Determinants of hand hygiene non-compliance in a cardiac center in Saudi Arabia

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ABSTRACT

الأهداف : تقييم المعدل الأساسي لعدم الالتزام بنظافة الأيدي والعوامل المؤدية إلى ذلك في أحد مراكز القلب المتخصصة بالمملكة العربية السعودية .

الطريقة : أجريت هذه الدراسة الوصفية في مركز الأمير سلطان لمعالجة أمراض وجراحة القلب بالرياض في المملكة العربية السعودية وهو مركز متخصص بسعة 176 سرير . وقد تم تسجيل 6,022 فرصة مراقبة لتنظيف الأيدي بواسطة ممرضي الارتباط لمكافحة العدوى في جميع أجنحة وأقسام المركز بنوعيها عالية ومنخفضة الخطورة وذلك خلال الفترة من أكتوبر إلى ديسمبر 2012م . وقد تم جمع البيانات من خلال مراقبة التزام الممارسين الصحيين بالدواعي الخمسة لنظافة الأيدي وفق إرشادات منظمة الصحة العالمية . ولمعرفة العوامل المؤدية إلى عدم التزام الممارسين الصحيين بنظافة الأيدي تم قياس معدل عدم الالتزام باستخدام الانحدار اللوجستي .

النتائج : بلغ المعدل العام لعدم الالتزام بنظافة الأيدي حوالي 34% . أما العوامل المرتبطة به بشكل كبير فهي: الأطباء (OR=2.71, 95% CI=2.33-3.13)، داعي بعد لمس محيط المريض (OR=4.8, 95% CI=3.98-5.78)، داعي قبل لمس المريض (OR=3.3, 95% CI=2.87-3.86)، والمناطق عالية الخطورة (OR=1.16, 95% CI=1.03-1.31) . وقد ارتبطت فترة العمل الصباحية بعدم الالتزام بشكل كبير (OR=1.13, 95% CI=1.00-1.29) بالمقارنة مع فترة العمل المسائية .

خاتمة : أوضح التحليل الطبقي للبيانات أن عدم الالتزام بنظافة الأيدي لا يزال مشكلة ملحوظة . وخلصت الدراسة إلى التوصية بضرورة القيام بأنشطة تثقيفية شاملة وتطبيق استراتيجيات لتعديل السلوك المتعلق بممارسة تنظيف الأيدي لجميع الممارسين الصحيين وخصوصاً الأطباء ، مع التشديد على أهمية تنظيف الأيدي مع كل الدواعي الخمسة وليس مع بعضها فقط كداعي بعد لمس المريض .

Objectives: To evaluate the baseline hand hygiene non-compliance rate, and identify the factors associated with non-compliance in a cardiac center in Saudi Arabia.

Methods: This observational study was conducted in Prince Sultan Cardiac Center, Riyadh, Saudi Arabia, a 176 beds specialized cardiac center. In total, 6,022 observations were recorded by using the Infection Control Link Nurse program from all the high and non-high risk areas from October to December 2012. The data was collected from different healthcare workers (HCW) for World Health Organization 5 indications of hand hygiene. Non-compliance rate was calculated, and univariate and multivariate analysis was performed using logistic regression to identify factors significantly associated with non-compliance.

Results: The overall hand hygiene non-compliance rate was observed to be approximately 34%. Factors significantly associated with non-compliance included physicians (OR=2.71, 95% confidence intervals [CI]=2.33-3.13), after touching the patient's surrounding (OR=4.8, 95% CI=3.98-5.78), before touching a patient (OR=3.3, 95% CI=2.87-3.86), and high-risk areas (OR=1.16, 95% CI=1.03-1.31). Morning shifts were significantly associated (OR=1.13, 95% CI=1.00-1.29) with non-compliance as compared to the evening shifts.

Conclusion: Stratified analysis indicated that non-compliance is still a noticeable concern. The results suggest that broad spectrum educational activities and behavioral modification strategies should be advocated to include all HCW, particularly physicians, and should emphasize on performing hand hygiene during all the indications and not just the "after" indications.

Healthcare associated infections (HAI) account for 5-10 infections per 100 patient admissions in the western world, and 25 infections per 100 admissions in the developing world.[1] Healthcare associated infections produce great financial and social burdens on a patient, family, and healthcare facility.[2,3] These direct or indirect burdens can be minimized by adopting simple and adequate infection control practices. Hand hygiene (HH) is considered to be an effective, but challenging practice in any infection prevention and control program. The World Health Organization (WHO) initiated a global campaign in 2009, emphasizing on improving hand hygiene in healthcare settings.[4] Various studies have indicated that the hands of healthcare workers (HCW) are contaminated with pathogens during patient care and can be a potential vehicle for transmission to the environment and across patients.[4-6] Ample evidence suggested that the HAI rate can effectively be reduced by practicing HH, and a decreasing trend in the HAI rate can be achieved by improving HH compliance.[7-10] Although HH is considered to be a simplest technique to prevent and control HAIs, still the compliance rate remains at or below 50%.[11-13] Despite the implementation of multimodal strategies, improving HH is still a challenge. Poor compliance with hand hygiene has been observed in different settings, including intensive care units (ICUs).[11,14] The HH compliance among HCW in Saudi Arabia is no different from internationally observed practice. Al Subaie et al[15] from King Khalid University Hospital, Riyadh, found the non-compliance rate in ICUs to be 58%. Similarly, the rate was observed to be almost 50% from other region of the Kingdom.[16] Among HCW, physicians are considered to be more resistant to comply with HH. The stratified analysis in several studies indicated that doctors are less compliant than nurses and others HCW, with a 40% or less compliance rate.[11,13,17] The objectives of this study were to estimate the hand hygiene non-compliance rate, factors associated with non-compliance and introduce the Link Nurse Program for surveillance and assistance in Infection Prevention and Control (IPC) activities. Lack of published literature from the region necessitates more extensive research work, particularly in tertiary care medical complexes. The findings will enable us to take evidence based actions to modify and strengthen

the HH strategy and assist other similar facilities in the region to bench mark their findings and open channels of communication and further research.

Methods. Prince Sultan Cardiac Center (PSCC) provides a major portion of the cardiac services. It serves as a national referral center for cardiac services within the Ministry of Defense with a capacity of 176 beds. This specialized center serves for a variety of cardiac diseases in both the adult and pediatric population. The critical areas are adult surgical ICU, pediatric surgical ICU, the coronary care unit, and pediatric cardiology ICU, and the non-critical areas are adult and pediatric cardiology wards, adult and pediatric surgical wards including high dependency areas and the outpatients department. There are 4 operating rooms, 4 cardiac catheterization laboratories, 2 electrophysiology laboratories, and non-invasive areas such as echocardiography, stress laboratory, cardiac CT, and nuclear cardiology.

The HH infrastructure at PSCC is well planned and equipped. Except for a few beds, an alcohol based hand rub is placed within arms reach of each bed. The dispensers are also located within the corridor, nursing stations, medication preparation room, and at the entrance of each room. A sensor-faucet hand washing sink is placed in each room (one for 2 beds) with paper towel and hand soap. The HH posters "How to Hand Rub" and "How to Hand Wash" are positioned with each dispenser and sink.

Infection Control Link Nurse Program. Prince Sultan Cardiac Center, like other health care facilities visualize "Hand Hygiene Compliance" as an essential component of the infection prevention and control program, to ensure excellence in patient care and safety. Hence, the organization together with the Infection Control Department and Nursing Services, made the decision to implement the Infection Control Link Nurse (ICLN) program to assist HH monitoring and other infection control practices. Link nurses are the clinical nurses who have limited knowledge of infection prevention and control. These nurses were trained on the basic and essential components of the IPC program. In addition to their clinical duties, they assist the infection control staff in monitoring HH in their respective wards.

Development of the ICLN program. What did we do? The following steps were taken to develop the ICLN in their role: (1) Nursing department identified infection control link nurses for each ward; (2) the Infection Control Department provided education to all the link nurses on a regular basis; (3) an initial ICLN meeting was conducted after educational program; (4) Creation and distribution of ICLN badges to all ICLNs; (5)

Completion of a library presentations for ICLNs (7 topics), and (6) Every ICLN was given a soft copy of this library for "on the spot" in-service.

How are we sustaining this? The ICLN program is sustained through activities, that include: (1) Annual training of ICLNs through the ICLN program; (2) Annual appreciation and award for the best ICLN; (3) Involving ICLNs in HH and routine surveillance activities, and (4) Regular and constant reminders for HH by ICLNs

Observational sessions. The observations were recorded by ICLN and charge nurses from 1st October 2012 until 31st December 2012. All the observers were trained on monitoring HH compliance using the WHO guidelines and materials.[18,19] Each observation session lasted for 20 minutes. There were 2 sessions each day, excluding weekends, either during morning or afternoon. The sessions were based on the WHO recommendations to observe HH during 5 moments including: (1) before touching a patient, (2) before performing aseptic procedure, (3) after body fluid exposure, (4) after touching a patient, and (5) after contact with a patient's surroundings.[18] The HCW were unaware of being observed during the session, thereby minimizing the chances of Hawthorne effect.

Statistical analysis. We used STATA version 12.0 (Stata Corp. College Station, TX, USA) for statistical analysis. The clinical areas were classified as high-risk areas (including all the ICUs) and non-high risk areas (including other clinical areas). The HCW were categorized as physicians, nurses, and others (including students, housekeepers, respiratory therapists, physiotherapists and laboratory technicians). The timing of observation was classified as morning (AM) and afternoon (PM). Overall, non-compliance was calculated and was stratified by time, indications, clinical areas, and HCWs. To estimate measure of association of non-compliance with these variables, we performed univariate as well as multivariate analysis using the stepwise logistic regression. Factors in the model included; HH non-compliance, time, indications, areas, and HCWs. The factor with the highest compliance rate was selected as reference category, in each variable. The odds ratio (OR) with 95% confidence interval (CI) and *p*-value were recorded. The *p*-value of <0.05 was considered as significant.

The data was collected for the routine HH monitoring and internal reporting; therefore, no ethical review board was required.

Results. During the 3 months 6,022 opportunities were recorded. The overall non-compliance rate was observed to be 34%. It was observed that non-compliance to HH practice was high (35%) during the morning shifts as compared with evening shifts with 32% non-compliance rate. Among indications, the highest non-compliance was seen after touching patient's surrounding (54%) whereas after touching a patient and after body fluid exposure it was almost equal (19%). Similarly, high-risk areas (36%) were more non-compliant as compared with non-high risk areas (33%). Among the HCW, the highest non-compliance rate was observed in others (54%) followed by physicians (43%), whereas nurses were the least non-compliant (23%). **Table 1** shows the non-compliance rate with each factor. The univariate analysis indicated that

Table 1 - Non-compliance rate of each factor.

Factors	Total number of opportunities	Non-compliance n (%)	95% confidence intervals
Time			
Morning	4280	1508 (35.2)	33.8 - 36.7%
Afternoon	1741	552 (31.7)	29.5 - 33.9%
Indications			
Before touching a patient	2327	1004 (43.1)	41.1 - 45.2%
Before aseptic procedure	649	172 (26.5)	23.1 - 29.9%
After touching a patient	1808	347 (19.2)	17.4 - 21.0%
After touching patients surrounding	868	468 (53.9)	50.6 - 57.2%
After exposure to body fluid	370	69 (18.6)	14.7 - 22.6%
Areas			
High risk area	1995	714 (35.8)	33.7 - 37.9%
Non high risk area	4027	1346 (33.4)	32.0 - 34.9%
Healthcare workers			
Doctors	1194	519 (43.5)	40.7 - 46.3%
Nurses	3429	783 (22.8)	21.4 - 24.2%
Others	1399	758 (54.2)	51.6 - 56.8%

morning shifts were significantly associated (OR=1.17, 95% CI=1.04-1.31) with non-compliance as compared with the evening shifts. The stratified analysis of 5 moments of HH indicated that "after touching patients' surroundings" was most strongly associated with non-compliance (OR=4.92, 95% CI=4.12-5.88), followed by the indication "before touching a patient" (OR=3.19, 95% CI=2.76-3.68) and "before aseptic procedure (OR=1.51, 95% CI=1.23-1.87) as compared to "after touching a patient". There was no association between "after body fluid exposure" and non-compliance. There was no statistically significant association between high-risk areas and non-compliance (OR=1.11, 95% CI=0.99-1.24), when compared with non-high risk areas. It was interesting to observe that in reference to nurses, others (OR=3.99, 95% CI=3.50-4.55), and doctors (OR=2.59, 95% CI=2.26-2.98) were significantly associated with non-compliance.

In multivariate analysis all the associations remained statistically significant except among areas where non-compliance is significantly increased in high-risk areas (OR=1.16, 95% CI=1.03-1.31) as compared with non-high risk areas, as indicated in **Table 2**.

Discussion. Our results indicate that the HH non-compliance rate is 34%, which is lower than other findings in the region.[15,16] Despite, lower crude rates of HH non-compliance, the findings of stratified analysis pointed out many gaps that need to be filled. Timing was a significant factor and HH non-compliance was significantly high during the AM period as compared to the PM, probably because more observations were noted during the AM time. A similar study from Riyadh by AlSubaie et al [15] had concurrent findings. However, Erasmus et al[17] in their systematic review observed that 6 out of 10 studies did not find any association of compliance with time.

The non-compliance in physicians remained a considerable problem, as compared with nurses. This finding was consistent with the existing literature.[13,20,21] It may possibly be attributed to our observational and educational activities that are primarily targeted towards nurses, while physicians and others especially technicians and housekeeping staff are rarely captured or missed. This necessitates increasing the monitoring and advocacy role of the nurses to regularly remind their co-workers and report any non-compliance. Additionally, it calls for immediate planning and execution of behavioral modification strategies, to target mainly the physicians. These strategies should accentuate the importance of HH as a cornerstone of

Table 2 - Multivariate analysis of associated factors.

Factors	Multivariate analysis		
	OR	95% CI	*P*-value
Time			
Morning	1.13	1.00 - 1.29	0.048
Afternoon	1		
Indications			
Before touching a patient	3.33	2.87 - 3.86	<0.001
Before aseptic procedure	1.63	1.31 - 2.02	<0.001
After touching a patient	1		
After touching patients surrounding	4.81	3.98 - 5.78	<0.001
After exposure to body fluid	1.13	0.84 - 1.52	0.401
Areas			
High risk area	1.16	1.03 - 1.31	0.014
Non high risk area	1		
Healthcare workers			
Doctors	2.71	2.33 - 3.13	<0.001
Nurses	1		
Others	3.87	3.37 - 4.45	<0.001

patient safety, and infection control. However, it was interesting to observe that the non-compliance was the highest "after touching patients' surroundings" and "before touching a patient". The low compliance after touching patient's surrounding indicates that HCW lack the conceptual understanding of the patient zone and patient surroundings. We found that compliance was high after touching a patient, which was similar to the observation made by others.[22,23] Based on our findings, we assume that this increase in practice can be attributed to HCW's perception about self-susceptibility of acquiring infections from a patient. In our educational activities, it is deemed necessary to highlight the consequences of non-compliance with each moment, and to clearly demonstrate the concept of the patient zone and surroundings.

The multivariate analysis indicated that the high-risk areas were significantly non-compliant with HH as compared with the non-high-risk area. This can be attributed to other factors not included in the model such as high workload, nurse to patient ratio, and so forth. We suggest more comprehensive research, which also incorporates these factors. The results indicate the need for intensive educational activities and regular monitoring of all the staff in high-risk areas. Although HH has been equally emphasized in most of the religions, religious beliefs and culture can be a potential barrier to HH compliance, mainly because of alcohol-based solutions.[21,24] It is considerably necessary to incorporate religious and cultural factors while formulating HH improvement strategy. The educational lectures should be designed to clear any misconceptions and promote HH.

Study limitations. The results were based on observations noted by ICLN who were not totally dedicated to monitoring HH, and their prime duties included clinical tasks; therefore, human error cannot be disregarded. The percentage of physicians observed out of the total pool accounts for 20%. Gathering more observations from physicians might better explain the non-compliance. Direct observations are considered to be the gold standard;[5] however, possibility of human error in making observations cannot be excluded as it requires intensive training and practice to obtain accurate readings. Additionally, we did not evaluate the correct technique and duration for HH during the study. Therefore, effectiveness of HH compliance could not be evaluated. Throughout the observation period, the HCW were completely unaware of being observed; thereby, decreasing the chances of Hawthorne effect.

In conclusion, this study presented the baseline non-compliance rate, and the factors significantly associated with non-compliance from a cardiac center in the Kingdom of Saudi Arabia. In the light of the findings, targeted efforts and resources can be focused and prioritized to the areas for immediate improvement. Hand hygiene improvement strategies should focus particularly on physicians along with other HCW. The plan should emphasize on increasing HH during all the "before" indications, and should provide a clear concept of the patient surroundings to all HCW. Further research activities are needed in the region to provide benchmarking data and open channels of communication between different healthcare facilities across the region so that excellent patient care can be ensured.

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Ethical Consent

All manuscripts reporting the results of experimental investigations involving human subjects should include a statement confirming that informed consent was obtained from each subject or subject's guardian, after receiving approval of the experimental protocol by a local human ethics committee, or institutional review board. When reporting experiments on animals, authors should indicate whether the institutional and national guide for the care and use of laboratory animals was followed.