Hand hygiene compliance among caregivers of inpatients with multidrug-resistant organism infection in China: a cross-sectional study

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Research

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Abstract

Background

Caregivers are an important provider of daily living care for multidrug-resistant organism (MDRO) inpatients in China, they are at risk for contracting and spreading MDRO from frequent interactions with patients. Improving the hand hygiene (HH) compliance of caregivers has important significance in reducing the incidence of infection. However, we have little information about HH compliance among caregivers of MDRO inpatients in most medical institutions. Therefore, we decide to examine HH compliance among caregivers of MDRO inpatients in China.

Methods

Using direct observations, we investigated HH compliance among caregivers of MDRO inpatients between March and August 2019 in a large university-affiliated hospital in China. Using the WHO's Hand Hygiene Observation Tool, we surveyed a total of 440 HH opportunities.

Results

Out of the total participants, 16.2% were elderly. Overall HH compliance was 46.8%. The most frequent moment for HH was "after a touching patient" (69.2%) and the lowest compliance was "before clean/aseptic procedures" (25.6%). Compliance during "visiting" was highest (66.7%), with hands being less frequently washed during "resting" (29.0%).

Conclusions

Overall compliance with HH when caring for MDRO inpatients is less than optimal. Elderly caregivers should be valued by society and the public. These results may be used to identify issues and interventions to address HH practices and achieve a reduction in MDRO infections.

Background

According to the World Health Organization (WHO), adverse events in healthcare-associated infections are a growing problem worldwide, and multidrug-resistant organism (MDRO) infections are among the most frequent events. In China's acute care hospitals, MDRO incidence ranges from 2.43–30.2%[1]. Furthermore, MDROs result in direct annual hospital costs of approximately 61 million U.S. dollars, prolong the length of stay by 14 days per patient, and are responsible for more than 2,000 deaths per year[2, 3]. Therefore, preventing MDRO acquisition remains an important component of infection control. Proper hand hygiene (HH) is the most important approach in the prevention of MDRO and pathogen

transmission[4, 5]. HH can consist of hand washing with water and soap followed by drying the hands with paper towels, or hand disinfection with an alcohol-based hand rub (ABHR). Both healthcare workers (HCWs) and patients alike have made great efforts to improve HH practice, and this has improved globally[6], but the role of caregiver HH has so far been neglected. Evidence suggests that the contaminated hands of caregiver have been identified as a vector for MDRO transmission[7], and that improving the HH compliance of caregivers has important significance in reducing the incidence of infection, hospitalisation rates and mortality[8].

Caregiver can be defined as workers who provide daily living healthcare and assistance to patients, and are supervised by health professionals directly or indirectly. In many developed countries, they belong to the nursing system together with nurse, and have become an essential part of the modern healthcare system[9]. However, due to social, financial, political, and cultural factors, caregivers are not the basic allocation of human resource in public hospitals in China, patient' daily living care is provided by a family member stay in patient wards or a professional caregiver employed by the patient in most hospitals. They are essential to MDRO inpatient care in China due to the persistent shortage of HCWs in public hospitals. In China' public hospitals, the nurse to patient ratio is 1:8.0 during the day on average, the insufficient number of nurses may be not able to offer the timely and adequate healthcare for patients, the use of caregiver can effectively guarantee patient safety and quality of care[10, 11]. Studies have shown that nurses spend only 5.3% of their duty time in direct patient care activities, with caregivers providing most of the care to MDRO hospitalized patients[12, 13, 14]. In some cases, caregivers provide up to 90% of hands-on patient care[15]. Consequently, caregivers are at risk for contracting and spreading hospital-acquired infection from intense, consistent, and frequent interactions with patients in hospital wards[16]. Furthermore, caregivers have no infection control training and are more likely to transmit infections since when their contaminated hands come into contact with the shared equipment in the ward, a bidirectional exchange of microorganisms between hands and the touched object occurs, resulting in a risk of pathogen transmission to nearby patients or other caregivers[17, 18, 19]. However, we have little information about HH among caregivers of MDRO patients in most medical institutions in China, and there are few data regarding the investigation of HH compliance among caregivers of MDRO inpatients in China, with some of them only focusing on the self-protection status of the caregiver.

Accordingly, this study aims to assess HH compliance among caregivers of MDRO inpatients and identify some factors associated with HH practice. The findings of this study can provide a substantial theoretical basis for the formulation of HH training plans for caregivers of MDRO inpatients.

Methods

Study design period and area

This cross-sectional, single-centre study targeted HH compliance among caregivers of MDRO inpatients between March 2019 and August 2019 in a 2,000-bed university-affiliated medical hospital in China. The

study was conducted in clinical wards, excluding those that did not have caregivers such as intensive care unit (ICU), operating rooms and psychiatric wards. In this hospital, patients with MDRO infection shared large wards with patients with non-infection where family members and visitors had access.

Direct observation is regarded as the current gold standard for determining compliance[20]. In this study, HH compliance was defined as the ratio of observed HH behavior to the total number of HH opportunities[21]. HH practices include handwashing, and the use of alcohol-based hand rubs or disinfecting wipes to disinfect hands[22].

Study population and sampling

Between March 2019 and August 2019, all caregivers who met the inclusion criteria were regarded as the study population. The inclusion criteria for participants were being: at least 18 years of age and mainly responsible for taking care of MDRO inpatients for a duration of longer than 1 day. They were excluded if they refused to engage, were simultaneously taking part in any other research, or if they had severe diseases or other factors that could have hindered study participation.

HH monitoring and data collection

A quantitative method of data collection was employed for assessment of HH compliance. The survey instrument was an adapted self-designed scale that was based on the “My five moments for hand hygiene” concept issued by the WHO in 2009. The scale included two parts, with part 1 mainly collecting personal information, including age (which was categorized into four groups: 18–39, 40–49, 50–59, and 60 or above years), sex (female and male), profession [cadre (who was paid by technology or management, include teacher, doctor, lawyer, administer and so on), worker (who was paid by labour, include iron worker, the salesman and so on) or farmer, unemployed, retiree] and department (internal medicine, external medicine, pediatrics, and emergency), and part 2 focusing on the HH compliance rate among caregivers. We evaluated compliance rate across different departments and observation time periods among caregivers. The observation time periods included morning and evening care, dining, treatment, resting and visiting. Within the observational time period, all HH opportunities were classified according to the “Five Moments of Hand Hygiene”, namely before touching a patient, before clean/aseptic procedures, after body fluid exposure risk, after touching a patient, and after touching patient surroundings. As in other studies using this method, we did not distinguish between the use of soap and water and alcohol-based hand cleaners.

Direct observation was conducted to monitor optimal HH practice compliance. Each participant was observed for 20 ± 10 min by four trained observers, who were HCWs selected by the author. They had undergone three days of training conducted by the principal researcher, which consisted of topics including the WHO direct observation method, the purpose of the study, contents of the scale, and data collection skills. The four observers were required to test the feasibility of the self-designed scale for HH compliance rate monitoring for a period of three weeks. From March 1 to August 30, 2019, the observers then officially monitored the caregivers and collected data using the scale. Before the survey, each

participant was informed about the purpose and voluntary nature of the study, data anonymity and security and the professional background of the observers. Data reviews were also completed by the principal researcher after study visits.

Statistical analysis

During the quality control, scales with less than 80% completed were excluded from the analysis. Descriptive statistics for the baseline characteristics of the participants and HH compliance rate were presented. The Chi-squared test was used to explore any possible correlation of the predicted variables with HH compliance between groups. Statistical significantly was considered at $P < 0.05$. All statistical analyses were conducted using the Statistical Package for the Social Sciences (SPSS for windows, version 20.0, SPSS Inc, Chic ago, IL, USA).

Results

Baseline characteristics of participants

A total of 68 participants, of which 60.3% were females, were observed for HH compliance in 11 inpatient departments between March 1 and August 30, 2019. Thirty-two (47.1%) were older than 50 years old. The majority were workers or farmers (44.1%) or retirees (27.9%). The sample was distributed of participants across the inpatient service departments with 80.9% from external medicine, 13.2% from internal medicine, the rest comes from pediatrics and emergency. Demographic characteristics are detailed in Table 1.

Table 1
Demographic characteristics of participants

Characteristics	Number	Percent (%)
Sex		
Male	27	39.7
Female	41	60.3
Age, years		
18–39	13	19.1
40–49	22	33.8
50–59	21	30.9
60 or above	11	16.2
Profession		
Cadre	6	8.8
Worker or farmer	30	44.1
Unemployed	13	19.1
Retiree	19	27.9
Department		
Internal Medicine	9	13.2
External Medicine	55	80.9
Pediatrics	2	2.9
Emergency	2	2.9

Observation

A total of 440 observations were made, during the six-month study period. Overall, the total HH compliance among caregivers was 46.8%. There was some evidence ($p = 0.029$) that compliance varied among different departments. Pediatrics had the highest rate of compliance at 60.0%, followed by internal medicine at 48.8%, and external medicine at 47.0%. Within external medicine and internal medicine, neurology had the highest compliance at 62.3% and 55.6%, respectively, as shown in Table 2.

Table 2
HH compliance of different departments from direct observation

Department	Number of observations	Compliant n (%)	Non-compliant n (%)	*p*-value
Internal Medicine				0.029
Neurology	36	20 (55.6)	16 (44.4)	
Pneumology	12	6 (50.0)	6 (50.0)	
Gastroenterology and Hematology	18	9 (50.0)	9 (50.0)	
General Medicine	16	5 (31.3)	11 (68.8)	
Internal Medicine: Total	82	40 (48.8)	42 (51.2)	
External Medicine				
Neurology	130	81 (62.3)	49 (37.7)	
General Surgery	50	9 (18.0)	41 (82.0)	
Urology	128	58 (45.3)	70 (54.7)	
Orthopedics	22	7 (31.8)	15 (68.2)	
External Medicine: Total	330	155 (47.0)	175 (53.0)	
Pediatrics	10	6 (60.0)	4 (40.0)	
Emergency	18	7 (38.9)	11 (61.1)	
Total	440	216 (46.8)	224 (53.2)	

Abbreviation: HH hand hygiene, *p-value* demonstrates whether the variable had statistically significant correlation with hand hygiene compliance, *p*-significant value < 0.05

Among caregivers, HH compliance varied according to type of contact ($p < 0.001$), varying from 69.2% after touching a patient to 25.6% before clean/aseptic procedures. Of the opportunities observed, touching a patient was the most commonly observed moment. Handwashing was least common before clean/aseptic procedures, as shown in Table 3.

Table 3
Compliance with HH at five key moments

Variable	Number of observations	Compliant n (%)	Non-compliant n (%)	*p*-value
Five key moments				< 0.001
Before touching a patient	130 (29.5)	59 (45.4)	71 (54.6)	
Before clean/aseptic procedures	78 (17.7)	20 (25.6)	58 (74.4)	
After body fluid exposure risk	12 (2.7)	6 (50.0)	6 (50.0)	
After touching a patient	130 (29.5)	90 (69.2)	40 (30.8)	
After touching patient surroundings	90 (20.5)	31 (34.4)	59 (65.6)	
Abbreviation: HH hand hygiene, *p-value* demonstrates whether the variable had statistically significant correlation with hand hygiene compliance, *p*-significant value < 0.05				

Univariate comparison showed statistically significant variations in HH compliance rates during different observational periods. HH practices during “treatment” had the highest compliance rate of 66.7%, followed by “morning and evening care” at 55.6% and “visiting” at 61.3%. HH compliance during “resting” was lowest throughout the study.

Table 4
HH compliance of different observation periods from direct observation

Variable	Number of observations	Compliant n (%)	Non-compliant n (%)	*p*-value
Observation period				< 0.001
Morning and evening care	90	50 (55.6)	40 (44.4)	
Dining	90	38 (42.2)	52 (57.8)	
Treatment	60	40 (66.7)	20 (33.3)	
Resting	138	40 (29.0)	98 (71.0)	
Visiting	62	38 (61.3)	24 (38.7)	
Abbreviation: HH hand hygiene, *p*-value demonstrates whether the variable had statistically significant correlation with hand hygiene compliance, *p*-significant value < 0.05				

Discussion

The main aim of this study was to observe HH compliance among caregivers of MDRO inpatients and identify some factors associated with HH practice. HH was observed between March 1 and August 30, 2019, following the WHO's "My five moments for hand hygiene" concept. Our findings suggest that standardizing HH among caregivers of MDRO inpatients is critical in influencing the effectiveness of infection control. In this study, caregivers who were over 50 years old accounted for 47.1% of the total participants, 16.2% of whom were more than 60 years old, which is a concern. This is because to the best of our knowledge, the physical function of this population is reduced, and their immune system has changed due to aging[23, 24]. Repeated and close exposure to MDRO inpatients increases the risk of infection[16]. This result confirmed that a large proportion of caregivers were not only unable possessed not only the inability to care for patients, but also harbored a high risk of potential infection. Influenced by economic issues and family-oriented concepts, care provided by family members in hospitals accounted for more than 80% of the total participants, few of which had received formal medical education and training, and most of whom were lacking adequate HH and knowledge about disease transmission. This result was in contrast to the mandatory training each HCW received[16, 18].

We found that overall HH compliance rate among caregivers of MDRO inpatients was 46.8%, which is higher than those in caregivers of non-MDRO inpatients[17, 25]. This is often attributed to diagnosed MDRO inpatients and caregivers receiving health education about HH and having access to adequate supplies of equipment like handwashing materials[26, 27]. Optimal levels of adherence were not achieved, however, since HH should be performed in at least 80% of case to interrupt cross transmission in settings with high infection risks[28, 29]. It is suggested that effective measures should be further implemented to improve compliance rate of caregivers. HH compliance also differed between ward type, with the pediatrics ward in the study showing the highest compliancy of 60%, whereby this finding is higher than other studies in the literature[18, 26, 29]. Since we made fewer observations in the pediatrics ward, there is a need for more detailed investigation of pediatrics ward so that this result can be confirmed.

HH compliance was different across the five key moments, with compliance after touching a patient remaining significantly higher than after touching patient surroundings, which was in agreement with the results of other studies[18, 30]. This result may reflect in how participants make judgments about the potential risk of infection resulting from the area they are exposed to. Affected by inherent HH practice, the caregiver's assessment of the need to wash their hands was strongly influenced by the emotional concepts of "dirtiness" and "cleanliness," which drive most of HH behavior and come into play when hands are visibly dirty[31]. When a caregiver touched a patient, hands were generally considered dirty, causing an immediate desire to wash hands. HH compliance remained higher for interactions that occurred after approaching a patient rather than before, a finding in agreement with those of other studies[26, 27, 32]. This instinct to protect oneself, rather than protecting the patient, has been confirmed elsewhere[18, 33]. However, touching patient surroundings were not perceived to pose a threat of infection, and were thus given a relatively low compliance rate. The lowest level of compliance was evident for the moment "before clean/aseptic procedures", a result in line with the observations of the caregivers. Such failure to comply before clean procedures is worrying, as there is a risk of transmitting microbes to the

patient. This in turn may increase the danger of cross-contamination, giving rise to some of more severe types of healthcare-associated infections.

We found that compliance rates for HH practices varied during different observation periods and was relatively high during “treatment”. This result might have been influenced by HCWs who followed aseptic techniques during “treatment,” just like social learning theory suggests that people observe and learn by watching the behavior of other HCWs, resulting in caregivers and patients paying increased attention to HH during this period[34]. We observed a low HH compliance rate during “resting”, which was related to either the patients or caregivers, or both, being extremely relaxed physically and mentally, the awareness of HH being weak, and HH compliance rates being less emphasized by HCWs. Therefore, HCWs should pay more attention to the supervision of HH implementation during “resting.”

The strengths of this study are as follows. Most importantly, this is the first study to evaluate HH compliance among caregivers of MDRO inpatients in China using direct observation and makes an important contribution to determining the factors influencing HH compliance. This knowledge can be used to conduct caregiver HH interventions that would reduce infection. There are also limitations. First, data were collected using handwritten notes which may have influenced the observer’s ability to record and recall all the details of their observations accurately. Second, the potential for the Hawthorne effect exists whereby participants alter their behavior as a result of being part of an experiment or study, as was found in another observational study[18]. Third, the study was conducted in a single hospital. Thus, this research only involved a small number of participants who were not blinded.

Conclusions

Overall, we find that compliance with hand washing when caring for MDRO inpatients is likely less than optimal. This survey identifies that some of caregivers are elderly and present a high risk of potential infection. They might represent an important transmission group for MDRO. HH is performed better after touching a patient and body fluid exposure than at other moments, and compliance is at a higher level during “treatment”. These findings may be useful in identifying issues and interventions to address HH practices and a reduction in MDRO infections.

Abbreviations

WHO: World Health Organization; MDRO: multidrug-resistant organism; HH: hand hygiene; HCW: healthcare worker; ICU: intensive care unit

Declarations

Availability of data and materials

Data are available from the corresponding authors upon reasonable request.

Ethics approval and consent to participate

The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of the first affiliated hospital of Shihezi University (Project identification code: 2019-114-01). Written consent was obtained from each study participants before carrying out the investigation and confidentiality was secured.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no conflict of interest.

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Author' Contributions

WYC and TYL were the principal investigator, conceived the study and its original design. WYH involved in the instrument validation and collected the data. Both authors, WYC and XBC, contributed significantly to the collection of data, the data analysis, the interpretation of data and to draft the manuscript. TYL, WYC and XBC worked iteratively on the creation and revision of the manuscript for important intellectual content. All Authors read and approved the final manuscript.

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