



Isolation Precautions Compliance Rates Among Healthcare Workers in a Tertiary Care Educational Hemato-Oncology Hospital

Üçüncü Basamak Eğitim Hemato-Onkoloji Hastanesinde Sağlık Çalışanlarının İzolasyon Önlemlerine Uyum Oranları

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ABSTRACT

Introduction: The use of personal protective equipment (PPE) by healthcare workers (HCWs) is a key component of infection prevention in patients requiring isolation precautions (IP) and represents one of the essential practices. The objective of this study was to assess the compliance with IP in a 164-bed tertiary-care educational hospital.

Materials and Methods: The study was conducted in our center between April 2023 and July 2024. We conducted unblinded individualized observations to determine whether HCWs complied with the use of gowns and gloves when providing direct care to patients in IP. The fundamental principle of IP is to wear gloves and gowns when in contact with the patient and surrounding surfaces. In this study, we considered it non-compliance with IP when HCWs did not have a gown and/or gloves while touching the patients and/or surroundings. We excluded observations in two cases: when HCWs did not touch the patient or the patient's environment during the observation; and when emergency cardiopulmonary resuscitation or other emergency interventions were performed. We performed statistical analysis using the Chi-square test and multivariate Chi-square test, and a p-value <0.05 was considered significant.

Results: During the study period, a total of 633 observations were conducted, resulting in an overall compliance rate of 86.4% (547/633). Nurses demonstrated the highest compliance rate at 92%. On the other hand, doctors had the lowest compliance rate at 76% (p< 0.001). The baseline compliance rate at the beginning of the study was approximately 42%. From April 2023 to July 2024, verbal warnings were given to staff who were not compliant (n= 23), in September 2023 (n= 16), and in May 2024 (n= 10), official emails were sent to address the issue with non-compliant staff. Compliance subsequently increased to 100% (30/30) in November and then fluctuated between 80% and 100% until July 2024. When comparing April 2023 with July 2024, overall PPE compliance was significantly higher in July 2024 (p< 0.001), with significant increases among doctors (p= 0.001) and nurses (p< 0.001), but not among auxiliary staff (p= 0.379).

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Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Conclusion: While the baseline compliance rate was 42%, it increased to 100% during the study period. Moreover, the compliance rate remained above 80% after September 2023. These findings highlight the potential importance of ongoing follow-up and reminders in maintaining a high level of infection prevention compliance.

Key Words: Compliance; Healthcare workers; Isolation precautions; Infection prevention and control; Personal protective equipment

ÖZ

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Giriş: Sağlık çalışanları tarafından kişisel koruyucu ekipman kullanımı, izolasyon önlemleri gerektiren hastalarda enfeksiyon kontrolünün temel unsurlarından biridir. Bu çalışmanın amacı, 164 yataklı bir üçüncü basamak eğitim hastanesinde izolasyon önlemlerine uyumu değerlendirmektir.

Materyal ve Metod: Çalışma, merkezimizde Nisan 2023 ile Temmuz 2024 tarihleri arasında yürütüldü. Sağlık çalışanlarının izolasyon önlemleri kapsamındaki hastalara doğrudan bakım sağlarken önlük ve eldiven kullanıp kullanmadıklarını belirlemek amacıyla bireysel-leştirilmiş, kör olmayan gözlemler yapıldı. İzolasyon önlemlerinin temel ilkesi, hasta ve çevresindeki yüzeylerle temas halinde eldiven ve önlük kullanılmasıdır. Çalışmada, sağlık çalışanlarının hasta ve/veya çevresiyle temas ederken önlük ve/veya eldiven kullanmaması izolasyon önlemlerine uyumsuzluk olarak kabul edildi. İki durumda gözlemler çalışma dışında bırakıldı: sağlık çalışanı gözlem sırasında hasta veya hasta çevresiyle temas etmemişse; acil kardiyopulmoner resüsitasyon veya diğer acil müdahaleler gerçekleştirilmişse. İstatistiksel analizlerde ki-kare testi ve çok gözlü ki-kare testi kullanıldı ve $p < 0.05$ değeri anlamlı kabul edildi.

Bulgular: Çalışma süresince toplam 633 gözlem yapıldı ve genel uyum oranı %86.4 (547/633) olarak bulundu. Hemşireler %92 ile en yüksek uyum oranını gösterdi. Öte yandan, doktorlar %76 ile en düşük uyum oranına sahipti ($p < 0.001$). Çalışmanın başlangıcındaki uyum oranı yaklaşık %42 idi. Nisan 2023 ile Temmuz 2024 arasında, uyumsuzluk gösteren personele sözlü uyarılar yapıldı ($n = 23$) ve Eylül 2023 ($n = 16$) ile Mayıs 2024 ($n = 10$)'te uyumsuz personele yönelik resmi e-postalar gönderildi. Sonrasında kasım ayında uyum oranı %100 (30/30)'e ulaştı ve Temmuz 2024'e kadar uyum oranı %80-100 arasında dalgalandı. Nisan 2023 ile Temmuz 2024 karşılaştırıldığında, genel kişisel koruyucu ekipman uyumu Temmuz 2024'te istatistiksel olarak anlamlı derecede daha yüksekti ($p < 0.001$); doktorlar ($p = 0.001$) ve hemşireler ($p < 0.001$) için anlamlı fark bulunurken, yardımcı personel için anlamlı bir fark saptanmadı ($p = 0.379$).

Sonuç: Başlangıçta %42 olan uyum oranı, çalışma süresince %100'e kadar yükseldi. Ayrıca, Eylül 2023'ten sonra uyum oranı sürekli olarak %80'in üzerinde kaldı. Bu bulgular, izolasyon önlemleri uyumunun sürdürülmesinde düzenli takip ve hatırlatmaların önemini vurgulamaktadır.

Anahtar Kelimeler: Uyum; Sağlık çalışanları; İzolasyon önlemleri; Enfeksiyon önleme ve kontrol; Kişisel koruyucu ekipman

INTRODUCTION

Contact isolation precautions refer to a series of steps followed by healthcare workers (HCWs), including performing hand hygiene upon entering and leaving patient rooms, donning gowns and gloves before entry, and doffing them upon exit^[1].

In up to 69% of interactions with patients infected or colonized with multidrug-resistant (MDR) pathogens of epidemiological importance (methicillin-resistant *Staphylococcus aureus*, carbapenem-resistant *Enterobacteriaceae*, *Candida auris*, etc.), the HCWs' gloves and gowns invariably become

contaminated^[1]. Besides, it has been shown that as high as 73% of the time, the environment in these rooms is contaminated^[1]. The potential of the pathogens to be resistant to commonly used antimicrobials and to spread rapidly in the environment and among patients is problematic. These pathogens are difficult to treat, costly antimicrobial agents are required, longer duration of hospitalization may be necessary, and mortality and morbidity may be higher compared to other infections^[2]. Therefore, compliance with contact isolation precautions provides an opportunity to reduce the spread of MDR pathogens and mitigate the associated negative impact of these infections. Although guidelines exist regarding when contact isolation precautions are required, compliance rate with these precautions may be suboptimal^[3-8]. The aim of our study was to determine the compliance rate with contact isolation precautions in a 164-bed tertiary-care educational hemato-oncology hospital in a country with a population of 1.5 million, as well as to assess the impact of interventions aimed at improving these rates. To our knowledge, this is the first such data reported from our country.

MATERIALS and METHODS

Our study was conducted in a 164-bed tertiary-care educational hospital in a country with a population of 1.5 million. We performed unblinded, individualized observations at our center to assess whether HCWs complied with the use of gowns and gloves when providing direct care to patients under isolation precautions. The study was conducted between April 2023 and July 2024.

The fundamental principle of isolation precautions is to wear gloves and gowns when in contact with the patient and surrounding surfaces. Transmission-based precautions include contact, droplet, and airborne isolation measures. The use of personal protective equipment (PPE) varies depending on the type of precaution: gowns and gloves are required for contact precautions; gowns, gloves, and a surgical mask for droplet precautions; and gowns, gloves, and a particulate respirator (e.g., N95 mask) for airborne precautions^[9]. In our facility, following the coronavirus diseases-2019 pandemic, the use of surgical

masks became mandatory in clinical areas due to the immunocompromised status of our patients. This policy remained in effect throughout the study period. Consequently, all HCWs were already wearing surgical masks in accordance with hospital regulations. During the study period, no indications for N95 respirator use were observed. Hence, in this study, we considered it non-compliance with isolation precautions when HCWs did not have a gown and/or gloves while touching the patients and/or surroundings. We excluded observations in two cases: i) when HCWs did not touch the patient or the patient's environment during the observation, and ii) when emergency cardiopulmonary resuscitation or other interventions were performed.

Statistics

We performed statistical analysis using the Chi-square test and multivariate Chi-square test via SPSS version 25. A p-value <0.05 was considered significant.

Ethics

This study was reviewed and approved by Royal Medical Services Institutional Review Board with the approval number: (Ref: 2024-833, dated 18 August 2024).

RESULTS

During the study period, a total of 633 observations were conducted, resulting in an overall compliance rate of 86.4% (547/633). Nurses demonstrated the highest compliance rate at 92%, for which they deserve special recognition. On the other hand, doctors had the lowest compliance rate at 76%. The difference between the three subgroups was significant ($p < 0.001$).

The baseline compliance rate at the beginning of the study was approximately 42%. From April 2023 to July 2024, verbal warnings were given to staff who were not compliant ($n = 23$), in September 2023 and May 2024, official emails were sent to address the issue with non-compliant staff. When each month was compared separately, the isolation precautions compliance rates differed significantly during the study period ($p < 0.001$). Besides, the difference between April 2023 and July 2024 was statistically significant

Table 1. Contact isolation compliance data according to months

Contact isolation	Doctors Compliance (n, %) Opportunities (Complied/Overall)	Nurses Compliance (n, %) Opportunities (Complied/Overall)	Auxiliary Staff * Compliance (n, %) Opportunities (Complied/Overall)	Total	Remarks
April 2023	9% (1/11)	60% (6/10)	100% (3/3)	42% (10/24)	Immediate verbal warnings were given to noncompliant staff.
May 2023	57% (4/7)	94% (17/18)	53% (5/8)	79% (26/33)	
June 2023	33% (1/3)	44% (4/9)	15% (2/13)	28% (7/25)	
July 2023	100% (2/2)	94% (15/16)	100% (3/3)	95% (20/21)	
August 2023	55% (6/11)	71% (17/24)	100% (12/12)	74% (35/47)	
September 2023	69% (9/13)	86% (24/28)	95% (19/20)	85% (52/61)	On 10 September 2023, 16 official emails were sent to noncompliant staff.
October 2023	100% (4/4)	95% (20/21)	100% (14/14)	97% (38/39)	
November 2023	100% (5/5)	100% (3/3)	100% (22/22)	100% (30/30)	
December 2023	100% (6/6)	100% (8/8)	75% (3/4)	94% (17/18)	
January 2024	100% (8/8)	100% (9/9)	100% (5/5)	100% (22/22)	
February 2024	100% (4/4)	100% (6/6)		100% (10/10)	On 23 May 2024, 10 official emails were sent to noncompliant staff.
March 2024	33% (1/3)	100% (12/12)	100% (2/2)	88% (15/17)	
April 2024	93% (14/15)	100% (29/29)	100% (7/7)	98% (50/51)	
May 2024	78% (14/18)	94% (16/17)	100% (6/6)	88% (36/41)	
June 2024	100% (10/10)	99% (66/67)	100% (3/3)	99% (80/81)	
July 2024	67% (18/27)	99% (67/68)	79% (15/19)	82% (93/114)	
Total	73% (107/147)	92% (319/345)	86% (121/141)	86.4% (547/633)	

*Patient Care Assistant/Health Care Assistant, Housekeeping/Porter, Allied (Physiotherapists and Technicians).

($p < 0.001$), for doctors ($p = 0.001$), nurses ($p < 0.001$), but not auxiliary staff ($p = 0.379$). Table 1 provides a detailed dataset and highlights the significant events and interventions that took place during the study period. Throughout the study period, there was no shortage of PPE.

DISCUSSION

In this study, we analyzed the PPE compliance rate before and after intervention in our center. Issuing verbal warnings and send-

ing emails to HCWs had a notable impact on improving PPE compliance rates.

When compared with compliance rates of similar studies, such as 18% from Türkiye, 39.5% from Brazil, 49.5% from Spain, and 34% from Japan, our baseline compliance rate of 42% in the first month was higher or compatible with the literature^[5-8]. Furthermore, after serial interventions including face-to-face warnings as well as official emails, the compliance rate increased considerably and statistically significantly

up to 100% and did not drop less than 80% during the study period.

Despite the availability of infection prevention and control guidelines provided by international health organizations and governments, the transformation of this knowledge into practice remains a significant challenge, and adherence to PPE protocols continues to fall short of expectations^[10]. The factors influencing successful implementation are multifaceted and include the clarity and interpretation of guidelines, organizational culture, healthcare facility infrastructure, the quality of training and support, accessibility to PPE, confidence in its effectiveness, and the commitment to delivering high-quality patient care^[10]. Our facility has a mandatory general orientation program for all HCWs at the start of their employment, which includes training on the proper application of transmission-based precautions. This structured training might have contributed to a baseline compliance rate that is higher than reported in the literature. Additionally, the procurement department closely monitors PPE stock levels and places orders in a timely manner to prevent shortages. All PPE is placed on trolleys either in front of regular patient rooms or in the anterooms of isolation rooms. Nurse managers in each ward, in coordination with Infection Control Practitioners, ensure that adequate PPE is supplied to their units and properly positioned. Making PPE readily available and easily accessible might have contributed to a significantly improved compliance rate.

Although the related evidence is quite limited, proper donning and doffing of PPE is considered to be a critical component of safe PPE use and may play a key role in preventing self-contamination. To mitigate the risk of contamination during PPE removal, the Centers for Disease Control and Prevention (CDC) has outlined a recommended doffing sequence^[11]. However, the sufficiency of the CDC's doffing protocol is discussed from several points^[12-16]. Furthermore, the World Health Organization recommends a slightly different donning and doffing sequence^[17,18]. Hence, further research is needed to establish the best donning and doffing protocol to ensure maximal safety for healthcare workers. In our study,

unfortunately, the sequence of donning and doffing was not considered during compliance observation. Although this may be regarded as a limitation, as mentioned above, the absence of an evidence-based, universally accepted consensus on the optimal sequence and the presence of varying recommendations in the literature may reduce the impact of this limitation. Additionally, hand hygiene before donning and after doffing was not included in the compliance observation. While this represents another limitation of the study, hand hygiene compliance is monitored separately in our institution. Following multiple interventions, our hand hygiene compliance rates have exceeded the institutional target of 80%^[19]. Given the overall acceptable hand hygiene performance, we anticipate that noncompliance with hand hygiene would not significantly affect the observed PPE compliance rates. The other main limitations of our study were i) the study did not address the barriers to implement PPE compliance, and ii) we cannot exclude the Hawthorne effect. The Hawthorne effect refers to individuals modifying their behavior when they know they are being observed. This phenomenon has been frequently reported during hand hygiene audits^[21,22]. As our observations were unblinded, its influence cannot be ruled out in either the pre- or post-intervention phases. These data suggest that continuous follow-up and feedback may cause an increase in contact isolation compliance.

In conclusion, our findings highlight that implementing PPE is a multifaceted process that demands a comprehensive range of strategies. Multiple interventions can enhance PPE compliance rates, but maintaining sustainability requires continuous effort and commitment.

ETHICS COMMITTEE APPROVAL

This study was approved by the Royal Medical Services Institutional Review Board (Decision no: 2024-832, Date: 18.08.2024).

CONFLICT of INTEREST

The authors have no conflicts of interest to declare that are relevant to the content of this article.

AUTHORSHIP CONTRIBUTIONS

Concept and Design: UE, ORS, NA

Analysis/Interpretation: UE, ORS, HS, CSDR, JP, CV

Data Collection or Processing: CSDR, JP, CV, NA, CPO, ZS, RARM, EF

Writing: UE, NA, ORS

Review and Correction: ORS, HS, CSDR, JP, CV, CPO, ZS, RARM, EF

Final Approval: All of authors

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