Knowledge and perceptions on hand hygiene among nurses in the Asir region, Kingdom of Saudi Arabia

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Introduction: Hand hygiene plays a significant role in controlling the spread of health-care infections. As nurses are in direct contact with patients for a significant proportion of the time, they can be a vehicle for cross-contamination within the hospital and as such, good hand hygiene protocols can ensure the safety of patients in a variety of settings. The aim of this study is to assess the knowledge and perception of hand hygiene among nurses in Saudi Arabian hospitals. Materials and Methods: A cross-sectional study was conducted between November 2017 and May 2018 to determine the nurses' knowledge of hand hygiene. Nurses from six hospitals in the Asir region of Saudi Arabia were recruited using multi-stage cluster sampling. The World Health Organization Knowledge and Perception Questionnaire for Health-care Workers were administered to collect the information. Results: During the recruitment phase, 300 nurses were contacted and 243 agreed to participate in the study, indicating a response rate of 81%. About 51.85% of the nurses demonstrated a good level of knowledge about hand hygiene and 50.2% of nurses had a negative perception of hand hygiene. The results have shown a positive association between knowledge, nurses' perceptions, and years of experience, and their participation on a training course about hand washing. Conclusion: Educational interventions should be undertaken to enhance the knowledge of nurses/health-care providers and to promote positive perceptions of hand hygiene among nurses.

Key words: Hand hygiene, knowledge, nurses, perception, Saudi Arabia
The WHO has initiated an evidence-based approach in 2009 for hand hygiene entitled “My 5 Moments,” which advocates the need for hand washing: before touching a patient, before performing aseptic and cleaning procedures, after exposure to body fluids, after touching a patient, and after touching a patient’s surroundings.[11] This particular idea has already been adopted and verified by the Kingdom of Saudi Arabia and several other countries including Mali and Italy worldwide.[11-13]

Previously published research found that this specific initiative has increased hand hygiene compliance rate from 51% to 67%.[3] A number of studies have been conducted in this area in the Kingdom of Saudi Arabia.[3,4] Proper training, awareness raising, and behavioral modification strategies were found to improve hand hygiene knowledge and practices among nurses in Iran.[4] This finding has been replicated in several other studies, which reported that better knowledge and understanding of hand hygiene among health-care professionals led to reductions in the overall number of cases of hospital acquired infections.[5]

However, no studies that focused on the perception of hand hygiene among nursing professionals in hospitals in the Asir region of Saudi Arabia. Therefore, the current study aims to address this gap in the literature, by assessing the knowledge and perception of hand hygiene among nurses in the hospitals in the Asir region, with the specific objective of determining the association between their stance on hand washing and the general demographic characteristics of these health-care professionals.

MATERIALS AND METHODS

Study design
A cross-sectional study was conducted to assess the level of knowledge among nurses regarding hand hygiene and their perception of hand washing in hospital protocol.

Study setting and participants
This study was conducted in selected hospitals in the Asir region of the Kingdom of Saudi Arabia from November 2017 to May 2018. A total of six hospitals were included in the study, with selection based on the hospital infrastructure and proportion of nurses. A total of 300 nurses were approached and 243 agreed to participate in the study.

Data collection
The sample size was calculated using the Raosoft sample size calculator. The margin of error was 5%, with a confidence interval of 95% and a response distribution of 68.1%. Utilizing the parameters set out in the previous literature[16] and a total population size of 850, the minimum sample size was 240. This study used multi-stage cluster sampling to select participants. First, we selected the cluster, then we selected the hospitals and finally, nurses were recruited from the selected hospitals to participate in the study. Official permission was obtained from the Ministry of Health-Asir region to conduct this study in the selected centers, which comprised five specialty hospitals and one central hospital in the Asir region. The nurses from the selected hospitals were enrolled in the study by using the simple random sampling technique, giving the nurses in the selected hospitals the same probability of selection.

Test-retest reliability was conducted using Cronbach’s Alpha reliability test for internal consistency, which equaled 0.70. Before the commencement of the study, the reliability test was applied to a pilot of 25 nurses, selected using convenience sampling and representing approximately 10% of the final sample size. SPSS (Version 16.0, SPSS Inc. Chicago, IL, USA) was used to analyze the pilot study data to test the validity and reliability of the questionnaire.

Inclusion criteria
Nurses who have direct contact with patients were included in the study.

Data collection tools
A self-administered, modified questionnaire was used to collect the data. The survey tool for the collection of participants' general demographic information was developed after an extensive literature search of various databases that includes PubMed, Science direct, and Web of science.

Questions pertaining to knowledge on hand hygiene were adapted from the WHO “Knowledge Questionnaire for Health-care Workers.”[17]

Scoring system for knowledge
There are 18 questions that score (1 and 0) for right and wrong answers, respectively. The total score ranged from 0 to 18. The score was then divided into three categories: “insufficient knowledge” (<9), “fair knowledge” (9–13), and “good knowledge” (14–18).

The questions investigating perceptions on hand hygiene were developed utilizing the WHO “Perception Survey for Health-Care Workers.”[18]

Scoring system for perception
This section contains 6 questions; however, only four were considered for the calculation of the perception score, because they mainly determine the perception of nurses on hand hygiene. The total score ranged from 0 to 4, which was divided into three categories: “negative perception” (<2), “neutral” (2), and “positive perception” (3–4).

Data analysis
The analysis was conducted using SPSS (Version 16.0, SPSS Inc. Chicago, IL, USA). Frequency tables were utilized to describe
the knowledge and perception of hand hygiene among nurses. Qualitative data were summarized as percentages and then nonparametric tests of significance (Chi-square test) were applied to nominal scales. The Pearson correlation between the two variables was applied. The \( P \) value was two-tailed and statistical significance was set at \(< 0.05\).

**Ethical permission**

Ethical permission was obtained from the Research Ethics Committee, at the College of Medicine, King Khalid University, Abha, in the Asir region of the Kingdom of Saudi Arabia. Participation in this research was completely voluntary and every effort was taken to ensure that the collected information was treated in a way that protects the privacy of the study participants.

**RESULTS**

A total of 300 nurses from five specialty hospitals and one central hospital were approached to participate in this study. The response rate was 81%, meaning that 243 nurses gave consent to take part in the investigation. The nurses in this study operate in different departments of the participating hospitals (five specialty centers and one central hospital) and their general demographic characteristics can be seen in Table 1. The gender distribution was fairly even, as 51.9% of the nurses are males. In terms of age, 50.6% of the nurses are between 25 and 34 years and only 5.3% of the nurses belong to the 20–24 age group. About 38.3% of the nurses have 6–10 years of clinical experience. Finally, a significant majority (77.8%) of the nurses in this study have attended the training course on hand washing.

Table 2 presents the responses given by the nurses to the knowledge and perception questionnaire. 77.8% of nurses were aware of the main route of cross-transmission for potentially harmful infections between patients in a health-care facility. 89.3%–93.8% of nurses in the study were conscious of the fact that hand hygiene actions can prevent the transmission of infections to patients. 66.3% of nurses believed that hand rubbing is a faster and more effective method for hand cleansing than simply leaving the hand under running water (hand washing). About 47.7% of the nurses agreed that hand rubbing causes more skin dryness than hand washing. 53.5% of nurses disagreed with the statement that hand rubbing is more effective against germs than hand washing. 81.1% of the nurses recommended that hand washing and hand rubbing should be performed in sequence. 63% of nurses recommended hand rubbing before giving an injection.

The nurses in this study strongly advocated for hands to be washed after emptying a bed pan, after removing examination gloves, after making a patient’s bed and after visible exposure to blood. Most of the nurses in the study also recommended that health professionals avoid wearing jewelry, using artificial finger nails, cover damaged skin, and that they should regularly use hand cream, given that this practice is associated with an increased likelihood of colonization of hands with harmful infections. 31.3% of the nurses reported that an average of 0%–25% of hospitalized patients will develop a health-care-associated infection. 45.7% of the nurses stated that health-care-associated infections tend to have a very high impact on a patient’s clinical outcome. 55.1% of the nurses noted the effectiveness of proper hand hygiene in preventing health-care-associated infections.

About 45.7% of the nurses stated that hand hygiene has been given a very high priority in comparison to other patient safety issues within their organizations. 68.3% reported that they endeavor to maintain good standards of hand hygiene while caring for their patients. An overview of the distribution of nurses in terms of their knowledge and perception of hand hygiene is presented in Table 3. In total, 51.85% of nurses were found to have “good knowledge” about hand hygiene, whereas only 3.71% of nurses have “insufficient knowledge.” 50.21% of the nurses in this study have negative perceptions of hand hygiene.

Table 4 shows the association between the knowledge and perception of nurses regarding hand hygiene and the aforementioned general demographic variables. A positive significant association can be seen between the knowledge

| Questions asked | Answer category | Total, \( n (\% ) \) |
|-----------------|-----------------|------------------|
| Q1. Gender      | a) Male         | 126 (51.9)       |
|                 | b) Female       | 117 (48.1)       |
| Q2. Age         | a) 20-24        | 13 (5.3)         |
|                 | b) 25-34        | 123 (50.6)       |
|                 | c) 35-44        | 81 (33.3)        |
|                 | d) 45-54        | 26 (10.7)        |
| Q3. Department  | a) Internal medicine | 23 (9.5)       |
|                 | b) Surgery      | 32 (13.2)        |
|                 | c) Intensive care unit | 31 (12.8)       |
|                 | d) Mixed medical/surgical | 36 (14.8)       |
|                 | e) Emergency unit | 39 (16)         |
|                 | f) Obstetrics   | 13 (5.3)         |
|                 | g) Paediatrics  | 12 (4.9)         |
|                 | h) Long-term/rehabilitation | 28 (11.5)    |
|                 | i) Outpatient clinic | 29 (11.9)      |
| Q4. Years of experience | a) 1-5       | 56 (23)          |
|                 | b) 6-10         | 93 (38.3)        |
|                 | c) 11-15        | 58 (23.9)        |
|                 | d) >15          | 36 (14.8)        |
| Q5. Did you attend a training course about hand washing? | a) Yes       | 189 (77.8)       |
|                 | b) No           | 31 (12.8)        |
|                 | c) Not sure     | 23 (9.5)         |
### Table 2: Nurses responses to the knowledge and perception questionnaire (n=243)

| Questions asked                                                                 | Answer category                                      | Total, n (%)  |
|---------------------------------------------------------------------------------|------------------------------------------------------|---------------|
| Q6. Which of the following is the main route of cross-transmission of potentially harmful germs between patients in a health-care facility? | a) Health-care workers’ hands when not clean        | 189 (77.8)    |
|                                                                                 | b) Air circulating in the hospital                   | 11 (4.5)      |
|                                                                                 | c) Patients’ exposure to colonized surfaces          | 37 (15.2)     |
|                                                                                 | d) Sharing non-invasive objects between patients     | 6 (2.5)       |
| Q7. Which of the following hand hygiene actions prevents transmission of germs to the patient? | a. Before touching a patient                         | 227 (93.4)    |
|                                                                                 | b. No                                                | 13 (5.3)      |
|                                                                                 | c) Not sure                                          | 3 (1.2)       |
|                                                                                 | b. Immediately after a risk of body fluid exposure   | 228 (93.8)    |
|                                                                                 | a) Yes                                               | 13 (5.3)      |
|                                                                                 | b) No                                                | 13 (5.3)      |
|                                                                                 | c) Not sure                                          | 2 (0.8)       |
|                                                                                 | c. After exposure to the immediate surroundings of a patient | 217 (89.3)    |
|                                                                                 | a) Yes                                               | 14 (5.8)      |
|                                                                                 | b) No                                                | 12 (4.9)      |
|                                                                                 | c) Not sure                                          | 12 (4.9)      |
|                                                                                 | d. Immediately before a clean/aseptic procedure      | 226 (93)      |
|                                                                                 | a) Yes                                               | 15 (6.2)      |
|                                                                                 | b) No                                                | 15 (6.2)      |
|                                                                                 | c) Not sure                                          | 2 (0.8)       |
| Q8. Which of the following statements on alcohol-based handrub and hand washing with soap and water are true? | a. Hand rubbing is more rapid for hand cleansing than hand washing | 161 (66.3)    |
|                                                                                 | b) False                                             | 70 (28.8)     |
|                                                                                 | c) Not sure                                          | 12 (4.9)      |
|                                                                                 | b. Hand rubbing causes skin dryness more than hand washing | 116 (47.7)    |
|                                                                                 | a) True                                              | 79 (32.5)     |
|                                                                                 | b) False                                             | 48 (19.8)     |
|                                                                                 | c) Not sure                                          | 48 (19.8)     |
|                                                                                 | c. Hand rubbing is more effective against germs than hand washing | 85 (35)       |
|                                                                                 | a) True                                              | 130 (53.5)    |
|                                                                                 | b) False                                             | 28 (11.5)     |
|                                                                                 | c) Not sure                                          | 28 (11.5)     |
|                                                                                 | d. Hand washing and hand rubbing are recommended to be performed in sequence | 197 (81.1)    |
|                                                                                 | a) True                                              | 17 (7)        |
|                                                                                 | b) False                                             | 17 (7)        |
|                                                                                 | c) Not sure                                          | 29 (11.9)     |
| Q9. Which type of hand hygiene method is required in the following situations?   | a. Before giving an injection                         | 153 (63)      |
|                                                                                 | b) Washing                                           | 85 (35)       |
|                                                                                 | c) None                                              | 5 (2.1)       |
|                                                                                 | b. After emptying a bedpan                           | 35 (14.4)     |
|                                                                                 | a) Rubbing                                           | 201 (82.7)    |
|                                                                                 | b) Washing                                           | 7 (2.9)       |
|                                                                                 | c) None                                              | 7 (2.9)       |
|                                                                                 | c. After removing examination gloves                 | 84 (34.6)     |
|                                                                                 | a) Rubbing                                           | 154 (63.4)    |
|                                                                                 | b) Washing                                           | 5 (2.1)       |
|                                                                                 | c) None                                              | 5 (2.1)       |
|                                                                                 | d. After making a patient’s bed                      | 91 (37.4)     |
|                                                                                 | a) Rubbing                                           | 134 (55.1)    |
|                                                                                 | b) Washing                                           | 18 (7.4)      |
|                                                                                 | c) None                                              | 18 (7.4)      |
|                                                                                 | e. After visible exposure to blood                   | 40 (16.5)     |
|                                                                                 | a) Rubbing                                           | 202 (83.1)    |
|                                                                                 | b) Washing                                           | 1 (0.4)       |

Contd...
A statistically significant association was found between the perception of nurses regarding hand hygiene and gender ($P = 0.008$), years of experience ($P < 0.001$) and having attended a training course on hand washing ($P < 0.001$).

The factors likely affecting the nurses’ level of knowledge on hand hygiene was determined using the bivariate analysis described in Table 5. Gender ($\chi^2 [df 1] = 17.28, P < 0.001$), Years of Experience ($\chi^2 [df 1] = 5.70, P = 0.017$), and training course on hand washing ($\chi^2 [df 1] = 7.52, P = 0.006$) all had a significant effect on the knowledge score of the study participants.

**DISCUSSION**

This study investigated the knowledge and perception of 243 nurses from six hospitals in Asir region regarding hand hygiene and gender ($P = 0.008$), years of experience ($P < 0.001$) and having attended a training course on hand washing ($P < 0.001$).
Table 4: Association between the knowledge and perception of nurses regarding hand hygiene and general demographic variables (n=243)

| Questions asked | Answer levels | Knowledge score | Perception score | Total, n (%) | P |
|-----------------|--------------|-----------------|-----------------|--------------|---|
|                 |              | Insufficient knowledge, n (%) | Fair knowledge, n (%) | Good knowledge, n (%) | Negative perception, n (%) | Neutral perception, n (%) | Positive perception, n (%) | P |
| Gender          | A            | 6 (2.47)         | 57 (23.46)      | 63 (25.93)   | 126 (51.86) | <0.001* |
|                 | B            | 3 (1.23)         | 51 (20.99)      | 63 (25.93)   | 117 (48.14) | <0.001* |
| Gender          | A            | 0 (0.0)          | 10 (4.12)       | 3 (1.23)     | 13 (5.35)   | <0.001* |
| Age             | B            | 5 (2.06)         | 55 (22.63)      | 63 (25.93)   | 123 (50.62) | <0.001* |
| Age             | C            | 4 (1.65)         | 31 (12.67)      | 46 (18.93)   | 81 (33.33)  | <0.001* |
| Age             | D            | 0 (0.0)          | 12 (4.94)       | 14 (5.76)    | 26 (10.70)  | <0.001* |
| Years of experience | A | 1 (0.41) | 30 (12.35) | 25 (10.29) | 56 (23.05) | <0.001* |
| Years of experience | B | 5 (2.06) | 71 (29.22) | 113 (46.50) | 189 (77.77) | <0.001* |
| Years of experience | C | 4 (1.65) | 18 (7.41) | 9 (3.70) | 31 (12.76) | <0.001* |
| Years of experience | D | 0 (0.0) | 19 (7.82) | 4 (1.65) | 23 (9.47) | <0.001* |
| Attend a training course about hand washing | A | 5 (2.06) | 71 (29.22) | 113 (46.50) | 189 (77.77) | <0.001* |
| Attend a training course about hand washing | B | 4 (1.65) | 18 (7.41) | 9 (3.70) | 31 (12.76) | <0.001* |
| Attend a training course about hand washing | C | 0 (0.0) | 19 (7.82) | 4 (1.65) | 23 (9.47) | <0.001* |

*P<0.05, statistically significant

Table 5: Bivariate analysis of the factors likely affecting level of knowledge of the nurses

| Characteristics of nurses | Knowledge score | Test statistic, χ² (df 1) | P |
|---------------------------|-----------------|---------------------------|---|
|                           | Insufficient Knowledge, n (%) | Fair knowledge, n (%) | | |
| Gender                    | 6 (2.47)         | 57 (23.46)                 | 17.28 | <0.001* |
|                           | 3 (1.23)         | 51 (20.99)                 | 0.77 | 0.782 |
| Age                       | 0 (0.0)          | 10 (4.12)                  | 43 (17.70) | 16 (6.58) | 4 (1.65) | 19 (7.82) | 7.52 | 0.006* |
| Years of experience       | 1 (0.41)         | 30 (12.35)                 | 5.70 | 0.017* |
|                           | 0 (0.0)          | 43 (17.70)                 | 0.017* |
|                           | 4 (1.65)         | 16 (6.58)                  | 0.006* |
|                           | 4 (1.65)         | 19 (7.82)                  | 0.006* |
| Attend a training course about hand washing | 5 (2.06) | 71 (29.22) | 113 (46.50) | 189 (77.77) | <0.001* |
|                           | 4 (1.65)         | 18 (7.41)                  | 7.52 | 0.006* |
|                           | 0 (0.0)          | 19 (7.82)                  | 0.006* |

*P<0.05, statistically significant

hygiene. The results showed that 77.8% of the nurses had attended a training course on hand washing. This finding is similar to a study conducted by Cruz and Bashtawi[19] among nursing students in the Kingdom of Saudi Arabia, which found
that 60.6% of the respondents had already participated in a training program or seminars related to hand hygiene in the last 6 months. Similarly, a 2018 study by Pawar et al. found in Western India showed that 94% of the nursing staff had undergone formal training on hand hygiene, which indicates a higher percentage of nurses receiving training on hand hygiene than the existing study.

The main finding of this study is that 51.85% of the nurses have “good knowledge” of hand hygiene. A study by Ra’awji et al. in the Al-Qassim region of the Kingdom of Saudi Arabia found that hand hygiene knowledge was very limited among all the health-care workers in Al-Qassim hospitals; this contradicts the findings of the current study. A study by Nair et al. among nursing and medical students in India confirmed that only 9% of the study participants have “good knowledge” about hand hygiene, which is a much smaller proportion than the findings of the current study. Similarly, a study by Zakeri et al. among the health-care workers of two teaching hospitals in Iran discovered that all the study participants had a moderate level of knowledge about hand hygiene which also contradicts our study results. Ariyarathne et al. found that 77% of the study participants in Sri Lankan hospitals have a moderate level of knowledge of hand hygiene, which also conflicts with the findings of the present study.

However, several other studies found higher levels of knowledge than in the current study. Hamadah et al. studied 4th-year clerkship medical students in Riyadh in 2015 and found that the majority of the participants had “fair knowledge” about hand hygiene.

A 2018 study in Northeast Ethiopia by Jemal found that 66% of the health-care professionals have a “good knowledge” about hand hygiene which is a higher percentage than that of the current study. Similarly, Ng et al. conducted a study in the United Arab Emirates and found that 73.5% of the nurses have a “good knowledge” in terms of hand hygiene, which is a much higher percentage of knowledgeable staff than in the results of our study.

Finally, in this study, 66.3% of the participants correctly answered that hand rubbing is faster, more effective approach to hand cleansing than hand washing. However, Ra’awji et al. found that 79.53% of respondents in Al-Qassim were able to answer this question correctly. In this study, 81.1% of the participants believed that hand washing and hand rubbing are recommended to be performed in sequence. However, only 70.5% of the participants recommended the sequential performance of hand washing and hand rubbing in the study conducted by Nair et al. 47.7% of the respondents in this study reported that hand rubbing causes skin dryness, and 53.5% stated a belief that hand rubbing is not more effective against infections than hand washing. Similarly, a study by Kudavidnange et al. in Sri Lanka stated that 55% of the health-care workers reported skin dryness due to hand rubbing, and 72.5% of them stated that hand washing is more effective in killing germs than hand rubbing which is same like the findings of the present study.

More than half of the participants (63%) in this study stated their belief that hand rubbing is sufficient before injection, whereas 82.7% felt that hand washing is mandatory after emptying a bedpan and 63.4% after the removal of examination gloves. Likewise in the current study, a significant proportion of nurses reported that hand washing is mandatory after making a patient’s bed (55.1%) and after visible exposure to blood (83.1%). However, a study conducted by Ariyarathne et al. found that 54% of the respondents agreed that hand rubbing is adequate before giving an injection, 73.95% recommended mandatory hand washing after emptying a bedpan, 76.05% after removing examination gloves, 52.45% after making a patient’s bed, and 56.5% after visible exposure to blood.

The current study results showed that 50.21% of the nurses have negative perceptions of hand hygiene. This supports other studies in the extant literature, such as the investigation in Korea by Kim et al. which found that the perception toward hand hygiene among health-care workers is poor. In contrast, in a study among health-care workers in Switzerland, Pessoa-Silva et al. reported that 64% of the respondents have a positive perception of hand hygiene.

In this study, more than one-quarter of the respondents (31.3%) stated that the risk of developing health-care-associated infections among hospitalized patients ranges between 0 and 25%. According to the WHO report on the role of hand hygiene in preventing health-care-associated infections, 5%–15% of the hospitalized patients were at risk of developing infections. Similarly, the Center for Disease Control and Prevention reported that the prevalence of hospital acquired infection in European countries varies between 4.6% and 9.3%. In this study, 45.7% of the participants believed that a health-care-associated infection would have a high impact on a patient’s clinical outcome, supporting practical guides for the prevention of hospital-acquired infections, which state that health-care-associated infections are a main cause of death and disability among patients.

The results of the current study showed a positive significant association between the knowledge about the hand hygiene of nurses and gender (P < 0.001). In contrast, a study conducted by Tavolacci et al. found no significant difference between male and female health-care workers in terms of their knowledge about hand hygiene. Similarly, a study conducted in the Kingdom of Saudi Arabia observed no statistical significance between the knowledge of hand hygiene and gender. This study showed a positive correlation between knowledge of hand hygiene and years of experience (P < 0.001), as well as a statistically significant difference between the knowledge of hand
hygiene and attendance on a training course about hand washing ($P < 0.001$).

There was positive association between the perception and training course about hand washing ($P < 0.001$) among nurses in this study. These results are supported by the findings of other studies, such as Kim et al., which found significant differences in the knowledge score and years of experience (above 5 years, $t = -2.463, P = 0.014$), in formal training in hand hygiene ($t = 5.50, P < 0.01$), and in perception and formal training in hand hygiene ($t = 2.4, P = 0.017$).

CONCLUSION

This study was primarily conducted to assess nurses’ knowledge and perception of hand hygiene. The findings show that half of the nurses have a good level of knowledge regarding hand hygiene; although partial amount of the nurses have a negative perception of this topic. The study established a positive association between attendance on a training course about hand washing and the knowledge and perception of nurses regarding this practice. If adequate hand hygiene protocols are strictly followed by the nurses it would significantly reduce the number of cases of hospital acquired infections. These findings can be used in future hand hygiene promotion strategies for nurses. There is a need for educational intervention along with the adoption of a multimodal strategic approach to enhance the knowledge and perception of hand hygiene among nurses. Future research should be conducted to assess the knowledge and perception of nurses regarding hand hygiene using observational measurements.

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Conflicts of interest

There are no conflicts of interest.

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