

Compliance of surgical hand washing before surgery: Role of remote video surveillance

Ambreen Khan, Sidrah Nausheen

Abstract

Objective: To evaluate and increase the compliance of surgical hand scrubbing with periodic feedback.

Methods: This study was conducted at the Aga Khan Hospital for Women and Children, Karachi, Pakistan, from April to July 2014. A remote video auditing system consisting of human auditors was used for visualising surgical hand wash compliance of the surgical team. The equipment, which used motion sensor, was installed in the scrub area wall, visualising the scrub sink only. A clock was displayed for the healthcare professionals to aid in ensuring two-minute hand washing. All surgeons, technicians and surgical assistants were included in the study. Surgical scrubbing was measured during a 4-week period by remote video auditing without feedback and a 12-week period with feedback. SPSS 19 was used for data analysis.

Results: Of the 534 observations, 150(28%) were made during the pre-feedback period and 384(71.9%) during the post-feedback period. During the first 4 weeks, the overall compliance was 22(14.6%). The rate of compliance increased to 310(80.7%) during the 12-week post-feedback period.

Conclusion: Video surveillance with feedback for hand washing was found to be an effective tool for measuring hand hygiene and improving compliance.

Keywords: Hand hygiene, Surgical scrub compliance, Camera. (JPMA 67: 92; 2017)

Introduction

Healthcare-associated infections (HAIs) are of a significant concern. It is well established that intensive care units (ICUs) have been a significant source of infection, but little has been known about the operating room (OR) as a primary source of infection. Much focus has been on the sterility of the operating theatre (OT), but little attention has been paid to the nosocomial infection sources through patient contact by hand hygiene practices of the operating staff. Hand hygiene is considered the simplest and cost-effective measure in preventing HAIs.¹ Limited data is available on the hand hygiene practices of the operating theatre staff, and their role in prevention of HAIs relating to operation theatre-borne infections.

Surgical site infection (SSI) is a globally recognised problem that results in significant morbidity (delayed healing, wound breakdown, sepsis) and negative economic impact² (prolonged hospital stays, revision surgery). Hand antisepsis remains a cornerstone of the overall aseptic technique in surgery, to eliminate transient micro-organisms and reduce resident skin flora.² Following effective hand hygiene practices has been recognised as the most important way to reduce the transmission of pathogens in healthcare settings.

Many studies, however, have shown that adherence to hand hygiene recommendations remains poor, and improvement efforts frequently lack sustainability.³ There have been studies showing that healthcare workers (HCWs) perform hand hygiene for very short periods and do not cover all surfaces of their hands and fingers.⁴ Transmission of bacteria can be reduced significantly by proper hand washing prior to surgery by healthcare professionals.

Measuring hand hygiene has always been a debatable task. Several methods have been identified but no one method has provided reliable results. Many studies have measured the effectiveness of an improvement intervention by both observing care and measuring product.

The majority of studies on hand hygiene are based on direct measurements, such as intermittent human observation, HCW self-reporting, and indirect measurement of hand hygiene product usage.⁵ A variation of direct observation is the use of video cameras to monitor human behaviour.

Nishimura et al.⁶ used concealed video cameras to observe hand hygiene practices of all people who entered the ICU for a 7-day period. Results showed a 71% compliance rate for ICU HCWs, 74% of non-ICU HCWs, and 95% of patient visitors. Brown et al.⁷ placed a video camera in a neonatal ICU to record hand hygiene

.....
Aga Khan University, Karachi, Pakistan.

Correspondence: Ambreen Khan. Email: ambreen.khan@aku.edu

compliance data on random nursing shifts at all times of the day for 2 months. The results of the 267 contacts reported the observed compliance rates: nurses, 24.7%; physicians, 31.8%; and respiratory therapists, 20.5%.

The use of video cameras to observe hand hygiene practices in healthcare settings has been limited. There is no such study in our country where the aid of camera was taken to measure hand hygiene. We propose to measure surgical hand hygiene of the surgical team with direct observation using video camera with periodic feedback to promote hand hygiene and improve compliance, by observing proper duration of surgical hand hygiene practices of surgical team prior to surgery. According to Centres for Disease Control and Prevention's (CDC) guidelines on hand hygiene in healthcare settings, duration of surgical scrubbing should be 2-6 minutes.⁸ Studies have shown that 2 or 3 minutes of duration of surgical scrub reduces bacterial count to acceptable levels.⁹

The current study was planned to monitor surgical hand hygiene practices through the eye of the lens and ensure compliance to at least two-minute surgical scrubbing by the surgical team prior to surgery.

Subjects and Methods

This observational study was conducted at the Aga Khan Hospital for Women and Children located at Kharadar, a densely populated area in Karachi, Pakistan, from April 1, 2014 to July 31, 2014.

A remote video auditing system consisting of human auditors, utilising software programme visualising hand hygiene compliance by healthcare workers in operating room with the use of video camera with motion sensor, was installed in the scrub area wall visualising the scrub sink only. The camera started recording with motion sensor. All surgeons, surgical assistants and operating room technicians were included in the study. Staff in operating room not involved in surgical procedure of patients was excluded.

A clock was displayed for the healthcare professionals to aid in ensuring two-minute hand washing. Video surveillance was done to see the hand scrubbing practices of the healthcare professionals. Hand hygiene was measured during a 4-week period by remote video auditing without feedback. All participants in the study were informed of camera monitoring, but they were not informed that they were being monitored for surgical scrub duration during the initial four weeks. Weekly feedback was given during the next 12 weeks. The results of surgical scrubbing of at least 2 minutes were displayed

on an operating room notice board. Performance feedback in percentage value was also continuously displayed on the notice board and the same was communicated to their respective departmental supervisors. An auditor was responsible for viewing the recordings and time analysis and recording the data. The auditor was a member of an infection control committee having proper knowledge of hand hygiene/scrubbing procedure and techniques as per institutional guidelines and policy. The data was password protected and was stored on computers which can be accessed by only with the auditor and team leader.

All healthcare professionals were informed of video monitoring of the hand hygiene practices. A sign indicating "camera monitoring" was displayed on the wall. The video camera only monitored the scrub sink area to observe privacy. All employees of the hospital underwent orientation of hand hygiene policy during appointment and had been informed that it was an integral part of patient care.

Confidentiality of the healthcare professionals involved in surgical procedure was maintained. No person was identified by name in pre- and post-feedback periods. Approval for the study was obtained from the ethical review committee of the Aga Khan University.

Frequency and percentage were calculated for compliance for each cadre as well as for overall participants. Generalised linear model was used to assess the expected improvement in compliance (i.e. hand washing for at least two minutes prior to surgery) over time. Outcome variable was defined as a binary variable, taking 0 = hand washing < 2 minutes prior to surgery and 1 = hand washing \geq 2 minutes prior to surgery. Logit link was used under the binominal distribution. $P \leq 0.05$ was considered statistically significant. SPSS 19 was used to analyse data.

Results

During the study period, 534 observations of surgical scrubbing were recorded. During the pre-feedback period of 4 weeks, 150(28.09%) observations were recorded; of them, 22(14.67%) recordings showed compliance with 2-minute hands scrubbing duration.

During the post-feedback period of 12 weeks, there were 384(71.91%) observations overall; of them, 310(80.7%) showed compliance. During the first four weeks of the post-feedback period, there were 147(38.28%) recordings, 118(30.73%) in the middle four weeks and 119(30.99%) in the last four weeks, whereas the compliance rate was 88(59.86%), 110(93.22%) and

Table: Compliance to surgical hand wash during pre- and post-feedback periods.

Team members	Pre-feedback period 4 weeks						Post-feedback period 12 weeks						p-value
	4 weeks pre-feed back			Initial 4 weeks			Next 4 weeks			Last 4 weeks			
	N	Compliance	CR%	n	Compliance	CR %	n	Compliance	CR%	n	Compliance	CR%	
Assistant	32	5	15.6	29	14	48.3	31	30	96.8	33	31	93.9	< 0.0001
Surgeons	59	6	10.0	60	30	50.0	46	40	87.0	43	40	93.0	< 0.0001
Technicians	59	11	18.6	58	44	75.9	41	40	97.6	43	41	95.3	< 0.0001
Total	150	23	14.6	147	88	59.9	118	110	93.2	119	113	94.1	< 0.0001

CR: Compliance rate.

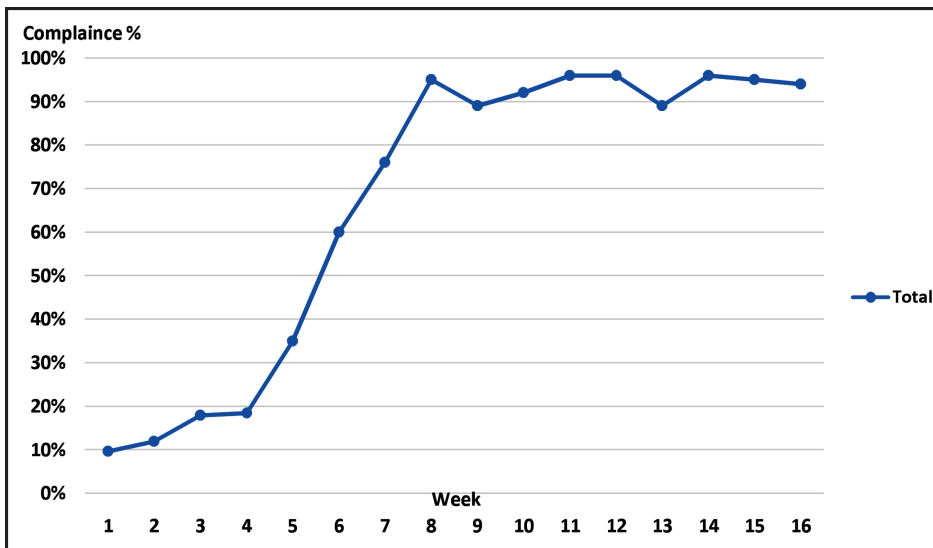


Figure: Weekly Compliance.

113(94.96%), respectively (p=0.0001).

The rate of compliance varied among the surgeons, technicians and surgical assistants. The lowest compliance rate was found among surgeons, i.e. 6(10%) during the pre-feedback period. The minimum compliance rate among surgical assistants and technicians was 5(15.6%) and 11(18.6%). As soon as feedback was given, compliance rose in all three groups with rates reaching as high as 40(97.6%) among technicians in the middle four weeks of the post-feedback period (Table; Figure).

Discussion

It is a well-established fact that healthcare professionals are not very vigilant about hand hygiene. We took up the surgical scrubbing time as a project to work on using video camera to record direct observations of surgical hand hygiene practices of surgical team. It was identified that many surgeons as well as OR technicians did not scrub for a certain duration as well as the technique of surgical scrubbing was not according to the guidelines. It

is a fact that nosocomial infections are spread by the healthcare professionals, mostly due to their ill hand hygiene practices. We took 2 minutes to be the least expected time duration for scrubbing following the CDC guidelines.⁸

Various studies have compared 2, 3, 5 and 10 minutes scrubbing duration and bacterial counts, immediately and post-procedure. Hingst et al.¹⁰ compared 3 minutes and 5 minutes scrub, and found 3 minutes scrubbing as effective as 5 minutes in reducing bacterial counts. O'Farrell et al.¹¹ compared 5-minute with 10-minute scrubbing before total

hip arthroplasty procedure. Their study recommended 5-minute scrub before total hip arthroplasty. In a study by O'Shaughnessy et al.,¹² durations of 2, 4 and 6 minutes were compared; according to them, scrubbing for longer than 2 minutes did not have any advantage.

It was interesting to note that the during the pre-feedback duration of 4 weeks, the compliance was 14.6% as the camera was installed but there was no feedback to as what was being observed. As soon as the feedback started, the compliance to 2-minute scrubbing rose from as low as 14.6% during the pre-feedback period to as high as 94% in the last four weeks. Overall compliance during the post-feedback period was 80.7%. Similar observations were experienced by Armellio et al.¹³

During the feedback period, healthcare workers were briefed about the proper technique and duration of compliance as we realised that most of the members involved in the surgical team did not know the significance of duration of surgical hand preparation.

Most of the time clinicians think their hand washing practices are optimum and do not focus on the fact that the duration of contact with scrubbing agent with hands is equally important. Sterilised gloves do not render surgical hand preparation unnecessary as bacteria from the hands of the surgical team may get released from an unnoticed puncture in a glove into the open wound. Several reported outbreaks have been linked to contaminated hands from the surgical team despite wearing sterile gloves.¹⁴ A recent trial demonstrated that punctured gloves double the risk of SSI.¹⁵ Surgical hand preparation eliminates the transient and reduces the resident bacterial flora in the hands.¹⁶

The risk of SSI arises not only from exposure to the patient's own natural flora, but also from the inadvertent transfer of microorganisms from surgeons and surgical team to the patient. Infection control epidemiology has clearly demonstrated that bacteria responsible for SSI can be shed from the surgical team's hands, despite standard antisepsis.¹⁷

Hand washing is recognised as the single most important factor in reducing and preventing healthcare-associated infections.¹⁸ It was interesting to note that during the study period, the SSI rate displayed by the hospital infection control department demonstrated dropped as compared to rates prior to the initiation of study, including the pre-feedback period. The SSI rate went down from 6.3% to 2.1% after initiation of feedback, which is quite interesting. However, the focus of this project was to increase compliance by innovative method of monitoring as well as the impact of feedback. Nevertheless, this decrease in SSI rate during the post-feedback period is a boost to our study and gives rise to another opportunity for further research.

Physicians' compliance to hand hygiene has always been challenged. In our study, the least compliant to 2-minute scrubbing were surgeons (10%); after feedback, this rate improved to 93% in the last four weeks of the study period. In a study conducted in Riyadh,¹⁹ the physicians' hand washing practices were consistently low. In that study, cardiac surgeons and cardiologists were observed for hand hygiene practices. It was observed that with nurses' motivation and encouragement, hand hygiene compliance was 83% for cardiac surgeons and 77% for cardiologists, but as soon as the motivation and encouragement was withheld the compliance dropped to 55.7% and 52% in both groups.¹⁹ It is believed that physicians perceive their hand hygiene practices to be superior, hence their attitude towards infection control practices is often casual.²⁰ Maintaining high hand hygiene

compliance rates is an organisational responsibility, but it also involves ethical and moral responsibility of individual healthcare workers, especially physicians. The overall behaviour towards hand hygiene needs to be focused and factors hindering compliance should be addressed.

This study was designed to create awareness among the healthcare workers, especially the staff involved in operating theatre, regarding optimum surgical scrubbing duration and proper technique. But the main point of this study was to validate that technology can monitor hand scrubbing of HCWs and can re-enforce the positive attitude for a prolonged period.

This technology allows us to record and analyse large volumes of performance data with subsequent opportunity to take action in the form of feedbacks, workshops and training sessions that can facilitate achieving high levels of compliance and performance. This practice should be a regular and continuous practice at healthcare facilities to ensure high levels of antiseptic measures.

The continuous monitoring of hand hygiene reduces selection bias which may be observed in intermittent human-observed audits that falsely increase rates due to the Hawthorne effect.²¹ Whether in OT, ICU or at any other health sector, ongoing monitoring and feedback are required to sustain high rates of hand hygiene compliance.²²

The positive feedback and re-enforcements have been associated with improved practice.²³ We believe that motivational and meaningful feedback to the healthcare workers creates an environment of healthy competition among departments in achieving optimum compliance. It is also important how the feedback is given and how it is perceived. The staff should take ownership of the outcome and collectively be involved in improving compliance. In our experience, auditing through video monitoring seems far more superior than other methods of monitoring as direct observational audits are impractical, time-consuming and, most importantly, misleading.²⁴ Product measurement and surveys are some other methods of monitoring, but measuring products can give false results, especially during spillage and waste. The surveys about HCW perceptions to hand hygiene can be misleading, especially when questioned about self-compliance.²⁴ This new technology of video camera monitoring is expensive, but offers superior results in areas where minimal risks of infection is required, such as operating room, emergency room and intensive cares.

Fewer number of observations was one of the limitations of this study, as this study was conducted in a secondary care facility where majority of surgical procedures were Caesarean section, followed by gynaecological surgeries. Moreover, the duration of the study was shorter. We plan to do such audits once in a quarter to maintain sustainability and improve further.

Conclusion

Video monitoring combined with real-time feedback of HCW hand hygiene rates produced a significant and sustained improvement in hand hygiene compliance. This technique has the potential to improve the quality of patient care.

Disclaimer: None.

Conflict of Interest: None.

Source of Funding: None.

References

- Pittet D, Allegranzi B, Sax H, Dharan S, Pessoa-Silva CL, Donaldson L, et al. Evidence-based model for hand transmission during patient care and the role of improved practices. *Lancet Infect Dis.* 2006; 6:641-52.
- Fry DE. The economic costs of surgical site infection. *Surg Infect.* 2002;3:S37-S43.
- Haas JP, Larson EL. Compliance with hand hygiene. *Am J Nurs.* 2008; 108:40-4.
- Guideline for Hand Hygiene In Health-Care Settings: Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. *Infect Control Hosp Epidemiol.* 2002; 23: S3-S40.
- Haas JP, Larson EL. Measurement of compliance with hand hygiene. *J Hosp Infect.* 2007; 66:6-14.
- Nishimura S, Kagehira M, Kono F, Nishimura M, Taenaka N. Handwashing before entering the intensive care unit: what we learned from continuous video-camera surveillance. *Am J Infect Control* 1999;27:367-9.
- Brown J, Froese-Fretz A, Luckey D, Todd J. High rate of hand contamination and low rate of hand washing before infant contact in a neonatal intensive care unit. *Pediatr Infect Dis J.* 1996; 15:908-10.
- Centers for Disease Control and Prevention. Guideline for Hand Hygiene in Health-Care Settings: Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. *MMWR* 2002;51(No. RR- 16).
- Nicolay CR. Hand hygiene: An evidence-based review for surgeons. *Int J Surg.* 2006; 4: 53-65.
- Hingst V, Juditzki I, Heeg P, Sonntag HG. Evaluation of the efficacy of surgical hand disinfection following a reduced application time of 3 instead of 5 min. *J Hosp Infect.* 1992; 20: 79-86.
- O Farrell DA, Kenny G, O Sullivan M, Nicholson P, Stephens M, Hone R. Evaluation of the optimal hand-scrub duration prior to total hip arthroplasty. *J Hosp Infect.* 1994; 26: 93-8.
- O Shaughnessy M, O Malley VP, Corbett G, Given HF. Optimum duration of surgical scrub-time Short note. *Br J Surg.* 1991; 78: 685-6.
- Armellino D, Hussain E, Schilling ME, Senicola W, Eichorn A, Dlugacz Y, et al. Using High-Technology to Enforce Low-Technology Safety Measures: The Use of Third-party Remote Video Auditing and Real-time Feedback in Healthcare. *Clin Infect Dis.* 2012; 54: 1-7.
- Lark RL, VanderHyde K, Deeb GM, Dietrich S, Massey JP, Chenoweth C. An outbreak of coagulase-negative staphylococcal surgical-site infections following aortic valve replacement. *Infect Control Hosp Epidemiol.* 2001; 22: 618-23.
- Misteli H, Weber WP, Reck S, Rosenthal R, Zwahlen M, Fueglistaler P, et al. Surgical glove perforation and the risk of surgical site infection. *Arch Surg.* 2009; 144: 558.
- Trampuz A, Widmer AF. Hand hygiene: a frequently missed life-saving opportunity during patient care. *Mayo Clinic Proc.* 2004; 79: 109-16.
- McNeil SA, Nordstrom-Lerner L, Malani PN, Zervos M, Kauffman CA. Outbreak of Sternal surgical site infection due to *Pseudomonas aeruginosa* traced to a scrub nurse with onychomycosis. *Clin Infect Dis.* 2001; 33: 317-23.
- Parienti JJ, Thibon P, Heller R, Le Roux Y, von Theobald P, Bensadoun H, et al; Hand-rubbing with an aqueous alcoholic solution vs traditional surgical hand-scrubbing and 30-day surgical site infection rates: a randomized equivalence study. *JAMA.* 2002; 288: 722-7.
- Mortell M, Balkhy HH, Tannous EB, Jong MT. Physician defiance towards hand hygiene compliance: Is there a theory-practice-ethics gap? *J Saudi Heart Assoc.* 2013; 25: 203-8.
- Squires JE, Linklater S, Grimshaw JM, Graham ID, Sullivan K, Bruce N, et al. Understanding practice: factors that influence physician hand hygiene compliance. *Infect Control Hosp Epidemiol.* 2014; 35: 1511-20.
- Roethlisberger FJ, Dickson WJ. *Management and the Worker: An Account of a Research Program Conducted by the Western Electric Company, Hawthorne Works, Chicago.* Cambridge, MA: Harvard University Press, 1967.
- Maury E, Moussa N, Lakermi C, Barbut F, Offenstadt G. Compliance of healthcare workers to hand hygiene: awareness of being observed is important. *Intensive Care Med* 2006; 32: 2088-9.
- Mayer J, Mooney B, Gundlapalli A, Harbarth S, Stoddard GJ, Rubin MA. Dissemination and sustainability of a hospital-wide hand hygiene program emphasizing positive reinforcement. *Infect Control Hosp Epidemiol* 2011; 32: 59-66.
- The Joint Commission Division of Quality Measurement and Research. *Measuring hand hygiene adherence: overcoming the challenges.* Oakbrook Terrace, IL: The Joint Commission, 2009.