

Development of an Educational-Training Program for Infection Control Practitioners in Long-Term Care Hospitals Using the Dacum Method: A Descriptive Study

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Abstract

Background: Elderly persons in Korea are at risk of infection due to underlying diseases and weak immune systems. In addition, they require care in long-term care hospitals (LTCHs) that have well-trained infection control practitioners (ICPs). This study aimed to develop an educational-training program for ICPs working in LTCHs using the Developing A Curriculum (DACUM) method.

Methods: A total of 209 ICPs participated in a survey and rated 12 duties and 51 tasks according to frequency, importance, and difficulty. Tasks that scored above the mean for each of the three factors were selected as key tasks and divided into five modules. Subsequently, 29 of the ICPs participated in a pilot educational-training program.

Results: Of a maximum of 5.00, the mean task frequency, importance, and difficulty were 2.71, 3.90, and 3.67, respectively. The mean program satisfaction level was 93.23 (standard deviation: ± 3.79 points) out of 100 points. The total knowledge, skills, and teaching efficacy scores were significantly higher after the program ($p < 0.001$, $p < 0.001$, and $p < 0.006$, respectively).

Conclusions: The DACUM method was used to develop an educational-training program based on the duties of ICPs. This systematically developed program was effective and has the potential to improve ICP performance and the quality of care in LTCHs.

1. Background

Korea is an aged society where elderly people aged 65 years or older account for 14.8% of the entire population, as of 2018.¹ As the elderly population increased, rates of chronic illnesses increased to more than 90% in 2014, and the demands for long-term care service increased accordingly.²

In Korea, long-term care hospitals (LTCHs) are equipped with at least 30 sickbeds to provide care and medical services for patients who require long-term hospitalization for senility or chronic illness, surgical operations, and injuries.³ The number of such LTCHs in Korea increased drastically from 19 in 2000 to 1,529 in 2017. This is because the burden of medical expenses was less in LTCHs than in acute-phase medical institutions where both treatment and care services are provided. Additionally, LTCHs are highly accessible to provide long-term hospitalization service.⁴

Elderly persons hospitalized in LTCHs suffer from various underlying problems and are vulnerable to infection due to relatively weak immune functions.⁵ LTCHs are exposed to high risks of healthcare-associated infection (HAI) due to an insufficiency of infection control workforce and infection supervisory systems.^{6,7} In order to address such problems, since January 2013, the Korean government has obligated all LTCHs nationwide to obtain a medical center certificate including a strengthening criterion regarding infection control among the certification items.

To strengthen infection control, LTCHs need to establish appropriate infection control policies and conduct educational-training programs for their employees to ensure that they become familiar with such policies. Moreover, it is necessary to monitor and evaluate whether employees implement such policies appropriately and whether infection control is practiced properly among patients through timely feedback.⁸ For these purposes, LTCHs require well-trained infection control practitioners (ICPs).⁹

Currently, in Korea, various educational programs are conducted by graduate schools, academic institutes, and governmental organizations for ICPs.¹⁰ However, most of the programs focus on infection control theories, with the practical training based on large-scale acute phase medical center cases.

DACUM stands for "Developing A Curriculum." The term itself represents the function of an educational development process, but it has been widely used as a job analysis method.¹¹ This method is systematic in that it effectively helps to identify tasks to be implemented based on a job analysis and the development of an educational process through which trainees can acquire knowledge, attitudes, and skills necessary for their tasks.¹² DACUM job analysis is effective in developing an educational process for specific tasks because it is based on workshops with the DACUM committee, an expert panel that consists of one trained facilitator and experienced practitioners who have carried out the tasks in the field.

Thus, the present study sought to develop an infection control educational-training program for ICPs working in LTCHs based on a job analysis that utilizes the DACUM method, with the aim of improving work performance of ICPs in LTCHs.

2. Methods

2.1. Research Design

This is a descriptive study that analyzed duties of ICPs in LTCHs and developed an educational-training program by means of the DACUM method.

2.2. Study Subject and Data Collection

In order to analyze the duties of ICPs in LTCHs, a six-member DACUM committee was organized with experts including ICPs in LTCHs, nurses specializing in infection control, and nursing professors. DACUM committee members included two infection control nurses with at least 10 years of professional experience, two ICPs working in LTCHs, and two nursing professors who conduct a Master's degree course on infection control. By means of the simplified DACUM method,¹³ the researcher examined, in a preliminary step, duties of ICPs in long-term care facilities based on a literature review.^{8,9} A one-day workshop was then conducted to identify the duties and tasks of ICPs in LTCHs.

In order to verify the identified tasks, a list of 1,408 LTCHs was presented by the Korean Association of Geriatric Hospitals. From this list, 250 LTCHs were selected in total, with 10–20 from each region and hospital level, through convenient sampling, and then instructions and questionnaires were distributed among their nursing departments. Completed questionnaires were collected using enclosed self-addressed envelopes. Tasks with average frequency, importance, and difficulty levels were selected as key tasks for the educational-training program development. DACUM committee members identified task elements for each key task during a workshop, with a subsequent process to derive knowledge, skills, and tools required for each task element. Finally, a 4-day educational-training program that included five modules was developed.

A survey was conducted on 209 ICPs to determine their preference to undertake the program by e-mail. In order to verify the effectiveness of the educational-training program, 30 ICPs who volunteered were recruited on a first come, first served basis to participate in a pilot study. The sample size was estimated using the G*power 3.1.1 software program. Sample size estimation was based on the following Wilcoxon signed-rank test criteria: statistical power of 0.80, significance level of 0.05, effect size of 0.50, and one-sided test. Therefore, we needed a sample size of 28 participants. Allowing for attrition, we recruited a total of 30 participants for the study. Of the 30 ICPs, the 29 who completed the 4-day program had their post-program satisfaction level measured as the process evaluation. To evaluate the effectiveness before and after the program, the level of knowledge, skills, recognition of the importance of infection control, teaching efficacy, and teaching state anxiety were measured.

2.3. Research Tool

2.3.1. Job Analysis

This study utilized a job analysis questionnaire developed by applying the DACUM method. The job analysis questionnaire consisted of questions regarding 51 tasks of ICPs that were identified through a workshop of DACUM committee members. The degree of frequency, importance, and difficulty was measured for each question on a 5-point scale. In this study, Cronbach's alpha indicating the reliability of each question's degree of frequency, importance, and difficulty was .963, .971, and .956, respectively.

2.3.2. Program Satisfaction

A tool developed by Jeong and Lee (2010) to measure the college educational level of satisfaction was utilized in this study.¹⁴ This tool consisted of 15 questions including educational themes, contents, instructors, methods, and materials. Each question was given points on a 5-point scale. The tool's reliability had a Cronbach's alpha = .899.

2.3.3. Knowledge and Skills

In order to determine whether the learning goals of each module were achieved, 30 questions each about knowledge and skills were developed. Each correct answer was given 1 point, and each incorrect or no answer was given 0 points. The perfect score of the knowledge questions was 30 points, and that of skill questions was 30 points.

2.3.4. Recognition of the Importance of Infection Control

The tool developed by Hong and Park (2016) was utilized.¹⁵ The two questions regarding catheter that were not applicable to ICPs in LTCHs were excluded, while 35 questions in total including hand hygiene, employee safety, intravascular catheter infection control, urinary tract infection control, pneumonia control, isolation, as well as disinfection and sterilization management were included. Each answer was

measured on a 5-point scale. Cronbach's alpha indicating the reliability of the tool before and after the education program was .962 and .965, respectively.

2.3.5. Teaching Efficacy Belief and Teaching State Anxiety

To measure infection control teaching efficacy, the revised version of the Science Teaching Efficacy Belief Instruments (STEBI) developed by Riggs and Enochs (1990) was utilized.¹⁶ The infection control teaching efficacy measuring tool included 22 questions in total. In order to measure the teaching state anxiety, 20 questions about state anxiety were selected from the State-Trait Anxiety Inventory (STAI) method developed by Spielberger et al. (1970) and revised for infection control teaching state anxiety measurement.¹⁷ Two infection control nurses and two nursing professors evaluated the content validity. The infection control teaching efficacy and teaching state anxiety were assessed on a 5-point scale. Cronbach's alpha was .782 and .814 before and after the education, respectively. The tool reliability of teaching state anxiety measurement Cronbach's alpha was .943 and .953 before and after the education, respectively.

2.4. Data Analysis

Subjects' general characteristics; each task's degree of frequency, importance, and difficulty; and educational level of satisfaction were analyzed using descriptive statistics and reported as frequency, percentage, average, and standard deviation. Differences before and after the education program in scores of knowledge, skill, recognition of the importance of infection control, teaching efficacy, and teaching state anxiety were analyzed by means of Wilcoxon signed-rank test. Data analysis was conducted using SPSS (IBM SPSS Statistics for Windows, Version 18.0. Armonk, NY: IBM Corp.)

3. Results

3.1. Job analysis: Duties and Tasks of ICPs in LTCHs

Based on the results of the literature review and the DACUM committee workshop, 12 duties and 51 tasks of ICPs were identified (Table 1). Specifically, the following were the 12 duties: preparing policies and guidelines; monitoring the infection process; planning and evaluating the infection control program; improving hand hygiene practice; managing tool disinfection and sterilization; isolating patients with infectious diseases including reportable diseases; infection control for each strain; infection control for each infection site; infection control over employees; environmental infection control; counseling and communicating with internal and external departments and self-development. One to seven tasks were included for each duty.

3.2. Task Verification

The degrees of frequency, importance, and difficulty of each task are presented in Table 1. The degree of frequency was 2.71 ± 0.64 on average, on the 5-point scale. The following included tasks with high frequency in that order: laundry management (3.92 ± 0.82), medical waste management (3.91 ± 1.01), and hand hygiene practice investigation (3.63 ± 0.92).

On a 5-point scale, the score indicating the level of importance was 3.90 ± 0.05 . Thus, the following included tasks with a high level of importance in that order: scabies control (4.32 ± 0.72), hand hygiene practice investigation (4.27 ± 0.68), and hand hygiene promotion activity (4.27 ± 0.68). Furthermore, on a 5-point scale, the score indicating the level of difficulty was 3.67 ± 0.44 . The following included tasks with a high level of difficulty in that order: preparation for certification evaluation (4.07 ± 0.75), HAI result analysis (3.89 ± 0.83), and scabies control (3.89 ± 0.74).

In summary, although laundry and medical waste management were performed frequently, the scores indicating their levels of importance and difficulty were lower. Hand hygiene-related tasks had high frequency and importance. However, despite the low frequency of preparation for certification evaluation, the degree of difficulty was very high.

3.3. Key Task Selection and Analysis

For educational-training program development, the selected key tasks among the actual tasks of ICPs in LTCHs were those with an average that were as high as the average levels of frequency (average 2.71), importance (average 3.90), and difficulty (average 3.67). These tasks included the following nine tasks: selecting disinfectant, identifying and advising how to disinfect medical equipment, methicillin-resistant *Staphylococcus aureus* (MRSA) infection control, influenza control, scabies control, bacteremia control, pneumonia control, urinary tract infection control, and preparing for the Korean accreditation program for healthcare organizations (Table 1). The elements for each key task were derived from the workshop involving the DACUM committee members. Several elements of the nine key tasks are shown in Table 2.

3.4. Educational-training Program Development

Knowledge, skills, and tools required for each element of each task were analyzed and the expected subject areas from the nine key tasks were classified into five modules of the educational-training program (Figure 1; Table 3). For each module, the lecture standards, practice standards, and monitoring of feedback forms were developed.

3.5. Educational-training Program Operation

The five educational-training program modules were conducted over a period of 32 hours during the 4-day educational process from February 8 to 11, 2017 (Table 3). Each module was conducted with lectures and practical sessions based on the developed lecture standards, practice standards, and monitoring of feedback forms.

3.6. Educational-training Program Evaluation

As a result of the process evaluation, the program satisfaction level was 93.23 ± 3.79 points on an average on a 100-point scale. All the modules had a minimum of 90 points on the satisfaction level. The average scores of infection control knowledge before and after the program were 18.89 ± 2.39 and 26.13 ± 1.09 points, respectively, indicating a significantly higher score after the education ($z = -4.70$, $p < .001$). The average score of infection control skills before and after the program (13.98 ± 2.39 and 24.91 ± 2.46 points, respectively) was also significantly higher after the education ($z = -4.70$, $p < .001$). Furthermore, the average score of teaching efficacy before and after the program (78.02 ± 8.58 and 81.84 ± 9.81 points, respectively) was also significantly higher after the program ($z = -2.75$, $p = .006$). However, the average scores of teaching state anxiety before and after the program (63.66 ± 11.67 and 66.48 ± 14.20 points, respectively) showed no statistically significant difference ($z = -1.92$, $p = .055$). The average scores of infection control recognition on a 175-point scale (168.90 ± 8.74 and 171.10 ± 7.36 points, respectively) also showed no statistically significant difference ($z = -1.77$, $p = .077$) (Table 4). In summary, program satisfaction was higher than 90 points, and knowledge, skills, and teaching efficacy improved after the program.

4. Discussion

This present study developed an educational-training program for ICPs working in LTCHs based on a job analysis that utilized the DACUM method. Following the analysis of the job of ICPs in LTCHs in Korea, 12 duties and 51 tasks were identified. In general, these duties and tasks were similar to those reported in previous studies on the activities of ICPs in acute-phase medical centers in Korea,¹⁸ guidelines for infection control in long-term care facilities in Japan,⁵ and core competencies of infection control nurse specialists in Hong Kong,⁸ as well as on the roles and competencies of the Association for Professionals in Infection Control and Epidemiology (APIC) infection preventionists.¹⁹ When the findings of this study were compared with those of Hobbs (2007) who similarly derived areas of duties of ICPs in Australia by applying the DACUM method used in this study,²⁰ the following additional duties were identified: hand hygiene promotion, tool disinfection and sterilization management, environmental infection control, and preparation for certification evaluation.

The ICPs' work derived by an infection control expert group, or by individuals working as ICPs at the time of the study, did not confirm the validity of the workshop results.²⁰ This study differs from that of Hobbs because of the current situation of LTCHs in Korea,²⁰ the participation of part-time ICPs as a DACUM workshop panel member, and the examination of the validity of the workshop results from 209 LTCH ICPs. Many ICPs working in long-term care facilities handle the duties of multiple departments including nursing, safety management, and quality management departments.²¹ Furthermore, as the main role of ICPs was changed recently from "control" to "prevention," it is thought that their duties on program and financial management, and regulatory and accreditation compliance were emphasized, in addition to previous main duties of surveillance, reporting, and educational duties.²²

However, additional tasks derived in this study were similar to duties aimed at minimizing risks of infection and transmission derived by Hobbs.²⁰ Thus, it is thought that there is not much difference in the duties of ICPs between those at LTCHs and at acute-phase medical centers. The purpose of infection control in medical centers is to enhance patient safety by reducing HAI.²² Although the priorities might differ depending on the patient groups and infection control infrastructures between acute-phase medical centers and long-term care facilities,⁹ there is no significant difference in the duties of ICPs themselves.

In this study, tasks with levels of frequency, importance, and difficulty that were as high as the average included the following nine tasks: selecting disinfectant, identifying and advising how to disinfect medical equipment, MRSA infection control, influenza control, scabies control, bacteremia control, pneumonia control, urinary tract infection control, and preparing for the Korean accreditation program for healthcare organizations. These tasks were selected as key tasks for educational and training program development. In long-term care facilities, patient to patient transmission of infection by MRSA carriers or infected patients is more common than transmission by

employees.²³ Accordingly, the importance of MRSA screening tests and proactive isolation is emphasized in addition to hand hygiene among employees. March et al. (2010) reported that long-term care patients were colonized with various multidrug-resistant bacteria such as MRSA,⁶ vancomycin-resistant Enterococci, metallo- β -lactamase-producers, and extended spectrum β -lactamase-producers. Antibiotic treatment, indwelling devices, and immobility are risk factors for multidrug-resistant colonization.⁶

Particularly, the fact that > 78.5% of patients in long-term care facilities have urinary catheters, and 93% receive influenza vaccines indicates the importance of urinary tract infection and influenza control in long-term care facilities.²⁴ Accordingly, it is thought that the five module (hand hygiene and safe injection practice, disinfection and environment control, risk assessment and multidrug-resistant strain control, urinary tract infection control, and respiratory infection and visitor control) program developed in this study is effective for competency enhancement of ICPs in LTCHs.

As part of this study, an educational-training program of lectures and practical sessions was conducted over a period of 32 hours in total during a 4-day program by means of lecture standards, practice standards, and monitoring of feedback forms for each of the five modules. This program is of significance in that it included both lectures and practical sessions as a reflection of the demands of ICPs in Korean LTCHs.⁷ In order to help hospital employees demonstrate their infection control knowledge, ICPs need to apply various educational methods including both theories and practical sessions during workshops, team-based learning, problem-based learning, on-site training, and through simulation.⁹ For ICPs to be able to apply such various educational methods, they need to be exposed to such methods in their natural settings.

The educational contents developed in this study are similar to those developed by the Nebraska Infection Control Network in 2002 for ICPs in long-term care facilities including surveillance, multidrug-resistant organisms control, isolation, and infection control program.²¹ However, this present study is of significance in that it reflected duties of high priority to the educational process based on the frequency, importance, and difficulty of tasks according to results of the job analysis conducted among ICPs in LTCHs through the application of the DACUM method.

The effect of the educational-training program developed in this study was measured through process evaluation and effectiveness evaluation. The level of satisfaction of subjects with the program measured through the process evaluation was high for each of the following aspects: educational theme, educational content, educational method, educational material, and educational condition. The effectiveness evaluation was used to measure the effect of the program on subjects' knowledge, attitude (teaching efficacy, teaching state anxiety, infection control recognition), and skills. In this study, the scores of knowledge and skills were higher after the program.

Daly et al. (1992) developed the infection control educational program for long-term care facilities and evaluated subjects' knowledge and skills before the program, 3 months after, and 12 months after the program.²⁵ Daly et al. measured the skills based on the time spent for infection control, whether infection surveillance was practiced daily, whether there were standards for infection surveillance, whether the infection rate was calculated, and whether influenza vaccination was practiced for hospital employees.²⁵ In contrast, this study measured the skills by checking whether subjects could practice what they had learnt regarding each of the five modules right after they completed the educational-training program. Although different skill-measuring methods were used, these two studies both show that knowledge and skills improved after program implementation.

Regarding attitude, however, significant improvement was shown only with regard to teaching efficacy, whereas there was no difference regarding teaching state anxiety and infection control recognition. This was probably because of the difficulty in verifying such factors; this methodological study developed the educational-training program and tested the program only among 29 individuals as a pilot project. Thus, a future study needs to include more subjects. Regarding infection control recognition, it is thought that because the subjects were ICPs in LTCHs, they could already recognize the importance of infection control even before the program.

This study is of significance in that it developed a program systematically based on the duties of ICPs in LTCHs by means of the DACUM method in order to improve infection control in LTCHs where human resources and infrastructure, such as facilities and devices, are inadequate in comparison to that of acute-phase medical centers. Nonetheless, it is necessary to include more ICPs in the DACUM panel to verify their duties more specifically. Since it takes more time to change attitudes than merely acquire knowledge, follow-up research needs to continue to verify the extent of HAI performance improvement and HAI rate decrease as indexes of educational-training program performance evaluation. To this end, it is necessary to form a network of ICPs working in LTCHs and continue to monitor HAI and obtain feedbacks.

5. Conclusions

An infection control education-training program was developed systematically in this study for ICPs working in LTCHs by means of the DACUM job analysis method and thorough application of the educational process development procedures. The process evaluation and effectiveness evaluation conducted before and after the educational-training program proved the outstanding training program performance. Particularly, regarding knowledge and skills, the scores after program implementation were significantly high for all five modules. The educational satisfaction level was as high as 90 points in every module. This program, therefore, can be utilized for ICPs in various LTCHs. Additionally, the policy plans, lecture plans, monitoring feedback forms, and report forms developed for each module in this educational-training program can be applied directly to infection control work in LTCHs, being expected to contribute to improved infection control practices in such facilities.

Declarations

Ethics approval and consent to participate: In order to protect the rights of the subjects, this study was carried out after the approval of the protocol by the Jeong: Konyang University Institutional Review Board (IRB No. KYUIRB-2016-004). In the first part of the questionnaire, the purpose of the study and voluntary participation in the research was explained. The information about anonymity, confidentiality of the data, and research ethics (including that no disadvantages will be encountered for not participating in the research) were presented. If they agreed, the subjects checked the box to indicate consent before their participation in the survey. In the process of recruitment of program subjects, we explained the purpose and method of research, the contents of educational-training program, time and place, effect expectation, confidentiality, benefits of participation in the research, and the possibility of withdrawal by e-mail. Finally, we obtained a signed written informed consent.

Consent for publication: Not Applicable.

Availability of data and materials: The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing Interest: None.

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Authors' contribution: SYJ conceived this study concept and designed the descriptive study. SYJ and OSK selected the participants. OSK conducted the statistical analysis and SYJ prepared the draft of the manuscript. OSK contributed substantial input and carried out critical revisions of the manuscript. SYJ and OSK reviewed and approved the manuscript prior to submission.

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Abbreviations

CRE, carbapenem-resistant *Enterobacteriaceae*

DACUM, Developing A Curriculum

HAI, healthcare-associated infection

ICP, infection control practitioner

LTCH, long-term care hospital

MRSA, methicillin-resistant *Staphylococcus aureus*

SD, standard deviation

VRE, vancomycin-resistant *enterococci*

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Tables

Table 1. Degree of Frequency, Importance, and Difficulty of Duties and Tasks (N=209)

Duties	Tasks	Frequency		Importance		Difficulty	
		M±SD	Rank	M±SD	Rank	M±SD	Rank
1. Preparing policies and guidelines	1-1. Developing infection control guidelines and policies	2.51±0.97	30	3.76±0.82	32	3.82±0.80	11
	1-2. Revising infection control guidelines and policies	2.58±0.96	27	3.78±0.79	31	3.78±0.80	14
2. Healthcare associated infection surveillance	2-1. Investigating healthcare associated infection (HAI) control practice	2.45±1.05	34	3.68±0.81	36	3.83±0.82	9
	2-2. Analyzing results of healthcare associated infection (HAI) control	2.41±1.05	36	3.66±0.81	41	3.89±0.83	2
	2-3. Evaluating and reporting healthcare associated infection (HAI) control results	2.46±1.05	32	3.67±0.80	40	3.86±0.83	6
	2-4. Investigating and reporting infection outbreaks	2.34±1.11	37	3.68±0.87	36	3.88±0.87	5
3. Planning and evaluating an infection control program	3-1. Planning an infection control program (including budgets)	2.24±0.98	42	3.68±0.81	36	3.84±0.77	7
	3-2. Establishing an infection control report system	2.52±0.97	29	3.68±0.82	36	3.69±0.75	25
	3-3. Index management (investigation, analysis, evaluation)	2.26±0.93	41	3.57±0.90	45	3.83±0.86	8
	3-4. Conducting infection control events (The Day of Infection Control, etc.)	1.94±0.94	49	3.34±0.92	49	3.66±0.90	29
	3-5. Reporting project results and preparing a report	2.09±0.98	48	3.44±0.91	48	3.66±0.85	30
4. Hand hygiene promotion	4-1. Investigating the level of hand hygiene practice	3.63±0.92	3	4.27±0.68	2	3.62±0.77	40
	4-2. Hand hygiene promotion activity	3.57±0.95	5	4.27±0.68	2	3.63±0.78	38
5. Tool disinfection and sterilization management	5-1. Selecting disinfectants*	3.21±0.95	12	4.09±0.67	16	3.68±0.72	28
	5-2. Identifying and advising how to disinfect medical equipment*	3.15±0.96	13	4.03±0.70	22	3.70±0.69	24

	5-3. Disposable goods recycling management	3.44±1.22	7	4.25±0.68	4	3.63±0.79	37
	5-4. Sterilization disinfection method investigation and suggestion	3.26±1.00	10	4.03±0.72	22	3.66±0.70	32
6. Isolation precautions to patients with infectious diseases including reportable diseases	6-1. Checking isolation precautions depending on the symptoms	2.71±1.21	20	4.03±0.79	22	3.64±0.76	35
	6-2. Isolating patients depending on the symptoms	2.59±1.17	25	4.01±0.78	27	3.62±0.84	39
	6-3. Isolation room management	2.65±1.24	23	4.05±0.80	20	3.68±0.82	27
	6-4. Wearing protective gears	2.79±1.23	19	4.12±0.71	15	3.64±0.80	33
	6-5. Reporting reportable diseases	2.14±1.27	45	4.16±0.75	11	3.66±0.84	31
	6-6. Transferring patients with reportable diseases to another hospital	2.16±1.27	44	4.18±0.74	9	3.76±0.84	16
7. Infection control of each strain	7-1. MRSA infection control*	2.62±1.31	24	4.13±0.76	14	3.81±0.70	13
	7-2. VRE infection control	2.58±1.35	26	4.17±0.76	10	3.89±0.71	4
	7-3. Other antimicrobial resistant bacteria control (CRE, etc.)	2.45±1.27	33	4.08±0.84	17	3.82±0.75	12
	7-4. Tuberculosis control	2.69±1.34	21	4.25±0.71	4	3.83±0.73	10
	7-5. Influenza control*	2.85±1.23	17	4.07±0.80	18	3.72±0.79	20
	7-6. <i>C. difficile</i> control	2.46±1.25	31	3.95±0.88	30	3.73±0.80	19
	7-7. Scabies control*	3.02±1.33	16	4.32±0.72	1	3.89±0.74	3
8. Infection control for each site	8-1. Bacteremia control*	3.09±1.17	15	4.15±0.71	13	3.70±0.75	23
	8-2. Pneumonia control*	3.23±1.15	11	4.22±0.70	8	3.78±0.74	15
	8-3. Urinary tract infection control*	3.54±1.06	6	4.24±0.70	7	3.72±0.75	21
9. Infection control for employees	9-1. Development and operation of an employee infection control program	2.34±1.03	38	3.73±0.76	33	3.75±0.75	17
	9-2. Development and operation of a vaccination program	2.57±1.01	28	3.72±0.76	34	3.60±0.75	41
	9-3. Management upon	2.67±1.05	22	3.96±0.72	29	3.69±0.72	26

	exposure to infectious disease						
	9-4. Blood and body fluid	2.83±1.11	18	4.02±0.72	26	3.64±0.77	34
	exposure management						
10. Environmental infection control	10-1. Air and water quality management	2.28±1.01	40	3.70±0.78	35	3.71±0.76	22
	10-2. Infection control in construction	2.11±0.98	47	3.61±0.82	43	3.73±0.81	18
	10-3. Clean/contaminated area distinction	3.43±1.00	8	4.03±0.70	22	3.46±0.82	44
	10-4. Suggestions on environmental cleaning	3.61±0.87	4	4.04±0.67	21	3.36±0.75	46
	10-5. Environmental disinfection method investigation and suggestion	3.14±1.00	14	3.99±0.71	28	3.64±0.70	36
	10-6. Laundry management	3.92±0.82	1	4.16±0.66	11	3.46±0.75	45
	10-7. Suggestions on medical waste management	3.91±1.01	2	4.25±0.70	4	3.52±0.80	43
11. Consultation and communication with internal and external departments	11-1. Consultation on infection control	2.23±0.96	43	3.62±0.83	42	3.35±0.73	48
	11-2. Participating in hospital meetings	2.43±1.09	35	3.53±0.86	46	3.28±0.81	49
	11-3. Organizing and participating in the infection control committee	2.34±1.02	39	3.52±0.88	47	3.35±0.78	47
	11-4. Practicing external administrative services (public health center, etc.)	1.92±0.93	50	3.19±1.00	50	3.23±0.88	51
	11-5. Publishing infection control newsletters	1.57±0.89	51	3.13±1.00	51	3.58±0.95	42
	11-6. Preparing for the Korean accreditation program for healthcare organizations*	3.32±1.03	9	4.06±0.73	19	4.07±0.75	1
12. Self-development	12-1. Participating in education programs and seminars outside the hospital	2.14±0.99	46	3.61±0.94	43	3.25±0.88	50
Total		2.71±0.64		3.90±0.50		3.67±0.44	

* Key tasks=tasks whose frequency (average 2.71), importance (average 3.90), and difficulty (average 3.67) are all as high as the average

M, mean; SD, standard deviation; MRSA, methicillin-resistant *Staphylococcus aureus*; VRE, vancomycin-resistant *enterococci*; CRE, carbapenem-resistant *Enterobacteriaceae*; *C. difficile*, *Clostridium difficile*

Table 2. Elements of key tasks

Key Task	Elements of Key Task
Selecting disinfectants	<p data-bbox="716 159 1382 233">Categorizing the risks of the object (goods, equipment, environment) to be disinfected</p> <p data-bbox="716 279 1511 352">Determining the level of disinfection according to the risks of the disinfection target</p> <p data-bbox="716 399 1365 426">Selecting disinfectants according to disinfection level</p> <p data-bbox="716 447 1317 474">Performing procedures to introduce disinfectants</p>
Identifying and advising how to disinfect medical equipment	<p data-bbox="716 501 1268 529">Classifying the risks of equipment to disinfect</p> <p data-bbox="716 575 1511 648">Determining the level of disinfection according to the risks of the equipment to be disinfected</p> <p data-bbox="716 695 1430 768">Identifying disinfectant types and disinfection methods and procedures according to disinfection level</p> <p data-bbox="716 814 1544 888">Providing feedback to the department or staff about the disinfection method identified</p>
MRSA infection control	<p data-bbox="716 911 1479 984">Establishing guidelines (policies) for multidrug-resistant strain control</p> <p data-bbox="716 1031 1511 1058">Preparing sickrooms for patients with multidrug-resistant strains</p> <p data-bbox="716 1104 1414 1131">Selecting resources for multidrug-resistant strain control</p> <p data-bbox="716 1178 1471 1205">Education for employees on multidrug-resistant strain control</p> <p data-bbox="716 1251 1455 1325">Monitoring employees on the compliance with guidelines and precautions for isolation</p> <p data-bbox="716 1371 1235 1398">Collecting feedbacks on monitoring results</p> <p data-bbox="716 1444 1049 1472">Preparing outbreak reports</p> <p data-bbox="716 1518 1073 1545">Preparing monitoring reports</p> <p data-bbox="716 1591 1398 1619">Activity for multidrug-resistant strain control promotion</p>
Influenza control	<p data-bbox="716 1635 1373 1663">Establishing guidelines (policies) for influenza control</p> <p data-bbox="716 1684 1268 1711">Education for employees on Influenza control</p> <p data-bbox="716 1736 1097 1764">Monitoring influenza outbreaks</p> <p data-bbox="716 1810 1373 1837">Managing patient and employee exposure to influenza</p> <p data-bbox="716 1883 1300 1911">Monitoring compliance with droplet precautions</p> <p data-bbox="716 1936 1430 1963">Feedback monitoring results to department and employees</p> <p data-bbox="716 1988 1463 2016">Preparing outbreak reports and monitoring reports if needed</p>

Scabies control	Establishing guidelines (policies) for scabies control Education for employees on scabies control <hr/> Monitoring the occurrence of scabies Managing patient and employee exposure to scabies <hr/> Monitoring compliance with contact precautions <hr/> Preparing outbreak reports and monitoring reports if needed
Bacteremia control	Establishing guidelines (policies) for bacteremia, pneumonia,
Pneumonia control	urinary tract infection control
Urinary tract infection control	Determining healthcare-related infection surveillance standards and methods Training procedures and methods to prevent infection Monitoring compliance with guidelines (policies) Preparing outbreak reports and monitoring reports if needed Activity for infection control promotion (ex: bundle approach)
Preparing for the Korean accreditation program for healthcare organizations	Identifying the accreditation criteria for infection control Ensuring that infection control policies meet accreditation criteria Identifying the infrastructure required to implement infection control policies Monitoring compliance with infection control policies Preparing reports and evidence data for accreditation

Table 3. Education-training program for infection control practitioners in long-term care facilities based on the DACUM method

Module name	Schedule	Theme
Hand hygiene and safe injection practice	1st Day	30 minutes Pre-test and introduction to the education process
		100 minutes Hand hygiene theories and practice
		90 minutes Hand hygiene practice evaluation and promotion activity
		90 minutes Safe injection theories and practice
		60 minutes Safe injection practice evaluation and promotion activity
Disinfection and environment control	2nd Day	100 minutes Understanding of disinfection and sterilization/ Standards for disinfection and environment control
		90 minutes Principles of disinfection and environment control
		60 minutes Practical application of disinfection and environment control
		60 minutes Activity for disinfection and environment control enhancement
Risk assessment and multidrug-resistant strains control	3rd Day	100 minutes Risk assessment methodology
		90 minutes Risk assessment application and reporting
		90 minutes Multidrug-resistant strain dynamics and infection control
		60 minutes Practical application of multidrug-resistant strain infection, performance evaluation, and promotion activity
Urinary tract infection control	4th Day	100 minutes Urinary tract infection dynamics and infection control
		90 minutes Urinary tract infection control indexes and reporting
Respiratory infection and visitor control		90 minutes Aspiration pneumonia infection control intervention and index management
		60 minutes Influenza infection control intervention and index management/visitor management

Table 4. Evaluation of education-training program for infection control practitioners in long-term care facilities based on the DACUM method (N=29)

	Before program implementation	After program implementation	z(p)*
	M±SD	M±SD	
Process evaluation			
Program satisfaction level ¹⁾		93.23±3.79	
Hand hygiene and Safe injection practice		90.57±10.05	
Disinfection and sterilization		92.55±10.06	
Multidrug-resistant strains		95.91±6.89	
control			
Urinary tract infection control		93.38±9.05	
Respiratory infection control		93.47±10.40	
Effectiveness evaluation			
Knowledge ²⁾	18.89±2.39	26.13±1.09	-4.70 ($<.001$)
Hand hygiene	2.50±0.56	2.89±0.40	-2.96 (.003)
Safe injection practice	4.46±1.02	5.00±0.00	-3.06 (.002)
Disinfection and sterilization	3.21±1.05	4.79±0.49	-4.34 ($<.001$)
Multidrug-resistant strains	3.83±1.17	5.00±0.00	-3.89 ($<.001$)
control			
Urinary tract infection control	3.43±0.94	4.63±0.47	-4.06 ($<.001$)
Respiratory infection control	1.47±1.02	3.82±1.00	-4.47 ($<.001$)
Skill ²⁾	13.98±3.56	24.91±2.46	-4.70 ($<.001$)
Hand hygiene	2.69±1.56	4.53±0.61	-4.25 ($<.001$)
Safe injection practice	1.04±1.06	3.24±1.59	-4.22 ($<.001$)
Disinfection and sterilization	2.64±1.17	4.46±1.15	-4.42 ($<.001$)
Multidrug-resistant strains	3.34±1.11	4.86±0.44	-4.45 ($<.001$)
control			
Urinary tract infection control	2.05±1.49	4.02±1.24	-4.38 ($<.001$)
Respiratory infection control	2.21±1.29	3.79±1.21	-3.93 ($<.001$)
Attitude			
Teaching efficacy ³⁾	78.02±8.58	81.84±9.81	-2.75 (.006)
Teaching state anxiety ⁴⁾	63.66±11.67	66.48±14.20	-1.92 (.055)
Recognition of infection	168.90±8.74	171.10±7.36	-1.77 (.077)
control ⁵⁾			

* Wilcoxon signed-rank test

Perfect Score: 1) 100 points; 2) 30 points; 3) 110 points; 4) 100 points; 5) 175 points

DACUM, Developing A Curriculum; M, mean; SD, standard deviation

Figures



Figure 1

Educational-training program modules based on the identified key tasks using the DACUM method. This figure shows that five modules were developed to teach the knowledge and skills needed to perform nine key tasks. For example, the “risk assessment and multidrug-resistant strains control” module was developed to teach knowledge and skills required for “MRSA infection control,” “scabies control,” and “preparing for the Korean accreditation program for healthcare organizations.” MRSA, methicillin-resistant *Staphylococcus aureus*; DACUM, Developing A Curriculum