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FROM PRACTICE TO PERFECTION: A SURGICAL HAND SCRUBBING AUDIT IN INTERNEE TRAINING

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Abstract

Background: *Proper surgical hand scrubbing is essential for maintaining asepsis and preventing surgical site infections (SSIs), which remain a major challenge, particularly in developing countries. Although surgeons understand its importance, many fail to follow the complete protocol, compromising patient safety and increasing the risk of hospital-acquired infections due to inadequate sterilization practices.*

Methods: *A prospective audit assessed surgical hand scrubbing compliance among 25 trainees, including residents and house surgeons. Baseline data were gathered in cycle one, followed by interventions—video demos, hands-on training, and feedback—before cycle two. WHO standard criteria guided pre- and post-intervention assessments. Data was checklist-based, analyzed quantitatively for compliance rates, and qualitatively to explore adherence barriers.*

Results: *In the first audit cycle, overall compliance was 86.25%, which improved to 93.25% after targeted interventions. Significant improvements were observed in previously weak steps, with gains between 30% and 45%. Strong initial compliance steps were maintained. The findings highlight that structured training, feedback, and continuous auditing can significantly enhance adherence to surgical hand hygiene protocols.*

INTRODUCTION

Handwashing has long been a key aspect of personal hygiene and cultural or religious practices, yet its connection to health was established less than 200 years ago. Ignaz Semmelweis, a Hungarian doctor at Vienna General Hospital, is often called the father of hand hygiene. He introduced mandatory handwashing with chlorine, which led to a dramatic drop in maternal deaths by marking the first clear proof that clean hands could prevent infections.[1] Surgical site infections (SSIs) arise from a combination of risk factors involving the patient, surgeon, and healthcare environment. The microorganisms responsible for SSIs often originate from sources within the operating room, including

the surgical team's hands. To prevent these infections, surgical hand preparation (SHP) has long been a standard practice. Unlike routine handwashing or hand rubbing, SHP aims to eliminate transient microorganisms and significantly reduce resident skin flora.[2] Even with major advances in surgical techniques and infection control, surgical site infections (SSIs) continue to be the most common healthcare-associated infections. They lead to more complications, longer hospital stays, and increased healthcare costs. Globally, SSI rates vary widely from 2.5% to as high as 41.9% with developing countries facing the highest burden.[3]Despite its critical role in infection prevention, only about 40% of healthcare workers consistently follow hand hygiene protocols. While alcohol-based hand rubs offer a faster, effective alternative, compliance remains low due to time, awareness, and resource constraints—posing serious risks, especially in surgical settings.[4]Studies have shown that surgical glove puncture rates can range from 17% to 35% during procedures, emphasizing the crucial need for proper hand scrubbing before surgery. Thorough surgical hand preparation helps reduce microbial presence, offering an essential line of defense against infection. Implementing effective hand hygiene protocols, particularly preoperative scrubbing, is vital in lowering the risk of surgical site infections (SSIs). [5]

This study aimed to evaluate how closely healthcare professionals follow recommended hand-scrubbing techniques before surgery. Proper surgical hand preparation is a cornerstone of infection control; however, compliance can vary significantly. In 2009, the World Health Organization (WHO) comprehensive guidelines on hand scrubbing. These guidelines emphasize that surgical hand scrubbing should involve approximately 20 specific steps and should be performed thoroughly for 2 to 5 minutes, covering both the hands and forearms. The goal is to eliminate transient microorganisms and significantly decrease resident skin flora, which ultimately reduces surgical site infection creating a safer environment for both patients and surgical staff. By focusing on adherence to these standards, this study seeks to identify gaps in practice and promote improved techniques that can reduce the risk of surgical site infections.

Materials and methods

Study design

This study was conducted as an observational cross-sectional audit with the aim of evaluating and improving adherence to surgical hand scrubbing and washing practices. Specifically, it focused on compliance with the World Health Organization (WHO) guidelines. To ensure a comprehensive assessment, the audit was carried out in two cycles at Gulab Devi Teaching Hospital between March 15th and April 1, 2025.

Aims and Objectives

This study is designed to identify areas of non-compliance in surgical hand scrubbing practices, assess improvements over time, and enhance adherence to international standards through targeted, corrective interventions. By evaluating how consistently the surgical team follows established hand scrubbing guidelines the results will not only help raise awareness about the importance of surgical hand hygiene but also serve a fundamental role in decreasing surgical site infection in our hospital.

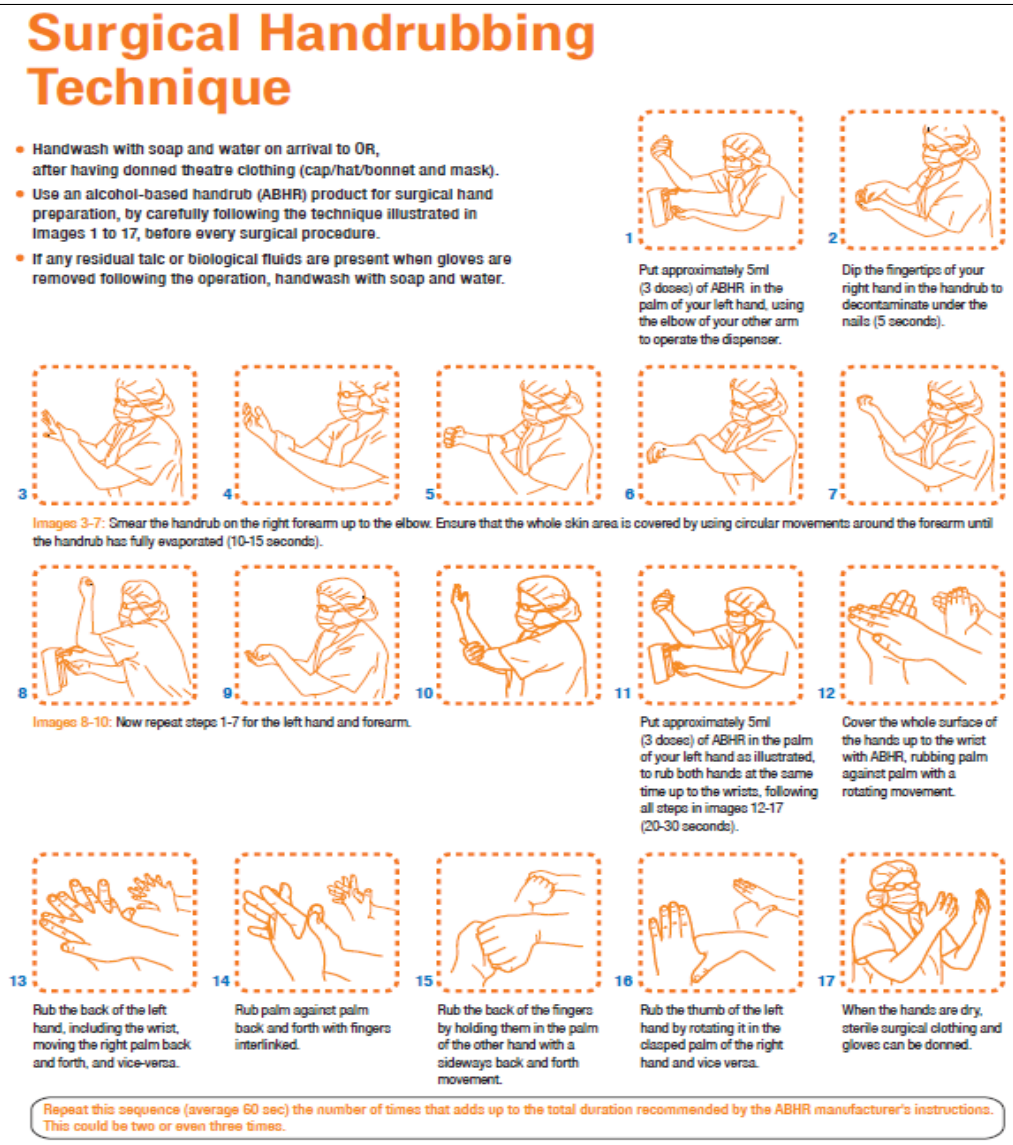


Figure 1: WHO Guideline for surgical hand rubbing technique [2]

Study area and population

The study was conducted in the operating theater of Gulab Devi Teaching Hospital and involved all 25 surgical residents and house surgeons actively participating in procedures during the audit period. This inclusive approach allowed for a well-rounded assessment of the team's adherence to hand scrubbing protocols. In each audit cycle, 20 parameters were observed, offering a meaningful sample size to evaluate compliance levels and identify areas for improvement across both phases of the study.

Data collection and analysis

Participants were observed over a two-week period as they performed hand scrubbing prior to surgical procedures; however, they were unaware that their practices were being audited, ensuring that the observations reflected their routine behavior. The assessment was conducted using WHO's recommended hand hygiene guidelines, and each participant's technique was evaluated against a structured checklist outlined in Figure 2. This checklist included 20 critical steps, where a "yes" indicated the correct performance of a step and a "no" indicated either incorrect or missed action. In

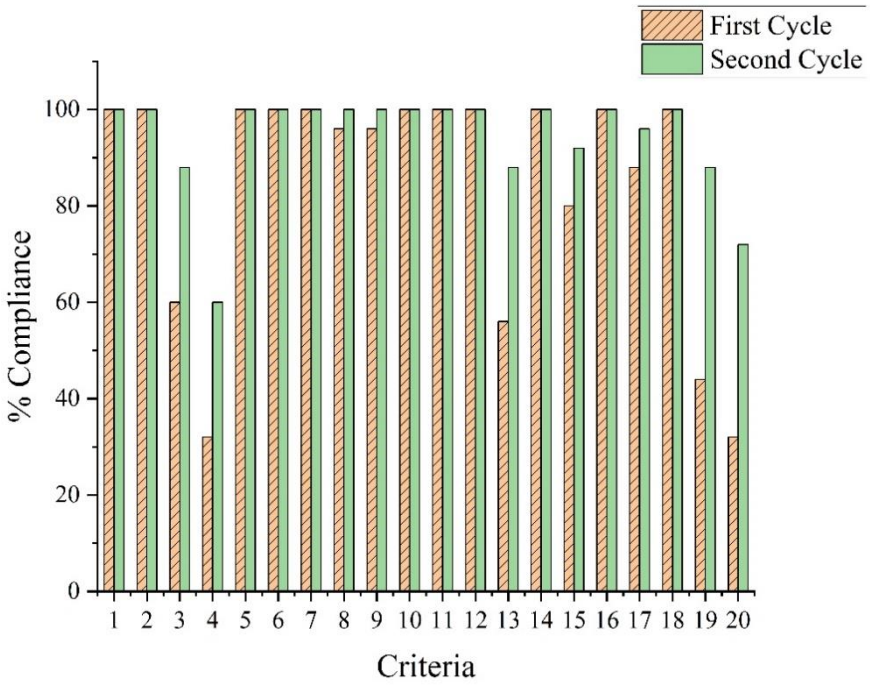
addition to evaluating individual steps, the study assessed adherence to a hand hygiene criterion, and the results were compiled into percentages to determine the overall compliance rate for each participant. These findings allowed for a clear comparison of adherence levels. Between the two audit cycles, staff were provided with targeted interventions, which included video demonstrations, hands-on training sessions, and regular feedback; these measures aimed to enhance awareness, correct deficiencies, and improve adherence to proper hand scrubbing techniques in the subsequent cycle. We have analyzed our data with SPSS version 26. Frequency and percentage were calculated for qualitative variables while mean and standard deviation for quantitative variables.

WHO Guideline on Hand Hygiene in Health Care

Name: _____ Designation: _____

Sr. No	Criteria Description	Yes	No
1	Remove hand accessories (Nail Polish, Rings, Bracelets etc.)		
2	Wet hands with water		
3	If hands are visibly soiled, wash hands with plain soap before surgical hand preparation.		
4	Remove debris from underneath fingernails using a nail cleaner, preferably under running water		
5	Apply enough soap to cover all hand and forearm surfaces		
6	Rub hands palm to palm		
7	Right palm over left dorsum with interlaced fingers and vice versa		
8	Palm to palm with fingers interlaced		
9	Backs of fingers to opposing palms with fingers interlocked		
10	Rotational rubbing of left thumb clasped in right palm and vice versa		
11	Rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice Versa		
12	Rubbing each side of both forearms till the elbows		
13	Minimum recommended time of 2 minutes completed while rubbing		
14	Rinse hands with water		
15	Don't move arm back and forth through the water		
16	Hands above elbows during rinsing		
17	Don't splash water on to the dress		
18	Hold the hands above the elbow all the time		
19	Dry hands thoroughly with a single use towel		
20	Complete the first scrub of the day within 5 minutes and other consecutive scrubs within 3 minutes		

Figure 2: WHO Guideline on Hand Hygiene in Healthcare [2]



Results

Figure 3: Comparison of Compliance Rates Across 20 Hand Scrubbing Criteria in First and Second Audit Cycles

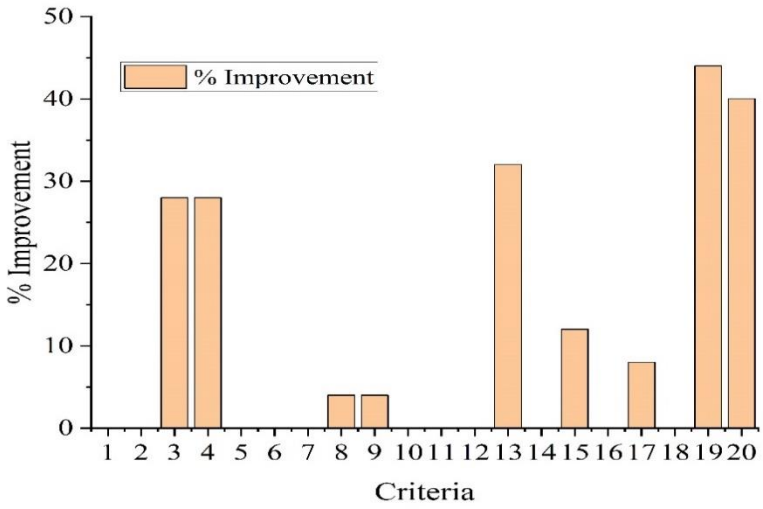


Figure 4: Bar chart showing Percentage Improvement in Compliance Across Hand Scrubbing Criteria Between Audit Cycles

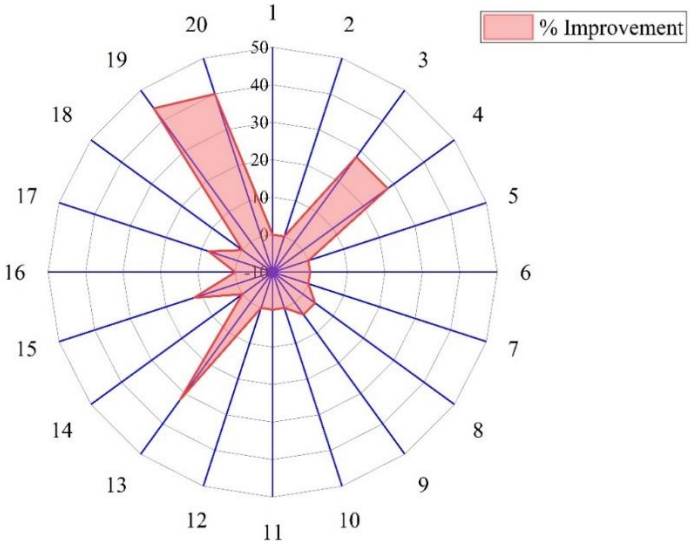


Figure 5: Radar plot showing percentage improvement in compliance across 20 hand scrubbing criteria after targeted interventions.

In the first audit cycle, overall compliance with surgical hand scrubbing protocols was around **86.25%**. After implementing targeted interventions, there was a clear and significant improvement, with compliance rising to **93.25%** in the second cycle. A total of **25 general surgery internees and house surgeons** were observed to evaluate their hand scrubbing techniques. Participants were randomly assigned to different cohorts, and their adherence was assessed over two audit cycles, with the same sample size of 25 participants observed in each round. Compliance was evaluated across **20 specific criteria** based on established hand hygiene standards by WHO. During the first cycle, compliance rates varied considerably. Although some steps showed high adherence, several key areas—particularly steps **3, 4, 12, 18, 19, and 20**—had much lower compliance rates, sometimes dropping to just **30–40%**. These gaps clearly highlighted the need for focused interventions to improve technique and consistency.

To address these deficiencies, a series of corrective measures were introduced, including **hands-on training sessions, video demonstrations,** and **real-time feedback**. Following these interventions, the second audit cycle demonstrated a significant improvement. Compliance rates increased across almost all criteria, with many steps achieving or approaching **100% adherence**. This underscores the powerful impact of structured educational efforts in enhancing surgical hand hygiene practices.

Moreover, the **radar plot (figure 5)** and **bar chart (figure 4)** further illustrated these improvements, showing the most substantial gains—ranging from **30% to 45%**—in steps that were initially weak (criteria 3, 4, 12, 18, 19, and 20). Meanwhile, criteria that had strong compliance from the beginning maintained their high standards, reflecting consistency and retention of proper scrubbing techniques.

Overall, these results highlight that **targeted education, practical demonstrations, and continuous feedback** can significantly improve adherence to surgical hand hygiene protocols. Nevertheless, ongoing emphasis on the finer details of hand scrubbing and drying remains essential to ensure these high standards are maintained consistently over time.

Discussion

We sincerely acknowledge and express our gratitude to Professor Dr. Khalil Ahmed, Head of the Surgical department at Gulab Devi Hospital, for his invaluable guidance, mentorship, and support throughout our scrubbing sessions. His encouragement and expertise were instrumental in the successful execution and improvement of our surgical hand hygiene audit.

According to the WHO guidelines on Hand Hygiene in Health Care, hand washing is defined as the act of cleaning hands using plain or antimicrobial soap and water.[2] Surgical hand antisepsis holds a significant place in the history of hand hygiene, as invasive procedures inherently carry a higher risk of transmitting infectious organisms from surgeons to patients, leading to surgical site infections and sepsis.[6] Pre-operative hand washing by the surgical team with an antibacterial solution has been shown to be highly effective in preventing nosocomial infections. This is particularly important because the skin's normal microflora is not limited to the surface; instead, it is often hidden beneath the superficial layers, residing within hair follicles, sweat glands, and sebaceous glands. Therefore, thorough and proper hand preparation is essential to minimize the risk of transmitting infections during surgical procedures[7] Several authentic surveys have consistently emphasized the importance of hand scrubbing in preventing infections; however, poor adherence among healthcare workers remains a major concern. Al Sawafi KM (2021) also highlighted that effective hand hygiene policies and a strong patient safety culture are key to improving compliance. Nevertheless, studies continue to show low adherence, often due to insufficient training, limited resources, and heavy workloads. Similarly, a Saudi ICU study using WHO's "Five Moments for Hand Hygiene" reported 58% non-compliance, particularly among new staff and in high-pressure settings.[8] Surgical hand antisepsis demands a specific set of skills that go well beyond routine handwashing, aiming for complete decontamination before surgery. In our study, targeted interventions—such as hands-on training, video demonstrations, seminars, and regular feedback—led to a significant improvement in compliance rates. This clearly highlights the crucial role structured educational programs play in building a strong culture of safety and ensuring adherence to hand hygiene protocols. Moreover, proper hand drying after washing is just as important, since improper drying can lead to recontamination with infectious agents at a critical stage.

Based on our observations and feedback from healthcare professionals, we noted that some hand scrubbing criteria were still not fully compliant. Several practical reasons for this non-adherence emerged. Firstly, some staff assumed that using an antiseptic solution alone was sufficient, leading them to skip the essential initial step of pre-cleaning with plain soap. Secondly, time pressure and a reluctance to delay the scrubbing process discouraged proper cleaning under the fingernails. Many professionals tended to scrub quickly, believing that covering all hand surfaces was more important than strictly observing the recommended scrubbing duration. In addition, proper drying was often neglected, as staff prioritized moving quickly into the sterile field after scrubbing. Furthermore, the distinction between the first scrub and subsequent scrubs was not consistently observed, with many defaulting to a shorter scrubbing time. Overall, workload pressures, high patient volume, and time constraints significantly contributed to these lapses in adherence. To address the gaps observed in surgical hand scrubbing and move toward achieving 100% compliance, several practical strategies must be implemented. First, continuous education and regular refresher sessions are essential to reinforce the importance of every scrubbing step. Moreover, hands-on workshops combined with visual reminders at scrub stations can help embed correct techniques into daily practice. Managing operating room schedules more efficiently could also reduce time pressures that often lead to rushed scrubbing. Furthermore, senior staff should lead, by example, promote a culture of accountability and patient safety. Importantly, conducting continuous audit cycles plays a critical role by providing regular feedback, tracking progress, identifying persistent weak areas, and ensuring that improvements are maintained over time.

Conclusion

This study reinforces the vital role of surgical hand scrubbing in preventing surgical site infections and promoting patient safety. Although compliance improved significantly after targeted interventions, complete adherence was not fully achieved. Structured education, hands-on training, continuous feedback, and regular audit cycles proved effective in closing many gaps. However, barriers like time pressure, habitual shortcuts, and inconsistent technique remain. Moving forward, continuous education, leadership support, and workflow optimization are essential to achieving 100%

compliance. It is important to note that the sample size in this audit was small, and certain limitations should be considered.

Ethical Clearance

The study's ethical clearance was obtained from the ethical committee/Internal Review Board (IRB) at Gulab Devi Teaching Hospital.

References

1https://globalhandwashing.org/about-handwashing/history-of-handwashing

2 WHO Surgical Site Infection Prevention Guidelines 2009 Available from https://www.who.int/gaps/5may/tools/9789241597906/en/. Accessed 22 Jun 2020

3 Asaad, A. Morad, and S. Ahmad Badr. "Surgical site infections in developing countries: current burden and future challenges." Clin Microbiol 5.6 (2016): 1-2.

4 Muhammed, Abubakr, et al. "Improving Quality and Compliance of Surgical Hand Scrubbing Practices: A Clinical Audit." Cureus 17.3 (2025).

5 Aslan, Lercan, et al. "A new checklist surgical hand scrub to replace time-based methods–A pixel intensity analysis." The Surgeon 21.6 (2023): 344-350.

6 Mukherjee, Ramanuj, Pritha Roy, and Madhav Parik. "Achieving perfect hand washing: an audit cycle with surgical internees." Indian Journal of Surgery 83.5 (2021): 1166-1172.

7 Hussain, Fahad, et al. "Surgical Hand Washing–A Clinical Audit of Young Surgeons at a Tertiary Care Hospital." *Pakistan Journal of Medical & Health Sciences* 16.06 (2022): 205-205.

8 Al Sawafi, Khalid M. "Examining the importance of hand hygiene policy and patient safety culture on improving healthcare workers' adherence to hand hygiene practice in critical care settings in the Sultanate of Oman: A scoping review." Cureus 13.11 (2021).