Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 4, 736-745
2025
Publisher: Learning Gate
DOI: 10.55214/25768484.v9i4.6062

The mediating effect of information and communication technology utilization on cognitive function and activities of daily living in eldery with cognitive decline

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Abstract: This study aimed to identify the mediating effect of information and communication technology (ICT) utilization on cognitive function and activities of daily living (ADL) / instrumental activities of daily living (IADL) in Korean elderly individuals with cognitive decline. A total of 2,448 individuals aged 65 and older with cognitive decline were selected as study subjects from the original dataset of the 2023 National Survey on the Status of the Elderly. The data were analyzed using SPSS/WIN 25.0 with a complex sample analysis method. Frequency and descriptive statistics, partial correlation analysis, general linear model analysis, and Sobel's test were performed. The results showed a negative correlation between cognitive function and ADL/IADL, and a positive correlation between cognitive function and ICT utilization. ICT utilization was shown to be negatively correlated with ADL/IADL. Results also indicated that ICT utilization partially mediates the relationship between cognitive function and ADL/IADL. These findings suggest that using ICT can be a preventive factor in reducing the ability to perform daily activities that can be attributed to cognitive decline. This implies that we should consider strategies to strengthen the use of ICT that affect the maintenance and improvement of daily life performance for older adults with cognitive decline.

Keywords: *Activities of daily living, Aged, Cognition, Information technology, Instrumental activities of daily living.*

1. Introduction

As the world's population ages, it is estimated that the number of people aged 60 and over will increase to 1.4 billion by 2030, representing one-sixth of the world's population World [1]. This rapid increase of elderly population is considered a major risk factor for the increase in the incidence of dementia [2]. This is a global phenomenon, and the incidence of dementia is increasing every year in Korea as the older population grows. In 2023, the elderly population aged 65 and above in Korea reached 9.462 million, representing 18.5% in the total population, and the prevalence of dementia reached 9.25% and that of mild cognitive impairment (MCI) reached 28.42%. Estimated number of dementia patients reaching 1 million and number of people diagnosed with MCI reaching 3 million by 2026 [3].

Dementia is described as a marked deterioration in cognitive function in more than one cognitive dimension compared to former performance, which significantly impairs the ability to perform independent daily activities. MCI is a decline but not a loss of cognitive function, and ability to carry out daily activities and social roles are maintained [4]. MCI is a transitional phase from normal aging to dementia. While symptoms may stabilize or improve over time, many older adults with MCI progress to dementia more quickly than normal adults [5]. This suggests that more effective and preventive interventions at the stage of mild cognitive decline are important to decrease the incidence of dementia in older adults.

History: Received: 31 January 2025; Revised: 31 March 2025; Accepted: 4 April 2025; Published: 8 April 2025
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The cognitive decline of the elderly begins as subjective complaints of memory problems, which over time can lead to a decline in daily life, increased dependence on care, a decline in quality of life, and social isolation [6]. Maintaining the performance of activities of daily living is necessary for healthy aging and independent old age. Decreased performance of daily activities due to cognitive decline is recognized as an important challenge for the elderly and their caregivers. Unlike activities of daily living (ADL), which are basic physical functions of the elderly, instrumental activities of daily living (IADL) are more complicated socio-economic activities. IADL is generally known to be more susceptible to subtle deterioration associated with cognitive decline, as it requires not only cognitive and motor skills but also social skills and complex neuropsychological processing [7].

Previous studies on the cognitive function and ADL in the elderly have shown that there is a highly relevant interrelationship between cognitive function and ADL/IADL [8, 9]. In addition, ADL/IADL disability is related to gender, age, and the level of education., social participation, and quality of life [10] and has been reported to be associated with physiological factors like physical dysfunction and frailty, as well as psychological factors like depression and cognitive dysfunction [11]. The decline in cognitive function in old age is closely related to the decline in ADL/IADL and is a risk factor that negatively affects not only mental health but also overall daily activities and quality of life. Therefore, research is needed to explore important protective factors that can mediate the relationship between cognitive decline in old age and the ability to conduct ADL/household chores.

Recently, proactive utilization in information and communication technology (ICT) has been proposed as an efficient way to mitigate the negative effects of cognitive decline due to aging [12]. The use of information technology can be used in the home of the elderly or anywhere the elderly are, which can help overcome the mobility problems of elderly people with cognitive decline [13]. Mutual social participation has an effective role for improving the cognitive function and daily life performance of the elderly [14] so the use of ICT such as computers, smartphones, mobile devices, and personal digital devices is recommended to enhance the functioning of cognition in elderly [15]. In home-based clinical assessments, the more computer use, the higher the cognitive function in older people [16] and the more information technology used, the higher the level of cognitive function [17]. Results of these studies suggest using ICT helps in promoting cognitive function in the elderly and that it may act as a positive mediator between cognitive function and the performance of everyday activities.

The use of various information technology devices by the elderly allows them to acquire information, communicate with others, and participate in social relationships [10]. The use of smartphones and computers has a favorable effect on the executive function and the speed of cognitive processing of older adults [17] suggesting that the use of various information technologies can be used as an intervention to improve the function of cognition and daily living performance in eldery [18]. In particular, the daily use of information technology at home can serve as a cost-effective and pragmatic approach to the sustainability of cognitive interventions.

The purpose of this study is to determine whether the association between cognitive function and daily performance in elderly with cognitive decline is influenced by the utilization of ICT. By verifying whether the daily use of ICT can be a protective factor against the decline in daily life performance due to cognitive decline, it will provide useful basic data to inhancing the quality of life in elderly.

2. Methods

2.1. Research Design

This study was implemented as a secondary analysis to assess the mediating effect of ICT utilization between cognitive function and ADL/IADL in elderly people with cognitive decline using the 2023 National Survey on the Status of the Elderly.

2.2. Research Data

The primary data comes from the 2023 National Survey on the Status of the Elderly, a triennial statutory survey performed by the Korea Institute for Health and Social Affairs (KIHASA: IRB 2023-

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 4: 736-745, 2025
DOI: 10.55214/25768484.v9i4.6062

078), was used. The survey was conducted from September 4 to November 12, 2023, among people aged 65 and older in general households across the country. Of the total 10,078 subjects in the original data, 7,503 subjects classified as having normal cognitive function and 127 proxy respondents were excluded, leaving a total of 2,448 subjects in the analysis.

2.3. Instruments

2.3.1. Characteristics of the Subjects

The general characteristics of the subjects were gender, age, marital status, education level, residence, work status, and family type. The age variable was grouped into "over 65 and under 75," "over 75 and under 85," and "over 85." The marital status was divided into " not having a spouse" and "having a spouse." The level of education was further classified into " no school attendance," " Elementary school graduate," "middle school graduate," "high school graduate," and " college graduate or higher. Residence was categorized as " city " and " countryside,"and work status was classified into "working" and "not working." and the family type was reclassified into "living alone," "elderly couple," and "living with family."

2.3.2. Cognitive Function

The Korean Mini-Mental State Examination2nd Edition (K-MMSE-2) was used to assess the function of cognition. This test is almost identical to the existing K-MMSE, but it provides more information for the screening of MCI by increasing the discriminability of the items that are related to language comprehension [19]. The test consists of 27 questions in the following areas: memory registration (3 items), memory recall (3 items), temporal memory (5 items), spatial memory (5 items), attention and calculation (5 items), language comprehension and command performance (5 items), and drawing (1 item). If the answer to each question is correct, it is scored as 1 point, and if it is incorrect, it is scored as 0 point. The two questions in the language comprehension and command performance areas are subdivided into 1 to 2 points or 1 to 3 points for correct answers. Scores on this test run from 0 to 30, with higher scores denoting superior cognitive functioning. If the score is below a certain level based on the converted score (T-score) adjusted for age and education level, it is determined as "cognitive decline.". Pearson correlations for test-retest reliability of this instrument ranged from .54 to .63, and Cohen's weighted kappas for inter-rater reliability ranged from .87 to 1.00 [20]. The study's reliability was determined to be Cronbach's α=.89.

2.3.3. Activities of Daily Living (ADL) / Instrumental Activities of Daily Living (IADL)

The subject's ability to conduct daily activities were assessed using the Korean version of the ADL/IADL [21]. The ADL includes seven items: washing and brushing teeth, dressing, bathing or showering, eating prepared food, rising and going outside, using the restroom, and regulating bowel and bladder movements. These are the basic things an older person needs to live independently. For each question, a score is given for complete independence (1 point), partial assistance (2 points), and complete assistance (3 points). Scores range from 7 to 21, and the lower the scores, the more independent. The study's reliability was determined to be Cronbach's α=.90.

In addition, IADL are scored as complete independence (1 point), partial assistance (2 points), or complete assistance (3 points) for seven questions: personal care, housekeeping, meal preparation, laundry, taking medications, managing money, and walking short distances. Purchasing items, making and answering phone calls, and the three questions on going out with transportation are scored as follows: complete independence (1 point), partial assistance (2 points), substantial assistance (3 points), and complete assistance (4 points). Scores range from 10 to 33, and the lower the scores, the more independent. The study's reliability was determined to be Cronbach's α=.94.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 4: 736-745, 2025
DOI: 10.55214/25768484.v9i4.6062

2.3.4. Information and Communication Technology (ICT) Utilization

The extent to which the subject's utilized ICT was gauged according to the number of ICT-using activities they engaged in. Activities included sending and receiving messages, searching and retrieving lots of information, taking pictures or videos, playing games, listening to music and streaming videos, using social networking services, e-commerce, financial activities, finding and installing applications, and ordering from kiosks. For each of the 13 areas, one point was awarded for answering "yes" using ICT and services. Scores run from 0 to 13, with higher scores indicating a more advanced ability to use ICT.

2.4. Ethical Consideration

The use of original data from the 2023 National Survey on the Status of the Elderly was approved by the Korea Institute for Health and Social Affairs (KIHASA). Additionally, this study was conducted with the approval for exemption of the deliberation by the Institutional Review Board of J University (JIRB-2024110501-01-241216).

2.5. Data Analysis

The collected data were processed using the IBM SPSS/WIN 25.0 program as follows. Given the original data's nature as a stratified cluster sample, a complex sample analysis method was used, and all statistical values except frequency were expressed as weighted values. Frequency and descriptive statistics were used to determine the general characteristics of the subjects and the study variables. Frequency analysis presented the frequency without weighting and the percentage with weighting, and descriptive statistics presented the weighted mean and standard deviation. To test the differences in the study variables according to the characteristics of the subjects, the means were compared using general linear model analysis. In addition, to test the mediating effect of ICT utilization between cognitive function and ADL/IADL, Baron & Kenny's three-step analysis was conducted, and in each step, general linear model analysis was used. The Sobel test was performed to verify the significance of the mediating effect.

3. Results

3.1. Characteristics of the Subjects

The general characteristics of the subjects of this study, elderly people with cognitive decline, are presented in Table 1. A total of 60.1% of the subjects were women, while 39.9% were men. and the mean age of the subjects was 74.69±0.18, with the largest number of subjects aged 65 or older and under 75 years old, accounting for 54.9%. Of the subjects, 44.4% responded had no spouse, 15.1% had not attended school, 28.2% had graduated from elementary school, and 32.2% had graduated from high school. In addition, 69.6% lived in urban areas and 65.8% did not work. In terms of family type, 37.1% of the elderly live alone, 52.1% live with elderly spouse, and 10.8% live with their families.

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DOI: 10.55214/25768484.v9i4.6062

Table 1.
General chacteristics of the subjects (N = 2,448).

Characteristics	Categories	N (%)+
Gender	Men	813 (39.9)
	Women	1,635 (60.1)
Age (year)	65-74	1,320 (54.9)
	75-84	912 (34.0)
	≥ 85	216 (11.2)
Marital status	Not having a spouse	1,127 (44.4)
	Having a spouse	1,321 (55.6)
Level of education	No school attending	462 (15.1)
	Elementary school graduate	725 (28.2)
	Middle school graduate	440 (19.1)
	High school graduate	709 (32.2)
	College graduate or higher	112 (5.4)
Residence	City	1,606 (69.6)
	Countryside	842 (30.4)
Work status	Working	850 (34.2)
	Not Working	1,598 (65.8)
Type of family	Living alone	950 (37.1)
	Elderly couples	1,229 (52.1)
	Living with family	269 (10.8)

Note: +N (%): unweighted frequency (weighted %).

3.2. Differences in Cognitive Function and ADL/IADL by Characteristics of the Subjects

The differences in cognitive function and ADL/IADL by the characteristics of the subjects are presented in Table 2. Cognitive function showed significant differences depending on the age of the subject (F=63.08, p<.001), level of education (F=76.99, p<.001), residence (t=7.52, p<.001), and working status (t=4.45, p<.001). In the post-analysis, the cognitive function of the 85 years and older group and the group had not attended school was significantly lower than other groups.

ADL showed significant differences depending on the gender of the subject (t=2.03, p=.042), age (F=14.98, p<.001), level of education (F=3.44, p=.009), work status (t=-7.73, p<.001), and family type (F=3.32, p=.021). For men who are elderly and do not work, the ADL score is significantly higher, indicating that they are more dependent on help in their daily lives. The results of the post-analysis show that the ADL score is significantly higher for 85years and older group, the group of people with no academic qualifications and those who have only completed elementary school, and the group living with their families than for other groups, indicating that they require a lot of help in their basic daily lives.

In addition, the IADL also showed significant differences depending on the gender of the subject (t=2.30, p=.022), age (F=29.49, p<.001), level of education (F=3.75, p=.005), working status (t=-9.52, p<.001), and There were significant differences depending on the family type (F=6.20, p<.001). In the case of older men and do not work, the IADL score was significantly higher, indicating that they are highly dependent on help in their instrumental daily lives. post-hoc analyses indicated that the group of subjects aged 85 years and over and the group living with family members had significantly higher IADL scores than the other groups, indicating that they require a lot of help in instrumental daily life that requires social skills as well as cognitive and motor performance.

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ISSN: 2576-8484
Vol. 9, No. 4: 736-745, 2025
DOI: 10.55214/25768484.v9i4.6062

Table 2.
Differences in Cognitive Function and ADL/IADL by chacteristics of the subjects (N = 2,448).

Chacteristics		Cognitive Function		ADL		IADL	
		M±SE	t /F(*p*)‡	M±SE	t /F(*p*)‡	M±SE	t /F(*p*)‡
Gender	Men	18.90±0.26	0.94 (.349)	7.60±0.09	2.03 (.042)	12.26±0.25	2.30 (.022)
	Women	18.65±0.25		7.46±0.08		11.91±0.24	
Age (year)	65-74 [a]	20.46±0.21	63.08 (<.001) a,b>c	7.14±0.05	14.98 (<.001) a,b<c	10.80±0.15	29.49 (<.001) a,b<c
	75-84 [b]	19.07±0.27		7.27±0.06		11.40±0.19	
	≥ 85 [c]	16.80±0.34		8.18±0.21		14.04±0.51	
Marital status	Not having a spouse	18.32±0.30	1.88 (.060)	7.65±0.15	-0.80 (.425)	12.08±0.55	0.01 (.996)
	Having a spouse	19.23±0.34		7.42±0.18		12.08±0.34	
Level of education	No school attending [a]	15.76±0.30	76.99 (<.001) a<b,c,d <e	7.74±0.11	3.44 (.009) a,b>e	12.55±0.28	3.75 (.005)
	Elementary school [b]	18.59±0.22		7.65±0.11		11.95±0.25	
	Middle school [c]	18.98±0.25		7.50±0.11		12.08±0.28	
	High school [d]	18.49±0.40		7.42±0.09		11.68±0.24	
	≥ College [e]	22.07±0.31		7.35±0.11		12.14±0.48	
Residence	City	20.18±0.23	7.52 (<.001)	7.58±0.09	1.33 (.185)	12.12±0.25	0.49 (.625)
	Countryside	17.37±0.33		7.48±0.09		12.04±0.25	
Work status	Working	19.36±0.26	4.45 (<.001)	7.36±0.08	-7.73 (<.001)	11.54±0.23	-9.52 (<.001)
	Not Working	18.20±0.24		7.70±0.08		12.62±0.25	
Type of family	Living alone [a]	18.78±0.32	2.41 (.066)	7.34±0.15	3.32 (.021) a<c	11.66±0.46	6.20 (<.001) a,b<c
	Elderly couples [b]	17.94±0.31		7.64±0.17		11.91±0.41	
	Living with family [c]	18.44±0.27		7.82±0.16		13.19±0.45	

Note: ‡Post hoc sequential Bonferroni correction for multiple comparison test.

3.3. Levels and Correlations among Cognitive Function, ADL/IADL, and ICT Utilization

The level of study variables and correlations among cognitive function, ADL/IADL, and ICT utilization scores were presented in Table 3. The subject's cognitive function was 19.13±0.13, which was lower than the cutoff score of 23 points for mild cognitive impairment in the KMMSE. The ADL was 7.37±0.03, the IADL was 11.28±0.08, and the ICT utilization score was 3.86±0.08. In addition, a partial correlation analysis was conducted to control for general characteristics that showed significant results in the difference test to analyze the correlation between research variables. The results showed that cognitive function was significantly correlated with ADL (r=-.154, p<.001), It showed a negative correlation with IADL (r=-.183, p<.001), but a positive correlation with ICT utilization (r=.118, p<.001). In addition, ICT utilization was found to have a negative correlation with ADL (r=-.042, p<.001) and IADL (r=-.072, p<.001).

Table 3.
Levels and correlations among cognitive function, ADL/IADL, and ICT utilization (N = 2,448).

Variables	M±SE	Cognitive function	ADL	IADL
		r (*p*)	r (*p*)	r (*p*)
Cognitive function	19.13±0.13	1		
ADL	7.37±0.03	-0.154 (<0.001)	1	
IADL	11.28±0.08	-0.183 (<0.001)	0.770 (<0.001)	1
ICT utilization	3.86±0.08	0.118 (<0.001)	-0.042 (<0.001)	-0.072 (<0.001)

3.4. Mediating Effect of ICT Utilization between Cognitive Function and ADL

The results of the general linear model using a complex sample analysis to examine whether ICT utilization has a mediating effect between cognitive function and ADL are presented in Table 4. In the first stage of the analysis, in which cognitive function was used as an independent variable and ICT utilization was used as a dependent variable, ICT utilization increased by 0.175 times more than cognitive function (B=.175, p<.001), and the model's significance was determined to be statistical proven

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 4: 736-745, 2025
DOI: 10.55214/25768484.v9i4.6062

(F=54.335, p<.001). In the second step of the analysis, in which cognitive function was used as an independent variable and ADL as a dependent variable, ADL decreased by 0.054 times more than cognitive function (B=-.054, *p*<.001), and the model's significance was determined to be statistical proven (F=41.022, *p*<.001). In the third stage, the model for ADL demonstrated a significant effect (F=37.410, *p*<.001) as a result of the simultaneous input of cognitive function and ICT utilization, and ADL decreased by 0.043 times more than cognitive function (B=-.043, p<.001) and by 0.065 times more than ICT utilization (B=-.065, p<.001). Compared with the second stage, the third stage analysis shows that the estimated value of B for cognitive function decreases, indicating that ICT utilization has a partial mediating effect between cognitive function and ADL.The Sobel test was used to determine the significance of the mediating effect of ICT utilization, and the results indicated that the mediating effect was statistically significant (Z=-5.131, p<.001).

Table 4.
Mediating effect of ICT utilization between cognitive function and ADL (N = 2,448).

Step	Variables	B	SE	t(*p*)	R^2	F(*p*)
1	Cognitive function → ICT utilization	0.175	0.024	7.371(<.001)	0.075	54.335(<.001)
2	Cognitive function → ADL	-0.054	0.008	-6.405(<.001)	0.047	41.022(<.001)
3	Cognitive function → ADL	-0.043	0.007	-5.851(<.001)	0.072	37.410(<.001)
	ICT utilization → ADL	-0.065	0.009	-7.126(<.001)		
		Sobel Z = -5.131 (*p*<.001)				

3.5. Mediating effect of ICT Utilization between Cognitive Function and IADL

The results of the general linear model using a complex sample analysis to examine whether ICT utilization has a mediating effect between cognitive function and IADL are presented in Table 4. In the first stage of the analysis, in which cognitive function was used as an independent variable and ICT utilization was used as a dependent variable, ICT utilization increased by 0.175 times more than cognitive function (B=.175, *p*<.001), and the model's significance was determined to be statistical proven (F=54.335, p<.001). In the second step of the analysis, in which cognitive function was used as an independent variable and IADL as a dependent variable, IADL decreased by 0.147 times more than cognitive function (B=-.147, *p*<.001), and the model's significance was determined to be statistical proven (F=48.935, *p*<.001). In the third stage, the model for IADL demonstrated a significant effect (F=72.713, *p*<.001) as a result of the simultaneous input of cognitive function and ICT utilization, and IADL decreased by 0.109 times more than cognitive function (B=-.109, *p*<.001) and by 0.218 times more than ICT utilization (B=-.218, *p*<.001). indicating that the use of ICT has a partial mediating effect between cognitive function and IADL. Compared with the second stage, the third stage analysis shows that the estimated value of B for cognitive function decreases, indicating that ICT utilization has a partial mediating effect between cognitive function and IADL. The Sobel test was used to determine the significance of the mediating effect of ICT utilization, and the results indicated that the mediating effect was statistically significant (Z=-5.967, p<.001).

Table 5.
Mediating effect of ICT utilization between Cognitive function and IADL (N = 2,448).

Step	Variables	B	SE	t(*p*)	R^2	F(*p*)
1	Cognitive function → ICT utilization	0.175	0.024	7.371(<.001)	0.075	54.335(<.001)
2	Cognitive function → IADL	-0.147	0.021	-6.995(<.001)	0.056	48.935(<.001)
3	Cognitive function → IADL	-0.109	0.018	-6.148(<.001)	0.102	72.173(<.001)
	ICT utilization → IADL	-0.218	0.021	-10.600(<.001)		
		Sobel Z = -5.967 (*p*<.001)				

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ISSN: 2576-8484
Vol. 9, No. 4: 736-745, 2025
DOI: 10.55214/25768484.v9i4.6062

4. Discussion

Since cognitive decline in old age is closely related to a decreased ability to execute daily activities and is a maker of risk that negatively affects the quality of life of the elderly, research is necessary to explore significant protective determinants that can mediate the relationship between cognitive decline in old age and the ability to perform daily activities. To find out whether the use of information technology in everyday life at home can be used as a cognitive intervention, the mediating effect of ICT utilization between cognitive function and ADL/IADL in the elderly was verified.

The cognitive function of 2,448 subjects classified as having cognitive decline in the 2023 National Survey of older Koreans was 19.13±0.13, which was lower than the cutoff score of 23 for mild cognitive impairment in the KMMSE, a mental state test for the elderly. The results showed that cognitive function was significantly lower in older people, those with lower education levels, those living in rural areas, and those without a job, which is in accordance with former studies [22, 23]. In particular, many previous studies have shown that age and education level have a significant impact on cognitive function, and the two variables are also important in the standards of cognitive tests [23]. In this study, the difference in cognitive function by gender was not significant, which is consistent with studies of older adults that found no difference in cognitive function by gender, and studies that found that gender differences in cognitive function decrease with aging [24].

ADL/IADL were significantly higher for men, non-working elderly, and especially for those aged 85 years and older, those with no education, and those with low education levels, the degree of assistance and dependence was also significantly higher for ADL, which are basic activities of daily living. This reflects the fact that ADL/IADL are significantly higher in family households with children or family members than in those living alone or with elderly couples, suggesting the burden on family members and caregivers. This result is in accordance with a study that found differences in IADLs by gender [25] but there is also a study that showed different results [23], so it is necessary to further confirm the differences in ADL/IADL by gender in future studies.

The cognitive function of the subjects was inversely related to ADL/IADL and positively related to ICT utilization, as cognitive function elevates, ADL and IADL decrease in proportion, resulting in reduced levels of assistance and dependence. In addition, in accordance with previous studies [8, 9, 11] ICT utilization was positively related to cognitive function and negatively related to ADL/IADL, meaning that the more the ICT used, the more advanced the cognitive function and the worse the ADL/IADL, which decreases the need for assistance in daily life and increases independence.

In addition, the mediating effect of ICT utilization between cognitive function and ADL/ IADL was tested and a partial mediation effect was found. These results show that ICT utilization by the elderly could be a preventive determinant against the decline in ADL/IADL abilities due to cognitive decline, and can help maintain and improve ADL/IADL abilities in the elderly. Although it is difficult to find previous studies that directly demonstrate the mediating effect of ICT utilization between cognitive decline and ADL/IADLs in the elderly, which limits the discussion, the results of this study can be viewed within the same context of the other studies that confirmed that smartphone and computer use positively affects cognitive processing speed and executive function in the elderly [17] computer-based cognitive intervention [26, 27] and ICT-based cognitive intervention improves the function of cognition and quality of ageing life [13]. In addition, a mobile app-based health communication intervention for the elderly with cognitive decline was found to be an effective alternative to address independence and self-care issues in home life [18] which supports the findings of the presented study. For elderly people having limited mobility due to cognitive decline, increasing the daily use of ICT in the home can provide practical and lasting cognitive interventions, so it is necessary to actively utilize it in mental health interventions. This study is significant in that it confirms that ICT utilization can function as a positive mediator between cognitive function and ADL/IADL performance in elderly with cognitive decline, thus providing evidence for the effectiveness of ICT utilization to improve daily living performance in prevention and intervention at an early stage for MCI and dementia.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 4: 736-745, 2025
DOI: 10.55214/25768484.v9i4.6062

5. Conclusions

This study provided meaningful results confirming the mediating effect of ICT utilization between cognitive function and daily living performance of the elderly with cognitive decline by utilizing a wide-ranging data on the situation of the elderly in Korea. These findings indicate that ICT utilization could be a significant preventive determinant of the effects of cognitive decline on daily living performance, providing a basis for the use of ICT in the prevention and intervention of cognitive decline in the future. On the basis of the results, repeated studies should be conducted on the effectiveness of cognitive interventions through ICT utilization in the home of the elderly with cognitive decline, and strategies for prevention and intervention of cognitive decline should be developed and applied.

Funding:

This paper was supported by Joongbu University Research & Development Fund, in 2024.

Institutional Review Board Statement:

This study was approved for exemption of the deliberation by the Institutional Review Board of Joongbu University (JIRB-2024110501-01-241216).

Transparency:

The author confirms that the manuscript is an honest, accurate and transparent account of the study that no vital features of the study have been omitted and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

Competing Interests:

The authors declare that they have no competing interests.

Authors' Contributions:

All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

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Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 4: 736-745, 2025
DOI: 10.55214/25768484.v9i4.6062