

The current status of hand washing and glove use among care staff in Japan: its association with the education, knowledge, and attitudes of staff, and infection control by facilities

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Abstract

Objective Hand hygiene is a basic measure to prevent infections. The purpose of this study was to obtain suggestions for the improvement of hand hygiene by evaluating the education, knowledge, and attitudes of care staff at facilities for the elderly in regard to hand washing and glove use, as well as infection control policies by those facilities.

Methods Among a total of 147 special nursing homes and health service facilities for the elderly in Yamaguchi Prefecture, Japan, questionnaires were sent from October to November 2007 to 56 facilities which had agreed to participate in this survey. Two types of questionnaire, one for the facility manager and the other for care staff, were sent to each facility.

Results The questionnaire was responded to by 42 managers (response rate 28.6%) and 1,323 staff members (response rate 26.3%). The rate of compliance with hand hygiene among them was 34.0%. Personal factors promoting hand hygiene were education and attitudes, while facility-related factor was the implementation of hand-washing evaluation.

Conclusion Since the hand hygiene compliance rate is low among care staff at facilities for the elderly, it is necessary to take measures to improve hand hygiene.

Educational programs for hand hygiene should be developed in view of the conditions of individual facilities.

Keywords Hand washing · Glove · Hand hygiene · Facilities for the elderly · Care staff

Introduction

Hand hygiene is emphasized as a basic measure to prevent infections. However, the rate of compliance with hand hygiene in medical practitioners is low, and the US Centers for Disease Control and Prevention (CDC) published a guideline for hand hygiene in healthcare settings in an effort to promote it [1]. Hand hygiene means either washing the hands with soap and water or hand antisepsis with an alcohol-based hand-rub [2].

Research on hand hygiene at facilities has mainly targeted physicians and nurses working for hospitals. In Japan, Osuka [3] investigated the rate of practicing hand washing and factors affecting hand hygiene behavior among 93 nurses at two hospitals, and reported that the rate was 50.9% on average, and factors such as workload, education, and experience affected hand hygiene behavior.

Infection control is important at special nursing homes and health service facilities for the elderly as well as at hospitals. These facilities for the elderly, however, less frequently involve invasive procedures [4], and therefore they are expected to depend more on hand hygiene for the prevention of infections. Challenges to infection control at facilities for the elderly have been reported, including: (1) there are many elderly people who cannot voluntarily take preventive actions such as hand washing due to paralysis or dementia, and this impairs the effectiveness of infection control; (2) elderly residents are often less resistant due to

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their chronic diseases [5]; (3) there are few medical practitioners at facilities for the elderly, as special nursing homes do not have a system of resident physicians/nurses [6]. Thus, care workers and nurses (care staff) who take care of residents were expected to play an important role in preventing infections at facilities for the elderly.

When an outbreak of norovirus infection occurred at facilities for the elderly over the period from December 2004 to January 2005, with 7 deaths of residents at a special nursing home, the Ministry of Health, Labor, and Welfare issued a notification requiring those facilities to strengthen their infection control measures [7]. The number of cases infected by norovirus at facilities for the elderly is rising annually; it increased by more than 2.5 times during the period from September 2006 to August 2007 [8]. Infection with norovirus is the most common at facilities for the elderly, and the route of infection is human-to-human infection [9]. Since the possibility of norovirus being transmitted to multiple patients by a single care worker who missed a single occasion of hand hygiene has been demonstrated [10], it is important for, and a challenge to, facilities for the elderly to encourage care staff to comply with hand hygiene measures.

Regardless of the importance of promoting hand hygiene among care staff at facilities for the elderly, studies targeting individual facilities or surveying the compliance of care staff with hand hygiene on the occasion of their attending a training session have only been conducted in Japan; no study has investigated the current status of hand hygiene, and factors associated with it, among care staff. Given the association of various factors with the practice of hand hygiene [11], it is necessary to clarify both personal and facility-related factors to improve the compliance of care staff.

Focusing on the practice of hand washing and glove use as preventive measures against infection, and targeting care staff at facilities for the elderly, this study evaluated their education, knowledge, and attitudes in regard to hand washing and glove use, as well as infection control by those facilities, to clarify the relationships between these conditions and compliance with hand hygiene.

Materials and methods

Subjects

The subjects were the managers and care staff of special nursing homes and health service facilities for the elderly in Yamaguchi Prefecture, Japan.

The target institutions were 147 facilities for the elderly (87 special nursing homes and 60 health service facility) in Yamaguchi Prefecture, Japan, listed as of December 14,

2006, on the Welfare and Medical Service Network System (WAMNET). Each of the 147 facilities was requested in writing to participate in this study, and a questionnaire was sent to 56 facilities (31 special nursing homes and 25 health service facilities) which had agreed to cooperate with us. The questionnaire survey was conducted from October 22, 2007 to November 10, 2007.

The questionnaire for managers was collected from 42 facilities. The response rate was 28.6%, and 41 facilities (27.9%) were used for analysis. On the other hand, the questionnaire for care staff was answered by 1,323 (26.3%) of a total of 5,026 staff members; 1,282 (25.5%) who answered all of the 9 questions about hand washing and glove use were subjected to analysis.

To evaluate any bias in the characteristics of these facilities, 41 responding and 91 nonresponding facilities, excluding 15 whose attitudes to the survey were unclear, were tested for location, type, capacity, and number of care staff, but no significant differences were found.

Data collection

A questionnaire was developed in consultation with previous studies [3, 12, 13], the CDC guideline for hand hygiene in healthcare settings [1], and an infection control manual by the Ministry of Health, Labor, and Welfare [14] for the elderly in a facility.

A copy of the questionnaire for the facility manager and a necessary number of copies for care staff were sent in an envelope to each facility.

The completed questionnaire for care staff was put in an envelope by each staff member, collected together with that for the facility manager, and returned by the person responsible at each facility.

Survey items

Questionnaire for the facility manager

Items of the questionnaire for the facility manager included basic characteristics (facility type, capacity, number of staff, numbers of new/retired employees), resident information (number of residents by care level), establishment of an infection control committee, presence of an infection control manual, provision of infection and hand-washing training, implementation of hand-washing evaluation, guidance for hand washing and glove use, vaccination (influenza, *Streptococcus pneumoniae*, hepatitis B), stocks of disposable gloves, gowns, masks, and N95 masks, availability of private rooms upon the onset of infection, availability of a sink in the residents' rooms, installation of alcohol-based hand-rubs, and carrying of alcohol-based hand-rub in the pocket.

Questionnaire for care staff

Items on the questionnaire for care staff included basic characteristics (age, gender, job type, years of experience, years of continuous employment, employment status), education (receipt of pre- and post-employment education on infection and hand washing), practice of hand washing and glove use, knowledge of infection routes (itch, methicillin-resistant *Staphylococcus aureus* [MRSA], influenza virus, tubercle bacillus [TB], hepatitis B and C viruses, human immunodeficiency virus [HIV], norovirus), knowledge of hand washing (hand-washing methods for visibly unsoiled and soiled hands), and attitudes (thinking that you will take standard precautions, that hand washing is effective, that infection can be prevented by knowledge, that infection can be prevented by proper behavior, that you have knowledge of infection, that you can take appropriate actions in poor health, and that you are busy at work).

Statistical analysis

The statistical software package SPSS version 15.0 for Windows was used for statistical analysis.

Hand washing and glove use were designated as dependent variables, and those who answered yes to all of the 9 questions about the practice of “hand washing required by the CDC guideline for hand hygiene in healthcare settings [1],” “hand washing during daily work,” and “glove use required by standard precautions [15, 16]” were regarded as the hand-hygiene compliant group, and those who answered no to any of the 9 questions were regarded as the hand hygiene noncompliant group. The questions were about: (1) hand washing before direct contact with residents, (2) hand washing after direct contact with residents, (3) hand washing when moving from a contaminated body site to a clean one during resident care, (4) hand washing after removing gloves, (5) hand washing before eating and after using the restroom, (6) hand washing during busy work, (7) use of a new pair of gloves for each care episode, (8) glove use in the presence of possible infection, and (9) glove replacement when moving from a contaminated body site to a clean one during resident care.

Although glove use itself cannot guarantee hand hygiene [1], this study considered it within the scope of hand hygiene as the standard precautions require glove use as a measure to prevent infection via the hands.

Analysis of personal factors and compliance with hand hygiene

Correlations between the levels of compliance with hand hygiene and the variables of care staff were examined by the chi-square test or *t* test.

To clarify personal factors contributing to compliance with hand hygiene, multiple logistic regression analysis was performed with hand hygiene compliance levels used as dependent variables, and basic characteristics, education, knowledge, and attitudes as explanatory variables.

The variables entered were “years of experience,” “job type (nurse or other),” “education,” “knowledge of hand-washing methods for visibly soiled or unsoiled hands,” “knowledge of infection routes of infection with scabies, MRSA, influenza, TB, hepatitis B/C, HIV, or norovirus,” “I think I will take standard precautions,” “I think hand washing is effective in preventing infection,” “I think infection can be prevented by knowledge,” “I think infection can be prevented by proper behavior,” “I think I have knowledge of infection,” “I think I can take appropriate actions in poor health,” and “I think I am busy at work.”

For the variable “education,” those who answered “received adequate education” or “received education” on both infection and hand washing before employment, and “received training” on both infection and hand washing after employment were regarded as adequate, and others were regarded as inadequate.

Analysis of facility-related factors and compliance rate with hand hygiene

To clarify the relationships between those facilities conditions and compliance rate with hand hygiene, multiple regression analysis was performed compliance rate with hand hygiene used as dependent variables, and basic characteristics and infection control by the facility and its environment as explanatory variables.

The variables entered were “facility type,” “number of residents per staff member,” “infection training,” “implementation of hand-washing evaluation,” “hand-washing environment in the residents’ room,” “carrying an alcohol-based hand-rub in the pocket,” and “guidance for hand-washing and glove use.”

The variable “hand-washing environment in the residents’ room,” was categorized into three: both a sink and alcohol-based hand-rub available was scored as 2 point, either one available was scored as 1 point, or both unavailable was scored as 0 point.

For the variable “guidance for hand-washing and glove use,” the correct answer to 8 questions for care staff with hand-washing and glove use, except the question about hand washing during busy work, guidance by explain was scored as 2 point, only paper was scored as 1 point, no guidance was scored as 0 point, and then these values were summed.

Ethical considerations

Explanation to the subjects was made by the responsible person at each facility using briefing material that described the purpose of the survey, how to complete the questionnaire, protection of privacy, the completely voluntary nature of participating in the study, and consideration for the subjects not to be disadvantaged.

This study was conducted with the approval of the Medical Research Ethics Committee of the Faculty of Health Sciences, Yamaguchi University Graduate School of Medicine.

Results

The overall condition of the facilities

By facility type, 52.4% were special nursing homes and 47.6% were health service facilities. Capacity was 78.4 ± 20.9 (mean \pm standard deviation, SD) and number of staff was 39.8 ± 14.8 (mean \pm SD).

Regarding the facility environment, “availability of a sink in the residents’ room” (56.1%), “installation of alcohol-based hand-rubs” (43.9%), and “carrying an alcohol-based hand-rub in the pocket” (24.4%) were confirmed (Table 1).

Personal factors and compliance with hand hygiene

The subjects included more women (79.1%) than men (20.9%); mean age was 37.5 years. Regarding job type, “certified care worker” was the most common (51.1%), followed by “care worker (helper)” (20.7%) and “nurse” (17.5%). Compliance with hand hygiene was confirmed in 436 (34.0%) of the 1,282 staff members, being 30.5% in certified care workers, 33.7% in care workers (helpers), and

41.5% in nurses. No item of the basic characteristics showed significant difference between the hand-hygiene-compliant and noncompliant groups (Table 2).

Regarding pre- and post-employment education, about 50% of care staff stated they had “received adequate education” or “received education” on both infection and hand washing before employment, and some 60–70% of them had received such education after employment. For all items, the compliant group had more educated staff members than the noncompliant group, showing a significant difference except for the item “previous receipt” of “post-employment education on infection” (Table 3).

Those who chose alcohol-based hand-rubs as a hand-washing method for visibly unsoiled hands accounted for 31.2%. Concerning their knowledge of infection routes, more than 90% answered correctly for scabies, influenza virus, and norovirus, whereas the correct answer for tuberculosis (TB) was given by some 80%; the lowest rate was 49.5%, for methicillin resistant *Staphylococcus aureus* (MRSA). For each of influenza virus, TB, hepatitis B/C viruses, and HIV, a significant difference was observed, with more correct answers in the noncompliant group (Table 4).

Regarding attitudes toward hand hygiene, those who answered yes to each of the questions regarding thinking “that infection can be prevented by knowledge” and “that infection can be prevented by proper behavior” were significantly more common in the compliant group. Those who thought they “had knowledge of infection,” and/or “could take appropriate actions such as having a rest and seeing a doctor in poor health” accounted for about 50% of all; more precisely, those with the positive attitude comprised 58.2% and 41.5% of the compliant and noncompliant groups, respectively, and those with the negative attitude comprised 65.3% and 46.5%, respectively (Table 5).

Table 1 Facility conditions (n = 41)

Item	Category		Values
Facility type	Special nursing home	n (%)	22 (53.7)
	Health service facility		19 (46.3)
Capacity	Number	Mean \pm SD	78.4 ± 20.92
Number of staff	Number	Mean \pm SD	39.8 ± 14.78
Number of residents per staff member	Number	Mean \pm SD	1.9 ± 0.37
Compliance rate with hand hygiene	Proportion	Mean \pm SD	34.7 ± 16.41
Infection training	Yes	n (%)	33 (80.5)
Implementation of hand-washing evaluation	Yes	n (%)	23 (56.1)
Availability of a sink in the residents room	Yes	n (%)	25 (61.0)
Installation of alcohol-based hand-rubs	Yes	n (%)	18 (43.9)
Carrying an alcohol-based hand-rub in the pocket	Yes	n (%)	10 (24.4)
Guidance for hand washing and glove use	Score	Mean \pm SD	10.0 ± 3.40

Table 2 Basic characteristics and compliance with hand hygiene ($n = 1,282$)

Item	Category		Total	Compliant $n = 436$	Noncompliant $n = 846$	<i>P</i> value
Gender	Male	n (%)	268 (20.9)	99 (22.8)	169 (20.0)	0.246
	Female		1,013 (79.1)	336 (77.2)	677 (80.0)	
Age	Year	Mean \pm SD	37.5 \pm 12.21	37.1 \pm 12.26	37.5 \pm 12.09	0.642
Years of experience	Year	Mean \pm SD	8.8 \pm 8.21	9.3 \pm 9.04	8.5 \pm 7.64	0.109
Years of continuous employment	Year	Mean \pm SD	5.3 \pm 5.16	5.4 \pm 5.41	5.3 \pm 5.02	0.759
Job type	Nurse	n (%)	224 (17.5)	91 (21.0)	133 (15.8)	0.112
	Certified care worker		652 (51.1)	205 (47.3)	447 (53.0)	
	Care worker (helper)		264 (20.7)	94 (21.7)	170 (20.1)	
	Others		27 (2.1)	10 (2.3)	17 (2.0)	
	Unqualified		110 (8.6)	33 (7.6)	77 (9.1)	
Facility type	Special nursing home	n (%)	715 (56.7)	243 (56.3)	472 (56.9)	0.815
	Health service facility		546 (43.3)	189 (43.8)	357 (43.1)	
Employment status	Full-time	n (%)	1,132 (89.3)	388 (90.0)	744 (89.0)	0.574
	Part-time		135 (10.7)	43 (10.0)	92 (11.0)	

Chi-square test, *t* test**Table 3** Education and compliance with hand hygiene ($n = 1,282$)

Item	Category		Total	Compliant $n = 436$	Noncompliant $n = 846$	<i>P</i> value
Pre-employment education on infection	Received adequate education	n (%)	114 (9.0)	61 (14.0)	53 (6.4)	0.000
	Received education		505 (39.8)	183 (42.0)	322 (38.6)	
	Received education, but not adequate		391 (30.8)	123 (28.2)	268 (32.1)	
	Yet to receive education		193 (15.2)	48 (11.0)	145 (17.4)	
	Unsure		67 (5.3)	21 (4.8)	46 (5.5)	
Pre-employment education on hand washing	Received adequate education	n (%)	153 (12.1)	78 (17.9)	75 (9.0)	0.000
	Received education		548 (43.2)	196 (45.0)	352 (42.2)	
	Received education, but not adequate		331 (26.1)	89 (20.5)	242 (29.0)	
	Yet to receive education		162 (12.8)	50 (11.0)	112 (13.4)	
	Unsure		75 (5.9)	22 (5.1)	53 (6.4)	
Post-employment education on infection	Received training	n (%)	941 (74.5)	333 (77.6)	608 (72.9)	0.068
	Yet to receive training		322 (25.5)	96 (22.4)	226 (27.1)	
Post-employment education on hand washing	Received training within the past year	n (%)	745 (60.1)	274 (65.4)	471 (57.4)	0.007
	Received no training within the past year		494 (39.9)	145 (34.6)	349 (42.6)	
Post-employment education on hand washing	Received training	n (%)	907 (72.1)	337 (78.9)	570 (68.6)	0.000
	Yet to receive training		351 (27.9)	90 (21.1)	261 (31.4)	
	Received training within the past year	n (%)	712 (57.8)	267 (64.2)	445 (54.5)	0.001
	Received no training within the past year		520 (42.2)	149 (35.8)	371 (45.5)	

Chi-square test

Personal factors contributing to compliance with hand hygiene

Multiple logistic regression analysis was performed using hand hygiene compliance levels as dependent variables,

and personal factors such as basic characteristics, education, knowledge, and attitudes as explanatory variables.

The results showed that the item “I think infection can be prevented by knowledge” was the strongest factor promoting compliance with hand hygiene (odds ratio, OR

Table 4 Knowledge and compliance with hand hygiene (*n* = 1,282)

Item	Category	Total	Compliant <i>n</i> = 436	Noncompliant <i>n</i> = 846	<i>P</i> value
Hand-washing methods	Soap for visibly soiled hands	<i>n</i> (%) 1,114 (87.9)	364 (84.7)	750 (89.5)	0.012
	Methods other than soap for visibly soiled hands	154 (12.1)	66 (15.3)	88 (10.5)	
	A hand-rub for visibly unsoiled hands	<i>n</i> (%) 395 (31.2)	153 (35.6)	242 (28.9)	
	Methods other than a hand-rub for visibly unsoiled hands	872 (68.8)	277 (64.4)	595 (71.1)	0.015
Infection routes	Scabies	<i>n</i> (%) 1,148 (91.4)	388 (90.9)	760 (91.7)	0.628
	Contact transmission	108 (8.6)	39 (9.1)	69 (8.3)	
	Routes other than contact				
	MRSA	<i>n</i> (%) 614 (49.5)	198 (47.0)	416 (50.8)	0.209
	Contact transmission	626 (50.5)	223 (53.0)	403 (49.2)	
	Routes other than contact				
	Influenza	<i>n</i> (%) 1,204 (95.0)	398 (92.6)	806 (96.3)	0.004
	Droplet transmission	63 (5.0)	32 (7.4)	31 (3.7)	
	Routes other than droplet				
	TB	<i>n</i> (%) 982 (78.8)	319 (75.6)	663 (80.5)	0.047
	Airborne transmission	264 (21.2)	103 (24.4)	161 (19.5)	
	Routes other than airborne				
	Hepatitis B/C	<i>n</i> (%) 1,084 (86.3)	356 (83.2)	728 (87.9)	0.020
	Blood transmission	172 (13.7)	72 (16.8)	100 (12.1)	
	Routes other than blood				
	HIV	<i>n</i> (%) 1,111 (88.9)	366 (86.3)	745 (90.2)	0.039
	Blood transmission	139 (11.1)	58 (13.7)	81 (9.8)	
	Routes other than blood				
	Norovirus	<i>n</i> (%) 1,238 (98.7)	421 (99.1)	817 (98.6)	0.450
	Contact/droplet transmission	16 (1.3)	4 (0.9)	12 (1.4)	
	Routes other than contact/droplet				

Chi-square test

Table 5 Attitudes and compliance with hand hygiene (*n* = 1,282)

Item	Category	Total	Compliant <i>n</i> = 436	Noncompliant <i>n</i> = 846	<i>P</i> -value
I think I will take standard precautions	Yes	<i>n</i> (%) 1,026 (83.0)	361 (85.7)	665 (81.6)	0.065
	No	210 (17.0)	60 (14.3)	150 (18.4)	
I think hand washing is effective in preventing infection	Yes	<i>n</i> (%) 1,252 (97.9)	429 (98.6)	823 (97.5)	0.191
	No	27 (2.1)	6 (1.4)	21 (2.5)	
I think infection can be prevented by knowledge	Yes	<i>n</i> (%) 1,177 (92.2)	413 (95.2)	764 (90.7)	0.005
	No	99 (7.8)	21 (4.8)	78 (9.3)	
I think infection can be prevented by proper behavior	Yes	<i>n</i> (%) 1,163 (91.4)	406 (94.2)	757 (89.9)	0.010
	No	110 (8.6)	25 (5.8)	85 (10.1)	
I think I have knowledge of infection	Yes	<i>n</i> (%) 599 (47.2)	252 (58.2)	347 (41.5)	0.000
	No	671 (52.8)	181 (41.8)	490 (58.5)	
I think I can take appropriate actions in poor health	Yes	<i>n</i> (%) 661 (52.9)	277 (65.3)	384 (46.5)	0.000
	No	589 (47.1)	147 (34.7)	442 (53.5)	
I think I am busy at work	Yes	<i>n</i> (%) 1,159 (91.3)	402 (92.8)	757 (90.4)	0.151
	No	111 (8.7)	31 (7.2)	80 (9.6)	

Chi-square test

1.95). Other hand-hygiene-promoting factors identified by the analysis included “education” (OR 1.38), “I think I have knowledge of infection” (OR 1.86), and “I think I can

take appropriate actions such as having a rest and seeing a doctor in poor health” (OR 1.66). Education and attitude showed significant correlations as hand-hygiene-promoting

Table 6 Personal factors contributing to compliance with hand hygiene ($n = 1,033$)

Factor	Conditions compared/factor	Odds ratio	Confidence interval
Education	Adequate/inadequate	1.38	1.04–1.83
I think I have knowledge of infection	Yes/no	1.86	1.41–2.48
I think infection can be prevented by knowledge	Yes/no	1.95	1.05–3.60
I think I can take appropriate actions in poor health	Yes/no	1.66	1.26–2.18

Logistic regression analysis (step-down method)

factors, while basic characteristics and knowledge were not significant contributing factors (Table 6).

Facility-related factors contributing to compliance rate with hand hygiene

Multiple regression analysis (stepwise method) was performed using compliance rate with hand hygiene as dependent variable, and facility-related factors such as basic characteristics, infection control by the facility, and its environment as explanatory variables ($n = 37$).

“Implementation of hand-washing evaluation” (regression coefficient $\beta = 0.42$) was strongly related with hand hygiene compliance rate. However, there was no significant related factor. The adjusted coefficient of determination was $R^2 = 0.15$.

Discussion

In this study, not many facilities responded, but the response rate of employees in the responding facilities was high. Therefore bias is small.

There were special nursing homes (59.1%) and health service facilities (40.8%) in Yamaguchi Prefecture, Japan, whose capacity was 71.6 ± 20.2 (mean \pm SD) and number of staff was 36.0 ± 12.2 (mean \pm SD). We were able to collect data to represent the facilities in Yamaguchi Prefecture, Japan, because their type, capacity, and number of staff were not different from the subjects of this study.

The rate of compliance with hand washing and glove use was 34.0%. Specifically, it was 30.5% in certified care workers, 33.7% in care workers (helpers), and 41.5% in nurses, with no significant differences between job types. Especially, the compliance rate in nurses was some 40%, regardless of their learning about infections, infection control, standard precautions, and hand hygiene over the course of basic education. According to literature that summarized hand hygiene compliance rates in previous foreign studies, the compliance rates differed greatly, ranging from 5% to 81%, and the mean rate was 40% [1]. The overall compliance rate in this study was 34.0%, showing a trend similar to those in previous studies. The

relatively low rate of compliance with hand hygiene has raised a problem at these facilities, and it is a major challenge to them to improve the compliance rate.

The study showed that hand hygiene was complied with by those who thought “infection can be prevented by knowledge,” and/or “I have knowledge of infection.” It is said that intentional behavior is associated with attitudes toward behavior and the subjective norm of behavior, and can be modified by approaching these factors [17]. Since the importance of attitudes was suggested in this study as well, the promotion of hand hygiene requires that care staff recognize the importance of hand hygiene and its effectiveness in preventing infection.

Education is essential in promoting compliance with hand hygiene. A previous study revealed that, as a result of intervention including education, the compliance rate improved from 56% before intervention to 83% after intervention, and then reduced to 76% during follow-up [18]. The hand hygiene compliance rate can improve through education, but this effect does not persist. As a correlation between those who had received education during the past year and their compliance with hand hygiene was observed in this study as well, it is necessary to continually encourage them to be aware of the importance of hand hygiene. While the importance of monitoring the compliance of care staff with hand hygiene is emphasized as a means to maintain and improve the compliance rate [19], evaluation of their hand-washing activities was found to be a factor increasing hand hygiene rate in this study as well. Hand washing can be evaluated by such methods as self-evaluation by a check sheet, observation, measurement of the amount of alcohol-based hand-rubs used, and evaluation using fluorescent lotion, which is applied to the hands and irradiated with ultraviolet rays from a black-light lamp after washing the hands to check for any remaining contamination. Black light provides a convenient, easy-to-use approach that allows self-check and facilitates self-awareness. Although only 26.2% of the facilities that responded to this survey applied the black-light method, one idea to improve the hand hygiene compliance rate is to combine lectures with opportunities to self-evaluate hand washing by such means as a black-light in education for care staff.

Preparing an environment readily conducive to hand washing brings about an improvement of hand hygiene, and, in fact there is a study demonstrating an improvement in the hand hygiene compliance rate by carrying a hand-rub in the pocket [20]. This study, however, did not show a correlation between carrying a hand-rub in the pocket and compliance with hand hygiene. As a hand-washing method for visibly unsoiled hands, the “use of an alcohol-based hand-rub,” rather than “washing the hands with soap and water,” is recommended [1]. However, the rate of correctly answering the question about this issue was only 31.2%. This suggests the presence of care staff not knowing this CDC recommendation at facilities for the elderly, and the necessity to disseminate the CDC-recommended hand-washing methods and alcohol-based hand-rubs among facilities.

Regarding the questions about infection routes, the correct answer rate was low for the question on MRSA, probably because the survey regarded droplet transmission as an incorrect answer to this question. Although MRSA is mainly transmitted via contact, there is still a possibility of it being transmitted by droplets. However, the survey requested the subjects to choose a more common infection route at facilities for the elderly when there was more than one possible route. For MRSA, these facilities primarily take preventive measures against contact transmission [14].

The subjects’ knowledge of infection routes was scored and subjected to multivariate analysis, and it was found not to be a factor significantly correlated with compliance toward hand hygiene. While knowledge of infection routes was not a factor promoting hand hygiene, as described above, a positive attitude toward prevention was found to be a factor positively contributing to compliance with hand hygiene. As reported by Gruber et al. [21] and Ronk et al. [22], imparting knowledge does not always promote behavior. Since this study demonstrated the importance of training after employment, and confirmed greater value of attitudes than of personal knowledge, it was considered significant to provide care staff with education with content that could improve their attitudes. To achieve this, it is recommended to first explain to care staff the reasons why hand hygiene is necessary using literature, then promote their understanding of hand hygiene and behavior through a group discussion, and finally evaluate their compliance with hand hygiene and provide them with feedback. Evaluation of compliance with hand hygiene and its feedback are important as a “motivation” [23], and considered to be an effective method to promote attitudes toward hand hygiene.

This study explored personal and facility-related factors expected to contribute to compliance with hand hygiene. “Receipt of adequate education,” “awareness of having knowledge of infection,” “belief that infection can be

prevented by knowledge,” “ability to take appropriate actions in poor health,” and “implementation of hand-washing evaluation” were found to be factors improving compliance with hand hygiene. Therefore, it is effective to include these factors in measures for improvement of hand hygiene.

This study was based on a questionnaire survey, and in general self-evaluation tends to be better than the actual condition. Kakeya et al. [24] examined nurses’ compliance with hand washing in 6 clinical scenes using both a questionnaire and observation, and reported compliance rates of 83.5% based on the questionnaire conducted among 39 nurses, and 68.9% based on the observation of 20 nurses. Since a questionnaire results in a higher compliance rate than observation, an accurate estimation of the hand hygiene compliance rate should be made based on observation. However, observation was not feasible in this study, which was based on a large-scale survey to collect as many data as possible to identify factors contributing to compliance with hand hygiene.

In addition, no causal relationship could be extracted from this study, which was cross-sectional. On the assumption that factors identified in this study are factors promoting compliance with hand hygiene, it is necessary to develop measures to improve the compliance rate, and conduct an interventional study.

In this study, the response rate to the questionnaire was relatively low, probably because it was conducted with the prior approval of the facility director. However, we could collect questionnaires from managers (75.0%, 42/56) and care staff (77.1%, 1,282/1,663). A response bias was considered, but we judged its influence to be small. Previous Japanese studies on compliance with hand hygiene mainly targeted one or several facilities, and no such studies have been conducted on a scale covering all facilities in a prefecture. Although its coverage was a single prefecture, this study was considered to be meaningful as it specifically targeted care staff at welfare facilities for the elderly, and explored not only personal factors but also facility-related factors contributing to compliance with health hygiene.

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