

IJACT 24-3-24

Effect of the ADDIE Model-based Distance Infection Control Education Program on Infection Control Performance of Care Workers

¹Min Sun Song

*1 Prof., Dept. of Nursing, College of Nursing, Konyang Univ., Korea
mssong@konyang.ac.kr*

Abstract

This study examined the effect of the distance Infection Control Education Program (ICEP), developed based on the ADDIE model, on infection control knowledge, attitude, and performance among care workers in long-term care facilities nationwide. The program, developed based on the ADDIE model, was applied to 173 care workers directly responsible for nursing care of elderly residents in long-term care facilities. The distance ICEP for care workers was conducted through the website and lasted 30 minutes for each of the eight topics. To determine the effectiveness of the education, infection control knowledge, attitude, performance, and satisfaction were surveyed before and four weeks after the program. Differences in infection control knowledge, attitude, and performance before and after the distance ICEP were assessed by a t-test. A significant difference was observed in knowledge and infection control performance after the distance ICEP was administered to care workers. In the sub-domains of infection control performance, overall understanding of infection, regular infection control education, infection control by special pathogen (multidrug-resistant bacteria, tuberculosis, tick-borne infectious diseases), and detailed infection control education by infection site (pressure ulcers and urinary tract infections) were significantly improved. Infection control knowledge and performance improved through the distance ICEP applied to care workers. Satisfaction also displayed high scores on most items and indicated that it was helpful for infection control in facilities, confirming the effectiveness of infection control education. Based on the survey of care workers nationwide, the infection education program can be effectively used for care workers in the future.

Keywords: *Care Worker; Distance education; Infection Control; Knowledge; Performance*

1. INTRODUCTION

The number of people aged 65 and over is expected to increase from 15.7% in 2020 to 40.1% in 2050. The elderly population is expected to increase rapidly from 2020 when baby boomers enter the 65 and over elderly population, and the elderly population will more than double by 2050 [1]. Amid this aging population, older adults who have significant mental and physical disabilities due to diseases related to aging, such as dementia and stroke, and need assistance are admitted to long-term care facilities to receive the convenience necessary

Manuscript received: January 9, 2024 / revised: February 12, 2024 / accepted: March 2, 2024

Corresponding Author: mssong@konyang.ac.kr

Tel:+82-42-600-8566, Fax: +82-42-600-8555

Dept. of Nursing, College of Nursing, Konyang Univ., Korea

Copyright©2024 by The International Promotion Agency of Culture Technology. This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/4.0>)

for their daily lives. However, many of these older adults are at high risk of exposure to infection owing to decreased immunity [2][3]. As of 2022, 564,243 care workers took care of elderly residents in long-term care facilities, an increase of 11.2% compared to the previous year [4]. A high risk of cross-infection between care workers and elderly residents exists as a care worker provides services to multiple elderly residents [5]. The facilities comprise multi-person rooms; therefore, the distance between the beds is close, and the possibility of infectious disease outbreaks is also high because residents share daily living and dining spaces attributed to community living [6]. Therefore, educating care workers, who mainly provide services to older adults in the facilities, is necessary. They are likely to become carriers of infection if their infection control is not adequately practiced [7].

Training on infection control for care workers in long-term care facilities has been in place since 2020; however, this training only briefly describes the definition of infection and how to prevent it [8]. The manuals and guidelines currently used in long-term care facilities are about reporting and isolation for medical personnel and do not provide specific infection control guidelines for long-term care facility care workers. Recently, the government announced a pilot project for a care worker promotion system to improve service quality by establishing a career development path for care workers. This project will enhance professionalism in the education of care workers and complete online training for those with more than five years of experience [9]. Strengthening the expertise of care workers for the care of older adults in long-term care facilities is crucial, and the prevention of emerging infectious diseases such as coronavirus disease 19 (COVID-19), which has recently put the world in a pandemic crisis, should also be included in the education content.

Previous studies on infection control education have examined the educational effect of hand hygiene through video and hands-on training [10] and the effect of in-person education on 1–2 nursing home workers as part of the National Health Insurance Service’s long-term care institution safety and infection control system project [6]. These studies focused on hand hygiene training or were limited to a small number of participants. The disaster and safety program, including the infection of care workers in long-term care facilities, was developed with lectures, small group discussions, presentations, and practical exercises for less than 1 hour and 30 minutes per week. However, these studies also highlighted a limitation, as they consisted of only one session on infection trends, problems, and prevention and did not cover the specific contents of the infection [11]. For online education, the National Health Insurance Service produced “Making Our Older Adults in Long-Term Care Safer and Healthier,” a learning content for safety and infection control education specialized for long-term care institutions, in November 2021 and uploaded it for care workers to learn through YouTube [12]. The content focuses on precautions against infectious diseases and how to respond in an emergency; however, it was not presented according to a specific classification, such as pathogen or infection site. Consequently, a program that is structured according to a systematic educational design and is presented with specific details for care workers is required.

Care workers’ knowledge of emerging infectious diseases has been suggested as an influencing factor for appropriate coping strategies and proper management of diseases, and COVID-19 knowledge and infection control performance were positively correlated [13]. Optimistic attitude toward infection control positively affected compliance with infection control prevention rules, and infection control attitude were suggested as an influencing factor in infection control performance [14]. Therefore, increasing confidence in the performance of infection control by changing attitude and knowledge in COVID-19 infection control is important. Therefore, this study developed a distance education program that provides various learning opportunities and enables repeated learning in situations where group and in-person education for caregivers in long-term care facilities is difficult, and applied this as a form of education necessary for care workers. The

distance Infection Control Education Program (ICEP) for care workers, developed based on the ADDIE model, was implemented to identify changes in infection control knowledge, attitude, and practices and, in the long term, to reduce the incidence of infections in long-term care facilities, thereby contributing to the improvement of the quality of life of the elderly residents.

This study aimed to verify the effectiveness of ICEP for care workers based on the ADDIE model. First, we assess the general characteristics, infection control knowledge, attitude, and performance of care workers. Second, we examine the differences in infection control knowledge, attitude, and performance of care workers before and after ICEP implementation. Third, we determine the satisfaction level of care workers after implementing ICEP.

2. METHODS

2.1. Study design

This study is a quasi-experimental design of a single-group pre- and post-test to investigate differences in infection control knowledge, attitude, and performance before and after implementing the distance ICEP based on the ADDIE model for care workers.

2.2. Study participants

The participants of this study were care workers from long-term care facilities nationwide. The inclusion criteria for this study included careworkers with a minimum of 6 months of experience, who understood the purpose and agreed to participate in the study. To participate in the program, individuals needed to have access to a smartphone or desktop, enabling them to connect to the website for program utilization. The exclusion criteria were those working in long-term care facilities who were qualified as care workers but were from administrative divisions that were not directly involved in providing care for recipients. This study included 200 care workers nationwide, considering the dropout rate, and was based on a study by Jeong, Hong, and Lee [15], who collected data online to obtain a representative sample of the population, and a study by Lee et al. [16], who selected 174 people to evaluate the quality of web-based programs. Out of the 200 participants, data from 173 were analyzed, excluding the data of 27 participants (15.6% dropout rate) whose responses to the pre- and post-questionnaires were inadequate.

2.3. Experimental intervention

This study developed the distance infection control education program (ICEP) to prevent emerging infectious diseases for care workers in long-term care facilities based on literature reviews, focus group interviews, and expert consultation [17]. Furthermore, the study used the website Infection Control Education (www.icedu.co.kr) for distance learning and conducted a pilot study based on the ADDIE research model. The distance ICEP for long-term care facility care workers consists of an introduction (5 minutes), development (20 minutes), and closing (5 minutes) on a total of eight topics. The contents of lectures by experts in each subject were produced and edited by professional videographers. If a demonstration was required during the training, the instructor's demonstration was filmed. The final edited video was uploaded to the website for e-learning. The problems in using the established website were complemented through continuous communication with two nursing care workers, geriatric nurse practitioners, researchers, and developers. The pilot study improved inconveniences, such as simplifying login, inconveniences when filling out pre- and post-questionnaires, and placing sound in videos and lecture materials on the screen so that care workers could

easily access them.

This program consists of a total of eight sections including overall understanding of infection (the concept of infection, the transmission route of infection, the symptoms of infection, and the impact of infectious diseases) for the 1st section, regular infection control (the importance of practicing hand hygiene) for the 2nd section, multidrug-resistant bacteria as infection control by special pathogens for the 3rd section, tuberculosis for the 4th section, tick-borne infectious disease for the 5th section, pressure ulcer as a detailed education on infection control by infection site for the 6th section, and urinary tract infection for the 7th section, and environmental management for the 8th section. The program was validated for content validity by experts. The training time for each topic was 30 minutes, and the total completion time was four hours. The training progress was checked through the website, and a post-test questionnaire was made available one month after completing all topics (to check infection control performance) [18]. The developed questionnaire was provided on the website before and after the training.

2.4. Measurements

Infection control knowledge. To measure infection control knowledge, a questionnaire consisting of 16 questions was developed in which each subject matter expert was asked questions corresponding to education. An education expert was consulted on the questionnaire, and content validity was tested by eight experts (three nursing professors, two infection control nurse practitioners, and three geriatric nurse practitioners). Each question scored 1 point for answering correctly and 0 for answering incorrectly and “don’t know.” The scores ranged from 0 to 16, with higher scores indicating higher infection control knowledge. In Song’s study [17], the reliability of the tool, Kuder-Richardson (KR-20), was .70, and in this study, Kuder-Richardson (KR-20) was .64.

Infection control attitude. Infection control attitude was measured by modifying Yuk’s [19] infection control attitude tool for nurses responding to COVID-19 and Park and Lee’s [20] infection control attitude tool for nurses from departments with negative pressure isolation wards after adapting them for long-term care facility care workers. It consisted of a total of eight items, and each item was measured on a 5-point scale, starting with 1 point for “strongly disagree” to “strongly agree.” The higher the scores, the more positive infection control attitude. The reliability of the tool in Yuk’s study [19] was Cronbach’s α .84, and the reliability for this study was Cronbach’s α .63.

Infection control performance. Based on the literature review of studies on infection control performance among long-term care workers, including the study by Hong and Song [21], Ryu and Ryu [10], Yang [22], and Choi et al. [23], the items for measuring performance by each education program topic consisted of a total of 25 items and four subdomains. Education experts were consulted for the questionnaire, and content validity was tested by eight experts (three nursing professors, two infection control nurse practitioners, and three geriatric nurse practitioners). The subdomains consisted of overall understanding of infection (five items), regular infection control education (four items), infection control by special pathogen (seven items), infection control by infection site (six items), and environmental management (five items). It was measured on a 5-point Likert scale, with 1 point for “not performing at all” to 5 points for “always performing.” Higher scores indicated higher infection control performance. In the study by Song [17], the reliability of the tool was Cronbach’s α .84, and in this study, the reliability of the tool was Cronbach’s α .93.

Satisfaction. A questionnaire consisting of eight items was used to measure satisfaction with the infection

control education program. It included satisfaction with training content, training time, instructors by content, guidance, usefulness for infection control after the education, willingness to participate in future education, introduction to colleagues or junior colleagues, and overall satisfaction. Each item was measured on a scale from 1 for “strongly disagree” to 5 for “strongly agree.” The higher the score, the higher the level of satisfaction. The reliability of this study was Cronbach’s α .93.

2.5. Data collection and procedures

The data were collected from May 16 to December 1, 2023. An official letter regarding the program was sent to the Korea Nursing Home Association, which registered long-term care facilities nationwide, and descriptions regarding the program were provided in person or via Zoom when an organization requested an explanation. Through the developed education site, the participants received education after the pre-test questionnaire and then answered a post-test questionnaire. The evidence for assessing the program’s effectiveness was based on the study by Ha et al. [18], and the post-test questionnaire was conducted one month after completing the program.

The education program for long-term care facility care workers was developed as an e-learning tool for distance learning. Manuals were provided to access the program, and research assistants were trained to help. Once the study participants were selected, the research assistants left their contact information on the site to help them access the program and receive the distance ICEP.

The care workers who wanted to participate in the study accessed the developed education site, confirmed the contents of the program, agreed to it, and participated in the study. For care workers to be interested in this study and voluntarily participate in the survey and education, the structure of the website and its content were explained, emphasizing that it was necessary for long-term care facilities. To enable experts to answer questions about infections in long-term care facilities through inquiries, a section where questions could be asked was created on the website to ensure that experts in the relevant educational subject could answer them. The questionnaire took about 20 minutes to complete, and after completing all the distance ICEP, a gift certificate worth 20,000 won was provided.

2.6. Data Analysis

The data were analyzed using the SPSS/WIN 26.0 program. First, the participants’ general characteristics, infection control knowledge, attitude, and performance were analyzed by descriptive statistics of frequency, percentage, mean, and standard deviation. Second, the differences in infection control knowledge, attitude, and performance before and after the distance ICEP were analyzed by the paired t-test. Third, the participants’ satisfaction after implementing the distance ICEP was analyzed by mean and standard deviation.

2.7. Ethical considerations

This study was approved by the Institutional Review Board of K University (IRB No. KYU 2023-03-018-002). For the ethical protection of study participants, the purpose and method of the research, anonymity, and confidentiality were explained before collecting the data. Documented data were stored in a locked place, and all data collected through the website were stored after being coded. The participants were informed that the data would be stored for three years after the end of the study, and after that, it would be shredded, and coded data would be permanently deleted. The participants were informed that the contact information collected to

provide gift certificates would be disposed of immediately upon delivery of the gift.

3. RESULTS

3.1. General characteristics of the participants

The mean age of the participants was 54.35 ± 10.87 years, and the majority were females (90.2%). The majority of the participants were middle school graduates (46.8%), and the average work experience was 6.54 ± 5.34 years. Regarding work type, most participants worked day shifts (57.8%). The average number of elderly patients they cared for was 11.17 ± 11.45 , and 107 care workers (61.8%) took care of less than eight patients. Regarding experience with infection control education, 121 people (69.9%) answered that they had received the training (Table 1).

Table 1. General Characteristics of the Participants (N = 173)

Variables	n (%)	Mean \pm SD
Age (yrs.)		
~<30		
30 \geq ~<40	5(2.9)	
40 \geq ~<50	14(8.1)	54.35 \pm 10.87
50 \geq ~<60	26(15.0)	
~ \leq 60	65(37.6)	
63(36.4)		
Gender		
Male	17(9.8)	
Female	156(90.2)	
Education level		
Illiteracy	9(5.2)	
Elementary school	15(8.7)	
Middle school	81(46.8)	
High school	32(18.5)	
College	32(18.5)	
Graduate school	4(2.3)	
Clinical career (yrs.)		6.54 \pm 5.34
Work type		
Day shift	100(57.8)	
Night shift	4(2.3)	
Working every other day	4(2.3)	
2 shift work	23(13.3)	
3 shift work	42(24.3)	
Number of patients		
\leq 8	107(61.8)	11.17 \pm 11.45

>8	66(38.2)
Experiences of infection control education	
Have	121(69.9)
None	52(30.1)

3.2. Differences in infection control knowledge, attitude, and performance before and after the distance ICEP

The knowledge after the distance ICEP was administered significantly improved from 11.62 ± 1.99 before the distance ICEP to 12.54 ± 1.83 after the distance ICEP ($t = 6.66, p < .001$) with an increase of 0.93 ± 1.54 . Regarding the difference in attitude after the distance ICEP, there was an improvement of 0.07 ± 0.43 points, from 3.81 ± 0.41 to 3.88 ± 0.42 post-ICEP; however, the difference was not significant.

The difference in performance after the distance ICEP was significant, with an improvement of 0.10 ± 0.33 points, from 4.73 ± 0.33 before the distance ICEP to 4.83 ± 0.28 after the distance ICEP ($t = 3.37, p = .001$). By items, there were significant differences in the overall understanding of infection from 4.72 ± 0.43 points to 4.85 ± 0.29 points ($t = 3.17, p = .002$), regular infection control from 4.70 ± 0.49 points to 4.83 ± 0.36 points ($t = 2.58, p = .011$), infection control by special pathogen from 4.77 ± 0.34 points to 4.85 ± 0.29 points ($t = 2.64, p = .009$), and detailed education on infection control by infection site from 4.74 ± 0.40 points to 4.86 ± 0.30 points ($t = 3.40, p < .001$). However, there was no statistically significant difference in environmental management, even though the performance score increased from 4.73 ± 0.42 points to 4.78 ± 0.36 points (Table 2).

Table 2. The Difference in Knowledge, Attitude, and Performance of Infection Control before and after the Distance Infection Control Education Program (N = 173)

Variables	Before	After	Difference (After-before)	t	p
	Mean \pm SD	Mean \pm SD			
Knowledge of infection control	11.62 ± 1.99	12.54 ± 1.83	0.93 ± 1.54	6.66	<.001
Attitude of infection control	3.81 ± 0.41	3.88 ± 0.42	0.07 ± 0.43	1.88	.062
Performance of infection control	4.73 ± 0.33	4.83 ± 0.28	0.10 ± 0.33	3.37	.001
Overall understanding of infection	4.72 ± 0.43	4.85 ± 0.29	0.12 ± 0.43	3.17	.002
Regular infection control	4.70 ± 0.49	4.83 ± 0.36	0.13 ± 0.54	2.58	.011

Infection control by special pathogen	4.77 ± 0.34	4.85 ± 0.29	0.08 ± 0.32	2.64	.009
Detailed education on infection control by infection site	4.74 ± 0.40	4.86 ± 0.30	0.12 ± 0.40	3.40	<.001
Environmental management	4.73 ± 0.42	4.78 ± 0.36	0.06 ± 0.40	1.53	.130

3.3. Participants’ satisfaction after the distance ICEP

Regarding the participants’ satisfaction after receiving the distance ICEP, the overall satisfaction was 4.68 ± 0.50 out of 5, and the highest score among the subcategories was 4.76 ± 0.48 for “After receiving the education, it helped with infection control in the facility.” The lowest satisfaction score was 4.59 ± 0.77 for “I would like to introduce this program to my colleagues or junior colleagues” (Table 3).

Table 3. Satisfaction with the Distance Infection Control Education Program (N = 173)

Variables	Mean ± SD
Satisfaction	4.68 ± 0.50
The educational content was easy to understand.	4.75 ± 0.52
The education time was appropriate for learning.	4.64 ± 0.64
I am generally satisfied with the instructors who lecture using the content.	4.65 ± 0.61
Appropriate instructions have been provided to take this course online.	4.68 ± 0.58
After receiving the education, it helped with infection control in the facility.	4.76 ± 0.48
I would like to participate in the education if it is provided in the future.	4.67 ± 0.64
I would like to introduce this program to my colleagues or junior colleagues.	4.59 ± 0.77
Overall, I am satisfied with this education.	4.72 ± 0.53

4. DISCUSSION

This study was conducted to test infection control knowledge, attitude, and performance by applying distance ICEP to care workers who were the primary care providers for older adults in long-term care facilities. At a time when COVID-19 had subsided, this study attempted to preemptively confirm the possibility of continuous education on infection control to prepare for the continuous risk of emerging infectious diseases.

In this study, the participants' knowledge of infection control improved because of the distance ICEP. This result is consistent with a study reporting improved knowledge after implementing the infection control program for care worker trainees [10]. Although the study target was different, knowledge had also improved in the infection control program implemented for home-visiting nursing assistant trainees [24]. A study that presented a significant difference in knowledge after implementing a single-group infection control education program for postpartum care workers [25] also confirmed the effectiveness of infection control education. Yang and Song [26] suggested that the higher the infection control knowledge of long-term care workers, the higher their performance, and the higher their educational demands, the higher their infection control performance. Kim et al. [25] suggested that expanding such a program to regular education for postpartum care workers and developing it as an online training using video to enable repeated training would improve infection control knowledge and practical skills. The program of this study was developed as an online education tool using video, and it is an effective educational method that can supplement these limitations. In addition, this study evaluated the participants four weeks after the program's implementation, but it is necessary to take repeated measures to check the retention of the acquired knowledge and to implement the video training at the point when the effectiveness of the training decreases.

In this study, the participants' attitude toward infection control improved after the distance ICEP but did not show significant changes. Although the subjects differed, the study results by Hong, Bae, and Lee [27] showed no significant difference in infection control attitude between groups, which was consistent with this study. In contrast, the results differed from the study by Ruy and Ruy [10], which reported a significant increase in attitude after applying an infection prevention education program for care worker trainees. These results suggest that 69.9% of the subjects had received infection control education at the time of recovering from the COVID-19 pandemic; therefore, the overall attitude score toward infection control was higher because the participants continued to receive education on infection prevention but not because of the effectiveness of distance ICEP. In terms of educational satisfaction, the fact that the program helped to control infection in facilities showed the highest score, and it seems that the participants showed a positive attitude towards infection control overall.

As a result of this study, infection control performance increased significantly after the distance ICEP, and care workers' overall infection control performance score was higher than 4.7 points. This was similar to the study by Cho [28], which showed an improvement in infection control performance after video-based infection control training for care workers, and a study [29], which showed an increase in standardized performance after case-based infection control training for nursing students. In this study, there was no significant difference only in environmental management, but in the study of Cho [28], there was a significant difference only in hand hygiene and environmental management between the experimental and control groups. Within the experimental group, there was an improvement in performance in all sub-domains where the education was implemented, which was different from the results of this study regarding environmental management. The environmental management section of the distance ICEP included education on disinfectants and how to use them, but it appears that the education was ineffective because the content on disinfection and ventilation has continued to improve because of COVID-19. Cho's [28] study was conducted before COVID-19 and thus can be interpreted as a difference in time.

Like this study, infection control education using smartphones or tablet personal computers (PCs) complements the limitations of existing lecture-style education and print media and is suitable for busy subjects such as students. It increases the efficiency of education by improving the understanding and retention of information [27]. Therefore, it is a suitable program for people occupations involving different working hours,

such as care workers. It can be repeated for participants of various ages and educational levels. When this program was first developed, it was composed of individual infectious diseases according to the educational needs of care workers so that only the necessary content could be learned repeatedly, resulting in positive feedback [17].

This study also revealed that care workers' satisfaction with distance ICEP was high. Kim and Song [29] found that the training content that was most useful for the practice of care workers was safety and infection control. They also suggested that education needs to be strengthened a little more than the current education [30]. It was emphasized that experts' special knowledge and skills are needed to strengthen the practical capabilities of care workers in Korea. Therefore, this educational program was considered to reflect the educational needs of care workers as it could cultivate professional knowledge.

In the future, it is necessary to develop educational methods that allow care workers to receive theoretical lectures and practice based on various cases. Yu et al. [24] suggested that establishing an educational environment was necessary, such as consultation services for infection control experts, the development of online education platforms, and the implementation of chatbots to ask for real-time infection control knowledge. Through these environments, it is possible to increase infection control knowledge, positive attitude, and infection control performance for various age groups and education levels, considering that 73.0% of care workers are in their 50s or older and 60.7% are middle school graduates or less in this study. In particular, it has been confirmed that the effectiveness of infection control through distance ICEP has been verified among careworkers. Considering this, it is believed that such educational programs and methods could be expanded to various fields of careworker.

There are several limitations to this study. The infection control performance level revealed a high score, which may mean that the overall infection control performance has improved after COVID-19 but may not reflect the actual performance level because it was measured by a survey. The interpretation needs to be handled cautiously. In addition, the reliability of research tools on infection control attitude was low, which limits the ability to generalize changes in attitude toward infection control among care workers after the program's implementation.

5. CONCLUSIONS

This study conducted a distance ICEP based on the ADDIE model for care workers in long-term care facilities across the country, reflecting the needs of the care workers. Through this, infection control knowledge and performance increased, and performance in all sub-domains except environmental management improved. Satisfaction also showed high scores in most categories, which was helpful for infection control in facilities, confirming the effectiveness of infection control education.

The program of this study was based on the ADDIE model and was developed through a pilot study reflecting actual needs. Although there was no control group, it is significant as it was conducted on care workers nationwide to confirm the effect on infection control knowledge and performance while providing a foundation for operating an educational program on infection in nursing care workers in the future.

Based on the above conclusions, this study suggests the following recommendations for future research: First, this study recruited care workers from long-term care facilities nationwide, but there is a need to expand this to include visiting home care facilities. Second, the performance was measured one month after the distance ICEP, but it is necessary to confirm the continuity of performance using objective tools such as

observation methods. Third, this study did not have a control group and was conducted on a large number of care workers across the country, and the effect of education only in the experimental group was confirmed because it was necessary to educate care workers on infection control in long-term care facilities. A survey should be conducted to confirm the continuity of the effectiveness of education in the future.

ACKNOWLEDGEMENT

This work has been supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIT)(No. 2021R1F1A1045448).

REFERENCES

- [1] Statistics Korea. Future Population Projections (Municipal and Provincial): 2020-2050 [Internet]. Seoul: Statistics Korea; 2022 [cited 2023 December 11]. Available from: <https://kostat.go.kr/board.es?mid=a10301020600&bid=207>.
- [2] S, H, Ok and S.J. Yoo, "A Study on Problems and Improvement of Cohort Isolation for Nursing Hospitals and Senior Care Facilities in Korea," *Law Review*, Vol.62, No.3, pp.261-290, August 2021.
- [3] K.P. High, S, F. Bradley, S. Gravenstein, D.R. Mehr, V.J. Quagliarello, C. Richards, and T.T. Yoshikawa, "Clinical Practice Guideline for the Evaluation of Fever and Infection in Older Adult Residents of Long-term Care Facilities: 2008 update by the Infectious Diseases Society of America", *Clinical Infectious Diseases*, Vol.48, No.2, pp.149-171, Jan 2009.
- [4] Statistics Korea. Manpower Status of Long-term Care Institutions by City, County, and District [Internet]. Seoul: Statistics Korea; 2023 [cited 2023 December 11]. Available from: https://kosis.kr/statHtml/statHtml.do?orgId=35006_N022&conn_path=I2
- [5] P.W. Smith, G. Bennett, S. Bradley, P. Drinka, E. Lautenbach, J. Marx, L. Mody, L. Nicolle, K, Stevenson, Society for Healthcare Epidemiology of America (SHEA), and Association for Professionals in Infection Control and Epidemiology (APIC), "SHEA/APIC Guideline: Infection Prevention and Control in the Long-term Care Facility," *American Journal of Infection Control*, Vol.36, No.7, pp.504-535, September 2008.
- [6] J.R. Choi, K.S. Cha, J.Y. Choi, and S.H. Han, "Effect of on-site Consultation and Education on Infection Control in Nursing Homes in Korea," *Korean Journal of Healthcare-associated Infection Control and Prevention*, Vol.27, No.1, pp.59-68, June 2022.
- [7] M.S. Shin and K.H. Song, "A Study on the Perception and Performance of Infection Control of Care Workers in Nursing Home," *Korean Journal of Safety Culture*, Vol.17, pp.57-69, July 2022.
- [8] Ministry of Health & Welfare. 2019 Standard textbooks of long-term care workers [Internet]. Won-ju; 2023 [cited 2023 March 8]. Available from: http://www.mohw.go.kr/react/jb/sjb030301vw.jsp?PAR_MENU_ID=03&MENU_ID=03&MENU_ID=0320&CONT_SEQ=352250#
- [9] National Health Insurance Service. Announcement on participation in the 2023 care workers promotion pilot project [Internet]. Won-ju: National Health Insurance Service; 2023 [cited 2023 March 6]. Available from: <https://longtermcare.or.kr/npbs/d/m/000/moveBoardView?menuId=npe0000000770&bKey=B0009&zoomSize=>
- [10] B.M. Ru and S.M. Ruy, "The Effects of Infection Prevention Education Program on Infection Prevention Knowledge and Attitude to Nursing Caregiver Students," *Journal of the Korea Industrial Information Systems Society*, Vol.15, No.5, pp.167-176, December 2010.
- [11] E.Y. Jung, J.W. Hwang, J.H. Seo, J.U. Hong, H.I. Kim, H.J Im, Y.J. CHo, and E.H. Seo, "Development of Disaster and Safety Accident Prevention Program for Caregivers in Nursing Home," *Journal of Korean Association for Crisis and Emergency Management*, Vol.9, No.2, pp.14-27, December 2020.
- [12] National Health Insurance Service. Posting of Long-Term Care Facility Specialized Safety and Infection Control Education Videos [Internet]. Won-ju: National Health Insurance Service; 2021 [cited 2024 March 11]. Available from: https://www.longtermcare.or.kr/npbs/d/m/000/moveBoardView?menuId=npe0000000940&bKey=B0020&search_

boardId=60030

- [13] R. McEachan, N. Taylor, R. Harrison, R. Lawton, P. Gardner, and M. Conner, "Meta-analysis of the Reasoned Action Approach (RAA) to Understanding Health Behaviors," *Annals of Behavioral Medicine*, Vol.50, No.4, pp.592-612, May 2016.
- [14] S.O. Kim, "Factors Affecting COVID-19 Infection Control Practice among Care Workers", *Journal of Next-generation Convergence Technology Association*, Vol.6, No.12, pp.2386-2399, December 2022.
- [15] S.A. Jeong, D.G. Hong, and C.J. Lee, "A Study on the Role, Awareness and Knowledge of Occupational Therapists in Hospice and Palliative Care Environment," *The Journal of Korean Society of Community Based Occupational Therapy*, Vol.11, No.2, pp.25-35, August 2021.
- [16] H.Y. Lee, I.S. Yang, Y.H. Kang, and H.Y. Kim, "How Can We Develop and Make Use of the Quality Assessment Tool of Web-Based Instruction (WBI) for Nutrition Education?", *The Korean Journal of Nutrition*, Vol.37, No.4, pp.310-315, May 2004.
- [17] M.S. Song, "Development of Infection Control E-learning Training Program for Preventing Emerging Infectious Diseases for Long-term Care Facility Careworkers," *Journal of Korean Academic Society of Home Health Care Nursing*, Vol.29, No.3, pp.329-338, December 2022.
- [18] B.Y. Ha, I.S. Lee, S.G. Jeong, and C.S. Jang, "Effect of Web-based Video Self-management Education Program for Infection Prevention in Patients with Cancer Receiving Chemotherapy: A Preliminary Study," *Journal of Korean Academic Society of Home Health Care Nursing*, Vol.27, No.2, pp.294-305, December 2020.
- [19] Yuk, J.W., Knowledge, Attitude, and Performance of Infection Control among Nurses Working at the COVID-19 Response Department, Mater's Thesis. Daejeon University, Daejeon, Korea, 2021.
- [20] M.J. Park and Y.M. Lee, "The Effect on COVID-19 Infection Control Practice of Nurses who Work in Working Sites with Negative Pressure Isolation Rooms", Vol.15, No.1, pp.35-46, February 2022.
- [21] K.H. Hong and H.J. Song, "Factors Related to Infection Control Performance of Care Workers in Nursing Home," *Journal of Kyungpook Nursing Science*, Vol.25, No.1, pp.47-55, February 2021.
- [22] Yang, S.H., Recognition of Skin Diseases and Skin Infection Prevention Management on Caregivers in Geriatric Hospital, Mater's Thesis. Chosun University, Gwangju, Korea, 2013.
- [23] S.Y. Choi, B.Y. Hur, H.J. Song, Y.K. Kim, E.O. Park, and M.Y. Hyun, "Relationship between Pressure Injury Prevention Knowledge and Practice for Nursing Home Care Worker," *Global Health & Nursing*, Vol.8, No.2, pp.82-89, July 2018.
- [24] S.M. Yu, J.H. Kong, and H.K. Kong, "The Effect of Infection Control Education Program on Infection Control Knowledge and Infection Control Performance of Visiting Nursing Assistant Trainee," *Journal of The Health Care and Life Science*, Vol.11, No.1, pp.127-133, July 2023.
- [25] S.R. Kim, S.H. Kim, H.J. Son, N.H. Cho, K.S. Cha, H.K. Chun, J.R. Choi, and H.K. Hong, "Development and Evaluation of an Infection Control Education Program for Postpartum Care Worker," *The Korean Journal of Healthcare-Associated Infection Control Prevention*, Vol.24, No.2, pp.60-68, December 2019.
- [26] N.Y. Yang and M.S. Song, "A Study on the Knowledge, Performance, and Education Needs of Infection Control related to Emerging Infectious Disease in Long-term Care Facility Workers", *Journal of the Korea Academia-Industrial Cooperation Society*, Vol.22, No.10, pp.585-593, October 2021.
- [27] S.J. Hong, H.J. Bae and J.M. Lee, "Effect of a Mobile-based Education Program for Nursing Students on Infection Control Prevention", *Journal of The Korean Data Analysis Society*, Vol.21, No.4, pp. 2179-2192, August 2019.
- [28] H.Y. Cho, "Effects of a Video-Based Infection Control Education Program Applying the Social Cognitive Theory on Caregiver," *International Journal of Contents*, Vol.15, No.2, pp.20-28, June 2019.
- [29] J.H. Kim and H.S. Song, "The Effect of the Scenario based Infection Control Education on Awareness and Performance of Standard Precautions in Nursing Students," *Asia-pacific Journal of Multimedia Services Convergent with Art, Humanities, and Sociology*, Vol.9, No.7, pp.85-94, July 2019.
- [30] J.H. Kim and H.Y. Lee, "Multi-faceted Reviews on Educational Courses of Personal Care Assistant: Perspectives from Educators, Learners, and Recipients," *Korean Journal of Health and Occupational Science*, Vol.3, No.1, pp.25-38, May 2023.