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Original Article

Effect of multi-mode combination intervention on improvement of hand hygiene compliance among family members of patients in intensive care units

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Abstract: Objective: We aimed to explore the effect of multi-mode combination intervention on improvement of hand hygiene compliance (HHC) among family members of patients in the intensive care unit (ICU). Methods: A total of 101 family members of ICU patients in our hospital were selected as subjects for retrospective analysis. These family members were divided into Group A (GA) (n=50) receiving routine intervention and Group B (GB) (n=51) receiving multi-mode combination intervention, so as to compare the two groups in mastery degree of hand hygiene (HH) knowledge, HHC, satisfaction degree, hand washing (HW) methods and nosocomial infection rate (NIR) before and after intervention. Results: The scores for basic knowledge of HH, HH indications, hand disinfection indications and proper HW steps in GB were higher than those in GA after intervention (P<0.05). In GB, the HHC before and after touching patients and after exposure to the environment of patient, the total satisfaction degree, and the number of family members using quick-dry hand disinfectant were higher than those of GA (P<0.05). The nosocomial infection rate of GB was lower than that of GA (P<0.05). Conclusion: Intervention with multi-mode combination hand hygiene can prevent nosocomial infection effectively.

Keywords: Multi-mode combination, intervention, intensive care unit, family member, hand hygiene, compliance

Introduction

Nosocomial infection (NI) refers to an infection acquired by inpatients in a hospital. In a broad sense, the subjects of NI include hospital staff, inpatients, outpatients, emergency patients, family members and visitors. The susceptible population of NI is patients undergoing invasive procedures, those with longer operation times, those with longer length of stay (LOS), those with long-term use of broad-spectrum antibiotics, those treated with immunosuppressors, those with malnutrition and immune damage, as well as infants and the elderly. At the present stage, NI has developed into a medical safety issue that troubles the world. It can prolong the LOS of patients and increase the death rate, which not only seriously threatens the safety of patients, but also wastes a lot of social resources [1, 2].

The intensive care unit (ICU) is a high-risk area for NI because of the particularity of patients seen in the ICU. The nosocomial infection rate (NIR) of this department is much higher than that of other departments [3]. According to research, the most economical, effective and the simplest measure is good hand hygiene (HH) to effectively control the NI and ensure the safety of medical staff and patients [4, 5]. HH has high cost effectiveness and efficiency to prevent and control NI [6]. Due to the correlation between the bacterial flora carried by medical staff and the pathogenic bacteria of NI, in addition to HH of medical staff, it is still necessary to enhance the consciousness of infection prevention and control and strengthen the education of HH knowledge among family members and caregivers of patients so as to minimize the spread of NI by family members [7, 8]. The hospital has achieved certain results in strengthening the education of HH knowledge by posting propaganda pictures, but it still needs to be further improved [9, 10]. The family members of ICU patients will frequently have contact with patients, their surrounding environment and

medical staff during their visits, so the nosocomial cross-infection rate increases without paying close attention to HH [11].

In view of this, this study mainly aims to explore the influence of multi-mode intervention combination, such as improving the sanitation facilities for hand washing (HW), standardizing the HW behaviors and strengthening the health education on HH knowledge, *etc*., along with improvement of hand hygiene compliance (HHC), satisfaction degree and mastery degree of HH knowledge among family members of ICU patients through retrospective analysis.

Materials and methods

Materials

A total of 101 family members of ICU patients admitted to our hospital were selected as subjects of the study and the retrospective analysis was conducted on the clinical data of patients. These family members were divided into Group A (GA) (n=50) receiving routine intervention and Group B (GB) (n=51) receiving intervention with multi-mode hand hygiene education. (1) Inclusion criteria: This study included family members who were informed of the study; those aged ≥18 years old; and those with normal mental state and communication ability. Informed consent was obtained from patients and their family members to participate in the study, which was approved by the Medical Ethics Committee of our hospital. (2) Exclusion criteria: This study excluded family members who withdrew midway; those with poor compliance; and those with cognitive and mental disorders.

Methods

GA received routine intervention, *i.e.* posting propaganda pictures about HH knowledge in hospital. The propaganda content included five important aspects of HW and proper steps of the seven-step HW method.

GB received intervention with multi-mode education, with the details shown below. (1) The health education of HH knowledge was strengthened by nurses assigned by this department. At the admission of patients, the medical staff informed the family members of patients of the importance and necessity of HH and demonstrated the proper HW methods and steps, including the correct seven-step HW method and HW time, by issuing health education brochures and playing propaganda videos, *etc*. Then, the places with higher contact frequency were placed with prompt cards to remind the family members of patients to strictly follow the steps for good HH. Before visiting patients, the family members watched propaganda videos about HH knowledge to prepare for HH. (2) The guidance on health behaviors of HH was strengthened and the education of theoretical knowledge was arranged among family members of patients to raise their attention to HH. Then, considering that the family members were not medical professionals, the individual characteristics of each family member were taken as the basis to formulate targeted health care guidelines, thus instruct them to wash their hands properly. The methods of behavior guidance included case based study and on-site presentation, *etc.* (3) The hospital sanitation facilities for HW were improved, such as elbow-touch sinks, induction type sinks, fast speed hand disinfectant and disposal of paper towels at the entrance and exit of ICU and quick hand disinfectant on each headboard, especially isopropanol disinfectant or ethanol disinfectant. Besides, with the advances in medical technology, hand sanitizing gels or disinfectants can be selected for use in departments of critical care medicine or isolation wards.

Observation targets

(1) Mastery degree of HH knowledge among family members of patients: The questionnaire for HH knowledge was formulated for family members of patients according to relevant literature. The mastery degree of HH knowledge was investigated in the two groups before and after intervention, including HH basic knowledge, HH indications, hand disinfection indications and proper HW steps. Each item was evaluated on a 100-point scale. Higher scores indicated a better mastery degree [12].

(2) HHC: The questionnaire for HHC was formulated for family members of patients based on relevant literature and the *WHO Guidelines on Hand Hygiene in Health Care* [13]. Professional NI supervisors investigated the HHC of family members durring the most frequent moments of HH, *i.e.* before touching patients, after touching patients and after exposure to the environ-

Table 1. Comparison of general material between the two groups [n (%)]/($\bar{x}$ ± s)

Material		GA (n=50)	GB (n=51)	t/X^2	*P*
Gender (number of cases)	Male	19 (38.00)	22 (43.14)	0.276	0.599
	Female	31 (62.00)	29 (56.86)		
Age (years)		32.15±2.18	32.12±2.12	0.070	0.944
Educational level (number of cases)					
Primary school or below		18 (36.00)	19 (37.25)	0.258	0.968
Junior high school or above		22 (44.00)	25 (49.02)		
University or above		10 (20.00)	7 (13.73)		

ment of patients, and recorded the results at different time points. Effective HHC (%) = effective numbers of family members performing HH/number of family members who performing HH at a certain moments ×100%.

(3) Satisfaction degree of family members [14]: After intervention, the satisfaction degree of family members was investigated in the two groups by questionnaire. The total score was 100, with satisfaction (≥90 scores), basic satisfaction (60-89 scores) and dissatisfaction (<60 scores). Total satisfaction rate (%) = number of satisfied and basically satisfied family members/total number of family members ×100%.

(4) HW methods of family members: HW methods before and after intervention were compared between the two groups, including liquid soap or quick-dry hand disinfectant.

(5) NIR: The two groups were compared in NIR.

Statistical analysis

SPSS 22.0 was used for data analysis. The measurement data were expressed as mean ± standard deviation (mean ± SD). *t* test was used for data in conformity with normal distribution and Mann-Whitney U test was used for data not in conformity with normal distribution. The enumeration data were expressed as [n (%)] and compared between groups through chi-squared test. *P*<0.05 was considered statistically significant.

Results

Comparison of general data between the two groups

There were 19 male family members in GA and 22 in GB, accounting for 38.00% and 43.14% respectively; and 31 female family members in GA and 29 in GB, accounting for 62.00% and 56.86% respectively. The family members of patients aged 25-52 years in GA, with an average age of (32.15±2.18) years; and those of GB were aged between 24-51 years, with an average age of (32.12±2.12) years. In GA, 18 family members graduated from primary school or below, 22 from junior high school or above and 10 from university or above, accounting for 36.00%, 44.00% and 20.00% respectively. In GB, 19 family members graduated from primary school or below, 25 from junior high school or above and 7 from university or above, accounting for 37.25%, 49.02% and 13.73% respectively. There was no statistical difference in gender, age and educational level between the two groups (*P*>0.05) (**Table 1**).

Comparison on mastery degree of HH knowledge between two groups

Before intervention, the scores for HH basic knowledge, HH indications, hand disinfection indications and proper HW steps were respectively (32.12±1.25), (35.12±5.28), (36.18±3.69) and (38.85±2.59) in GA; which were similar to (32.18±1.19), (32.18±5.22), (36.15±3.62) and (38.82±2.56) in GB, showing no significant difference (*P*>0.05) (**Figure 1**).

After intervention, the scores for HH basic knowledge, HH indications, hand disinfection indications and proper HW steps were respectively (88.12±2.16), (89.16±2.18), (90.12±1.27) and (85.13±3.68) in GB, which were higher than (52.12±1.18), (51.18±1.08), (53.16±1.15) and (51.08±3.17) in GA, showing significant differences (*P*<0.05) (**Figure 2**).

Comparison of HHC between the two groups

Before touching patients, the HHC was 52.94% (27/51) in GB, which was higher than 20.00% (10/50) in GA, showing a significant difference (*P*<0.05). After touching patients, the HHC was 49.02% (25/51) in GB, which was higher than 16.00% (8/50) in GA, showing a significant difference (*P*<0.05). After exposure to the environ-

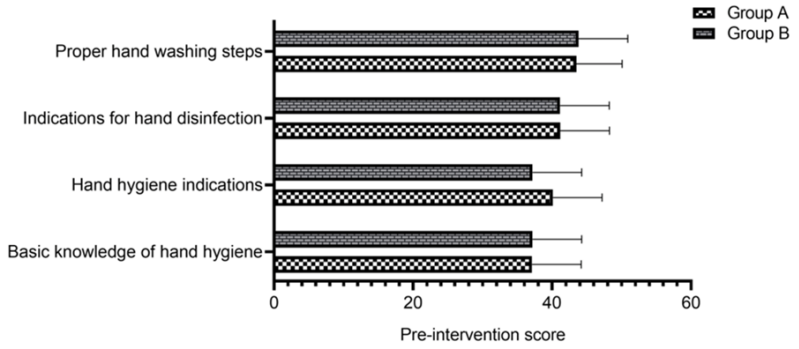

Figure 1. Comparison on mastery degree of HH knowledge between the two groups before intervention. The two groups were compared in scores for HH basic knowledge, HH indications, hand disinfection indications and proper HW steps before intervention ($P>0.05$).

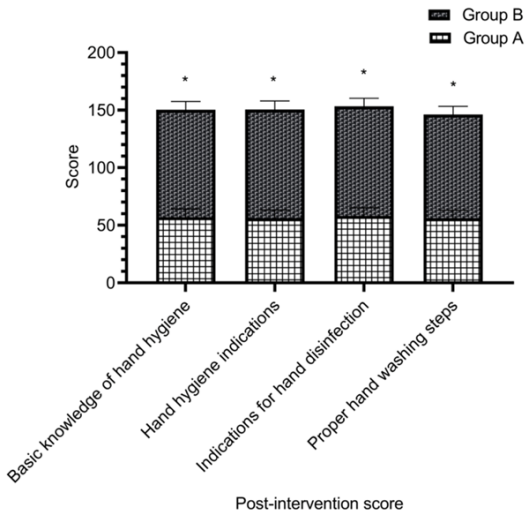

Figure 2. Comparison on mastery degree of HH knowledge between two groups after intervention. The scores for HH basic knowledge, HH indications, hand disinfection indications and proper HW steps in GB were higher than those in GA after intervention ($P<0.05$). *indicates $P<0.05$ in comparison with GA.

ment of patients, the HHC was 32.29% (18/51) in GB, which was higher than 10.00% (5/50) in GA, indicating a significant difference ($P<0.05$) (**Table 2**).

Comparison of satisfaction degree between the two groups

There were 13 satisfied family members, 11 basically satisfied members and 26 dissatisfied family members in GA, with a total satisfaction degree of 48.00%. There were 26 satisfied family members, 22 basically satisfied members and 3 dissatisfied family members in GB, with a total satisfaction degree of 94.12%. The total satisfaction degree of GB was higher than that of GA, indicating a significant difference ($P<0.05$) (**Table 3**).

Comparison of HW methods between two groups

The number of family members using liquid soap accounted for 49.02% in GB, which was higher than 32.00% in GA, showing a significant difference ($P<0.05$). The number of family members using quick-dry hand disinfectant accounted for 50.98% in GB, which was higher than 30.00% in GA, indicating a significant difference ($P<0.05$) (**Table 4**).

Comparison of NIR between two groups

One patient suffered from NI in GB, with the NIR of 1.96%. Eight patients suffered from NI in GA, with the NIR of 16.00%. The NIR of GB was lower than that of GA, indicating a significant difference ($P<0.05$) (**Table 5**).

Discussion

Hands are not only one of the important modes for pathogen transmission, but also one of the crucial reasons for NI [15]. Therefore, good HH is one of the important measures for the prevention and control of NI and also the basis for the life safety of patients and medical staff [16, 17]. Poor HH will cause NI directly or indirectly. Therefore, it is very necessary to strengthen the management of HH [18]. The implementation of HH starts from medical staff and then expands to hospital cleaners, support staff, patients and their family members [19].

ICU patients are in critical condition with low immunity, so they are the susceptible population of NI. Hands, as an important mode of pathogen transmission, can easily cause NI in case of carelessness [20]. For this purpose, the intervention in HH was strengthened among family members of ICU patients in this study to effectively control NI and thus guarantee the life safety of patients and medical staff. Routine intervention was very common in the past, including HH knowledge information posted in the hospital, with contents including the five

Table 2. Comparison of HHC between the two groups [n (%)]

Group	Case	Before touching the patient	After touching the patient	After exposure to the environment of patients
Group A	50	10 (20.00)	8 (16.00)	5 (10.00)
Group B	51	27 (52.94)*	25 (49.02)*	18 (32.29)*
X^2		10.702	12.514	9.185
P		0.001	0.000	0.002

Note: *indicates $P<0.05$ in comparison with GA.

Table 3. Comparison of satisfaction degree between the two groups [n (%)]

Group	Number of cases	Satisfaction	Basic satisfaction	Dissatisfaction	Total satisfaction degree
GA	50	13 (26.00)	11 (22.00)	26 (52.00)	24 (48.00)
GB	51	26 (50.98)	22 (43.14)	3 (5.88)	48 (94.12)*
X^2					26.234
P					0.001

Note: *indicates $P<0.05$ in comparison with GA.

Table 4. Comparison of HW methods between the two groups [n (%)]

Group	Number of cases	Liquid soap	Quick-dry hand disinfectant
GA	50	16 (32.00)	15 (30.00)
GB	51	25 (49.02)*	26 (50.98)*
X^2		6.289	4.608
P		0.002	0.032

Note: *indicates $P<0.05$ in comparison with GA.

Table 5. Comparison of NIR between the two groups [n (%)]

Group	Number of cases	NIR
GA	50	8 (16.00)
GB	51	1 (1.96)*
X^2		6.131
P		0.013

Note: *indicates $P<0.05$ in comparison with GA.

important moments of HW and proper steps of the seven-step HW method. It can serve as a reminder to a certain extent, but the family members of patients achieve good HH completely based on their awareness. Due to limited understanding or education, some family members are unable to fully understand the importance of HH. So the HHC is further improved [21, 22]. Secondly, some ward beds are equipped with quick-dry hand disinfectant, but most family members are unaware of its effect and usage due to the lack of specific guidance. This is also one of the key reasons for low HHC [23]. As shown in this study, the scores for HH basic knowledge, HH indications, hand disinfection indications and proper HW steps in GB were higher than those in GA after intervention; and the HHC of GB was higher than that of GA before touching patients, after touching patients and after exposure to the environment of patients. This implied that the intervention with multi-mode education could improve the HHC and mastery degree of HH knowledge among family members of ICU patients. This can be attributed to the fact that compared with routine intervention, a more comprehensive intervention could be achieved among family members of patients through multi-mode education. The health education about HH knowledge was strengthened among family members to make them fully aware of the importance and necessity of good HH [24, 25]. The family members were informed of the correct seven-step HW method and proper HW time through demonstration. In addition, under the guidance and supervision of nurses, the family members of patients could really participate in the propaganda and education of HH, deepen the understanding of HH knowledge, and improve the HHC [26, 27].

This study also indicated that the total satisfaction degree in GB was higher than that in GA; the proportion of family members of GB who used liquid soap and quick-dry hand disinfectant was higher than that of GA; and the NIR of GB was lower than that of GA ($P<0.05$). This further proved the effectiveness of intervention with multi-mode education, which is conductive to improving the satisfaction degree of family members, promoting the improvement of their HW methods and effectively preventing NI. To explore its mechanism of action, it may be was because strengthening the health education of HH knowledge to the family members of

patients can improve their awareness of infection prevention and control, enhance their attention to HH and promote them to participate in and cooperate with NI prevention and thus consciously abide by the cleanliness system [28]. What's more, the health behavior guidance of HH was conducted among family members of patients based on the education on theoretical HH knowledge. Proper HW methods were demonstrated through case based study and on-site presentation to improve the HW compliance and satisfaction degree of family members, so as to effectively prevent and control NI. The improvement of sanitation facilities, such as induction type sinks and disposal receptacles for paper towels, etc., not only prevented and controlled NI, but also significantly improved the HW compliance of family members.

In conclusion, the intervention with multi-mode education could improve the HHC and mastery degree of HH knowledge among family members of ICU patients, and improve their HW methods, so as to prevent NI effectively.

Although some achievements have been made in this study, there are still some limitations. The low number of subjects included in this study will be increased in future research to make a longer and more comprehensive analysis with a larger sample size.

Disclosure of conflict of interest

None.

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