, and they must be words registered in the MeSH (https://meshb.nlm.nih.gov/). Up to five Keywords shall be placed at the top of the first page in Korean, and the meaning of them shall match the meaning of the English keywords.

5. Main text

1) Introduction: The introduction section shall be clear and precise and provide only the necessary background information related to the purpose of the study.

2) Methods: Describes the study design, setting, samples, measurements/ instruments, data collection/procedure, ethical considerations, and data analysis used. The instrument can be omitted if it is qualitative research. In the section on ethical considerations, the author should describe that this study protocol was approved by the institutional review board (IRB No. ##-##-###).

[Description of subjects] Ensure the correct use of the terms sex (when reporting biologic factors) and gender (identity, psychological, or sociocultural factors), and unless inappropriate, report the sex or gender of the subjects, the sex of the animals or cells, and describe the methods used to determine sex or gender. The researcher should include gender or sex of the subjects, if possible. If the study was done involving an exclusive population, e.g., only one sex or gender, the authors should justify why, except in obvious cases. The authors should define how they determined race or ethnicity and justify their relevance.

3) Results: The findings of the study shall be described succinctly and logically.

4) Discussion: The study results shall be interpreted and compared with the findings of other related studies. The research results shall not be described repeatedly.

5) Conclusion: The results or methods of the study shall not be repeated. The interpretations or limitations found in the study must be described, and the purpose of the study shall be related to the results. Authors may propose future directions for research, education, or practice.

6) Conflict of Interests: Authors must disclose any financial or personal relationships with other individuals or organizations that could influence their work.

7) Funding: Authors must specify any funding sources (institu-

tional, private, and corporate financial support) for the work reported in their paper.

8) Author contribution: The RCPHN requires that all authors take public responsibility for the content of the work submitted for review. All authors reviewed the results and approved the final version of the manuscript.

9) Acknowledgments: Persons who have made contributions to the study, but who are not eligible for authorship can be named in this section. Their contribution must be specified, such as data collection, financial support, statistical analysis, or experimentation. The corresponding author must inform the named contributor of the acknowledgment, and acquire consent before manuscript submission.

10) Data availability: A data availability statement tells the reader where the research data associated with a paper is available, and under what conditions the data can be accessed. They also include links (where applicable) to the data set.

Tables and figures

1. Tables and Figures shall be expressed in English. The contents of the tables and figures shall not overlap.
2. The contents of the tables, figures, and pictures shall be easily understood and stand alone.
3. Table guidelines
   1) All lines shall be single-lined and vertical lines shall not be used.
   2) The title of the table shall be placed on top of the table, and the first letters of the important words shall be capitalized (e.g., Table 1. Overall Responses to Question Types).
   3) Separate tables shall be numbered in the order of their first appearance.
   4) Footnotes can be used to convey additional information. Nonstandard abbreviations used in the tables must be explained in the footnotes (e.g., HR = heart rate; T = temperature).
   5) Footnotes in tables should use symbols in the following sequence: $^{\dagger, \ddagger, \S, \|, \P, \#, \dagger\dagger, \ddagger\ddagger}$ The explanations for these superior characters shall be placed on the bottom left of the tables (e.g. †Survival case; ‡Dead case).
   6) 0 shall be placed in front of the decimal point if the number is close to 1 and left blank if the number is not close to 1 (e.g., $t = 0.26$, $F = 0.92$, $r = .14$, $R^2 = .61$).
   7) When reporting p-values, which refer to the significance probability, footnotes shall not be used, but the actual p-values shall be provided. If the p-value is .000, it shall be indicated as $p < .001$, and if the p-value is 1.000, it shall be indicated as $p > .999$.
   8) When reporting decimal numbers, the significance level shall be rounded to three decimal places. Standard deviations, other averages and means shall be rounded to two decimal places, and percentages rounded to one decimal place (e.g., $p = .002$, 23.98 ± 3.47, 45.7%).
   9) When p-values have to be reported using footnotes, *, ** shall be used (e.g., $^{*}p < .05$, $^{**}p < .01$).

4. Figure guidelines
   1) The title of the figure shall be placed below the figure with the first letter capitalized. Separate figures shall be numbered in the order of their first appearance.
   2) When there are two or more figures for the same number, alphabets shall be placed after the Arabic number. (e.g., Figure 1-A and Figure 1-B).

5. Tables and figures shall be in sharp, black lines and adjusted to fit within the A4 size page (width 150 mm × height 200 mm) with the explanations written separately.

6. The resolution of the figures shall be more than 3 million pixels.

In-text citation

Citations of references within the text should follow Citing Medicine: The NLM (National Library of Medicine) Style Guide for Authors Editors, and Publishers 2nd edition (2007) (https://www.ncbi.nlm.nih.gov/sites/books/NBK7256/)

Use [1], [2,3], or [4-6] in the text, and they should be listed in the Reference section in numerical order of their citation.

References

1. All references cited in the text must appear in the Reference section, and all items in this section shall be cited in the text. References cited in the manuscripts such as meta-analyses and systematic reviews are presented in the appendix. Authors are responsible for the accuracy and completeness of their references and correct text citations.
2. State Journal's full name (e.g., Research in Community and Public Health Nursing). The sequence is authors, the title of the paper, journals name, year published, and volume, followed

by page numbers and the Digital Object Identifier (if it is available). For citation from other sources, refer to The NLM Style Guide for Authors, Editors, and Publishers 2nd ed. (2007) (https://www.ncbi.nlm.nih.gov/books/NBK7256/).

3. If the number exceeds six, list only the first six authors followed by et al. shall be given.

Journal article:

1. Cho OH, Yoo YS, Kim NC. Efficacy of comprehensive group rehabilitation for women with early breast cancer in South Korea. Nursing & Health Sciences. 2006; 8(3): 140-146. https://doi.org/10.1111/j.1442-2018.2006.00271.x
2. Bang KS, Kang JH, Jun MH, Kim HS, Son HM, Yu SJ, et al. Professional values in Korean undergraduate nursing students. Nurse Education Today. 2011;31(1):72-75. https://doi.org/10.1016/j.nedt.2010.03.019

Forthcoming journal articles (articles published electronically ahead of the print version):

3. Scerri J, Cassar R. Qualitative study on the placement of Huntington disease patients in a psychiatric hospital: Perceptions of Maltese nurses. Nursing & Health Sciences. 2013. Forthcoming.

Periodicals or magazines:

4. Rutan C. Creating healthy habits in children. Parish Nurse Newsletter. 2012 May 15:5-6.

Newspaper articles:

5. Cho C. Stem cell windpipe gives Korean toddlers new life. The Korea Herald. 2013 May 2; Sect. 01.
6. Lyderson K. Risk of disease rises with water temperatures. Washington Post [Internet]. 2008 Oct 20 [cited 2008 Dec 19]:A08. Available from: http://www.washingtonpost.com/wp-dyn/content/article/2008/10/19/AR2008101901533.html Article includes a correction.

Books:

7. Peate I. The student's guide to becoming a nurse. 2nd ed. Chichester WS: John Wiley & Sons; 2012. 660 p.

Parts of books (chapter):

8. Reed JG, Baxter PM. Library use: handbook for psychology. 3rd ed. Washington: American Psychological Association; c2003. Chapter 2, Selecting and defining the topic; p. 11-25.

Entire book on the Internet

9. Peterson K. Guide to life science careers [Internet]. Cambridge: NPG Education; c2014 [cited 2020 Jul 2]. Available from: https://www.nature.com/scitable/ebooks/guide-to-life-science-careers-14053951/.

Scientific and technical reports:

10. Perio MA, Brueck SE, Mueller CA. Evaluation of 2009 pandemic influenza A (H1N1) virus exposure among internal medicine house staff and fellows. Health Hazard Evaluation Report. Salt Lake City, Utah: University of Utah School of Medicine, 2010 October. Report No.: HETA 2009-0206-3117.

Dissertations and theses (This journal does not recommend citing dissertations or theses. If necessary, less than three should be cited.)

- Doctoral dissertation:

11. Jin HY. A study on the analysis of risk factors and characteristics for nosocomial infection in intensive care unit [dissertation]. [Seoul]: Yonsei University; 2005. 108 p.

- Master's thesis:

12. Kim JS. A study on fatigue, stress and burnout of pregnancy nurses [master's thesis]. [Gwangju]: Chonnam National University; 2012. 50 p.

Papers and poster sessions presented at meetings

- For a paper:

13. Bryar R. The primary health care workforce development roadmap. Paper presented at: The public health nursing contribution to primary health care 3rd International public health nursing conference; 2013 Aug 25-27; National University of Ireland Galway (NUIG). Galway.

- For a poster session:

14. Bigbee J. Promoting the health of the population: Public health nursing leading the way. Poster session presented at: The public health nursing contribution to primary health care 3rd International public health nursing conference; 2013 Aug 25-27; National University of Ireland Galway (NUIG). Galway.

Conference publications

15. Dostrovsky JO, Carr DB, Koltzenburg M, editors. Proceedings of the 10th World Congress on Pain; 2002 Aug 17-22; San Diego, CA. Seattle: IASP Press; c2003.

Citing material on the Internet

- Standard citation to an open serial database on the Internet:

16. TrialSearch [Internet]. New York: AIDS Community Research Initiative of America. c2003 - [cited 2007 Feb 1]. Available from: http://www.acria.org/.

- Standard citation to a retrieval system on the Internet:

17. WHOSIS: WHO Statistical Information System [Internet]. Geneva: World Health Organization. c2007 - [cited 2007 Feb 1]. Available from: http://www.who.int/whosis/en/.

- Standard citation to a homepage:

18. Statistics Korea. 2010 life tables for Korea [Internet]. Seoul: Statistics Korea; 2011 [cited 2012 January 16]. Available from: http://kostat.go.kr/portal/korea/kor_nw/3/index.board?bmode=read&aSeq=252533.

- Homepage with no authors or editors:

19. StatePublicHealth.org [Internet]. Washington: ASTHO; [cited 2007 Feb 23]. Available from: http://statepublichealth.org/.

Appendix

1. Authors should submit an appendix to show the developed final measurements in the instrument development study and a list of articles reviewed in the systematic review or meta-analysis research.
   1) Supplementary material: Supplementary material can support and enhance your scientific research. Supplementary files offer the author additional possibilities to publish supporting applications, high-resolution images, background datasets, sound clips, and more. Please note that such items are published online exactly as they are submitted; there is no typesetting involved (supplementary data supplied as an Excel file or as a PowerPoint slide will appear as such online).
   2) Please submit the material together with the article and supply a concise and descriptive caption for each file. If you wish to make any changes to the supplementary data during any stage of the process, please provide an updated file, and do not annotate any corrections on a previous version.
   3) Please also make sure to switch off the "Track Changes" option in any Microsoft Office files, as these will appear in the published supplementary file(s).

Data sharing and transparency

1. This journal encourages and enables you to share data that supports your research publication, where appropriate, and enables you to interlink the data with your published articles. Research data refers to the results of observations or experimentation that validate the research findings. To facilitate reproducibility and data reuse, this journal also encourages you to share your software, code, models, algorithms, protocols, methods, and other useful materials related to the project.
2. Data generated through the participation of subjects and the public should be put to maximum use by the research community and, whenever possible, translated to deliver patient benefit. Data sharing benefits numerous research-related activities: reproducing analyses; testing secondary hypotheses; developing and evaluating novel statistical methods; teaching; aiding design of future trials; meta-analyses; helping to prevent error, fraud, and selective reporting.
3. To promote more transparent and reproducible research, we ask authors to submit a Data Availability Statement in the manuscript to help authors understand how they can access the data, code and other resources that support the research findings.
4. The following are examples of data-sharing statements:
   Example 1. Data can be obtained from the corresponding author.
   Example 2. Data can be obtained from the supplementary material link.
   Example 3. (In the case of health care big data) Data can be obtained from (the name of the)__repository source.

Registration of a Clinical Trial

1. A clinical trial is defined as "any research project that prospectively assigns human subjects to intervention and comparison groups to study the cause-and-effect relationship between a medical intervention and a health outcome." We encourage the prospective registration of studies. Where a study has been registered, please give the number on your title page and include the registration number within the body of the paper as appropriate.
2. The journal accepts the registration in any of the primary registries that participate in the World Health Organization International Clinical Trials Portal (http://www.who.int/ictrp/en/), the National Institutes of Health ClinicalTrials.gov (https://clinicaltrials.gov/), the International Standard Randomized Controlled Trial Number Registry (https://www.isrctn.com/), or the Clinical Research Information Service, Korea Disease

Control and Prevention Agency (KDCA) (https://cris.nih.go.kr/cris/info/introduce.do).

3. This journal follows the data sharing policy described in "Data Sharing Statements for Clinical Trials: A Requirement of the International Committee of Medical Journal Editors" (https://doi.org/10.3346/jkms.2017.32.7.1051). As of July 1, 2018, manuscripts submitted to ICMJE journals that report the results of interventional clinical trials must contain a data-sharing statement. Clinical trials that began enrolling participants on or after January 1, 2019, must include a data-sharing plan when registering the trial. The ICMJE's policy regarding trial registration is explained at http://www.icmje.org/recommendations/browse/publishing-and-editorial-issues/clinical-trial-registration.html.
4. The journal follows the data-sharing policy described in "Data-sharing Statements for Clinical Trials: A Requirement of the International Committee of Medical Journal Editors (ICMJE)" (https://doi.org/10.3346/jkms.2017.32.7.1051) (http://icmje.org/icmje-recommendations.pdf).
5. If the data-sharing plan changes after registration, this should be reflected in the statement submitted and published with the manuscript and updated in the registry record. Based on the degree of the sharing plan, authors should deposit their data after de-identification and report the digital object identifier, or DOI, of the data and the registered site.

Reporting Guidance for Specific Study designs

For the specific study design, such as randomized control studies, studies of diagnostic accuracy, meta-analyses, observational studies, and non-randomized studies, it is recommended that the authors follow the reporting guidelines (https://www.equator-network.org/).

Editorial and peer-review process

1. Submitted manuscript

1) All contributions (including solicited articles) are critically reviewed by the Editorial Board members and reviewers. The decision to publish a paper is based on an editorial assessment and peer review.
2) Prereview: Initially, all papers are assessed by an editorial committee consisting of members of the editorial team. The primary purpose is to decide whether to send a paper for peer review and to give a rapid decision on those that are not put forward.
3) Review: Manuscripts going forward to the review process are reviewed by two or more reviewers and the editor. The Editorial Board reserves the right to refuse any material for publication. The Editor-in-Chief reserves the right to the final decision regarding acceptance. RCPHN uses a double-blinded review. The names of the reviewers will thus not be disclosed to the author submitting a paper, and the name(s) of the author(s) will not be disclosed to the reviewers.
4) The average time from manuscript submission to the author's receipt of the editor's decision about publication is approximately three months. Many excellent manuscripts are accepted, some pending minor revisions. Many other excellent manuscripts may receive a "revise and resubmit" decision.

2. Revised manuscript

1) When you prepare a revised version of your manuscript, you should carefully follow the instructions given in the Editor's letter. Authors are encouraged to follow the suggestions made by the reviewers to make changes and then resubmit with a detailed letter to the editor outlining the changes made following the reviewers' suggestions. Revised submission must also include a point-by-point response to reviewer comments and a traced-changed version of the revised manuscript.
2) Revised manuscripts must be uploaded within two weeks of authors being notified of conditional acceptance pending satisfactory revision.
3) Authors who are responsive to the reviewers' suggestions are well placed to have their manuscripts accepted for publication.
4) The revised manuscript should have changes highlighted (either by using the "Track Changes" function in MS Word or by highlighting or underlining the text) with notes in the text referring to the editor or reviewer query.

After acceptance of a manuscript

1. Paper proof

1) RCPHN provides the corresponding author with paper proofs for their correction. The corresponding author will receive electronic page proofs to check the copyedited and typeset article before publication. Corrections should be kept to a minimum.
2) The Editor retains the prerogative to question minor stylistic alterations and major alterations that might affect the scientific content of the paper. Any fault found after the publication is the authors' responsibility.

3) We urge our authors to proofread their accepted manuscripts carefully. The corresponding author may be contacted by the Editorial Office, depending on the nature of the correction in the proof.

2. Publication fee

1) Authors are asked to pay a fee to allow perpetual, unrestricted online access to their published articles for readers globally, immediately upon publication to cover some part of the costs associated with publication, depending on the number of pages of the published article.

2) The publication charges are 60,000 won (50 US dollars) per printed page.

3. Errata and Corrigenda

1) An erratum will be used if a significant error has been introduced by us during the production of the journal article, including errors of omission such as failure to make factual proof corrections requested by authors within the deadline provided by the journal and within journal policy. A ‘significant error’ is one that affects the scholarly record, the scientific integrity of the article, the reputation of the authors, or of the journal.

2) A corrigendum is a notification of an important error made by the author(s) that affects the publication record or the scientific integrity of the paper, or the reputation of the authors or the journal.

3) We will publish a correction of your article if a significant or important error is discovered after publication.

Additional clauses

These regulations are effective from March 24, 2023.

RCPHN
Research in Community and Public Health Nursing

Author's Check List

Please check below items before submission of the manuscript.

Publication Ethics

☐ This manuscript is not duplicated, and it follows the ethical guidelines of the Research in Community and Public Health Nursing.
☐ Deliberation of the Institutional Ethics Committee (excludes review and editorial)

Title page

☐ Use the title page template.

Manuscript preparation

☐ Delete the personal information of the author from the file name or the contents of the manuscript.
☐ A4 MS word with 1- inch margin on all sides.
☐ The font shall be in size 12-point batang or 12 point Times New Romans font. The line spacing shall be double-spaced or 200%.
☐ Put page numbers at the bottom.

Abstract

☐ 250 words or less
☐ Use the sub-titles of Purpose, Methods, Results, and Conclusion.
☐ English keywords: Use 3 to 5 words registered in MeSH in principle.

Main text

☐ Title, English abstract, keywords, main text (introduction, methods, results, discussion, conclusion), reference, tables, and figures in order
☐ The total volume of the manuscript: 20 pages or fewer (excluding title, abstract, reference, appendix)

Reference

☐ Follow the instructions for authors (NLM style): including the DOI and the full name of the journal.

Tables and figures

☐ Follow the instructions for authors.
☐ They must be written in English.
☐ The numbers shall be the same as those in the body without typographical errors.

RCPHN
Research in Community and Public Health Nursing

Statement of Copyright & Conflict of Interest

1. Transfer of copyright

If this manuscript is published in the Research in Community and Public Health Nursing, its copyright is transferred to the Korean Academy of Community Health Nursing, and the Korean Academy of Community Health Nursing will have the copyright for the concerned manuscript as well as the right to transmit the digital data. The author possesses all the rights except for the copyright, including the right to use all or a part of this manuscript for application for a patent or writing a future thesis. The author may use the material of this manuscript in another manuscript after obtaining written approval. All the authors of this manuscript made practical and intelligent contributions to this manuscript and share public responsibility for the contents of this manuscript. In addition, this manuscript has not been published by or submitted to another academic journal and is not being considered by any other academic journal.

2. Clear statement of interests

The author(s) of this manuscript clearly stated all the interests related to this manuscript, including financial interests (benefit of research funding, employment, possession of stocks, speaker's fees or consultancy fees, material support, etc.) and personal interests (concurrent position, conflict of interest, conflict in intellectual property rights, etc.).

Title of submitted manuscript: ____

Date ______________________

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(USE A CONTINUATION SHEET IF NECESSARY FOR ADDITIONAL SIGNATURE.)

Korean Academy of Community Health Nursing

Instructions for editors

Article 1

The purpose of these guidelines is to regulate the operation of the Editorial Board (hereinafter referred to as 'the Board') organized according to Article 7 (Committee) of the Bylaws of the Korean Academy of Community Health Nursing.

Article 2

The Board has 7 to 15 members, including the Editor-in-Chief and the Executive Editor, and Associate Executive Editor.

The Editor-in-Chief organizes the Board by recommending the members and obtaining the approval of the Executive Board.

Article 3

1. (Qualifications) The Editor-in-Chief is recommended by the Directors of the Academy in the current and next terms according to the member selection criteria.
2. (Criteria for member selection) One who is experienced in publishing in journals (candidates) registered in the Korea Research Foundation; one who is experienced in publishing in international academic journals; one who is experienced in editing and reviewing for a journal registered in the Korea Research Foundation; and one who has never been subjected to disciplinary punishment related to research and publication ethics.
3. (Procedure) The Director of the Academy or the Editor-in-Chief recommends those satisfying the member selection criteria among the professors at nursing colleges (departments) throughout the country. The Editor-in-Chief then reviews and selects the member candidates of the Board. The Board of Directors approves the candidates, and the Director of the Academy appoints them as the Board members.
4. (Term) The term of the Editor-in-Chief and the members of the Board is two years, and they may be reappointed.

Article 4

The Board deliberates on and decides the following matters for publishing the Research in Community and Public Health Nursing and related academic materials and reporting the results to the Executive Board.

1. Publishing the journal
   (1) Matters on editing
   (2) Review of received manuscripts and decision on whether to publish
   (3) Decision on the article processing charge
2. Issuing academic materials
   (1) Matters on editing and publishing
3. Managing the quality of the Research in Community and Public Health Nursing
   (1) Preparation for the evaluation of journal registered in the Korea Research Foundation
   (2) Preparation for evaluation by KoreaMed
   (3) Maintenance and management of CINAHL registration
   (4) Maintenance and management of SCOPUS registration
4. Regulations related to publishing
5. Matters referred to by the Board of Directors

Article 5

The Board selects and manages the reviewers.

1. (Qualifications) The reviewers are selected according to the following criteria.

A reviewer should be experienced in reviewing for a journal (candidate) registered in the Korea Research Foundation, have a doctoral degree, is a university professor or in an equivalent position, and is familiar with recent advances in each research area.

2. (Number) The number of reviewers shall be around 150, including English proofreaders.
3. (Procedure) The members of the Board recommend candidates among professors at nursing colleges (departments) throughout the country who satisfy the reviewer qualifications, and the Editorial Board reviews and selects among them. The Board of Directors approves them, and the Director of the Academy appoints them as reviewers.
4. (Term) The term of a reviewer is two years, and they may be reappointed.
5. (Special reviewer) If external reviewers are required for a special review of a dissertation, the Editor-in-Chief may appoint special reviewers and entrust them with the review of the dissertation.
6. The review of the manuscript follows separate regulations on review.

Additional Clauses

These guidelines were effective from March 24, 2023.

Criteria for Review

Title: ____

Rate this manuscript on the following criteria using the scale of 1 (lowest) to 5 (highest), then enter your comments in the text boxes below.

Score Items	1	2	3	4	5	N/A
Originality of the contribution						
Well written: organized, correct grammar and punctuation						
Significance to population health, nursing practice, and nursing science						
Research Question(s) and Purpose of Study: clearly explicated?						
Methodology: appropriate research design used and described in depth; setting(s) and selection criteria of the participants adequately described; valid and reliable instruments used; ethical issues considered; IRB approval acknowledged						
Findings: comprehensive and clearly described; linked with research questions; tables used appropriately and constructively						
Discussion/Conclusions: based on the data presented; linked with the current literature						
Reference: Does the research mostly use recently published references?						

Date : ____________________________ Reviewer : ___________________

RCPHN
Research in Community and Public Health Nursing

Instructions for reviewers

We believe that peer review is the foundation for safeguarding the quality and integrity of scientific and scholarly research. This is a guideline for reviewers who voluntarily participate in the peer review process of Research in Community and Public Health Nursing (RCPHN). All of the journal's contents including commissioned manuscripts are subject to peer-review.

1. According to the Bylaws of the Korean Academy of Community Health Nursing and the Regulations on the Editorial Board of KACHN, these guidelines are provided for the review of manuscript submitted to RCPHN.
2. Manuscripts are reviewed and accepted according to these guidelines
3. Manuscripts to be reviewed should be research papers related to community nursing, and dissertations for a master's or doctoral degree goes through the same review procedure. However, the reviewing process may be different in the case of special papers that are contributed to the development of community and public health nursing.
4. Manuscripts not complying with the qualifications and regulations related to the contribution will be rejected.
5. Role of the reviewers: The peer-reviewer's role is to advise editors on individual manuscript to revise, accept, or reject. Judgments should be objective, and comments should be described lucidly. Scientific soundness is the most important value of the journal. Therefore, logic and statistical analysis should be considered meticulously. The use of reporting guidelines is recommended for review. Reviewers should have no conflicts of interest. Reviewers should point out relevant published work that is not yet cited. Reviewed articles are managed confidentially. The editorial board is responsible for the final decision to accept or reject a manuscript based on the reviewers' comments..
6. How to become a reviewer: Reviewers are usually invited by the editorial board or recommended by authors. Anyone who wishes to work voluntarily as a reviewer can contact the editorial office.
7. Two or more reviewers are assigned to each manuscript and the reviewers are appointed by the Editorial Board.
8. Accepting an invitation to review: The Editors will invite you to review because they believe that you are an expert in a certain area. They would have judged this from your previous publication record or conference/posters sessions. Before you accept an invitation to review a paper, you should consider The following:
   · Are you qualified?
   You should decline to review the manuscript if it is too far outside your area.
   · Do you have time?
   If review comments cannot be submitted within the three weeks review period, please decline to review the manuscript or ask for an extension.
   · Are there any potential conflicts of interest?
   In case of any conflicts of interest, the reviewer should decline to review. The conflicts of interest should be disclosed if the reviewer still wishes to review.
9. Double Blind Peer Review: RCPHN adopts double blind review which means that the reviewer cannot identify author information and authors cannot identify reviewers, too.
10. Manuscript are reviewed according to the 'criteria for review'. The reviewer writes their review comments
    1) Criteria for review: Review table with 8 items (Originality, Well written, Significance, Research Question(s) and Purpose of Study, Methodology, Findings, Discussion/Conclusions, and References) using the scale of 1 (lowest) to 5 (highest) (if it is not applicable, check N/A) is provided for the reviewer's convenience.
    2) Comment to authors: Summarize the whole content of the manuscript in one sentence. Mention the strengths of the manuscript, and any problems that make you believe it should not be published, or that would need to be corrected to make it publishable.
    3) Comment to editor: Both the strength and weaknesses of the manuscript should be added. The reviewer's recommendation on acceptance may be added here, including any other opinions to the editor.
11. Ethical Guidelines for Reviewers
    1) Any information acquired during the review process is confidential.
    2) Please inform the editor of any conflicts of interest, such as
       - Reviewer is a competitor.
       - Reviewer may have some antipathy with the author(s).
       - Reviewer may profit financially from the work.

       In case of any of the above conflicts of interest, the reviewer should decline to review. The conflicts of interest should be disclosed if the reviewer still wishes to review. A history of collaboration with the authors or any intimate relationship with the authors does not preclude the review.

3) Reviewer should not use any material or data originating from the manuscript in review; however, it is possible to use the open data of the manuscript after publication.

12. The review procedures are as follows:
    1) The Editor-in-Chief chooses two or more reviewers and one editor online based on their research specialty.
    2) The reviewers examine the manuscript online and input the evaluation results, what to revise, and what needs to be supplemented in three weeks.
    3) The reviewers should keep confidential the fact that they have reviewed the manuscript.
    4) The results of the review by the two or more reviewers are deliberated by the editorial board, and the editorial Board makes the final decision.
13. Based on the review, the reviewers make general opinions and detailed reports, and decide one of the following: ‘Accept,’ ‘Minor Revision,’ ‘Major Revision,’ and ‘Reject.’
14. Based on the two or more reviewers’ review results, the Editorial Board decides whether to accept the manuscript.
    1) Accept: Accept without revision.
    2) Minor Revision: The authors should revise as commented by the reviewers, and the reviewers confirm the revisions.
    3) Major Revision: The authors should revise as commented by the reviewers, and the reviewers review the manuscript and decide whether to accept it.
    4) Reject: Only if the contents of the manuscript fall into any of the cases listed below:
        ① The research theme is not original or lacks the significance of nursing.
        ② The contents are plagiarized from previous studies.
        ③ The reliability or validity of the research results is questioned.
        ④ In the evaluation criteria, more than 30% of the items were graded ‘Lowest.’
        ⑤ It is considered impossible to revise.
15. The contents of the review shall not be disclosed to anybody other than the author.
16. The editorial board finally decides whether to publish the manuscript by combining the review results of the two or more reviewers and the review results of the editors.
17. If the authors fail to submit a revised manuscript within two weeks from the date of revision request by the Board, it is regarded as being withdrawn (If the author requests an extension, the due date may be extended for another month).

Additional Clauses

These regulations are effective from March 24, 2023.