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**Original Research Article**

# Hand-hygiene beliefs and practices of students in health-related departments of a university in Mogadishu, Somalia

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## ABSTRACT

**Background:** This study aimed to investigate the relationship between hand hygiene beliefs and practices of university students studying in health-related departments in Mogadishu, Somalia. Evidence on hand washing knowledge, attitudes and practices among healthcare students in low- and middle-income countries is limited.
**Methods:** This study aimed to investigate the relationship between hand hygiene beliefs and practices of university students studying in health-related departments in Mogadishu, Somalia. Evidence on hand washing knowledge, attitudes and practices among healthcare students in low- and middle-income countries is limited.
**Results:** The mean age of the participants was 20.31±1.85 years and the majority were female (76.6%). The mean Hand Hygiene Beliefs Inventory (HHBI) score was 55.90±11.48, while the mean hand hygiene practices inventory (HHPI) score was 80.16±15.23. A moderate, statistically significant positive correlation was found between HHBI and HHPI scores ($r=0.514$, $p<0.01$). Students who reported adherence to hand hygiene practices had significantly higher belief and practice scores compared to those who did not ($p<0.01$). Regression analysis demonstrated that hand hygiene beliefs were a significant predictor of hand hygiene practices.
**Conclusions:** Although students demonstrated moderate levels of hand hygiene beliefs and practices, gaps remain that may compromise infection prevention efforts. As hand hygiene belief levels increased, practice levels also improved. These findings highlight the need for targeted educational interventions and multimodal strategies to strengthen hand hygiene beliefs and practices among healthcare-related university students, particularly in resource-limited settings.

**Keywords:** Beliefs, Hand hygiene, Mogadishu, Somalia, University students

## INTRODUCTION

Healthcare-associated infections are considered a global health issue, with significant morbidity and mortality and substantial increase in healthcare costs.[1-3] The World Health Organization (WHO) reported that 7% of patients in developed countries and 10% in developing countries contracted at least one healthcare-associated infection and 10% of the affected patients died as a result.[4] There is limited data on healthcare-associated infections in low- and middle-income countries, but the incidence of nosocomial infections was reportedly higher. Furthermore, the prevalence of healthcare-associated infections in low- and middle-income countries was estimated to be 5.7%–19.1%.[4] It is well-established that unsanitized hands of healthcare professionals are the most prevalent pathogen transmission carriers that may cause healthcare-associated infections.[5,6] Although hand hygiene is a very simple procedure, it is one of the most important measures against the transmission of disease-causing pathogens.[2] Therefore, maintaining hand hygiene is a key strategy in the prevention and control of

infections and its importance was accentuated again during the COVID-19 pandemic. Your 5 moments for hand hygiene was designed by WHO to highlight the indications for hand hygiene to facilitate understanding, education and monitoring in a wide range of healthcare settings globally.[1] This approach is widely used to assess compliance with hand hygiene in healthcare facilities.[7] Kraker et al reviewed the characteristics, implementation and progress of hand-hygiene programs worldwide (3206 healthcare facilities across- 90 countries) and reported that approximately a quarter of the healthcare facilities in low-income countries implemented basic or inadequate hand hygiene.[3] Reports suggest that while the average hand hygiene compliance rate in high-income countries is 40%, the same decreases to <20% in low-income countries.[1,8] There is limited data on the level of hand washing knowledge, attitudes and practices among healthcare personnel in low- and middle-income countries.[8]

A study investigating compliance rates or barriers in compliance with hand hygiene practices among healthcare professionals in sub-Saharan African countries reported an overall compliance rate of 21.1% and lack of infrastructure and heavy workload as barriers.[9] Another study on hand hygiene compliance and associated factors among healthcare professionals in northwestern Ethiopia reported that lack of training, adequate soap and water and availability of alcohol-based hand antiseptics; hand hygiene knowledge; and attitude of healthcare professionals were significantly associated with hand hygiene compliance.[10] Prevention and control of healthcare-associated infections is an important global issue that concerns all healthcare stakeholders, including healthcare professionals, patients and the public.[2] As a part of the healthcare team, medical students play a crucial role in the transmission of pathogens and prevention of infectious diseases as they are typically involved in the treatment and care of patients during clinical practice.[11,12] Students may pose an increased risk of healthcare-associated infections by direct patient contact or through contaminated surfaces and devices.[13]

A systematic review investigated the hand hygiene competencies of nursing students and reported that students had low- to medium-level knowledge about hand hygiene guidelines.[12] Nevertheless, there is limited data on hand hygiene beliefs and practices for healthcare students in low-income countries. Characterized as a "fragile state," Somalia has insufficient health data due to a prolonged civil conflict.[14,15] Furthermore, infectious diseases, including malaria, cholera and measles, continue to pose significant public health risk in the country and inadequate access to clean water and sanitation facilities contribute to the spread of infectious diseases.[16] This study aimed to investigate the relationship between hand hygiene beliefs and practices of university students in Mogadishu, Somalia, studying in health-related departments. Identifying the status of hand hygiene practice is considered the first step toward developing teaching methods to improve and sustain the compliance of hand hygiene guidelines by university students.[17] This study sought answers to the following questions. What is the status of hand hygiene practice by the students ? What are the students' hand hygiene practice beliefs ? Is there a relationship between students' hand hygiene practices and hand hygiene practice beliefs ?

## METHODS

### *Study design*

This was a descriptive and cross-sectional study.

### *Study participants and sample size*

The study population included university students (n=607) studying in health-related departments (namely nursing, midwifery, emergency aid and disaster management) at a university in Mogadishu, Somalia. The medium of instruction in this department is Turkish. Students attend a 1-year preparatory class in the Turkish language and are, therefore, all literate in Turkish. Students attending the preparatory class were not included in the study. The Raosoft Sample Size Calculator program (Raosoft Inc., Seattle, WA, USA) was used to determine the sample size for the total number of students, with a 5% margin of error, 50% response distribution and 99% confidence interval to reach 318 students. The study included 320 students who volunteered to participate. Students participated in clinical practice in the hospital from the first year of their education.

### *Data collection*

#### *Student information form*

This section included a total of 10 items about the participants' age, department, class, parents' education level and hand washing habits. This form was developed by the researchers for this study and has not been published (Additional file 1).

#### *Hand hygiene practices inventory*

This was developed by Thea van de Mortel in English language in 2009. The Turkish validity and reliability study was conducted by Karadağ et al, in 2016. The HHPI included 14 items. The 5-point Likert scale was used to rate the items, with scores structured as follows: 1, strongly disagree; 2, disagree; 3, not sure; 4, agree; 5, strongly agree. The lowest and highest score that can be obtained from this scale is 14 and 70 points, respectively, with higher scores indicative of hand hygiene practices always being performed. Cronbach's alpha value in the original scale, the Turkish validity and reliability study of the scale (18) and in this study was 0.80, 0.76 and 0.88, respectively.

*Hand hygiene belief inventory*

This was developed by Thea van de Mortel in English in 2009 to investigate the perceptions on the necessity of handwashing practice. The Turkish validity and reliability study was conducted by Karadağ et al, in 2016. HHBI consists of 22 items on hand washing practices during clinical practices. The 5-point Likert scale was used with the scoring same as that for HHPI: 1, strongly disagree; 2, disagree; 3, not sure; 4, agree; 5, strongly agree. Items 5,8,16,17,18,19 and 20 were reverse coded. The lowest and highest scores were 22 and 110, respectively and no cut-off point was specified. A higher score on the scale is indicative of the fact that participants maintain positive beliefs about hand hygiene. Cronbach's alpha value in the original scale, the Turkish validity and reliability study of the scale (18) and this study was 0.74, 0.85 and 0.86, respectively.

***Data collection***

The preliminary application of the study involved a face-to-face questionnaire application with 10 students after collecting all necessary legal ethics. The comprehensibility of the questionnaire items was reviewed by the researchers during this phase. This data was included in the study as no change was necessary in the questionnaire. The principal investigator conducted the preliminary application between 05.27.2024–07.05.2024. Non-class times of the participants were preferred for the application of the data collection forms. Students were briefed about the application of the study and those meetings the inclusion criteria were included. The research was explained to the included students again and their informed consent was obtained. The data collection forms took an average of 15 min to complete.

***Data analysis***

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) for Windows, Version 25.0 statistical software (SPSS INC., Chicago, IL, USA) Frequency and percentage analyses were used to investigate the descriptive characteristics of the students and mean and standard deviation statistics were used to analyze the scale. Kurtosis and skewness values and the Kolmogorov–Smirnov test was used to determine whether the study variables met the normal distribution hypothesis. The Mann–Whitney U test (for two independent groups), Kruskal–Wallis test (for more than two independent groups), Bonferroni correction and Spearman correlation were used to compare the data.

***Ethical consideration***

Ethics committee approval No. 993, dated 22.05.2024 was obtained from the ethics committee of a training and research hospital in Mogadishu, Somalia, prior to the commencement of the study. The participants included in the study sample were briefed about the purpose of the research and informed that participation in the research was voluntary, upon which their consent was obtained. Participants were assured that not participating or withdrawing from this study would not have any adverse effect. The study adhered to the principles of the World Medical Association's (WMA) Declaration of Helsinki and permissions for the use of the scales were obtained from the authors of the validity and reliability study.

## RESULTS

The mean age of the participants was 20.31±1.85 years and the majority (76.6%) were females. Of the participants, 61.6% studied at the department of nursing, 27.8% were first-year students and 21.6% were fourth-year students. Moreover, 13.8% of students had illiterate mothers and 35.9% of the participants had fathers with a university degree. A comparison of HHBI and HHPI scores by the descriptive characteristics of the students is given in Table 1. There was no statistically significant difference in the HHBI and HHPI scores of the students in terms of sex, department and parents' educational status ($p>0.05$). Nevertheless, HHPI scores of first-year students were significantly lower than other grades (KW=9.884, $p=0.02$). A comparison of HHBI and HHPI scores in terms of hand-washing characteristics of the students is given in Table 2. Overall, 13.1% of the participants reported that they washed their hands only with water, whereas 40.3% washed their hands 6–10 times a day on an average. There was no significant difference between HHPI and HHBI scores in terms of hand-washing status with water or soap and average number of hand washes per day ($p<0.05$). Moreover, 69.1% of the students reported a good knowledge of hand hygiene, whereas 2.5% stated that they had no knowledge at all. HHPI scores of those without any knowledge were significantly lower than those of students with moderate and good knowledge (KW=10.913, $p=0.010$). Further, 93.8% responded "yes" to the item if they believed in the effectiveness of hand washing in preventing infections. HHBI and HHPI scores of these students were significantly higher than those of students who responded "no," ($Z=-3.102$, $p=0.002$, $Z=-3.456$, $p=0.001$, respectively).

The distribution of the participants' HHBI and HHPI mean scores is given in Tables 3 and 4. Remarkably, students scored <4 in certain items of HHPI (Table 3). In particular, the scores of the students with regard to hand washing before and after entering the isolated patient room, before endotracheal aspiration, after performing an invasive intervention on the patient and before and after contact with the patient's secretions were not at an optimum level. Mean scores of the items of HHBI are given in Table 4. The average of all items was <4. The mean HHBI score was 55.90±11.48 and the mean HHPI score was 80.16±15.23. Correlation analysis of HHBI and HHPI scores revealed a significantly positive relationship at a moderate level ($r=0.514$, $p<0.01$).

**Table 1: Comparison of HHBI and HHPI scores according to students' descriptive characteristics (n=320).**

| | N | % | HHPI | HHBI |
|---|---|---|---|---|
| | | | **Mean±SD** | **Mean±SD** |
| **Sex** | | | | |
| Female | 245 | 76.6 | 56.05±11.64 | 80.65±14.44 |
| Male | 75 | 23.4 | 55.41±11.02 | 78.52±17.60 |
| Statistical test/p value | | | Z=-0.737 p=0.461 | Z=-0.537. p=0.591 |
| Department | | | | |
| Nursing | 197 | 61.6 | 54.22±9.34 | 80.70±14.97 |
| Midwifery | 79 | 24.7 | 56.18±11.73 | 79.73±15.369 |
| Emergency aid and disaster management | 44 | 13.7 | 54.07±11.45 | 81.76±13.71 |
| Statistical test/p value | | | KW=0.923 p=0.630 | KW=0.792 p=0.673 |
| **Year** | | | | |
| 1 | 89 | 27.8 | 53.05±11.63 | 80.38±13.96 |
| 2 | 88 | 27.5 | 57.68±12.30 | 81.27±12.72 |
| 3 | 74 | 23.1 | 56.79±11.78 | 80.27±17.45 |
| 4 | 69 | 21.6 | 57.79±10.54 | 82.44±17.03 |
| Statistical test/p value | | | KW=9.884 p=0.02 1<2,1<3,1<4 | KW=0.200 p=0.978 |
| **Mother-education status** | | | | |
| Illiterate | 44 | 13.8 | 54.68±11.33 | 82.90±11.40 |
| Literate | 85 | 26.6 | 56.43±12.03 | 81.70±17.10 |
| Primary school | 74 | 23.1 | 54.50±12.73 | 77.95±14.58 |
| High school | 64 | 20 | 58.07±8.70 | 81.29±13.48 |
| University | 53 | 16.6 | 55.41±11.81 | 77.07±17.19 |
| Statistical test/p value | | | KW=2.849 p=0.583 | KWF=7.948 p=0.09 |
| **Father-education status** | | | | |
| Literate | 20 | 6.3 | 54.30±12.11 | 81.60±12.93 |
| Primary school | 61 | 19.1 | 55.98±10.32 | 81.25±14.67 |
| High school | 38 | 11.9 | 53.63±11.83 | 77.68±12.62 |
| University | 86 | 26.9 | 55.52±11.01 | 81.76±16.39 |
| | 115 | 35.9 | 57.18±12.20 | 78.95±15.79 |
| Statistical test/p value | | | KW=4.913 p=0.296 | KW=5.758 p=0.218 |

Z: Mann-Whitney U test, KW: Kruskal-Wallis test, SD: Standard Deviation.

**Table 2: Comparison of HHBI and HHPI scores according to hand washing characteristics of students (n=320).**

| | N | % | HHPI | HHBI |
|---|---|---|---|---|
| | | | **Mean±SD** | **Mean±SD** |
| **Hand washing status** | | | | |
| Water and soap | 278 | 86.9 | 56.31±11.21 | 80.56±14.19 |
| Just water | 42 | 13.1 | 53.15±12.77 | 76.91±22.66 |
| Statistical test/p value | | | Z=-1.530 p=0.126 | Z=-0.382 p=0.702 |
| **Average number of hand washes per day** | | | | |
| 1-5[1] | 118 | 36.9 | 53.87±12.53 | 79.94±15.90 |
| 6-10[2] | 129 | 40.3 | 57.22±10.58 | 80.98±13.69 |
| 11 and up[3] | 73 | 22.8 | 56.04±10.97 | 78.69±16.92 |
| Statistical test/p value | | | KW=4.664 p=0.09 | KW=0.383 p=0.816 |
| **Knowledge about hand hygiene status** | | | | |
| None at all [1] | | | | |
| Less[2] | 8 | 2.5 | 48.50±12.55 | 65.12±27.67 |
| Moderate[3] | 9 | 2.8 | 50.77±13.98 | 70.66±13.36 |
| Good[4] | 82 | 25.6 | 53.65±11.40 | 80.56±16.33 |
| | 221 | 69.1 | 57.21±11.16 | 80.95±13.95 |
| Statistical test/p value | | | KW=10.913 p=0.01 1<4 1<3 | KW=7.240 p=0.06 |
| **Belief in the effectiveness of hand washing in preventing infection** | | | | |
| Yes | 300 | 93.8 | 56.42±11.30 | 81.07±14.54 |
| No | 20 | 6.2 | 48.20±11.54 | 66.60±18.91 |
| Statistical test/p value | | | Z=-3.102 p=0.002 | Z=-3.456 p=0.001 |

Z: Mann-Whitney U test, KW:Kruskal-Wallis test.

**Table 3: The mean scores of students on items of the HHPI (n=320).**

| I cleanse my hands | Mean±SD |
|---|---|
| After going to the toilet | 4.22±1.28 |
| Before caring for a wound | 4.02±1.27 |
| After caring for a wound | 4.06±1.22 |
| After touching potentially contaminated objects | 4.10±1.20 |
| After contact with blood or body fluid | 4.14±1.20 |
| After inserting an invasive device | 3.83±1.33 |
| Before entering an isolation room | 3.79±1.32 |
| After physical contact with a patient | 4.02±1.24 |
| After exiting an isolation room | 3.82±1.39 |
| Before endotracheal suctioning | 3.65±1.39 |
| After contact with a patient's secretions | 3.93±1.32 |
| Before patient contact | 3.94±1.32 |
| After removing gloves | 4.17±1.21 |
| If they look or feel dirty | 4.17±1.23 |
| Total | 55.90±11.48 |

**Table 4: The mean scores of students on items of the HHBI (n=320).**

| | Mean±SD |
|---|---|
| Hand hygiene is considered an important part of the curriculum | 3.79±1.28 |
| The facilities in which I do clinical practicum emphasize the importance of hand hygiene | 3.89±1.13 |
| The importance of hand hygiene is emphasized by my clinical supervisors | 3.81±1.09 |
| I have a duty to act as a role model for other healthcare workers | 3.80±1.16 |
| When busy it is more important to complete my tasks than to perform hand hygiene | 3.25±1.39 |
| Performing hand hygiene in the recommended situations can reduce patient mortality | 3.58±1.22 |
| Performing hand hygiene in the recommended situations can reduce medical costs associated with hospital-acquired infections | 3.64±1.23 |
| I can't always perform hand hygiene in recommended situations because my patient's needs come first | 3.10±1.42 |
| Prevention of hospital-acquired infection is a valuable part of a healthcare worker's role | 3.96±1.15 |
| I follow the example of senior health care workers when deciding whether or not to perform hand hygiene | 3.61±1.26 |
| I believe I have the power to change poor practices in the workplace | 3.66±1.27 |
| Failure to perform hand hygiene in the recommended situations can be considered negligence | 3.64±1.34 |
| Hand hygiene is a habit for me in my personal life | 3.42±1.29 |
| I am confident I can effectively apply my knowledge of hand hygiene to my clinical practice | 3.90±1.27 |
| It is an effort to remember to perform hand hygiene in the recommended situations | 3.95±1.36 |
| I would feel uncomfortable reminding a health professional to handwash | 3.76±1.23 |
| If I disagree with a guideline I look for research findings to guide my practice | 3.13±1.57 |
| Performing hand hygiene slows down building immunity to disease | 3.42±1.29 |
| Dirty sinks can be a reason for not washing hands | 3.90±1.27 |
| Lack of an acceptable soap product can be a reason for not cleansing hands | 3.95±1.36 |
| Performing hand hygiene after caring for a wound can protect from infections | 3.76±1.23 |
| Cleansing hands after going to the toilet can reduce transmission of infectious disease | 3.13±1.57 |
| Total | 80.16±15.23 |

**Table 5: Correlation between HHBI and HHPI scores.**

| | | HHPI | HHBI |
|---|---|---|---|
| HHPI | Correlation coefficient | 1.000 | 0.514 |
| | P | . | 0.000 |
| HHBI | Correlation coefficient | 0.514 | 1.000 |
| | p | 0.000 | . |

## DISCUSSION

Good hand hygiene is considered as the cornerstone of highly cost-effective, safe and effective health-associated hygiene.[4] This study included 320 university students from health-related departments in Mogadishu, Somalia and investigated their hand hygiene beliefs and practices. In this study, 40.3% of the students washed their hands 5–10 times a day on an average and 13.1% used only water for hand washing. Furthermore, 93.8% of students believed in the effectiveness of hand washing in preventing infections and both HHBI and HHPI scores of such students were higher than those who believed otherwise. This result suggested that students believed that hand hygiene would prevent nosocomial infections and accepted the same as an important behavior.

In this study, the mean HHBI and HHPI scores of the students were 55.90±11.48 and 80.16±15.23, respectively, which are lower than those reported in previous studies using the same scales.[11,19-24] Moreover, students scored <4 on all HHBI items. Furthermore, HHPI scores of the students regarding hand washing before and after entering the isolated patient room, before endotracheal aspiration, after performing an invasive intervention on the patient and after contact with the patient's secretions were lower.

A study by Cambil-Martin et al on medical and nursing students from four universities in Spain reported that students showed poor compliance with hand hygiene behavior, particularly before contact with patients, before invasive procedures and after contact with the patient's surroundings.[25] Previous studies in Ireland and Norway suggested that nursing students had positive attitudes toward hand hygiene practices; however, hand hygiene practices were not at optimal levels after contact with patients and patients surrounding and before clean/aseptic procedures.[17,26] Another study in Cambodia reported that the level of hand hygiene knowledge, attitude and practice in nursing and midwifery students was moderate.[27]

In a Namibian study, majority of nursing students (67%) had low level of compliance with hand hygiene practices. A systematic review of 19 studies on nursing students' hand hygiene knowledge and compliance in Europe (9 studies), Asia (8 studies), Africa (1 study) and North America (1 study) suggested that nursing students had low to moderate knowledge and compliance with hand hygiene guidelines.[12] Somalia's health infrastructure is severely underdeveloped and multiple health facilities lack basic resources, including medical equipment, medicines and qualified healthcare personnel.[16] A study investigating the factors effective on the infection control implementation level of a hospital in Mogadishu reported that water, sink usage status and soap and alcohol-based hand antiseptics were inadequate.[28] It was estimated that certain factors, including availability of adequate soap and water, lack of alcohol-based hand antiseptic, lack of hand hygiene knowledge and attitude of healthcare professionals, affect the healthcare personnel's compliance with hand hygiene. In the same study, 46.2% of the participants responded "rarely," when asked how often they washed their hands after wound dressing.[28] In 2016, WHO reported that one of the reasons for high rates of health-associated infections in certain low-income countries was the healthcare professionals' failure to maintain appropriate hand-hygiene practices.[4] Healthcare personnel need to be the right role-model for students to adopt hand-hygiene practices in the clinical setting.[29] Kristofina et al and Peneyayambeko et al suggested that healthcare personnel's non-compliance with hand hygiene in health institutions could be imitated by students and, therefore, they would not follow hand hygiene practices correctly.[29] Therefore, the hand hygiene belief and practice scores of students in health-related departments may be lower. Sex, department and mother's/father's educational status had no effect on the total score obtained from HHBI and HHPI scales. Nevertheless, HHPI scores of first-year students were lower than other grades. Previous studies reported different research results on the effect of academic levels on hand hygiene practices.[13,20,30]

This result is important for demonstrating the need to improve hand-hygiene beliefs and practices of first-year students before they come into contact with patients. Healthcare students typically spend a significant portion of their course providing patient care in clinical settings from their freshman year onwards and often rotate between different clinical fields and are, therefore, at high risk of contributing to cross-infection.[31] In this study, 25.6% of the students reported that they had moderate knowledge about hand hygiene and 2.5% had no knowledge at all. This result is important to indicate that students needed further training on hand hygiene. Lack of knowledge has been considered a contributing factor to non-compliance with hand hygiene.[32] The Joint Commission Journal on Quality and Patient Safety reported that the reason for healthcare professionals' non-adherence to effective hand hygiene was that most of them lacked training in the necessity of hand hygiene.[33]

In this study, HHBI and HHPI scores of students with no knowledge were lower than those of students with moderate and good knowledge. This indicates that it is crucial for educators to understand the importance of theoretical knowledge on hand hygiene skills for students. Strategies that can have a positive impact on attitudes and opinions about hand hygiene are also required along with efforts to increase theoretical knowledge aimed at improving hand-hygiene habits.[34] Moreover, health education institutions have an important role to play in promoting a culture of strict hand hygiene practices.[34]

The theory of planned behavior is considered one of the most widely used models to explain hand hygiene behavior among healthcare professionals.[5,35-37] This theory is based on the assumption that the intention to

clean one's hands is a direct antecedent of behavior.[5,38] Intention is decided by psychosocial determinants, which are influenced by belief factors.[35] Belief in the importance and necessity of hand-hygiene was reported as an important factor, which facilitated compliance with hand hygiene.[11] In the present study, as the students' hand-hygiene belief score increased, their practice scores also increased. This result suggests the importance of hand hygiene beliefs in raising students' awareness about hand-hygiene practices.

Similarly, Mortel et al investigated the hand hygiene knowledge, beliefs and practices of healthcare students and reported a correlation between hand hygiene beliefs and practices. Furthermore, previous studies with nursing students reported a significant relationship between hand hygiene beliefs and practices.[20,21] These results suggested that improving hand hygiene practices may be possible if future healthcare professionals believed in the necessity of effective implementation of hygiene procedures.

Nevertheless, a study by Jeong et al and Kim et al which investigated the factors effective on nursing students' knowledge, beliefs (behavioral beliefs, normative beliefs and control beliefs) and behaviors about hand hygiene, found no significant relationship between hand hygiene knowledge and behavioral beliefs, normative beliefs, control beliefs or hand hygiene behaviors.[35] Multimodal approaches should be adopted particularly in resource-limited healthcare settings to strengthen hand hygiene practices. This approach has been associated with increasing hand-hygiene compliance, improving infrastructures, increasing knowledge and perception through education and training, providing reminders about the importance of hand hygiene and procedures in healthcare settings and increasing patient safety awareness at all levels.[39] Such approaches can contribute to the development and sustainability of health students' compliance with hand hygiene practices.[40]

To our knowledge, this is the first study to investigate the relationship between hand hygiene beliefs and practices among university students at health-related departments in Somalia; however, the study has few limitations. First, given that the present study was conducted with students from a single university in Mogadishu, it limits the generalizability of the results as urban areas generally have better equipped healthcare facilities compared to rural areas in terms of healthcare services.[16] Second, the relatively smaller number of emergency relief and disaster management students and, thus, the lower response rate limited the results of the study primarily to nursing and midwifery students. Third, the study data were based on students' self-reports. Therefore, the study may be susceptible to social desirability bias.

## CONCLUSION

The student's hand-hygiene beliefs and practices were low in this study. HHBI and HHPI scores of students with no knowledge about hand hygiene were lower than those of students with moderate and good knowledge. Both HHBI and HHPI scores of students who believed in the effectiveness of hand washing in preventing infections were higher than those of students who did not. As the students' hand hygiene belief score increased, their practice scores also increased.

Furthermore, hand hygiene beliefs were a significant predictor of hand hygiene practices. These results are suggestive of the need for educational interventions and multimodal strategies to improve hand hygiene beliefs and practices of university students involved in healthcare activities, particularly where resources are limited. The results also indicate the importance of adequate supervision of students during clinical practice to ensure correct application of hand hygiene techniques and increase their compliance. Future research in this area should focus on identifying additional determinants of hand hygiene beliefs and practices.

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