

Closed loop audit: How competent and compliant are surgeons (obstetrics) at surgical hand antisepsis prior to elective and emergency surgical procedures?

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Introduction

- Surgical hand antisepsis is known to effectively remove or destroy transient microorganisms and inhibit the growth of resident microorganisms. (1)
- Poor surgical hand scrubbing may contribute to a higher incidence of surgical site infections with its associated (2):
 - Higher morbidity
 - Prolonged hospital stays
 - Increased in resistance to antimicrobials

- Hand hygiene is so critical as newborns are more susceptible to infections because of their (2):
 - Immature immune system
 - Fragile integumentary system
 - Frequent contact with staff
 - Possible need for invasive procedures
- This also leads to an increase risk of maternal sepsis postpartum surgery. (3)
- Adherence to hand hygiene recommendations remains poor and improvement efforts frequently lack sustainability worldwide. (4)

Aim

- We aim to assess how competent and compliant are surgeons at hand scrubbing prior to elective and emergency surgical procedures by video-surveillance before and after the revision of the AFPP and WHO guidelines.



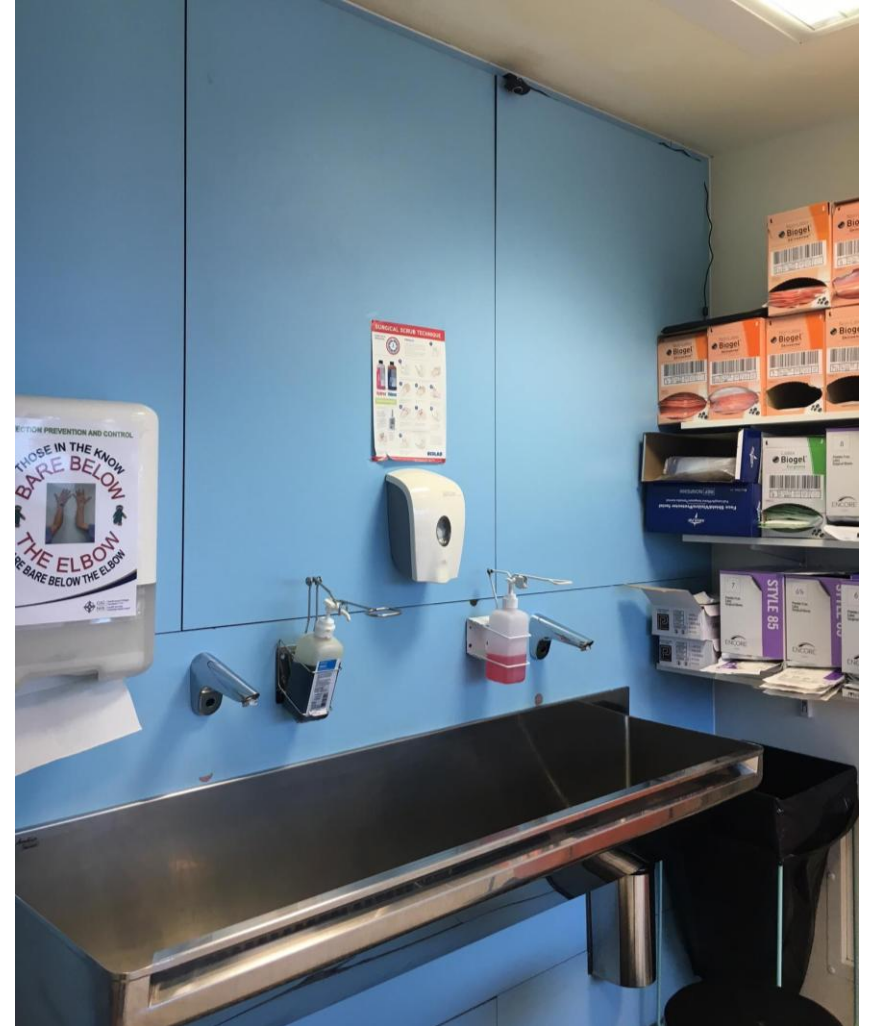
Figure 1. Hand drawn by first author.

Methods

Involved staff were notified through email and a micro-camera was assembled. The micro-camera was turned on at random to capture hand scrubbing footage over a period of 7 days.



Video recordings collected were compared with AFPP and WHO guidelines. Each recording was graded with a binary variable 1 = Obey and 0 = Disobey, scoring over 13 principal steps and 12 key steps into 3 categories (Excellent, Satisfactory, Unsatisfactory).



Surgical Hand Antisepsis Proforma

WHO & AFPP Steps

1. Put approximately 5ml (3 doses) of alcohol-based hand rub in the palm of your hand, using the elbow of your other arm to operate the dispenser.	8. Cover the whole surface of the hands up to the wrist with alcohol-based hand rub, rubbing palm against palm with a rotating movement.
2. Dip the fingertips of your hands in the hand rub to decontaminate under the nails (5 seconds).	9. Rub the back of the left hand, including the wrist, moving the right palm back and forth, and vice-versa. Interlace.
3. Smear the hand rub on the forearms up to the elbows. Ensure that the whole skin area is covered by using circular movements around the forearms until the hand rub has fully evaporated. (10 - 15s)	10. Rub palm against palm back and forth with fingers interlinked.
4. Rub both hands at the same time up to the wrists, and ensure that all the steps represented in the following steps 5. to 13. are followed. (20 - 30 seconds)	11. Rub the back of the fingers by holding them in the palm of the other hand with a sideways back and forth movement.
5. Clean under nails with pick and discard.	12. Rub the thumb of the left hand by rotating it in the clasped palm of the right hand and vice-versa.
6. Scrub hands and fingernails using bristle side of brush.	13. Rub finger tips on palms for both hands.
7. Wash all four sides of fingers using the sponge side only.	

Key Steps

Scrub each side of each finger, between the fingers, and the back and front of the hand for 2 minutes.

No artificial nails or nail polish

Hands kept higher than the arms at all times.

Arms bare below the elbow

Wash each side of the arm from wrist to the elbow for 1 minute.

Nail brushes used once and discarded

Rinse hands and arms by passing them through the water in one direction only, from fingertips to elbow. Do not move the arm back and forth through the water.

Scrub time lasts for at least 2 - 5 minutes

Proceed to the operating theatre holding hands above elbows.

Person with cut or burn should not scrub

No jewellery (rings, watches, bracelets)

Hand scrub repeated 3 times

The handrubbing technique for surgical hand preparation must be performed on perfectly clean, dry hands. On arrival in the operating theatre and after having donned theatre clothing (cap/hat/bonnet and mask), hands must be washed with soap and water. After the operation when removing gloves, hands must be rubbed with an alcohol-based formulation or washed with soap and water if any residual talc or biological fluids are present (e.g. the glove is punctured).

Surgical procedures may be carried out one after the other without the need for handwashing, provided that the handrubbing technique for surgical hand preparation is followed (Images 1 to 17).



1
Put approximately 5ml (3 doses) of alcohol-based handrub in the palm of your left hand, using the elbow of your other arm to operate the dispenser



2
Dip the fingertips of your right hand in the handrub to decontaminate under the nails (5 seconds)



3
Images 3–7: Smear the handrub on the right forearm up to the elbow. Ensure that the whole skin area is covered by using circular movements around the forearm until the handrub has fully evaporated (10-15 seconds)



4
See legend for Image 3



5
See legend for Image 3



6
See legend for Image 3



7
See legend for Image 3



8
Put approximately 5ml (3 doses) of alcohol-based handrub in the palm of your right hand, using the elbow of your other arm to operate the dispenser



9
Dip the fingertips of your left hand in the handrub to decontaminate under the nails (5 seconds)



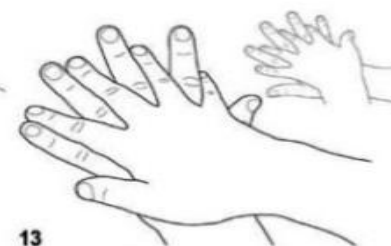
10
Smear the handrub on the left forearm up to the elbow. Ensure that the whole skin area is covered by using circular movements around the forearm until the handrub has fully evaporated (10-15 seconds)



11
Put approximately 5ml (3 doses) of alcohol-based handrub in the palm of your left hand, using the elbow of your other arm to operate the distributor. Rub both hands at the same time up to the wrists, and ensure that all the steps represented in Images 12-17 are followed (20-30 seconds)



12
Cover the whole surface of the hands up to the wrist with alcohol-based handrub, rubbing palm against palm with a rotating movement



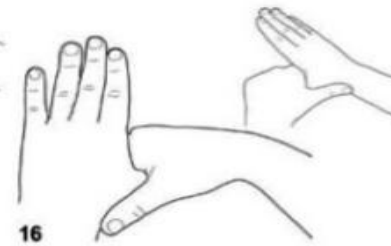
13
Rub the back of the left hand, including the wrist, moving the right palm back and forth, and vice-versa



14
Rub palm against palm back and forth with fingers interlinked



15
Rub the back of the fingers by holding them in the palm of the other hand with a sideways back and forth movement



16
Rub the thumb of the left hand by rotating it in the clasped palm of the right hand and vice versa



17
When the hands are dry, sterile surgical clothing and gloves can be donned

Repeat the above-illustrated sequence (average duration, 60 sec) according to the number of times corresponding to the total duration recommended by the manufacturer for surgical hand preparation with an alcohol-based handrub.

Excellent	Satisfactory	Unsatisfactory
<ul style="list-style-type: none"> - Completed five or all principal steps (step 8 to 13) - Hand scrubbing for more than 2 minutes - Followed 11 or all key steps 	<ul style="list-style-type: none"> - Followed only four or more principal steps (step 8 to 13) - Hand scrubbing between 1 to 2 minutes - Followed 8 or more key steps without including those highlighted as unsatisfactory 	<ul style="list-style-type: none"> - Three or more principal steps (step 8 to 13) were missed - Hand scrubbing for less than 1 minute - Wearing artificial nails or nail polish - Wearing jewellery (rings, watches, bracelets) - Arms not bare below the elbow - Person with cut or burn - Scrubbed person breach sterile hand field

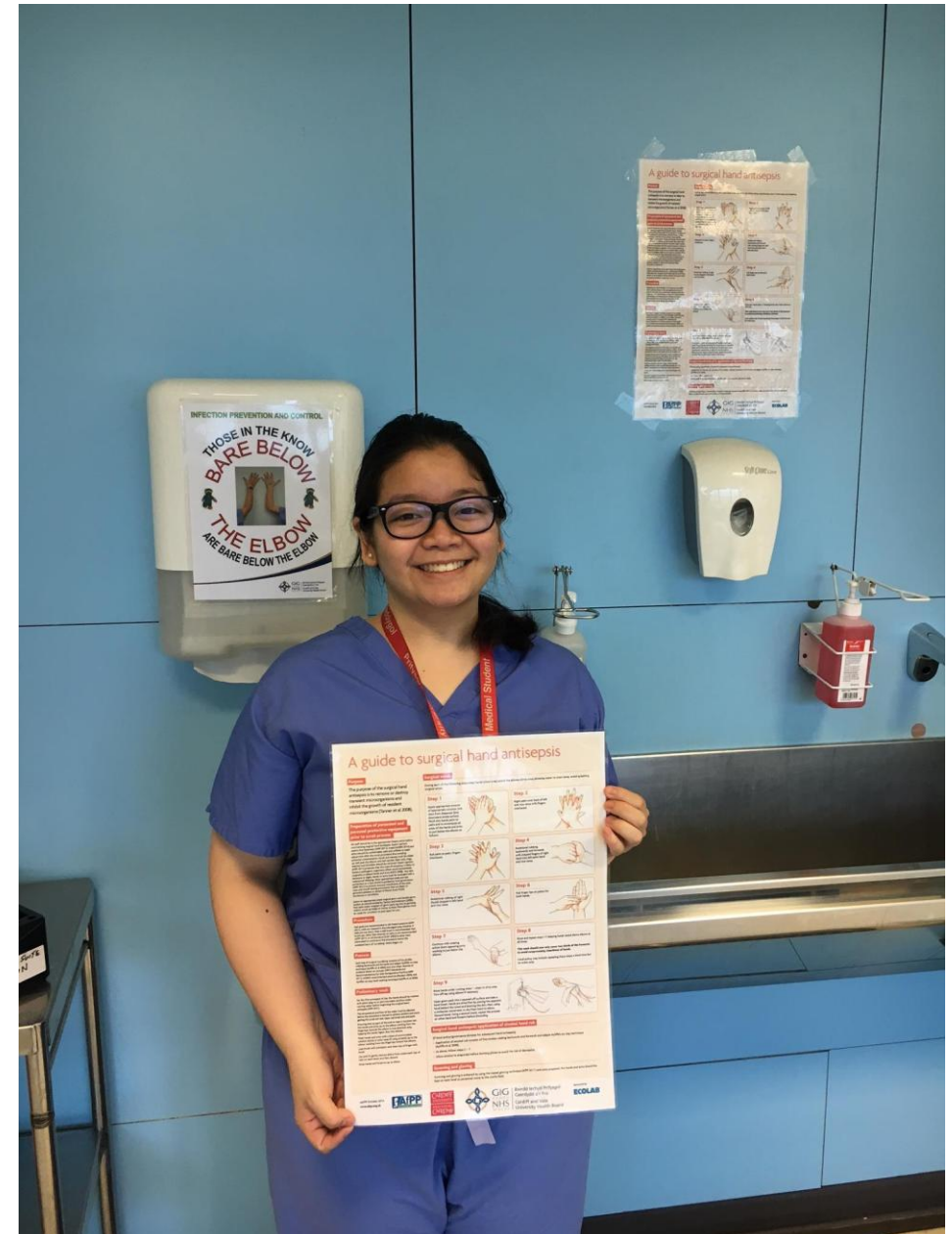
An updated interventional poster was created and strategically placed above all scrubbing stations in all obstetric theatres. Importance of surgical hand antisepsis too was addressed during the UHW Quality and Safety meeting.



A re-audit was performed 2 weeks after.



All footages were being analyzed anonymously and deleted. Descriptive statistics [mean (SD), frequency (%)] and charts were being used to demonstrate any change post-intervention.



A guide to surgical hand antisepsis

Purpose

The purpose of the surgical hand antisepsis is to remove or destroy transient microorganisms and inhibit the growth of resident microorganisms (Tanner et al 2008).

Preparation of personnel and personal protective equipment prior to scrub process

All staff should be in the appropriate theatre attire before commencing surgical hand antisepsis. Expert opinion asserts that headwear (AFPP 2011), masks (AORN 2014) and attire should be comfortable, safe and unlikely to need adjustment after the scrub procedure thus avoiding potential contamination. Scrub suit sleeves must be rolled up well past the elbows and nail varnish, false nails, rings, watches and bracelets should be removed. Expert opinion (AFPP 2011) proposes that this type of accessory is likely to harbour pathogenic organisms which could contaminate surgically scrubbed hands and arms (NICE 2008). Any skin abrasions to digits, hands or arms must be occluded with a waterproof dressing. Wear appropriate mask and eye protection or a face shield as guided by local governance (AFPP 2011) to protect mucous membranes of the eyes, nose and mouth during procedures that are likely to generate splashes or sprays of blood, body fluids, secretions or excretions.

Select an appropriate sized surgical gown and double glove system as recommended by Tanner and Parkinson (2006). Peel open outer wrapper of gown pack, lay this on gowning station, scrub up ledge or trolley surface. Place gloves close by ready for circulator to peel open for you.

Procedure

Nail picks are recommended in UK theatre practice (AFPP 2011), nails are cleaned in the subungual area, however if nails are too short, then a nail brush is recommended. Nail brush use, other than directly to nails, is not recommended (AFPP 2011). In US literature (CDC 2002) brushes were advocated to commence the procedure, hence the outdated term of 'scrubbing' which lingers on.

Process

Each step of surgical 'scrubbing' consists of five strokes rubbing backwards and forwards and adapts Ayliffe's six step technique (Ayliffe et al 2000) into nine steps. Sources of evidence drawn on include AFPP's Standards and Recommendations for Safe Perioperative Practice (AFPP 2011), AORN's recommended practices (Paulson 2004), and Ayliffe's six step hand washing technique (Ayliffe et al 2000).

Preliminary wash

For the first antisepsis of day the hands should be washed with plain soap or an anti-microbial solution under running water before beginning the surgical hand antisepsis (AFPP 2011).

The temperature and flow of the water must be adjusted before the procedure is started to achieve comfort and avoid getting the scrub suit wet. Open nail brush and pick pack. Ensuring that no part of the sink or taps is touched wet the hands and arms up to the elbow working from the fingertips towards the elbow in one direction only, keeping the hands higher than the elbows.

Wash hands and arms with a dose of antimicrobial solution (5mls) or plain soap (if using alcohol) up to the elbow, working from the fingertips toward the elbows. Load brush with antiseptic and clean tips of finger with brush.

Use pick to gently remove debris from underneath tips of nails on each hand, and then discard.

Rinse hands and forearms up to elbow.

Surgical scrub

During each of the following steps keep hands (clean area) above the elbows (dirty area) allowing water to drain away, avoid splashing surgical attire.

Step 1

Apply appropriate amount of appropriate solution: 5ml dose from dispenser (one downward stroke action). Work into hands palm to palm and to encompass all areas of the hands and arms to just below the elbows as follows:



Step 2

Right palm over back of left and vice versa with fingers interlaced.



Step 3

Rub palm to palm, fingers interlaced.



Step 4

Rotational rubbing backwards and forwards with clasped fingers of right hand into left palm hand and vice versa.



Step 5

Rotational rubbing of right thumb clasped in left hand and vice versa.



Step 6

Rub finger tips on palms for both hands.



Step 7

Continue with rotating action down opposing arms, working to just below the elbows.



Step 8

Rinse and repeat steps 1-7 keeping hands raised above elbows at all times.

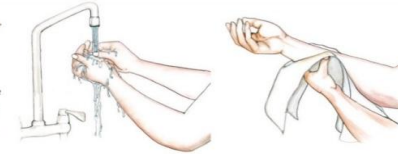
This wash should now only cover two thirds of the forearms to avoid compromising cleanliness of hands.

Local policy may include repeating these steps a third time but to wrists only.

Step 9

Rinse hands under running water – clean to dirty area. Turn off tap using elbows if necessary.

Open gown pack into a squared off surface and take a hand towel. Hands are dried first by placing the opposite hand behind the towel and blotting the skin, then, using a corkscrew movement, to dry from hand to elbow. Discard towel. Using a second towel, repeat the process on other hand and forearm before discarding.



Surgical hand antisepsis: application of alcohol hand rub

(If local policy/governance dictates for subsequent hand antisepsis)

- Application of alcohol rub consists of five strokes rubbing backwards and forwards and adapts Ayliffe's six step technique (Ayliffe et al 2000).
- As above, follow steps 2 – 7.
- Allow alcohol to evaporate before donning gloves to avoid the risk of dermatitis.

Gowning and gloving

Gowning and gloving is achieved by using the closed gloving technique (AFPP 2011) and once prepared, the hands and arms should be kept at waist level as personnel move to the sterile field.

Results

- 80 observations of surgical hand antisepsis were recorded.
- In regards to the use of nail brushes, it was discovered that there was only a 35% uptake by all healthcare professionals (emergency, 40%; elective, 30%) in the initial audit.
- It was later being studied that nail brushes do not have any additional antimicrobial effect unless visibly soiled and wasn't emphasized as a key step during the intervention period. (5)

- 40% of recordings showed compliance with 2-minute hand scrubbing time of which surgeons' performance were 31.3% in the initial audit. A slight improvement was seen in elective procedures in the re-audit.

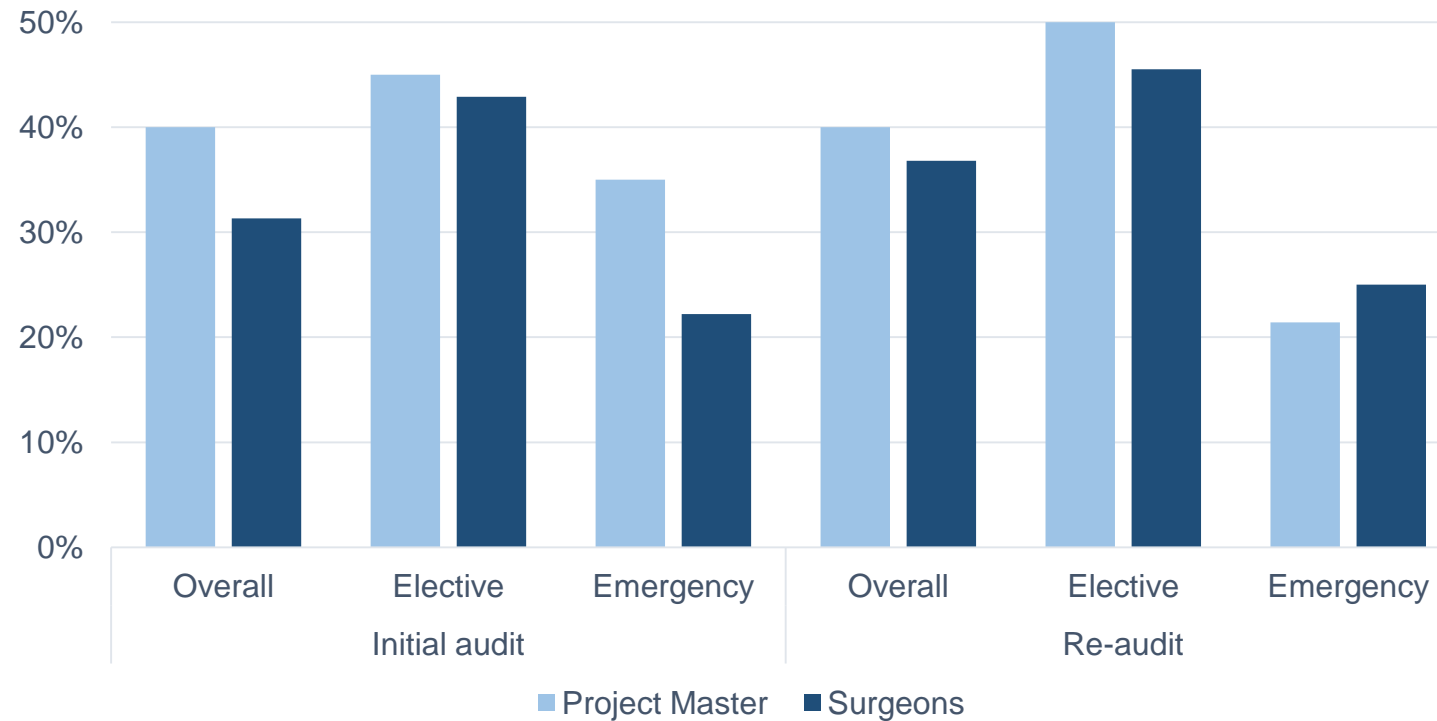


Figure 8. Bar graph showing compliance of 2-minute hand scrubbing.

- Unsatisfactory rates were higher in the night (initial audit, 57%; re-audit, 36%) compared to observations made during the day (initial audit, 46%; re-audit, 24.1%).

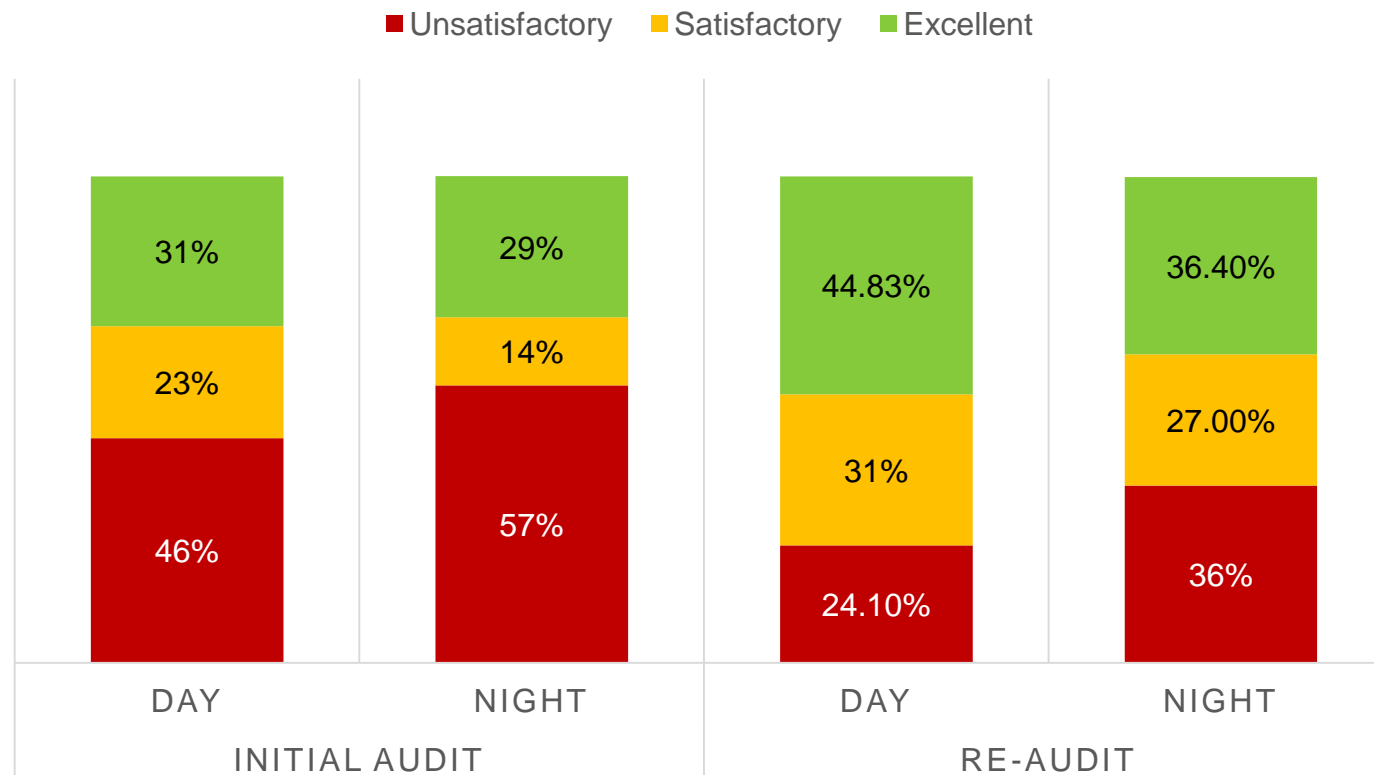


Figure 9. Stacked column comparing day and night performance in initial and re-audit.

- Unsatisfactory rates dropped after the intervention period from 50% to 27.5% overall; and 75% to 31.6% among surgeons.

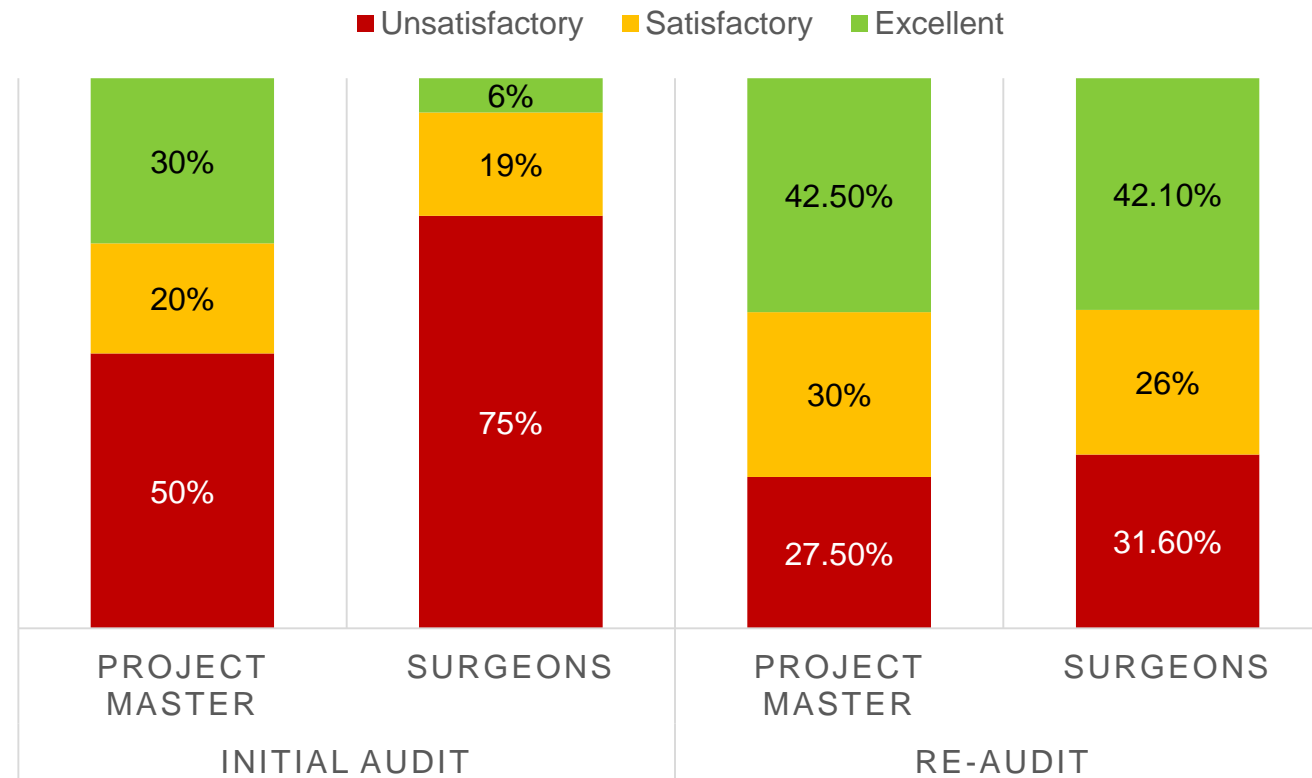


Figure 10. Stacked column showing impact of intervention period.

Conclusion

- Our results demonstrate that there is much need for improvement of hand-scrubbing compliance.
- Video surveillance combined with real-time feedback produced a significant and sustained improvement in hand hygiene compliance. (4)
- Use of the surgical hand antisepsis guidelines increased following the initial audit and intervention.
- This highlights the importance of regular audit and re-evaluation to develop compliance with clinical standards and consequently advancing patient care.

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Supporting Material

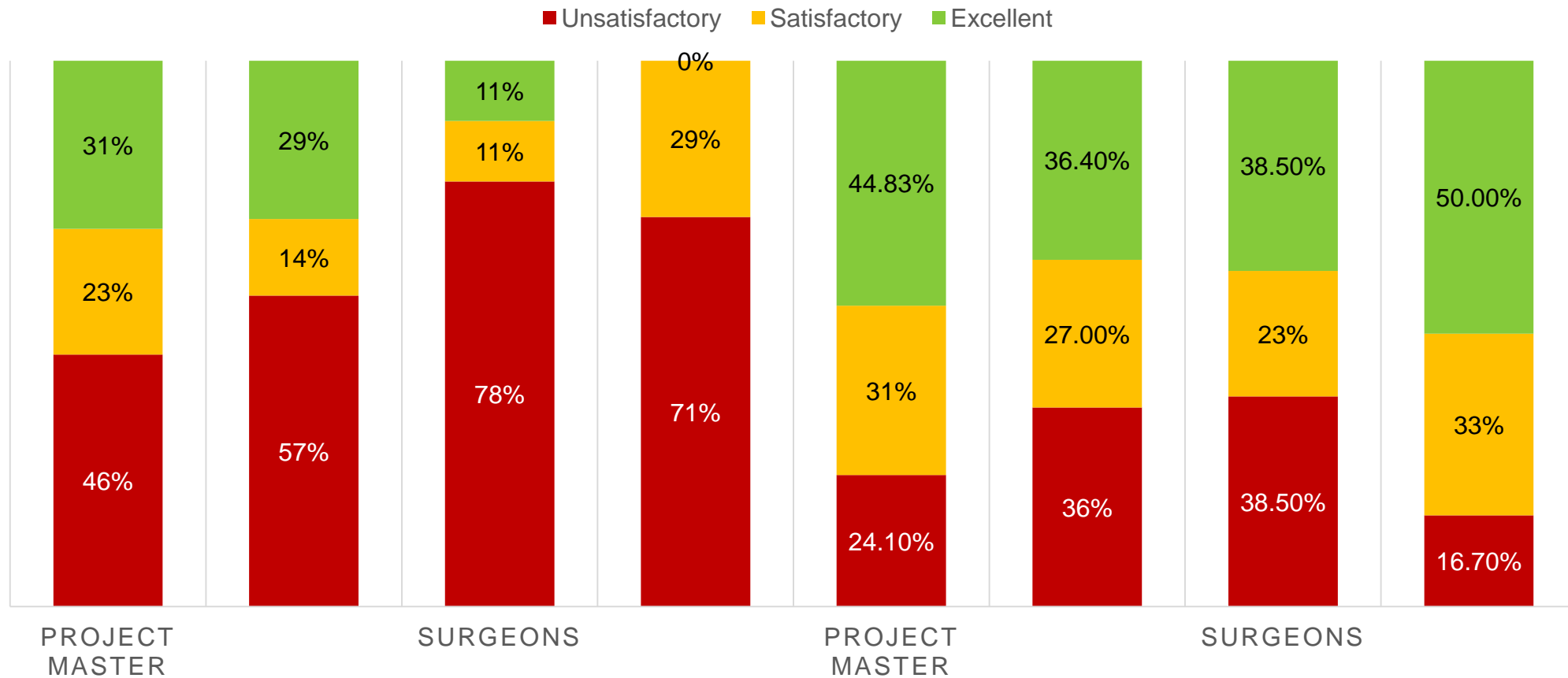


Figure 11. Stacked column comparing day and night results specifically looking at surgeons.

Discussion

- Surgical scrubbing time as observed in the footages was the least compliant step.
- We took 2 minutes to be the least expected time duration for scrubbing based on the AFPP and WHO guidelines. (1, 5)
- A study by O' Shaughnessy et al. using 4% chlorhexidine gluconate, durations of 2, 4 and 6-minutes were compared and found that scrubbing for longer than 2 minutes did not confer any advantage. (4, 5)

- Hingst and colleagues compared 3-minute and 5-minute scrubs with seven different formulations and found that the 3-minute scrub is as effective as the 5-minute scrub at reducing bacterial counts. (4, 5)
- Most of the time clinicians think their hand scrubbing practices are optimum enough and neglect the fact that the duration of contact with scrubbing agent is equally important.
- Sterilized gloves do not render surgical hand antisepsis preparation unnecessary as if an unnoticed puncture in a glove into an open wound were to occur, bacteria from the hands of the surgical team may be transferred. (4)

- The use of nail brushes was also unpopular among healthcare professionals.
- According to Heeg P et al. a brush may be beneficial on visibly dirty hands before entering the operating theatre. (5)
- However, recently, a randomized, controlled clinical trial by Loeb MB et al. failed to demonstrate an additional antimicrobial effect by using a brush. (5)
- Ergo, scrubbing with a disposable sponge or combination sponge-brush is now a recommended procedural step rather than a key step.

- Healthcare professionals were also noted to be less compliant in surgical scrubbing during night shifts (2000 – 0830).
- This could be due to the staff being more tired during out-of-hours shift. As stated in a study by Harrington, human error may be dependent to some extent on sleep related factors and circadian rhythm. (7)
- The efficiency of performance is seen to have a link with the circadian variation in body temperature.
- Particularly in the early hours of the morning, the disruption of circadian rhythm, combined with sleep deficit and fatigue, can be one of the causes of workplace inefficiency. (7)

Limitations

- Data collection period for both initial and re-audit were short durations (one week each).
- The study also did not analyse health-care associated infections or surgical site infections rate during the observation period. (2)
In the future, we aim to address this.