Research

Doctor, do you have a moment?

National Hand Hygiene Initiative compliance in Australian hospitals

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Abstract

Objectives: To examine hand hygiene compliance rates for medical and nursing staff, compliance with hand hygiene *before touching a patient* (Moment 1 of the Five moments for hand hygiene), and the effect of differential sampling of staff on the average national rate. Also, to establish whether hand hygiene rates impact *Staphylococcus aureus* bloodstream infections (SABSI).

Design and setting: Analysis of data from three different cross-sectional datasets — Hand Hygiene Australia data for 246 665 hand hygiene opportunities during the first quarter (1 January to 31 March) of 2013 from 82 public hospitals representing eight Australian states and territories, and hand hygiene rates and SABSI rates from the MyHospitals website reported for 1 July 2011 to 30 June 2012.

Main outcome measures: Compliance by medical and nursing staff for each hospital size (> 400 beds, 301–400 beds, 201–300 beds, and 101–200 beds); the proportion of hospitals with hand hygiene compliance rates for *before touching a patient* at or above, or below the national threshold of 70%; the impact of hand hygiene on SABSI.

Results: Medical staff consistently performed below the national threshold for hand hygiene compliance regardless of hospital size. Nurses' compliance was consistently above the threshold, and this inflated the total average national rate. A third of the patient interaction hand hygiene opportunities recorded involved *before touching a patient*, for which compliance was below the national threshold in 68% of hospitals. Hand hygiene has little impact on the rate of SABSI (incidence rate ratio, 0.97; $P < 0.01$).

Conclusions: Posting a national unadjusted average hand hygiene compliance rate on a public website conceals the fact that most hospitals and medical staff are performing below the national hand hygiene compliance threshold. Given the poor compliance after 4 years of auditing to capture non-compliance, we must shift our focus to providing medical staff with immediate feedback and move to improving a single hand hygiene indication at a time, starting with *before touching a patient*.

Hand hygiene is accepted as the cornerstone of preventing infection. Thus, the maxim "first do no harm"[1] should translate into the habitual practice of hand hygiene by health care workers (HCWs). In 2009, under the National Hand Hygiene Initiative,[2] Australian hospitals embarked on a hand hygiene program developed around the World Health Organization program, Five Moments for Hand Hygiene.[3] The "five moments" refer to the five indications for hand hygiene associated with interactions between HCWs, patients and the environment around patients. The moments are summarised in Box 1.

From 2010, mandatory quarterly reports of rates of compliance with the Five Moments program became embedded as a measure of patient safety for all Australian public hospitals. Another measure of patient safety is the rate of *Staphylococcus aureus* bloodstream infection (SABSI). These two rates are considered to be causally linked and are reported on the MyHospitals website[4] for public scrutiny.[2] Hand Hygiene Australia (HHA) reported the program a success with improvements in hand hygiene and reductions in the rate of methicillin-resistant SABSI.[2] When we examined the HHA website (www.hha.org.au) for evidence of further improvements in hand hygiene compliance from the third quarter of 2010 to the first quarter of 2013, we found unremarkable changes in the national rate — 8.6 percentage points (PP) improvement (76.9% compliance by the first quarter 2013) or < 4 PP improvement per year for total compliance and 9.5 PP improvement (72.6% compliance by the first quarter 2013) or < 4 PP improvement per year for *before touching a patient* (Moment 1).

Our overall aims in this study were to test whether hand hygiene rates reported by HHA had translated into:

- improvements at the hospital level for medical and nursing staff and for *before touching a patient* during the first quarter of 2013; and
- decreased rates of SABSI.

1 Five moments for hand hygiene[3]

Moment	Hand hygiene opportunity
1	Before touching a patient, such as when shaking patient's hand, helping a patient to move and before a clinical examination.
2	Before procedures performed on the ward such as, oral/dental care, aspiration of secretions, wound dressing, catheter insertion and giving medications.
3	After potential contact with body fluids, such as during oral/dental care, aspiration of secretions, drawing and manipulating blood, clearing up urine or faeces, and handling waste.
4	After any non-procedural contact with a patient.
5	After contact with a patient's surroundings such as bed linen, curtains and patient equipment.

Methods

We analysed three datasets. The first was provided by HHA and comprised data on 82 public hospitals with more than 100 beds, contributing a total of 246 665 hand hygiene opportunities during the first quarter (1 January to 31 March) of 2013. Data were linked to hospital size (number of beds) and location (state or territory). Data included numerator data for each of the five moments (compliance) and denominator data (number of moments observed) for 34 hospitals with > 400 beds, 14 hospitals with 301–400 beds, 20 hospitals with 201–300 beds, and 14 hospitals with 101–200 beds. Participating hospitals comprised 30 from New South Wales, 19 from Queensland, 17 from Victoria, seven from South Australia,

five from Western Australia, two from the Northern Territory, one from the Australian Capital Territory and one from Tasmania.

The second and third datasets were extracted from the MyHospitals website,[4] where SABSI and hand hygiene rates are mandatorily reported as two separate datasets. We chose SABSI data for 1 July 2011 to 30 June 2012 from the three largest states (NSW, Queensland and Victoria) to improve the power of the analysis, and hand hygiene data for the same three states, for the third quarter of 2011 to the second quarter of 2012.

Our ethics committee deemed that our analysis and publication of previously collected de-identifiable hand hygiene compliance data that are publicly available did not require ethics approval.

Hand hygiene compliance for doctors and nurses

The questions we aimed to answer were:

- What is the level of compliance for medical staff and nurses in hospitals of different sizes and in the three largest Australian states? and
- Could nurses' compliance bias the average national rate or average rate for hospitals of different sizes?

From the hand hygiene data for all five hand hygiene moments provided by HHA, we calculated the proportions of compliance and the margin of error for each estimate using 95% CIs for medical and nursing staff for all 82 hospitals. The rates and margins of error for medical and nursing staff were presented by hospital size and location (state). The potential for rates to be affected by the Hawthorne effect (changing hand hygiene compliance because you are being watched) precludes the need for proportions to be presented to one decimal place; proportions were rounded up at 0.6 and rounded down at 0.5.

The PP differences between the medical and nursing staff rates for each hospital size and for NSW, Queensland and Victoria were examined, and significant differences were tested with the χ^2 test. Each of the 82 hospitals sampled different proportions of medical and nursing staff. If nurses are sampled more frequently and have higher compliance rates than medical staff, the average crude hospital rate for hospitals of different sizes may be biased. Therefore, the rate for each hospital size was adjusted for the sampling fraction and the adjusted average rates were compared with unadjusted rates for PP differences and tested for significance using the χ^2 test.

2 Frequency of moments of hand hygiene observed nationally for 1 January to 31 March, 2013

Hospital size (no. of beds)	No. of hospitals in stratum	Total no. of moments observed	Frequency
> 400	34	142 910	28% Moment 1 8% Moment 2 11% Moment 3 30% Moment 4 23% Moment 5
301–400	14	38 774	30% Moment 1 9% Moment 2 12% Moment 3 31% Moment 4 18% Moment 5
201–300	20	42 484	29% Moment 1 8% Moment 2 10% Moment 3 30% Moment 4 23% Moment 5
101–200	14	22 497	28% Moment 1 7% Moment 2 10% Moment 3 29% Moment 4 25% Moment 5

Hand hygiene compliance for hospitals

The questions we aimed to answer were:

- What proportion of hospitals have compliance below (< 70%) and at or above (⩾ 70%) the national threshold for *before touching a patient*?
- How biased is the average compliance rate for *before touching a patient* in each hospital size by the proportion of hospitals with high compliance?

It is accepted globally that HCWs have poor hand hygiene associated with perceived "clean" touches (Moment 1) and better compliance with hand hygiene performed as self-protection (Moments 3, 4 and 5). Therefore we choose *before touching a patient* (Moment 1) to categorise hospital compliance into below, or at or above the national threshold of 70%.

The frequency of observations for *before touching a patient* was uniform across the hospital sizes and is performed three to four times more frequently than the other indication for hand hygiene that directly benefits the patient, such as before a procedure (Moment 2; Box 2). We provided the average aggregated compliance rate for *before touching a patient* with a margin of error (95% CI) for the total number of hospitals of each size. We calculated the proportion of hospitals categorised into the two compliance levels to determine which category of compliance influenced the average rate for *before touching a patient* in each hospital size. To illustrate the wide variation in performance from the average hand hygiene compliance rate within each hospital size, we calculated the rate of compliance for the hospital with the highest compliance rate and the one with the lowest rate in each hospital size.

Rates of *Staphylococcus aureus* bloodstream infection

The question we aimed to answer about SABSI was:

- Is there a strong inverse relationship between hand hygiene and SABSI rates in the three largest Australian states?

SABSI data were extracted for the reporting periods between 1 July 2011 and 30 June 2012, and hand hygiene rates (for all hand hygiene moments) were extracted for periods that were closest to the SABSI reporting period and averaged the third quarter of 2011 to the end of the second quarter of

3 Compliance rates for all five hand hygiene moments by doctors and nurses for 1 January to 31 March 2013, by hospital size nationally and by the three largest Australian states

Hospital size or state	No. of hospitals	Compliance rate (95% CI)		Percentage point difference between doctor and nurse compliance	*P*
		Doctors	Nurses		
Hospital size (no. of beds)					
> 400	34	63% (62%–64%)	80% (80%–80%)	17	< 0.01
301–400	14	62% (61%–64%)	79% (79%–80%)	17	< 0.01
201–300	20	65% (64%–66%)	82% (82%–82%)	17	< 0.01
101–200	14	65% (63%–66%)	83% (82%–83%)	18	< 0.01
State					
New South Wales	30	65% (64%–65%)	84% (83%–84%)	19	< 0.01
Queensland	19	61% (60%–62%)	79% (79%–80%)	18	< 0.01
Victoria	17	68% (67%–70%)	77% (77%–78%)	9	< 0.01

2012. There were 322 public hospitals in Australia with more than 100 beds; we extracted data for 200 NSW hospitals, 46 Queensland hospitals and 76 Victorian hospitals.

The generalised linear model for the Poisson distribution was applied to calculate incidence rate ratio between SABSI and hand hygiene rates (with SABSI considered the dependent or outcome variable). In the generalised linear model, the variable bed-days was considered the offset variable and state of residence was used as a factorial or explanatory variable. Analyses for all aims were performed using Stata statistical software, version 11 (StataCorp). The exact binomial distribution was used to calculate 95% CIs for compliance for doctors and nurses and compliance for hospitals. Significance was set at the 5% level.

Results

Hand hygiene compliance for doctors and nurses

Hand hygiene rates for medical staff in hospitals of all sizes were consistently below the threshold, and ranged from 61% to 68% across the three states while nurses' compliance ranged from 77% to 84% (Box 3). Compliance for medical staff was 17 to 18 PPs lower than that for nursing staff regardless of hospital size. After adjusting for the effect of differential sampling of high-performing nursing staff in 82 hospitals, the average adjusted total compliance fell by 5 PPs from 76% to 71%. The adjusted rate for the two largest hospital sizes (> 400 beds and 301–400 beds) fell 4 PPs to 71% (Box 4).

Hand hygiene compliance for hospitals

Compliance at 56 of the 82 hospitals (68%) was below the national threshold of 70% for *before touching a patient* (Box 5). The lowest compliance rate for > 400-bed hospitals was 55% and for 301–400-bed hospitals was 49%. When hospitals performed at or above the national threshold, the compliance were well above the national threshold. The highest compliance rates were 81% for > 400-bed hospitals, 78% for 301–400-bed hospitals, 87% for 201–300-bed hospitals, and 86% for 101–200-bed hospitals. A small number of hospitals with high compliance rates inflated the average compliance rates for each hospital size to reach or surpass the threshold (Box 5).

Rates of *Staphylococcus aureus* bloodstream infection

The average hand hygiene compliance rate for the reporting period ranged from 48% to 99%, while the SABSI rate ranged from 0 to 2.95 cases per 10 000 bed-days. Statistically, the association between hand hygiene and SABSI rates was significant for NSW only ($P < 0.01$), while the relationship was weak (incidence rate ratio, 0.97).

Discussion

We found that compliance by doctors was uniformly lower than that by nurses. Once adjustments were made for the inflation effect from oversampling high-performing nurses and a small number of high-performing hospitals, the average rates at the national and hospital levels were lower than those currently reported. The adjusted national average rate was 5 PPs lower than the crude rate. It is inaccurate to say hospitals on average meet the national threshold when medical staff, nationally, performed below the hand hygiene compliance threshold. Additionally, between 57% and 71% of all HCWs from our 82 Australian hospitals have hand hygiene compliance rates below the national threshold, regardless of hospital size, for *before touching a patient*.

We estimate that the cost of taking nurses away from clinical duties to act as auditors and to collect 246 665 hand hygiene moments over the 3-month auditing period in 82 hospitals, at 2.2 minutes per moment and up to $50 per hour, is $561 152 (authors' personal experience, and Anna Thornton, Director of Nursing, Liverpool Hospital, personal communication) or $2.2 million per year. The initiative resulted in an average improvement of 1 PP per year in hand hygiene compliance after adjusting for sampling. Nevertheless, it can be rightly argued that the program has raised national awareness. But rates at the hospital level are not yet reliable, and to improve reliability, each hospital must record at least 1750 observations for each of five main HCW groups (doctors, nurses, allied health workers, medical students and nursing students), a total of 8750 observations. The estimated burden on each hospital is 320 hours and $16 000 every quarter.

4 Unadjusted and adjusted total hand hygiene rates by hospital size for 1 January to 31 March, 2013

Hospital size (no. of beds)	Unadjusted rate	Adjusted rate	Percentage point difference
> 400	75%	71%	4
301–400	75%	71%	4
201–300	77%	72%	5
101–200	78%	72%	6
All	76%	71%	5

5 Margin of error for the current hand hygiene compliance rates for Moment 1 (*before touching a patient*) collected during 1 January to 31 March, 2013 by hospital size

National threshold (70%) compliance by hospital size	Proportion of hospitals (no. of hospitals at compliance levels/ total number of hospitals)	Moment 1 rate (95% CI) (no. of Moment 1 complied/total Moment 1 observations)		Average compliance rate for the hospital size (95% CI)
		Highest compliant hospital	Lowest compliant hospital	
> 400 beds				
At or above threshold	29% (10/34)	81% (79%–83%) (1256/1557)	55% (51%–59%) (375/682)	70% (67%–73%)
Below threshold	71% (24/34)			
301–400 beds				
At or above threshold	29% (4/14)	78% (76%–80%) (1485/1902)	49% (45%–53%) (300/608)	70% (67%–73%)
Below threshold	71% (10/14)			
201–300 beds				
At or above threshold	30% (6/20)	87% (84%–89%) (568/653)	56% (50%-62%) (158/284)	75% (70%–77%)
Below threshold	70% (14/20)			
101–200 beds				
At or above threshold	43% (6/14)	86% (83%–89%) (385/447)	69% (63%–74%) (174/253)	75% (70%–79%)
Below threshold	57% (8/14)			

One of us (MLM) is an adviser to the World Health Organization First Global Patient Safety Challenge — Clean Care is Safer Care, and we are committed to improving hand hygiene compliance. Our critical review of the audit data signals that it is now time to move from our obsession with auditing to the next phase — targeting practice and HCWs to effect change.[5]

The targeted intervention, focusing on the HCW group needing most assistance, which is currently doctors, should focus first on Moment 1 of the WHO's Five Moments for Hand Hygiene[3] — *before touching a patient* — before moving on to the remaining moments. The barrier to compliance with perceived "clean" interactions (such as *before touching a patient* and *before a procedure)* is HCWs believing they do not need to protect themselves from a clean touch and therefore do not need hand hygiene.[6,7] This is supported by poor rates globally for compliance with these two hand hygiene indications.[8]

Until auditing is universally automated, we recommend the strategies listed below.

- Focusing the campaign message on one moment at a time, commencing with *before touching a patient*.
- Focusing on one HCW group at a time, starting with medical staff.
- Designing an intervention to enable all health care workers to ask "Doctor, do you have a moment?" if doctors are not observed by any colleague to perform hand hygiene before touching a patient.
- Having auditors help staff by interrupting them and respectfully reminding them to perform hand hygiene before touching patients, thus making auditors agents for behaviour change.
- Changing the focus of auditing to documenting the number of times staff were reminded to perform hand hygiene as opposed to the previous method of not intervening and documenting the non-compliant moment.
- Having hospitals record at least 1750 observations per quarter to achieve reliable rates for a single HCW group, focusing on a single HCW group at a time, starting with medical staff and preferably using a "roving sentinel wards" approach (eg, intensive care unit, orthopaedic and other surgical wards, a general medical ward or neurological ward) to saturate the staff with the targeted message (using one moment at a time, starting with *before touching a patient*).

The poor relationship between SABSI and the average hand hygiene rate suggests that the causal link between the two patient safety indicators is weak.[9,10] Possible reasons for this include SABSIs being statistically rare events and currently reported hand hygiene compliance rates being inflated by a small number of high-performing hospitals, but there actually being insufficient compliance at most hospitals to influence the acquisition of SABSI.

We believe that *before touching a patient* is an appropriate moment on which to focus a hand hygiene behaviour change program as it is consistent with patient safety and the maxim "first do no harm".

Competing interests: Mary-Louise McLaws was epidemiology advisor to the World Health Organization First Patient Safety Challenge — Clean Care is Safer Care between 2005 and 2013. She is honorary advisor to the Clinical Excellence Commission for health care-associated infections and hand hygiene activities. She is currently testing the validity of an automated hand hygiene auditing system.

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