



HHS Public Access

Author manuscript

J Hosp Infect. Author manuscript; available in PMC 2016 August 01.

Published in final edited form as:

J Hosp Infect. 2015 August ; 90(4): 338–343. doi:10.1016/j.jhin.2015.04.006.

Self-reported hand hygiene practices, and feasibility and acceptability of alcohol-based hand rubs among village healthcare workers in Inner Mongolia, China

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Abstract

Background—Good hand hygiene is critical to reduce the risk of healthcare-associated infections. Limited data are available on hand hygiene practices from rural healthcare systems in China.

Aim—To assess the feasibility and acceptability of sanitizing hands with alcohol-based hand rubs (ABHRs) among Chinese village healthcare workers, and to assess their hand hygiene practice.

Methods—Five hundred bottles of ABHR were given to village healthcare workers in Inner Mongolia, China. Standardized questionnaires collected information on their work load, availability, and usage of hand hygiene facilities, and knowledge, attitudes, and practices of hand hygiene.

Findings—In all, 369 (64.2%) participants completed the questionnaire. Although 84.5% of the ABHR recipients believed that receiving the ABHR improved their hand hygiene practice, 78.8% of recipients would pay no more than US\$1.5 out of their own pocket (actual cost US\$4). The majority (77.2%) who provided medical care at patients' homes never carried hand rubs with them outside their clinics. In general, self-reported hand hygiene compliance was suboptimal, and the lowest compliance was 'before touching a patient'. Reported top three complaints with using ABHR were skin irritation, splashing, and unpleasant residual. Village doctors with less experience practised less hand hygiene.

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Conflict of interest statement

None declared.

The findings and conclusions of this report are those of the authors and do not necessarily represent the official position of the CDC.

Conclusion—The overall acceptance of ABHR among the village healthcare workers is high as long as it is provided to them for free/low cost, but their overall hand hygiene practice is suboptimal. Hand hygiene education and training is needed in settings outside of traditional healthcare facilities.

Keywords

Hand hygiene; Healthcare-associated infection; Village doctors

Introduction

Healthcare-associated infections (HCAIs) result in substantial morbidity and mortality worldwide.¹ Standard precautions, including hand hygiene, are minimum infection control practices that apply to all patient care.² Good hand hygiene is critical to reduce the risk of spreading infections. Using alcohol-based hand rubs (ABHRs) in healthcare settings is recommended by the US Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO) because of their activity against a broad spectrum of epidemiologically important pathogens, including multidrug-resistant pathogens (e.g. methicillin-resistant *Staphylococcus aureus* and vancomycin-resistant enterococcus), and various fungi.^{3,4}

Data on hand hygiene practice from China are limited. A tertiary hospital (>500 beds) in Beijing reported 30% hand hygiene compliance similar to WHO (<40%) and CDC (5–90%, with an average of 40%) reported compliance.^{3–5} Two multicentre studies of urban mid-sized hospitals showed 17–62% hand hygiene compliance among healthcare workers (HCWs).^{6,7} A small cross-sectional survey of rural HCWs in Anhui province showed non-compliance with glove use (61%) and hand hygiene (40%).⁸

The Chinese national rural healthcare network is composed of village clinics, township health centres/hospitals, and county health centres/hospitals, serving 50.32% of the 1.37 billion Chinese population.⁹ Village doctors provide primary medical and public health services. In 2010, ~1.1 million registered village doctors provided 1.7 billion occurrences of patient care, accounting for 45.9% of total patient visits in all primary healthcare facilities.¹⁰ Working conditions of Chinese village doctors are usually poor. Many village doctors do not have access to running water and soap.

In this study, we assessed the feasibility and acceptability of using ABHRs to perform hand hygiene among Chinese village doctors and other village HCWs, and assessed their self-reported hand hygiene practice.

Methods

Study population

In November 2011, 670 out of 880 village HCWs participated in a public health programme in two counties of Bayan Nur, Inner Mongolia Autonomous Region, China. Village HCWs were defined as those who received payment for working in a community health centre, village clinic or community centre in rural areas; a village doctor is a village HCW who is

registered and licensed as a doctor. We randomly distributed bottles (250 mL) of ABHR to 500 village HCWs at the time of enrolment into the public health programme. About one year later, we administered a follow-up questionnaire to the village HCWs who participated in the public health programme, regardless of whether they had received a bottle of ABHR.

Questionnaire administration

The standardized questionnaire included questions on demographics, personal characteristics, work load, the availability and use of hand hygiene facilities, and hand hygiene knowledge, attitudes, and practices. The hand hygiene practice questions were based on WHO's 'My five moments for hand hygiene'.⁴ The questionnaire required ~12 min to complete. Trained interviewers called the village HCWs to introduce the study, obtain participants' verbal consent, and administer the questionnaire. Village HCWs who were too busy to complete the telephone interview were recruited in person and completed a self-administered questionnaire. Questionnaire answers were entered into Epidata 3.1 during telephone interview; self-administered questionnaires were double-entered.

Data analysis

The eight knowledge questions were each scored 1 if answered correctly, and 0 if answered incorrectly, and the scores were summed (range: 0–8). Knowledge questions where <60% participants answered correctly were further analysed. Practice questions were scaled as 'never', 'seldom', 'sometimes', 'often', and 'always'. 'Not applicable' was selected for those who reported that they did not perform the procedure and therefore did not encounter that moment; participants who reported no patient contacts were excluded. Hand hygiene practice response was dichotomized by grouping 'always' and 'often', and grouping 'never', 'seldom', and 'sometimes'. Cochran Mantel Haenszel (CMH) tests based on rank scores were employed when comparing two groups on their hand hygiene knowledge and practice; one-way analysis of variance (ANOVA) or Cochran Armitage Trend (CAT) test was used to compare factors with multiple groups. $P < 0.05$ was considered significant. Data analysis was performed using SAS 9.3 (SAS Institute, Cary, NC, USA).

Ethics statement

This project was approved by the US CDC Human Subject Office as a public health programme activity.

Results

Population characteristics and their work load

Accurate contact information was available for 575 (85.8 %) out of 670 eligible village HCWs. Of the 575 village HCWs contacted, 369 (64.2%) participated (Figure 1). Median age was 41 years (range: 19–71), and the median years of work in healthcare was 18 years (range: 1–51). About half (43.6%) were female. The majority (71.8%) had finished education to high school level or below, and a similar proportion (74.0%) had an annual income >20,000 RMB (~US\$3,220), which is comparable to urban/suburban income level on average nationwide (Table I). Participants reported a median of 14 (range: 0–100) patient

contacts per day in the clinic. Many participants (43.4%) also provided medical care at patients' home (median was four home visits per week; range: 1–15 per week).

Availability and usage of hand hygiene facilities

Most participants (90%) reported that their clinics had running water and soap. Less than half (157, 42.5%) had access to ABHR in their clinics; of these, only 53.5% reported 'often/always' using ABHR for hand hygiene. Twenty (5.4%) reported that neither ABHR nor soap and running water were available in their clinics. Among those who also provided medical care at patients' home ($N = 160$), only 25.0% reported that the patients' homes they visited 'always' had soap and running water. The majority (77.2%) who provided medical care at patients' home never carried ABHR outside their clinics.

Of the 264 participants who received a bottle of ABHR from the public health programme in 2011, 57.5% reported 'often/always' using this ABHR for hand hygiene, and 84.5% believed that this bottle of ABHR improved their hand hygiene. Despite this, the majority of recipients reported that they would not be willing to pay the actual cost of the ABHR: 208 recipients (78.8%) were willing to pay no more than US\$1.5 out of their pocket to purchase the bottle of ABHR (actual cost ~US\$4).

Knowledge, attitude, and practice of hand hygiene practice

The percentage of village HCWs answering each of the eight knowledge questions correctly ranged from 12.5% to 90.8% (Table II). Summed knowledge score median was 6 (range: 1–8). No gender difference in knowledge was observed. A one-way ANOVA test showed significant differences in the summed score between those who had worked <10 years and those in 10–19 or 20–29 work-years groups (mean summed scores were 4.9, 5.7, and 5.7 in <10, 10–19, and 20–29 work-years groups, respectively; $P = 0.0018$). The longer they had worked in healthcare, the better they understood soap and water to be more irritant than ABHR (>60% correct among the participants working >10 years compared to 40% among <10 years; CAT test, $P = 0.0534$). Village doctors with a higher work load (i.e. more total patient events per day) tended to score better in knowledge about antimicrobial activity of ABHR (0.0%, 21.7%, 43.9%, 41.5%, and 71.3% answered correctly by those in groups of 0, 1–10, 11–20, 21–30, and >30 patient events per day respectively; CAT test, $P = 0.0004$). When comparing village doctors to other village HCWs, more doctors answered the question of duration required to perform hand hygiene using ABHR correctly (percentage correct: 15.6% among doctors vs 7.8% among other HCWs; CMH test, $P = 0.0269$).

Most participants believed that practising hand hygiene prevents HCAs (93.8%), and most reported that they worked in a clinic where hand hygiene was encouraged (92.4%) (Table III). Thirty (8.1%) participants felt that it was difficult to perform hand hygiene in their clinics; this was especially the case for those without access to hand hygiene facilities (17.4% without vs 7.6% with access to water and soap; 10.1% without vs 5.8% with access to ABHR). A total of 291 (78.9%) participants believed that their hand hygiene practice could be further improved. The top three reported reasons that might prevent them from using ABHR were: (1) they felt ABHR residual was not pleasant; (2) ABHR irritated their skin; and (3) splashing occurred when applying ABHR.

When asked about the WHO 'My five moments for hand hygiene' (moments 1–5, Table IV), the percentage of responders reporting 'always' performing hand hygiene ranged from 18.5% at moment 1 to 48.9% at moment 3.⁴ More women than men reported 'often/always' performing hand hygiene at moments 3 and 5 (Table V). Busier participants (i.e. more patient events per day) tended to have better hand hygiene practice, especially at moments 1 and 2. At moment 2, more non-smokers reported 'often/always' performing hand hygiene than smokers.

Cross-analysis between primary job category and hand hygiene practice showed that 19 out of 226 village doctors selected 'not applicable' for the question 'how often do you perform hand hygiene after body fluid exposure risk'; 12 of them selected 'not applicable' for moment 5; 11 out of 12 laboratory staff selected 'not applicable' for moment 3.

Discussion

This is the first study to explore ABHR as an alternative to water and soap for village HCWs in China. Although almost all participants believed that practising hand hygiene prevented HCAs and reported that they worked in a clinic where hand hygiene was encouraged, hand hygiene compliance was still suboptimal. The main barriers preventing village HCWs from using ABHR were cost and inconvenience of ABHR in the village setting. Participants' complaints about using ABHR included skin irritation, splashing, and unpleasant residual.

Overall the acceptance of ABHR was high but this was conditional on it being provided to village HCWs for free or at a low cost. Whereas >70% of the village HCWs reported higher annual income (20,000 RMB/year) compared to other rural residents (average 8000 RMB/year), cost of ABHR purchased out of pocket remains a major consideration among a rural population. Local production of hand rubs is a feasible alternative to address the cost issue. In 2009, WHO recommended hand rub formulations that could be locally produced with minimal equipment.⁴ We estimated that it would cost less than US\$1 to produce locally the WHO-recommended ethanol formulation (ethanol 80% v/v, glycerol 1.45% v/v, and hydrogen peroxide 0.125% v/v). The WHO formulations can be locally produced at low cost and are well tolerated and accepted by HCWs.¹¹ Convenience and ease of use are also important factors that affect ABHR use. A considerable proportion of village HCWs (43.4% in this study) reported taking care of patients at their home or other setting outside their clinic; the extent to which the ABHR product can be designed to be convenient for HCWs to carry around would be an important consideration. Future studies are needed in China to explore the feasibility and acceptability of in-house-prepared hand rubs, in particular to address aspects such as residual feeling, bottle, and dispenser design.

Misconceptions, attitudes, and misunderstandings about ABHR and hand hygiene also affected compliance. About half of the participants incorrectly thought that ABHR hand hygiene irritated skin more than using water and soap. When we asked about practices during WHO's 'My five moments for hand hygiene', there was evidence suggesting that some village HCWs may have misunderstood the definition of some of these moments.⁴ Some village HCWs reported that performing hand hygiene was 'not applicable' even after exposure to body fluids. The probability of these HCWs not encountering these

corresponding moments is low; their responses suggest that they may not understand the exact meaning of these moments, and therefore may not be aware when such events occur. In particular, 11 out of 12 laboratory staff reported that performing hand hygiene was 'not applicable' after bodily fluid exposure risk. Three out of the five hand hygiene moments involve the term 'patient' and the educational graphics show a patient bed.⁴ Some laboratory staff may have interpreted all of the moments as being patient-related rather than exposure-related (i.e. exposure to body fluids). Laboratory-specific educational materials may be needed to ensure that these types of HCW are included. Training should be provided together with hand hygiene resources to correct misconceptions and misunderstandings.

More training, education, and experience seemed to indicate better hand hygiene compliance and knowledge. Village HCWs who had worked in healthcare for >10 years, and those who were qualified doctors, reported significantly higher compliance with some WHO hand hygiene moments, and increased use and knowledge of ABHR. Also, village HCWs who met >20 patients per day reported better ABHR compliance and acceptability. This could be a function of more experience, but it is also possible that conditions of high patient turnover may prompt HCWs to perform hand hygiene between patients. Appropriate incentivized, targeted training and oversight mechanisms should be in place to encourage and strengthen good practice.

This study is subject to limitations. Participants' self-reported hand hygiene practices may not reflect real behaviour. Self-reported hand hygiene compliance has been shown to be inflated compared to compliance as measured by direct observation in healthcare settings.¹²⁻¹⁴ Selection bias is also possible since about 20% of village HCWs who refused to participate indicated that they were 'too busy'. Non-participating HCWs may have different hand hygiene compliance. Finally, the study population is from two counties of a prefecture in Inner Mongolia, which is one of the five ethnic minority autonomous regions in northern China, and therefore findings from this study may not be representative of all village HCWs in China.

Although village HCWs believe that hand hygiene can reduce healthcare-associated infection (HCAI), they lack training and financial resources to implement HCAI prevention policies in their clinics. HCWs in China are an overlooked worker population, particularly village HCWs. HCWs are not covered under China's labour laws. Moreover, employee medical screening and surveillance for work-related diseases is not mandated for any occupation.¹⁵ There is anxiety over discrimination if an HCW is determined to have a work-related or infectious disease. Thus, prevention should be a priority. China has high healthcare utilization rates with village HCWs providing primary care services for nearly 50% of China's population. HCW medical surveillance, infection control training, and financial resources for village HCWs should be strengthened to help prevent healthcare-associated infections in rural China.

Acknowledgements

The authors would like to thank the HCWs in Bayan Nur, Inner Mongolia, who took part in this study; collaborators in the National Center for Tuberculosis Control and Prevention in China, and Centers for Disease Control and Prevention (CDC) who co-ordinated the public health programme and dispensed the ABHR; student

interns Q. Huang, L. Zhang, and X. Zhu for conducting telephone interviews; and Dr D.R. Lu, a Pfizer Global Fellow, for helping with data analysis.

Funding sources

This publication was supported by the Cooperative Agreement Number 5U2GGH000018 from the CDC.

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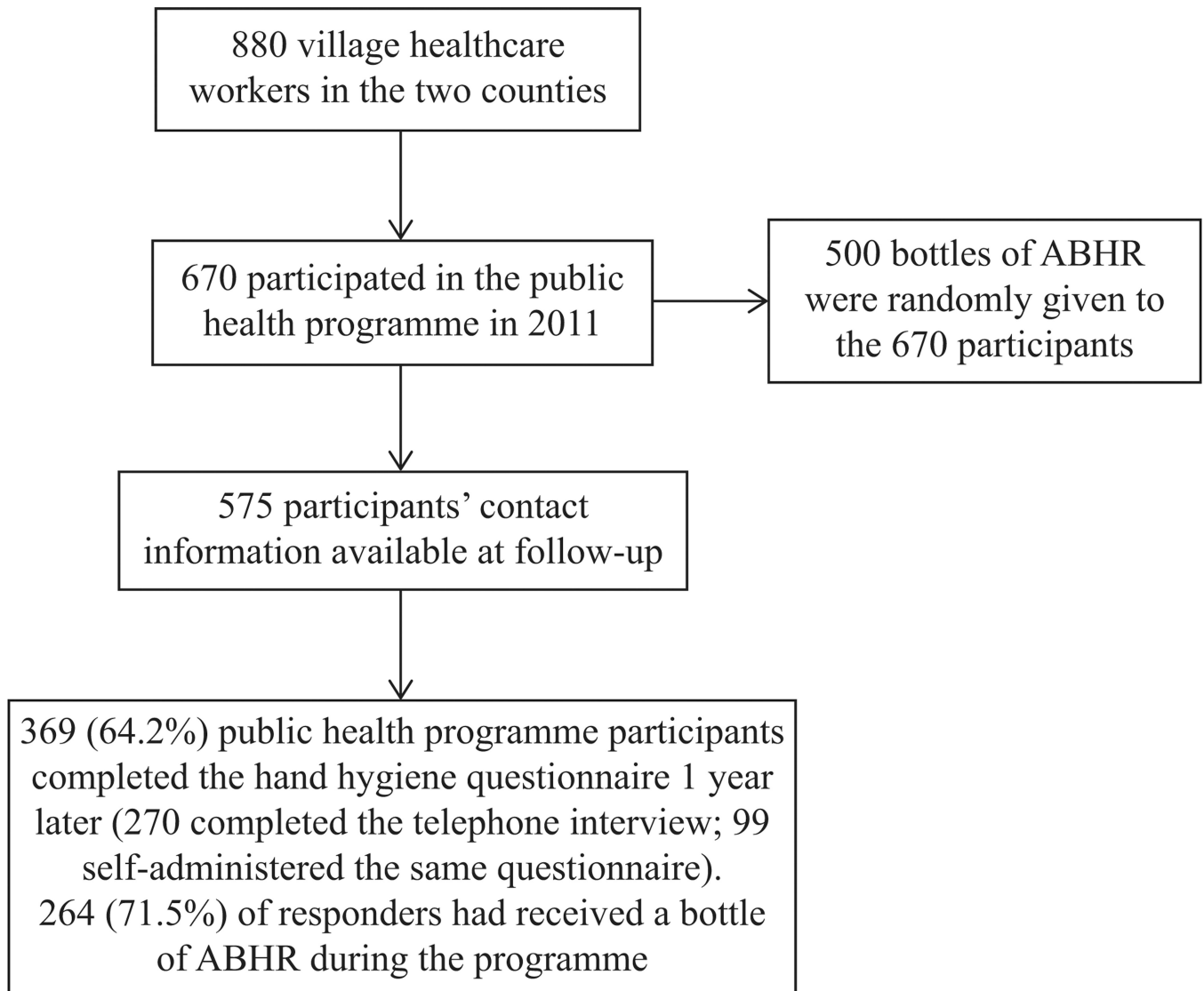


Figure 1.

Flow chart of hand hygiene survey enrolment: 369 (64.2%, 369/575) public health programme participants completed the hand hygiene questionnaire. ABHR, alcohol-based hand rub.

Table ICharacteristics of hand hygiene survey participants, Bayan Nur, Inner Mongolia, China ($N = 369$)

Characteristic	Participants
Age (years)	
19–29	30 (8.1%)
30–39	132 (35.8%)
40–49	148 (40.1%)
50	59 (16.0%)
Female	161 (43.6%)
Education	
Below high school	52 (14.1%)
High school	213 (57.7%)
Some college/technical school	91 (24.7%)
College degree or above	12 (3.3%)
Job category (primary)	
Village doctor	226 (61.2%)
Nurse	56 (15.2%)
Pharmacy	13 (3.5%)
Clerk	6 (1.6%)
Laboratory	12 (3.3%)
Public health	30 (8.1%)
Administration	5 (1.4%)
Other	1 (0.3%)
Years in healthcare	
<10	55 (14.9%)
10–19	145 (39.3%)
20–29	121 (32.8%)
30	48 (13.0%)
Income (RMB/year) ^a	
20,000	93 (25.2%)
>20,000	273 (74.0%)
Current smoking status	
Daily	43 (11.6%)
Occasionally	35 (9.5%)
Not at all	291 (78.9%)
Hepatitis B virus-vaccinated	
Yes	304 (82.4%)
No/don't know	65 (17.6%)

^a20,000 RMB \approx US\$3,220.

Table II

Hand hygiene knowledge

Knowledge (N = 369)	Correct answer
(F: false; T: true)	
When hands are visibly dirty, ABHR alone can be used for hand hygiene (F)	335 (90.8%)
Hand hygiene is not necessary if gloves are used when touching patients (F)	332 (90.0%)
When hands are contaminated with blood, ABHR alone can be used for hand hygiene (F)	332 (90.0%)
Poor adherence to hand hygiene practice is a primary contributor to HCAs (T)	330 (89.4%)
Using ABHR requires less time than handwashing with soap and water (T)	301 (81.6%)
Handwashing with soap and water irritates hands more than using ABHR (T)	214 (58.0%)
ABHR has good antimicrobial activity against bacteria, viruses, fungi, and bacterial spores (F)	137 (37.1%)
Using ABHR requires at least 1min (F)	46 (12.5%)

ABHR, alcohol-based hand rub; HCAI, healthcare-associated infection.

Table III

Hand hygiene attitudes

Attitudes (<i>N</i> = 369)	Agree
Practising hand hygiene prevents HCAs	346 (93.8%)
I work in a clinic where hand hygiene is encouraged	341 (92.4%)
It is difficult for me to perform hand hygiene in this clinic	30 (8.1%)
My hand hygiene practice can be further improved	291 (78.9%)
If ABHR is provided, it is difficult for me to use it because:	
ABHR residual is not pleasant	145 (39.3%)
ABHR irritates my skin	134 (36.3%)
Splashing occurs when applying ABHR	112 (30.4%)
ABHR is not pleasant	44 (11.9%)
ABHR is not as effective as handwashing with soap and water	40 (10.8%)
ABHR is not easy to use	30 (8.1%)
My skin condition prevents me from using ABHR	22 (6.0%)

HCAI, healthcare-associated infection; ABHR, alcohol-based hand rub.

Table IV

Hand hygiene practices

Practices (N = 345)^a	Often/always
Moment 1: Before touching a patient	215 (63.0%)
Moment 2: Before clean/aseptic procedure	253 (76.7%)
Moment 3: After body fluid exposure risk	294 (92.7%)
Moment 4: After touching a patient	286 (83.9%)
Moment 5: After touching patient surroundings	241 (73.9%)

^aParticipants who reported zero patient events were excluded from practice question analysis.

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Table VHand hygiene practice among different groups (only statistically significant results are listed, $N = 345$)

Hand hygiene moment	Characteristics	'Always' or 'often' perform hand hygiene n/N (%)	P -value (CMH test ^a)	
1. Before touching a patient	1–20 patient events/day	157/264 (59.5%)	0.0028	
	>20 patient events/day	58/74 (78.4%)		
2. Before clean/aseptic procedure	1–20 patient events/day	186/258 (72.1%)	<0.0001	
	>20 patient events/day	67/69 (97.1%)		
	Smoker	48/70 (68.6%)		0.0475
	Non-smoker	205/257 (79.8%)		
Other village HCWs	79/114 (69.3%)	0.0108		
	Village doctor		174/213 (81.7%)	
3. After body fluid exposure risk	Male	168/186 (90.3%)	0.0256	
	Female	124/128 (96.9%)		
4. After touching a patient	No significant difference among groups			
5. After touching patient surroundings	Male	135/193 (70.0%)	0.0293	
	Female	105/130 (80.8%)		

^aCMH, Cochran Mantel Haenszel statistics (based on rank scores); HCW, healthcare worker.