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Hand Hygiene Compliance Rates and Interventions to Increase Hand Hygiene Compliance Among Healthcare Workers in a Tertiary-Care Educational Hemato-Oncology Hospital: A Prospective Observational Study

Üçüncü Basamak Hematoloji-Onkoloji Eğitim Hastanesinde Sağlık Çalışanları Arasında El Hijyeni Uyumluluk Oranları ve El Hijyeni Uyumluluğunu Artırmak için Yapılan Müdahaleler: Prospektif Gözlemsel Çalışma

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Abstract

Introduction: This study aimed to assess hand hygiene (HH) compliance across occupational groups in a tertiary-care hemato-oncology teaching hospital.

Materials and Methods: A prospective observational study was performed to determine HH compliance among doctors, nurses, and auxiliary staff before and after multiple interventions, including in-house education, immediate feedback to the staff on HH non-compliance, and dissemination of warning and appreciation emails. Infection control nurses conducted unblinded HH observations following the World Health Organization's five indications between November 2022 and July 2024. Statistical analysis was performed using the chi-square test. A p-value <0.05 was considered significant.

Results: A total of 6990 HH opportunity observations were conducted over the 21 month period yielding a compliance rate of 71.8% (5020/6990). HH compliance was highest among nurses (76.6%) and lowest among doctors at 63.4% (p<0.001). Monthly HH compliance ranged from a low of 36% in May 2023 to a high of 92.1% in April 2024. Following the first cycle of emails distributed in May, compliance steadily increased from 36% to 74%. Statistical analysis revealed a significant improvement in HH compliance between May 2023 and June 2023 (p=0.013). Further analysis comparing compliance rates from May to October 2023 revealed statistically significant differences (p<0.001). Besides, the HH compliance improved consistently across the periods November 2022-April 2023 [606/1102; 55%], May-October 2023 [1405/2376; 59.1%], November 2023-April 2024 [1866/2242; 83.2%], and May-July 2024 [1143/1270; 90%] (p<0.001). After December 2023, HH compliance was sustained at rates exceeding 80%.

Conclusion: After an 21-month implementation period, our HH compliance rates surpassed 80%. Implementation of personalized feedback mechanisms and other interventions was associated with a substantial positive impact on HH compliance.

Fair and transparent observations among the staff on duty were also warranted. Further supportive studies are needed to enhance HH compliance.

Keywords: Hand hygiene, infection control, multimodal interventions, nosocomial infections, hospital-acquired infections, healthcare-asssociated infections

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Öz

Giriş: Bu çalışmada, bir üçüncü basamak hematoloji-onkoloji eğitim hastanesinde farklı meslek gruplarının el hijyeni (EH) uygulamalarına uyumunu değerlendirilmesi amaçlandı.
Gereç ve Yöntem: Doktorlar, hemşireler ve yardımcı personel arasında, kurum içi eğitim, EH uyumsuzluğu durumunda personeli anında bilgilendirme, uyarı ve takdir e-postaları gönderilmesi dahil olmak üzere birden fazla müdahaleden önce ve sonra EH uyumunu değerlendirmek için prospektif gözlemsel bir çalışma yürütüldü. Kör olmayan bir şekilde yapılan EH gözlemleri, Dünya Sağlık Örgütü'nün 5 endikasyonuna uygun olarak, Kasım 2022 ile Temmuz 2024 arasında enfeksiyon kontrol hemşireleri tarafından gerçekleştirildi. İstatistiksel analiz ki-kare testi ile yapıldı ve p-değeri <0,05 anlamlı kabul edildi.
Bulgular: Yirmi bir aylık dönemde toplam 6990 EH gözlemi yapıldı ve %71,8 (5020/6990) oranında EH uyumu saptandı. En yüksek uyum hemşirelerde (%76,6) iken en düşük uyum doktorlarda %63,4 (p<0,001) oldu. Aylık bazda en düşük EH uyumu Mayıs 2023'te (%36) iken en yüksek uyum Nisan 2024'te (%92,1) oldu. Mayıs ayında gönderilen ilk e-posta döngüsünden sonra uyum %36'dan %74'e istikrarlı bir şekilde arttı. İstatistiksel analiz, Mayıs 2023 ile Haziran 2023 arasında EH uyumunda önemli bir yükselme olduğunu gösterdi (p=0,013). Mayıs ile Ekim 2023 arasındaki uyum oranlarını karşılaştıran daha ileri analiz, istatistiksel olarak önemli farklılıklar ortaya koydu (p<0,001). Ayrıca, EH uyumu Kasım 2022-Nisan 2023 [606/1102-%55], Mayıs-Ekim 2023 [1405/2376-%59,1], Kasım 2023-Nisan 2024 [1866/2242-%83,2] ve Mayıs-Temmuz 2024 [1143/1270=%90] arasında istikrarlı bir şekilde yükseldi (p<0,001). Aralık 2023'ten sonra EH uyumu tutarlı bir şekilde %80'in üzerinde kaldı.
Sonuç: On sekiz aylık bir uygulama süresinin ardından, EH uyum oranlarımız %80'i aştı. Kişiselleştirilmiş geri bildirim mekanizmalarının ve diğer müdahalelerin uygulanması, EH uyum seviyeleri üzerinde önemli bir olumlu etki gösterdi.
Ayrıca bu durum, görev başındaki personel arasında adil ve şeffaf gözlemlerle de doğrulandı. EH uyumunu daha da artırmak için ek destekleyici çalışmalara ihtiyaç bulunmaktadır.
Anahtar Kelimeler: El hijyeni, enfeksiyon kontrolü, multimodal müdahaleler, nosokomyal enfeksiyonlar, hastane kaynaklı enfeksiyonlar, sağlık bakımı ilişkili enfeksiyonlar

Introduction

Healthcare-associated infections (HAIs) present major challenges to healthcare systems, resulting in longer hospitalizations, higher costs, and adverse patient outcomes, including increased morbidity and mortality[1]. Hand hygiene (HH) plays a pivotal role in preventing the transmission of microorganisms and mitigating the incidence of HAIs[2]. The World Health Organization (WHO) advocates the "My 5 Moments for HH" approach to promote HH compliance among all healthcare workers (HCWs)[3]. The "My 5 Moments for HH" approach recommends HH before and after patient contact, prior to clean-aseptic procedures, after exposure to body fluids and following contact with patient surroundings[3].

However, despite considerable data underscoring the critical role of HH, research indicates that healthcare professionals frequently underestimate its relevance, leading to persistently low compliance rates[4]. Multiple studies have demonstrated that HH compliance improves significantly following the implementation of HH interventions[5,6]. However, it remains unclear which specific measures are the most effective and feasible and how such improvements in HH can be sustained over the long term[7,8]. Herein, we aimed to evaluate the HH compliance rates following the implementation of multiple targeted interventions. This study primarily aimed to examine HH compliance among HCWs at our center and to contribute to the growing body of research on the effectiveness of interventions designed to enhance HH compliance.

Materials and Methods

A prospective observational study was conducted to assess the compliance of doctors, nurses, and auxiliary staff with HH in a tertiary-care academic hemato-oncology hospital within a country with a population of 1.5 million. Our hospital comprises 110 single-bedded inpatient rooms, 45 outpatient clinics, and a 42-bed daycare unit. Each room is equipped with a sink for convenience. Additionally, inpatient rooms are equipped with a minimum of one hand rub dispenser, with 56 rooms having one, 48 rooms having two, and six rooms having three dispensers. All hospital areas were included within the scope of HH observations. Infection control nurses performed unblinded HH observations following the WHO guidelines and the "My 5 Moments for HH" indications[3,9]. The study was conducted from November 2022 to July 2024. HH data were recorded using a person-based, individualized method.

The following multimodal interventions were implemented during the study period:

i) Immediate feedback to staff observed to be noncompliant with HH practices, starting in *December 2022.*

ii) Provision of practical HH training to all hospital employees during the observation period.

iii) Implementation of a performance feedback system, the study's critical intervention, whereby warning notifications were issued to staff members with compliance rates below 70%, while recognition messages were forwarded to those with compliance rates above 90%.

These communications were distributed thrice: May 2023, September 2023, and May 2024. *Individualized HH data were utilized to identify staff with five or more HH observations for the distribution of warning/gratitude emails. Furthermore, letters of commendation (per department) were also emailed on June 14, 2023, September 20, 2023, and May 22, 2024.*

In addition to these interventions, no changes were made to the number or placement of alcohol-based hand rub dispensers throughout the study period. Inpatient rooms were equipped with a minimum of one and a maximum of three hand rub dispensers, as well as at least one sink which is detailed above This distribution ensured the adequate availability of hand rub dispensers and sinks from the outset of the study. Consequently, we tailored our strategies to address the specific needs of our facility.

Statistical Analysis

Statistical analysis was performed using the chi-square test. A p-value <0.05 was considered statistically significant.

Results

A total of 6990 HH opportunity observations were recorded during the 21-month period, resulting in an overall compliance rate of 71.8% (5020/6990).

The highest HH compliance was observed among nurses (76.6%, 3304/4310), followed by auxiliary staff (64.3%, 1213/1887), with the lowest compliance among doctors (63.4%, 503/793) (p<0.001).

On a monthly basis, the lowest HH compliance was recorded in May 2023 (36%), while the highest was observed in April 2024 and July 2024 (92%). In the March 2023, the number of HH observations tripled, which might have contributed to a decline in observed HH compliance from 92% to 46%.

Following the initial email communication in May 2023, we noted a significant improvement in compliance rates, which exhibited a sustained upward trend from 36% to 74%. Statistical analysis revealed a significant improvement in HH compliance between May 2023 and June 2023 (p=0.013). A comparative analysis of compliance rates between May and October 2023 revealed statistically significant differences (p<0.001). Moreover, the HH compliance improved consistently across the mentioned periods November 2022-April 2023 [606/1102; 55%], May-October 2023 [1405/2376; 59.1%], November 2023-April 2024 [1866/2242; 83.2%], and May-July 2024 [1143/1270; 90%] (p<0.001). After December 2023, the HH compliance consistently exceeded 80%.

Table 1 details the overall monthly distribution of HH compliance, while Table 2 presents the distribution of warning and gratitude emails by profession.

Table 1. Monthly distribution of overall HH compliance among HCWs stratified by occupation

HH	Doctors Compliance (n%) Opportunities (Complied/ overall)	Nurses Compliance (n%) Opportunities (Complied/ overall)	Auxiliary Staff* Compliance (n%) Opportunities (Complied/ overall)	Total	Remarks
November 2022	31% (10/32)	90% (46/51)	78.7% (26/33)	71% (82/116)	
December 2022	65% (34/52)	96% (49/51)	38% (8/21)	81% (101/124)	
January 2023	53% (10/19)	100% (33/33)	92.8% (13/14)	85% (56/66)	
February 2023	53% (16/30)	90% (44/49)	77.2% (17/22)	76% (77/101)	
March 2023	29% (20/68)	60% (96/161)	34.9% (38/103)	46% (154/332)	
April 2023	36% (17/47)	42% (87/208)	29.6% (32/108)	37% (136/363)	
May 2023	37% (15/41)	39% (82/212)	40.2% (53/132)	36% (140/385)	25 May-Warning (n=13) and gratitude (n=3) emails were sent**
June 2023	51% (18/35)	52% (114/218)	30.3% (36/119)	45% (168/372)	Email commendation letters (per department) were sent on June 14
July 2023	60% (12/20)	53% (135/256)	46.5% (53/114)	51% (200/390)	
August 2023	57% (43/75)	74% (169/228)	74.7% (100/134)	71% (312/437)	
September 2023	81% (42/52)	75% (183/245)	69% (76/110)	74% (301/407)	10-12 September-Personal warning (n=53) and gratitude (n=11) emails were sent**. Email commendation letters (per department) were sent on September 20, 2023

Table 1. Continued

HH	Doctors Compliance (n%) Opportunities (Complied/ overall)	Nurses Compliance (n%) Opportunities (Complied/ overall)	Auxiliary Staff* Compliance (n%) Opportunities (Complied/ overall)	Total	Remarks
October 2023	64% (9/14)	77% (175/226)	69% (100/145)	74% (284/385)	
November 2023	62% (8/13)	76% (200/264)	64% (71/111)	72% (279/388)	
December 2023	79% (15/19)	82% (112/136)	69% (37/54)	78% (164/209)	
January 2024	96% (22/23)	84% (223/264)	81% (64/79)	84% (309/366)	
February 2024	90% (19/21)	85% (223/263)	80% (77/96)	84% (319/380)	
March 2024	80% (35/44)	88% (221/252)	79% (95/121)	84% (351/417)	
April 2024	88% (37/42)	94% (318/337)	86% (89/103)	92% (444/482)	
May 2024	75% (41/55)	89% (255/285)	90% (81/90)	88% (377/430)	22 May 2024: Warning (n=50) and gratitude (n=51) emails were sent
June 2024	89% (31/35)	94% (290/310)	83% (81/98)	91% (402/443)	
July 2024	88% (49/56)	95% (249/261)	83% (66/80)	92% (364/397)	
Total	63.4% (503/793)	76.6% (3304/4310)	64.3% (1213/1887)	**71.8% (5020/6990)**	

*Patient care assistant/healthcare assistant, Housekeeping/Porter, Allied [Physiotherapist, Radiotherapist, Technicians (including Laboratory, Electrocardiogram, Echocardiogram)].
**Person-based HH observations were conducted, and staff with ≥5 HH opportunities were evaluated

Table 2. Distribution of warning and gratitude emails by professional category

Profession	May 25, 2023		10-12 September 2023		May 22, 2024	
	Warning	Gratitude	Warning	Gratitude	Warning	Gratitude
Doctor	5	-	1	1	3	5
Registered Nurse	3	-	38	10	29	30
Patient care assistant	3	-	9	-	1	4
Allied	2	-	4	-	14	3
Housekeeping	-	3	1	-	3	9
Total	**13**	**3**	**53**	**11**	**50**	**51**

Discussion

This study analyzed the HH compliance rate among doctors, nurses and auxiliary staff, comparing compliance rates before and after the implementation of multimodal interventions. The interventions implemented during the study period were:

i. Providing immediate feedback to staff noncompliant with HH practices.

ii. Delivering HH education to all hospital employees.

iii. Issuing warning emails to staff with <70% compliance and gratitude emails to those with >90% compliance.

Commendation letters recognizing outstanding HH compliance were forwarded to departments with the highest rates of compliance. Our main observation were:

1. Prior to the interventions, the HH compliance rate among all HCWs was below the WHO recommendations.

2. During the study period, the lowest HH compliance rate was observed among doctors, whereas the highest compliance was among the nurses.

3. After the interventions, HH compliance rates significantly increased and remained stable across all occupational groups.

Despite robust evidence supporting the necessity of HH, numerous studies have shown that healthcare professionals frequently undervalue its relevance, resulting in persistently suboptimal compliance rates. Uyan Önal et al.[10] conducted a multicenter-study with 15 centers in Türkiye. They reported HH compliance rates of 76.9% in 2015 (60071/78116) and 79.6% in 2016 (66551/83607). A study conducted at the Umberto I Teaching Hospital in Rome reported HH compliance rates of 79.7% in clinical departments, 73.5% in surgical departments, and 63.1% in intensive care units. These findings underscore the inconsistency in compliance rates as well as the need for further monitoring and training[11]. A study conducted at a respiratory

care facility in Bangladesh demonstrated a significant improvement in the HH practices and knowledge among HCWs following an educational intervention. Specifically, the compliance rates increased substantially from 66.0% to 88.3%, highlighting the efficacy of structured training and educational programs in enhancing HH compliance[12]. In a study conducted at the Ege University, Türkiye, which involved 24,153 HH opportunities (2014: 5695; 2015: 5307; 2016: 4563; 2017: 4821; 2018: 3767), the overall HH compliance rates for the employees were as follows: 2014: 34%, 2015: 55.7%, 2016: 61.0%, 2017: 55.6%, and 2018: 68.1%[13]. The primary factors contributing to low HH compliance among HCWs are reported to be i) lack of awareness of its importance in preventing HAIs, ii) insufficient education on proper techniques for handwashing and use of alcohol-based hand rubs, iii) time constraints, iv) skin irritation, v) limited accessibility of handwashing facilities, and vi) inadequate leadership support[14].

Several previous studies have demonstrated that multimodal interventions may significantly contribute to enhanced HH compliance rates[15,16]. Midturi et al.[15] reported that the HH compliance rate significantly increased up to 93.2% from 72.7% ($p<0.002$) after the implementation of a multifaceted strategy. The interventions primarily included establishing a task force committee actively engaging several departments and hospital administration in the implementation process. Barnett et al.[16] described a multifaceted intervention strategy to enhance HH compliance, which included multiple initiatives, such as implementing a "Secret Shopper" program, awarding trophies to departments with the highest compliance rates, and issuing warning letters to noncompliant staff. Following these multimodal interventions, the HH compliance rates improved significantly ($p < 0.0001$)[16]. These findings from previous studies are in line with our study results.

Previous studies have consistently shown that, among all occupational groups, nurses demonstrated the highest HH compliance rate[17]. Similarly, in our study, nurses exhibited the highest HH compliance rate compared to auxiliary staff and physicians. Notably, pediatricians were found to demonstrate the highest compliance rate, followed by nurses, in a cluster-randomized trial conducted by Martín-Madrazo et al.[18]. Our facility exclusively comprises oncology, hematology, radiation oncology, infectious diseases, and palliative care units; therefore, the assessment focused on personnel within these specialized departments.

Study Limitations

This study has several limitations. Since multiple interventions were implemented concurrently, it was not feasible to determine the individual contribution of each intervention to the observed improvements in HH compliance. Previous research has demonstrated that individuals tend to alter their behavior when they are aware of being monitored, a phenomenon commonly referred to as the Hawthorne effect[19]. This behavioral modification has been well-documented in the context of HH compliance monitoring[20]. Given that our observations were unblinded, the Hawthorne effect cannot be excluded for observations made both before and after the interventions. However, this study is among the few that have analyzed HH in our country and within a hemato-oncology hospital, thereby providing a potential benchmark for similar healthcare settings.

Conclusion

In conclusion, the implementation of multimodal interventions, particularly the individualized feedback strategy, made a significant impact and led to a relatively high and consistent HH compliance rate among HCWs in a tertiary-care hemato-oncology hospital. Nevertheless, there is a need to develop strategies that ensure long-term sustainability of high HH compliance rates in healthcare settings.

Ethics

Ethics Committee Approval: This study was reviewed and approved by the Bahrain Defence Royal Medical Services Local Institutional Review Board (approval number: 2024-833, dated: 18.08.2024).

Informed Consent: This study involved routine hand hygiene observations as part of an institutional quality improvement initiative. As the study did not involve direct patient interaction or intervention beyond standard infection control measures, individual informed consent was not required.

Footnotes

Authorship Contributions

Surgical and Medical Practices: C.S.D.R., J.P., C.V., Concept: U.E., O.R.S., Design: O.R.S., Data Collection or Processing: N.A., C.S.D.R., J.P., C.V., Analysis or Interpretation: H.S., E.F., A.R., S.P., T.Y., O.R.S., Literature Search: U.E., N.A., O.R.S., Writing: U.E., O.R.S.

Conflict of Interest: No conflict of interest was declared by the authors.

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