Educational sessions may not be enough to improve knowledge about hand hygiene: Assessing the knowledge about hand hygiene of health workers before and after an educational workshop in Sudan [version 1; peer review: 1 approved with reservations]

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Abstract

Background: In an attempt to defeat the high prevalence of health care associated infections, by raising the awareness about hand hygiene, we implemented a quasi-experimental study as part of a quality improvement project to evaluate the efficacy of focused educational workshop on knowledge about hand hygiene among health care workers in Sudan. Methods: Seventy-three participants were recruited from two public hospitals and one private hospital in Khartoum, Sudan in September 2017. The knowledge before and after the educational workshop was assessed for each participant using the World Health Organization hygiene associated infection questionnaire. We analyzed data using SPSS v22 and used McNemar’s test to compare knowledge before and after the workshop.

Results: Around 40% of participants worked in general ward and 85% of them were women. Almost 70% were midwives or nurses. The mean age of participants was 28.4 years. We compared the knowledge of hand hygiene between nurses and doctors before the workshop, and the results showed that nurses had better knowledge in almost all aspects of hand hygiene. When we compared the knowledge before and immediately after the workshop for all participants, we found that there was no significant improvement in almost all aspects of knowledge about hand hygiene (P>0.05).

Conclusion: Comparing the knowledge before and after the workshop, we found no significant improvement in almost all aspects of hand hygiene. Of note, nurses’ knowledge about hand hygiene was consistently higher than doctors. Additional studies are needed to identify the optimal design of educational sessions.
Keywords
Educational sessions, hand hygiene, infection control, nurses and doctors, workshop, health-care associated infections

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Introduction

Health-care associated infections (HAIs) are regarded as a major health problem endangering hospital-admitted patients in particular. In developed countries, 5–15% of hospitalized patients were at risk to acquire infections, especially those admitted to intensive care units; HAIs in Europe and USA were 4.6–9.3% and 4.5%, respectively. In contrast, the prevalence in some developing countries is as high as (19.1–14.8%). Health care associated infections (HAIs) results in prolonged hospital stay as it can add 18–24 days to the length of hospital stay and may result in more deaths. For instance, in Europe HAIs are responsible for 50,000–135,000 deaths out of 5,000,000 cases of HAIs, annually. Moreover, it contributes to €13–24 billion of added healthcare costs. All these facts highlight the morbidity and mortality from HAI.

Hand hygiene is a general term, referring to any action of hand cleansing using water and detergent and/or the use of alcohol-based hand sanitizers for the removal of transient microorganisms from hands. It is widely accepted that improved hand hygiene compliance contributes to the prevention of HAIs. This consensus has been supported by several studies. For example, a hand hygiene culture changing program was conducted by Grayson et al. (2008) over two years in six Australian hospitals. This study demonstrated that the incidence of Methicillin-resistant-Staphylococcus aureus (MRSA) bacteraemia and the number of MRSA-positive clinical isolates were significantly reduced at the end of the study period. Hand hygiene is found to be the single most effective measure to guard against healthcare-associated pathogens.

There are various educational methods adopted to improve knowledge about hand hygiene as a key element to control HAI. For instance knowledge about hand hygiene could be included in the curriculum for medical and nursing students. Another way is by taking advantage and to introduce the appropriate knowledge about hand hygiene to health care professionals gathered at conferences and professional meetings. In addition educational workshops and sessions about hand hygiene among hospital staff should be arranged from time to time. Lastly, educational hand-outs and posters about hand hygiene should be available in the working environments of health workers.

Implementation of different approaches regarding boosting hand hygiene knowledge shows a wide range of variability in the efficacy between educational and interventional approaches. Hand hygiene compliance improvement has been shown to be greater using educational approaches than practical interventions. For instance, after delivery of an educational hand-out and poster campaign the rate of study participant complying with hand-washing guidelines was 83%. In addition, after two years of commencement of The Australian National Hand Hygiene Initiative in 2009, hand hygiene compliance increased from 43.6% to 67.8%. Thus, giving educational lectures and workshops about hand hygiene practice appeared to have a noticeable impact on the knowledge and practice of hand hygiene among health care workers in these settings.

This study aimed to evaluate the knowledge about hand hygiene among health care workers in Sudan. In addition, we assessed the role of an educational session as a recommended tool to improve the knowledge about hand hygiene among these same health care workers.

Methods

Ethical approval

Ethical approval was obtained from Soba University Teaching Hospital and Soba Centre for Audit and Research (approval no S248). All participants were fully informed about the workshop and the study prior to participation. Written consent was obtained from all participants for participation.

Study design

We implemented a quasi-experimental study as part of a quality improvement project designed and implemented by Soba University Hospital, University of Khartoum, to evaluate the efficacy of focused educational workshop on knowledge about hand hygiene among health care workers.

All health care providers in departments of emergency and internal medicine (73 participants) were recruited from two public hospitals (Soba Teaching Hospital and Saad Abuelela Hospital) and one private hospital (Fedail Hospital) in Khartoum, Sudan, in September 2017. Participants were recruited by the departments of infection control in their hospitals to enrol in this quality improvement project. Their knowledge before and after the educational workshop (see below) was assessed using the World Health Organization (WHO) HAI questionnaire.

WHO hygiene associated infection questionnaire

The questionnaire is composed of 20 single best answer questions. The first seven questions assess demographic variables; hospital name, ward, age, gender, profession, and previous hand hygiene training. The remaining questions assess different aspects of knowledge about hand hygiene.

Educational workshop

The educational workshop was composed of lectures and practical sessions delivered over eight working hours (see Supplementary File 1). The workshop was delivered by a qualified instructor who has completed a PhD on infection control. The knowledge about hand hygiene measures was delivered mainly through lectures, while the practical sessions focused on training about proper hand washing technique according to the WHO.

Statistical analysis

We analyzed data using SPSS v22. We used McNemar’s test to compare knowledge of participants before and after the educational workshop.

Results

Descriptive statistics

Around 40% of participants worked in general ward and 85.9% of them were women. Almost 70% were midwives or nurses. The mean age of participants was 28.4 years.

Table 1 shows the demographic characteristics of the participants.
Multivariate analysis

We compared the knowledge of hand hygiene between nurses and doctors, and the results showed that nurses had a better knowledge in almost all aspects of hand hygiene. When we compared the knowledge immediately after the workshop we found out that there was no significant improvement in almost all aspects of knowledge about hand hygiene (P>0.05). Table 2 illustrates these findings in more details. The text in bold are the correct answers. P values in bold are the significant probabilities.

Dataset 1. Participant responses to the WHO handwashing questionnaire data before and after the educational session

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Table 1. Demographic characteristics of the participants.

|                              | %     |
|------------------------------|-------|
| Ward worked in               |       |
| General                      | 40.0  |
| Private                      | 51.4  |
| Not applicable               | 8.6   |
| Gender                       |       |
| Female                       | 85.9  |
| Male                         | 14.1  |
| Profession                   |       |
| Nurse/midwife                | 69.8  |
| Doctor/resident              | 30.2  |
| Received training in hand    |       |
| hygiene previously           |       |
| Yes                          | 33.8  |
| No                           | 66.2  |

Table 2. Results of health-care associated infections questionnaire before and after an education workshop on hand hygiene.

(A) Hand disinfection topics; (B) hand rubbing, hand washing, and accessories topics. We used McNemar’s test to compare knowledge of participants before and after the educational workshop. P values <0.05 indicates significant difference.

| Table 2A                                              | Before % | After % | Difference % | P value | Nurse/midwife | Doctors |
|-------------------------------------------------------|----------|---------|--------------|---------|---------------|---------|
| Use alcohol handrub                                    |          |         |              |         |               |         |
| Yes                                                   | 76.9     | 74.3    | -2.60        | 0.68    | 81.4          | 57.9    |
| No                                                    | 23.1     | 25.7    | 2.60         |         | 18.6          | 42.1    |
| Germ transmission between patients                     |          |         |              |         |               |         |
| Healthcare workers’ hands when not clean               | 75.8     | 77.5    | 1.70         | 0.31    | 75.0          | 73.7    |
| Air circulating in the hospital                        | 6.1      | 1.4     | -4.70        | 2.3     | 0             | 0       |
| Patients’ exposure to colonized surfaces               | 15.2     | 12.7    | -2.50        | 13.6    | 15.8          |         |
| Sharing non-invasive objects between patients          | 3.0      | 8.5     | 5.50         | 9.1     | 10.5          |         |
| Source of germs                                        |          |         |              |         |               |         |
| The hospital’s water system                            | 6.1      | 5.7     | -0.40        | 0.21    | 4.7           | 10.5    |
| The hospital air                                       | 1.5      | 4.3     | 2.80         | 4.7     | 5.3           |         |
| Germs already present on or within the patient         | 10.6     | 18.6    | 8.00         | 20.9    | 21.1          |         |
| The hospital environment (surface)                     | 81.8     | 71.4    | -10.40       | 69.8    | 63.2          |         |
| Hand disinfection before touching a patient            |          |         |              |         |               |         |
| Yes                                                    | 95.5     | 92.5    | -3.00        | 0.37    | 93.0          | 88.9    |
| No                                                     | 4.5      | 7.5     | 3.00         | 7.0     | 11.1          |         |
| Hand disinfection immediately after a risk of body fluid exposure |          |         |              |         |               |         |
| Yes                                                    | 71.2     | 65.0    | -6.20        | 0.3     | 66.7          | 57.1    |
| No                                                     | 28.8     | 35.0    | 6.20         | 33.3    | 42.9          |         |
| Hand disinfection after exposure to the immediate surroundings of a patient |          |         |              |         |               |         |
| Yes                                                    | 75.8     | 64.4    | -11.40       | 0.17    | 64.1          | 71.4    |
| No                                                     | 24.2     | 35.6    | 11.40        | 35.9    | 28.6          |         |
| Hand disinfection immediately before a clean aseptic procedure |          |         |              |         |               |         |
| Yes                                                    | 81.8     | 74.6    | -7.20        | 0.3     | 74.4          | 78.6    |
| No                                                     | 18.2     | 25.4    | 7.20         | 25.6    | 21.4          |         |
| Hand disinfection after touching a patient             |          |         |              |         |               |         |
| Yes                                                    | 86.4     | 81.0    | -5.40        | 0.581   | 92.9          | 57.1    |
| No                                                     | 13.6     | 19.0    | 5.40         | 7.1     | 42.9          |         |
### Table 2A

|                                       | Before % | After % | Difference % | P value | Nurse/midwife % | Doctors % |
|---------------------------------------|----------|---------|---------------|---------|-----------------|-----------|
| Hand disinfection immediately after a risk of body fluid exposure | Yes      | 83.1    | 80.3          | -2.80   | 0.15            | 82.1      |
|                                       | No       | 16.9    | 19.7          | 2.80    | 17.9            | 80.0      |
| Hand disinfection immediately before a clean aseptic procedure | Yes      | 67.7    | 56.7          | -11.00  | 0.02            | 50.0      |
|                                       | No       | 32.3    | 43.3          | 11.00   | 50.0            | 0.0       |
| Hand disinfection after exposure to the immediate surroundings of a patient | Yes      | 80.0    | 79.7          | -0.30   | 1.0             | 80.5      |
|                                       | No       | 20.0    | 20.3          | 0.30    | 19.5            | 20.0      |
| Hand rubbing is more rapid for hand cleaning than hand washing | True     | 75.8    | 60.3          | -15.50  | 0.02            | 64.9      |
|                                       | False    | 24.2    | 39.7          | 15.50   | 35.1            | 50.0      |
| Hand rubbing causes skin dryness more than hand washing | True     | 63.6    | 54.1          | -9.50   | 0.15            | 57.9      |
|                                       | False    | 36.4    | 45.9          | 9.50    | 42.1            | 50.0      |
| Hand rubbing is more effective against germs than handwashing | True     | 47.0    | 58.6          | 11.60   | 0.38            | 67.6      |
|                                       | False    | 53.0    | 41.0          | -11.60  | 32.4            | 42.9      |
| Handwashing and hand rubbing are recommended to be performed in sequence | True     | 75.8    | 67.8          | -8.00   | 0.82            | 68.4      |
|                                       | False    | 24.2    | 32.2          | 8.00    | 31.6            | 35.7      |

### Table 2B

| Type required before palpation of the abdomen | Before % | After % | Difference % | P value | Nurse/midwife % | Doctors % |
|-----------------------------------------------|----------|---------|---------------|---------|-----------------|-----------|
| Rubbing                                       | 50.0     | 43.9    | -6.10         | 0.26    | 43.9            | 47.0      |
| Washing                                       | 43.9     | 53.0    | 9.10          | 0.0     | 53.7            | 47.1      |
| None                                          | 6.1      | 0.0     | -6.10         | 0.0     | 0.0             | 0.0       |
| Type required before giving an injection      | Rubbing  | 34.8    | 34.4          | -0.40   | 0.56            | 43.6      |
|                                               | Washing  | 60.6    | 62.5          | 1.90    | 53.8            | 76.5      |
|                                               | None     | 3.6     | 3.9           | 0.30    | 2.6             | 5.9       |
| Type required after emptying a bedpan         | Rubbing  | 24.2    | 38.8          | 14.60   | 0.025           | 41.5      |
|                                               | Washing  | 71.2    | 59.7          | -11.50  | 58.5            | 61.1      |
|                                               | None     | 4.5     | 1.5           | -3.00   | 0.0             | 5.6       |
| Type required after removing examination gloves | Rubbing | 21.2    | 40.0          | 18.80   | 0.12            | 39.0      |
|                                               | Washing  | 75.8    | 60.0          | -15.80  | 61.0            | 75.0      |
|                                               | None     | 3.0     | 0.0           | -3.00   | 0.0             | 0.0       |
| Type required after making a patient bed      | Rubbing  | 45.5    | 37.9          | -7.60   | 0.33            | 46.3      |
|                                               | Washing  | 48.5    | 62.1          | 13.60   | 53.7            | 82.4      |
|                                               | None     | 6.1     | 0.0           | -6.10   | 0.0             | 0.0       |
| Type required after visible exposure to blood | Rubbing | 36.4    | 44.8          | 8.40    | 0.096           | 53.7      |
|                                               | Washing  | 59.1    | 55.2          | -3.90   | 46.3            | 66.7      |
|                                               | None     | 4.5     | 0.0           | -4.50   | 0.0             | 0.0       |

Avoid wearing jewellery:
- **Yes**: Before % 97.0, After % 82.5, Difference % -14.50, P value 0.012, Nurse/midwife % 75.0, Doctors % 100.0
- **No**: Before % 3.0, After % 17.5, Difference % 14.50, P value 0.25, Nurse/midwife % 25.0, Doctors % 0.0

Avoid contacting damaged skin:
- **Yes**: Before % 87.9, After % 84.4, Difference % -3.50, P value 0.267, Nurse/midwife % 82.5, Doctors % 88.2
- **No**: Before % 12.1, After % 15.6, Difference % 3.50, P value 0.15, Nurse/midwife % 17.5, Doctors % 11.0

Avoid having artificial fingernails:
- **Yes**: Before % 93.9, After % 83.1, Difference % -10.80, P value 0.065, Nurse/midwife % 77.5, Doctors % 88.2
- **No**: Before % 6.1, After % 16.9, Difference % 10.80, P value 0.02, Nurse/midwife % 22.5, Doctors % 11.8

Avoid regular use of hand cream:
- **Yes**: Before % 53.0, After % 33.9, Difference % -19.10, P value 0.017, Nurse/midwife % 30.8, Doctors % 43.8
- **No**: Before % 47.0, After % 66.1, Difference % 19.10, P value 0.12, Nurse/midwife % 69.2, Doctors % 56.3
Discussion

Our study revealed that knowledge about hand hygiene and HAI is better among nurses and midwives in comparison to doctors. Some studies concluded the same results. In a study conducted by Ameer et al., nurses were found to have a better hand hygiene compliance rate (43.08%) compared to doctors (31.25%). Another study by Han et al. revealed that nurses’ knowledge score was significantly higher than doctors\(^3\). On the other hand, other studies showed opposite results. For example, Ekwere et al. conducted a study in a tertiary hospital in Southwest Nigeria and concluded that doctors had no significant better knowledge of hand washing than nurses\(^3\).

Overall there was no significant improvement in knowledge about hand hygiene and HAI after the educational workshop. Similarly, in a study done by Lee et al. there was no significant improvement in hand hygiene compliance or alcohol-based hand rub consumption following education\(^8\). In contrast, a case–control study that evaluated the effect of using educational activities and posters on hand hygiene compliance revealed a significant improvement in hand hygiene compliance compared to control hospitals.\(^8\) Similarly, Abdraboh et al. (2012) concluded that performing educational sessions was among the most important activities to attain better health care worker hand hygiene compliance\(^8\).

But why didn’t we improve hand washing knowledge after administration of the workshop? This could be attributed to deficiency in contents, environment, and teaching methods. Regarding teaching methods; the lecture duration was 3 hours which may not only make some of the candidates fail to follow the instructor but may also make it difficult for the instructor to stay focused. Moreover, the large number of participants (n=73) might make it difficult for instructors to deliver effective education. The present result might be of help to alert instructors to review their teaching methods and these results emphasize the importance of feedback in improving learning methods. Cook in the article ‘Twelve tips for evaluating educational programs’ strongly advises that instructors should seek evaluation from stakeholders such as students and administrators. In addition, designing and validating an evaluation tool to evaluate the quality and effectiveness of educational programs would be of great help because it enables reliable evaluation and monitoring of the progress of the program\(^8\).

Conclusions

In conclusion, to meet the objectives of educational workshops we recommend that contents should be revised and cover all the hand hygiene guidelines that are stated by WHO. In addition, taking into consideration the language factor in delivering the information in understandable language to all participants. Lastly, the number of participants as well as the duration of the workshop should be reduced to a level that facilitates proper information delivery.

Data availability

Dataset 1: Participant responses to the WHO handwashing questionnaire data before and after the educational session. DOI 10.5256/f1000research.13029.d19968\(^8\)

Competing interests

No competing interests were disclosed.

Grant information

The author(s) declared that there were no grants involved in supporting this study.

Supplementary material

Supplementary File 1: Educational workshop content.

Click here to access the data.

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Sile A. Creedon
University College Cork, Cork, Ireland

Thank you for the opportunity to review this paper. I hope my comments are useful to you.

Introduction: Can you check the accuracy of the figures related to HCAI in developing countries please.

Intervention: The design of the educational intervention was face to face workshop. Given that this was the intervention, it needs to be described in much more detail. What other types of educational interventions were considered and why was this type chosen? Can you please add a referenced section to the introduction.

Design: The study design was quasi experimental. The authors need to explain more fully how the study met the criteria for quasi experimentation. Could it be more accurately described as an interventional study?

Sample: The participants were chosen by the infection prevention staff in each hospital. How did this occur? it needs a better explanation and the threat of bias also needs to be discussed. It seems to me that this may lead to targeting only staff who were ‘known to’ or perhaps were friendly with the infection prevention team.

Discussion: The discussion section needs to be developed more fully. In the opening paragraph, the authors state that there was no improvement in either knowledge or prevalence of HCAI’s after the workshop. Did the study measure prevalence of HCAI’s before and after the work shop? If not, then you might review making this statement.

There is an attempt made to elucidate why the intervention did not work but it needs more than this. It would benefit from discussion of the design. Is there value in assessing knowledge immediately post intervention? Did you consider a longitudinal design?

Overall, there is some merit in this paper but it needs further development.
Is the work clearly and accurately presented and does it cite the current literature?  
Partly

Is the study design appropriate and is the work technically sound?  
Partly

Are sufficient details of methods and analysis provided to allow replication by others?  
No

If applicable, is the statistical analysis and its interpretation appropriate?  
Partly

Are all the source data underlying the results available to ensure full reproducibility?  
Yes

Are the conclusions drawn adequately supported by the results?  
Partly

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** My area of research is in infection prevention in acute care settings

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

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