Improvements in hand hygiene across New South Wales public hospitals: Clean hands save lives, Part III

Mary-Louise McLaws, Annette C Pantle, Kimberley R Fitzpatrick and Clifford F Hughes

Objective: To describe improvements in hand hygiene compliance after a statewide hand hygiene campaign conducted in New South Wales public hospitals.

Design and setting: The campaign was conducted in all area health services in NSW (covering all 208 public hospitals). Alcohol-based hand rub (AHR) was introduced into all hospitals between March and June 2006. In each hospital, five overt observation surveys of hand hygiene compliance by health care workers (HCWs) were conducted: one pre-implementation survey and four post-implementation surveys (in August 2006, November 2006, February 2007 and July 2008).

Main outcome measures: Overtly observed hand hygiene compliance rates by HCWs, stratified by before- and after-patient contact, Fulkerson’s contact risk categories, and four health care professional groupings.

Results: The overall hand hygiene compliance rate improved from 47% before the intervention to an average of 61% over the last three observation periods (P < 0.001). All professional groups sustained improved compliance rates except medical staff, whose practices reverted to pre-intervention rates. Nursing staff maintained significantly improved compliance, with an average rate of 67% after the intervention. Overall hand hygiene compliance before patient contact improved from 39% (pre-campaign) to 52% (July 2008) (P < 0.001). Overall compliance after patient contact improved from 57% to 64% (P < 0.001) over the same period. Compliance associated with medium-risk contacts increased from an average of 51% in the first two observation periods to an average of 62% over the last three observation periods (P < 0.001). The corresponding compliance rates associated with low-risk contacts were 35% and 56%, respectively (P < 0.001).

Conclusion: An overall improvement in hand hygiene rates was achieved with the introduction of AHR. Increased adherence to before-patient contact compliance, especially by nursing staff, contributed to the progress made, but an acceptable overall level of hand hygiene practice is yet to be achieved. It is now time to focus on a long-term behavioural change program directed specifically at medical staff.

METHODS

The NSW campaign

The clean hands save lives campaign was rolled out in all 208 NSW public health care facilities located in 11 health authorities — eight geographical area health services (AHSs), the Children’s Hospital at Westmead, the Ambulance Service of NSW and Justice Health. Details of the content of the campaign and timelines are provided elsewhere. The campaign aimed to increase awareness of AHR and improve hand hygiene compliance, with the eventual goal of reducing rates of acquisition of MROs in wards providing clinical care. The campaign

Abbreviations

- AHR: Alcohol-based hand rub
- AHS: Area health service
- CEC: Clinical Excellence Commission
- HCW: Health care worker
- MRO: Multiresistant organism
did not address surgical scrub techniques; nor was it specifically aimed at improving hand hygiene in patients or hand hygiene associated with food handling.

Staff training
Staff attended training workshops on observational survey methods in February 2006 (see Appendix for instructions). A standardised data collection tool was developed from survey tools used in the cleanyourhands campaign in the United Kingdom and the Geneva program (see Appendix for survey tool). Using this tool, hand hygiene surveys were undertaken by ward staff appointed by the nurse unit manager, facility director of nursing or nurse manager and trained by the hand hygiene project officer. Ward staff responsible for collecting the surveys and submitting data were trained and tested by the CEC. When required, they could receive support from one of the CEC-funded project officers in each AHS. Data were de-identified and submitted to the local AHS before further aggregation and submission to the CEC for analysis.

Observation of hand hygiene practices
A pre-implementation overt survey of hand hygiene practices was undertaken by all hospitals in February and March 2006, and post-implementation surveys followed in August 2006, November 2006, February 2007 and July 2008. Observation methods were in line with the Geneva program described by Pittet et al and a program used by Johnson et al in an Australian hospital, except with regard to sample sizes. Representative sample sizes were determined by the NSW Hand Hygiene Steering Committee based on hospital category:

- Group 1 (major teaching or referral hospitals): four 20-minute observation periods were conducted in each of three wards;
- Group 2 (district hospitals): three 20-minute observation periods were conducted in each of three wards, and
- Group 3 (community-based hospitals): two 20-minute observation periods were conducted in each of two wards.

Each occasion for hand-washing or using AHR before or after patient contact was regarded as a “hand hygiene opportunity”11,12. An HCW who decontaminated his or her hands immediately after contact with a patient and then directly attended another patient — without touching any object (eg, medical notes, telephone, computer keyboard, monitor, curtain) or any other patient — was considered to have complied with before-patient hand hygiene practice in relation to the second patient. Hand hygiene compliance was expressed as a percentage, according to the following formula:

\[
\text{Compliance rate (%) = \frac{\text{Hand hygiene events observed}}{\text{Hand hygiene opportunities}} \times 100 (\%)
\]

Observations were categorised by:
- Fulkerson’s contact risk category (Box 1), a scale developed by the United States Centers for Disease Control and Prevention (CDC) to rank patient and environmental contacts for the potential to contaminate hands; and
- Professional group:
  - Nurses: registered nurses, enrolled nurses, assistants in nursing, nurse managers, clinical nurse educators, clinical nurse consultants, clinical nurse specialists;
  - Doctors: visiting medical officers, consultants, registrars, junior medical officers, residents, interns, medical students;
  - Allied health staff: physiotherapists, occupational therapists, dietitians, social workers; or
  - Other staff: staff in environmental services, hospital services, security, pastoral care.

Statistical analysis
The period from March to August 2006 was considered a run-in period, as much of the campaign activity was related to achieving high levels of AHR placement in hospitals, and thus hand hygiene awareness and behavioural changes could not occur immediately. Accordingly, November 2006, February 2007 and July 2008 were considered reflective of post-intervention behavioural change. The rates of hand hygiene compliance for these months were compared with pre-campaign rates to assess the degree of improvement.

Small sample sizes for allied health staff and “other staff” groups meant that only the data for medical staff and nurses could be analysed by risk activity category. Data for hand hygiene opportunities that were associated with low- or medium-risk activities in accordance with Fulkerson’s scale were combined to increase sample sizes for analysis of compliance by nursing and medical staff, stratified by AHS and before- and after-patient contact. A median hand hygiene compliance rate was calculated across the eight AHSs. The pre-campaign rate in each AHS was used as the referent against which post-implementation rates (November 2006 to July 2008) were compared.

### 2 Number (%) of hand hygiene opportunities,* by professional group and campaign period

<table>
<thead>
<tr>
<th></th>
<th>Pre-campaign period</th>
<th>Post-campaign period</th>
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<tr>
<td></td>
<td>August 2006†</td>
<td>November 2006</td>
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<tr>
<td></td>
<td></td>
<td>4718 (57%)</td>
</tr>
<tr>
<td>Nurses</td>
<td>5213 (65%)</td>
<td>4383 (61%)</td>
</tr>
<tr>
<td>Doctors</td>
<td>1408 (17%)</td>
<td>1394 (19%)</td>
</tr>
<tr>
<td>Allied health staff</td>
<td>728 (9%)</td>
<td>770 (11%)</td>
</tr>
<tr>
<td>Other staff</td>
<td>708 (9%)</td>
<td>682 (9%)</td>
</tr>
<tr>
<td>Total</td>
<td>8057</td>
<td>7229</td>
</tr>
</tbody>
</table>

* Each occasion for hand-washing or using alcohol-based hand rub (AHR) before or after patient contact was regarded as a “hand hygiene opportunity”. † AHR was introduced into all New South Wales public hospitals between March and June 2006. Thus, March to August 2006 was a run-in period.
Descriptive statistics for frequencies, relative risks (RRs), 95% confidence intervals, two-sided significant tests of incidence density rates, Fisher’s exact test and tests for trend were calculated using SPSS software, version 15 (SPSS, Chicago, Ill, USA) and EpiInfo software, version 6.04d (CDC, Atlanta, Ga, USA), with α set at the 5% level. All 95% confidence intervals were calculated using original count data.

Ethics approval
Ethics approval was not required for evaluation of the intervention, as data collection for the Clean hands saves lives campaign was considered a quality assurance activity.

RESULTS
A minimum of 212 overt surveys, each lasting 20 minutes, was conducted in each of the five data collection periods. The mean number of hand hygiene opportunities observed for the five observation periods was 7747 (range, 6972–8251) (Box 2). Over the five observation periods, the hand hygiene burden was three times greater for nursing staff (24 197 opportunities) than for medical staff (7 645 opportunities).

Hand hygiene compliance
Hand hygiene compliance increased significantly (Box 4). Prior to the campaign, hand hygiene compliance by medical staff was 30% (417/1408). Although they had increased their compliance rate to 58% (1055/1816) by November 2006, the rate at 18 months after the intervention (July 2008) had dropped by 19 percentage points (PP). By contrast, nursing staff maintained significant improvement in hand hygiene compliance, with an average of 67% compliance (9718/14 601) across the three post-intervention data collection periods.

Hand hygiene compliance before and after contact with patients
The rate of hand hygiene compliance before patient contact improved significantly, from 39% (1 653/4 287) to 52% (1 822/3 510) (P < 0.001), as did compliance after patient contact, from 57% (2 142/3 770) to 64% (2 219/3 462) (P < 0.001) (Box 5). After the initial run-in period, the average compliance rates before and after patient contact were 54% (6 363/11 809) and 68% (7 972/11 639), respectively. The higher compliance rate associated with after-patient contact compared with before-patient contact was consistent across all observation periods.

Hand hygiene compliance before and after patient contact, by professional group
All professional groups except allied health staff increased their rates of hand hygiene compliance before patient contact over the observation periods (Box 6). Nursing staff maintained their compliance rates for before-patient contact at an average of 59% (4 339/7 361) from November 2006 to July 2008. All staff significantly increased their after-patient hand hygiene compliance (Box 7). Over the period November 2006 to July
2008, average after-patient compliance rates were 74% (5379/7240) for nursing staff and 55% (1311/2381) for medical staff.

Hand hygiene compliance, by patient contact risk category (nursing and medical staff)

Staff responded to a key campaign message — hand hygiene associated with low- and medium-risk contacts — with significant increases in rates of hand hygiene compliance in relation to both low- and medium-risk contacts (Box 8). Compliance associated with medium-risk contacts increased from an average of 51% (4126/8678) to an average of 64% (1447/2262) to an average sustained at the same level to July 2008. During the planning stages, we chose to preserve the anonymity of facilities and kept observation surveys to a minimum to prevent ward staff becoming disaffected over a longer post-campaign period. These strategic decisions meant that facility-wide hand hygiene compliance rates were not available for direct evaluation. The relatively small size of datasets for glove use and low-risk contacts meant that compliance associated with these practices alone could not be included in the analysis.

DISCUSSION

During the planning stages, we chose to preserve the anonymity of facilities and kept observation surveys to a minimum to prevent ward staff becoming disaffected over a longer post-campaign period. These strategic decisions meant that facility-wide hand hygiene compliance rates were not available for direct evaluation. The relatively small size of datasets for glove use and low-risk contacts meant that compliance associated with these practices alone could not be included in the analysis.

Hand hygiene compliance for low- and medium risk patient contacts, by AHS (nursing and medical staff)

Between November 2006 and July 2008, the average compliance rate associated with before-patient contacts of low and medium risk was 57% (3550/6240) for nursing staff and 41% (855/2090) for medical staff (Box 9). Over the same period, the average compliance rate associated with after-patient contacts of low and medium risk was 73% (4424/6082) for nursing staff and 54% (1086/2025) for medical staff. Thus, in relation to low- and medium-risk patient contacts, nursing staff were 1.4 times more likely than medical staff to comply with both before-patient hand hygiene practices (RR, 1.4 [95% CI, 1.3–1.5]; P< 0.001) and after-patient hand hygiene practices (RR, 1.4 [95% CI, 1.3–1.4]; P< 0.001). The rates of compliance by nurses and doctors both before and after low- or medium-risk contacts differed significantly across the nine AHSs.

Hand hygiene compliance before and after patient contact (all staff)

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7 Hand hygiene compliance after patient contact, by professional group

Hand hygiene compliance rate % (95% CI) [n/N]

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<tbody>
<tr>
<td>Nurses</td>
<td>65.5–66.6</td>
<td>74.5</td>
<td>76.9</td>
<td>71.2</td>
<td>&lt;0.001,</td>
<td>65.07</td>
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<tr>
<td>Doctors</td>
<td>54.8–57.7</td>
<td>55.2</td>
<td>54.9</td>
<td>43.8</td>
<td>&lt;0.001,</td>
<td>35.63</td>
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<tr>
<td>Allied health</td>
<td>31.2–38.6</td>
<td>31.0</td>
<td>31.2</td>
<td>55.5</td>
<td>0.0026,</td>
<td>9.09</td>
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<tr>
<td>Other staff</td>
<td>42.6–54.2</td>
<td>60.5</td>
<td>69.7</td>
<td>58.2</td>
<td>&lt;0.001,</td>
<td>57.04</td>
</tr>
</tbody>
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8 Hand hygiene compliance, by patient contact risk category (all staff)

Hand hygiene compliance rate % (95% CI) [n/N]

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<tbody>
<tr>
<td>Low-risk</td>
<td>32.5–34.3</td>
<td>59.1</td>
<td>60.9</td>
<td>62.3</td>
<td>&lt;0.001,</td>
<td>298.80</td>
</tr>
<tr>
<td>Medium-risk</td>
<td>49.9–53.1</td>
<td>61.9</td>
<td>60.9</td>
<td>62.3</td>
<td>&lt;0.001,</td>
<td>157.35</td>
</tr>
<tr>
<td>High-risk</td>
<td>61.9–67.4</td>
<td>67.5</td>
<td>67.5</td>
<td>&lt;0.001,</td>
<td>59.47</td>
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</table>

We chose overt observation because it was a repeatable and easy method that could be sustained past the project timeline. This method, whose cost-effectiveness is supported by a WHO expert advisory panel, was based on the Geneva program, which has been successfully replicated in Australia. Patient mix, a wide range of individual hand hygiene practices and the Hawthorne effect will always have an impact on the measurement of compliance and cannot be overcome by indirect observation.

The level of activity in a ward during 20-minute observation periods may underestimate the number of hand hygiene opportunities. However, the same methodology was used in the seminal Geneva study, which made a mean of 2869 observations over a total of 7 months between 1994 and 1997, and also in a Victorian study involving a mean of 711 observations made at baseline, 4 months and 12 months. Our rates were based on a mean of 7747 hand hygiene opportunities for five observation periods, making our study three times larger than the seminal study and 11 times larger than the Victorian study. As long as the measurement of hand hygiene compliance is fairly simple, it can be made to be strictly repeatable and result in the Hawthorne effect having a similar impact across survey periods. Although the potential for the Hawthorne effect was high in our study, we believe the impact was limited, as the compliance rate recorded in the first audit (August 2006) remained similar to the pre-campaign rate. Moreover, the Hawthorne effect from peer group pressure does not need to be considered a negative outcome, as it may provide positive assistance towards culture change.

All 208 NSW public hospitals engaged in a 12-month rigorous campaign, collectively focusing on improving the cornerstone of infection control — hand hygiene. After an initial run-in period, the average compliance rate of 61% reflected an improvement of 14PP overall (15PP in before-patient compliance and 11PP in after-patient compliance). By international standards, this can be considered a success, with similar projects on a smaller scale (using slightly different but repeatable observational methods) achieving compliance rates of 48% at 12 months and 63%–66% after 3 years.

The Victorian project, conducted in 75 hospitals, achieved compliance rates of 48% at 12 months and 47% at 24 months, an improvement of 26PP. Although the PP...
With the increasing number of patient contacts made by medical staff, doctors (18PP) and other staff (22PP). How-ever, it must be remembered that the burden of contact for nursing staff is always higher than for other clinicians, with our nursing staff averaging three times the number of patient contacts made by medical staff. Doc-tors, allied health staff and other staff are more mobile throughout the hospital than nursing staff, and conceivably could move pathogenic organisms easily around the hos-pital. The relatively low compliance levels observed in our study support this hypothesis. Where gloves were used for high-risk contacts, staff may have used either AHR or hand-washing, whereas AHR will most likely always be used with low-risk contacts. The most inspiring outcome of our campaign was the increase in hand hygiene compliance associated with low-risk contacts — from 33% before the campaign to an average of 56% in the post-intervention period. When low- and medium-risk contacts were aggregated, nurses across nine AHSs complied with just over half of before-patient contact opportunities and 73% of after-patient contact opportunities.

The next step for hand hygiene in Australian hospitals is to continue a roll-out of AHR. It is clear that further activity beyond the initial 1-year campaign is required to continue to improve hand hygiene compliance in NSW. Our qualitative interviews and the results of other studies support our belief that deliberate lack of cooperation by HCWs is not the issue. Rather, compliance associated with low-risk contacts mirrors beliefs among hospital staff and in the community about hand hygiene practice for self-protection. Campaigns that have not been behaviourally based have achieved impor-tant inroads, but none have achieved perfect compliance. The next steps towards improvement may be the hardest, but perhaps the most rewarding — behavioural interventions.

ACKNOWLEDGEMENTS

Our project was a joint initiative of the CEC and NSW Health.

COMPETING INTERESTS

Mary-Louise McLaws has joined the WHO First Global Patient Safety Challenge pilot country project to provide epidemiological advice. Clifford Hughes operates the Australia and New Zealand Heart Valve Registry, which tracks patients with a Björk-Shiley convexo/concave heart valve. He distributes guidelines to these patients through their doctors as developed by the medical supervisory panel of the Bowling-Pfizer Heart Valve Settlement. He is the Principal Investigator of the On-X Heart Valve Study in Australia, for which On-X Life Technologies pays the expenses. He has received funding from Roche Diagnostics for travel expenses to attend meetings.
SUPPLEMENT

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REFERENCES

(See Appendix on following page)

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APPENDIX: hand hygiene observation tool and instructions

Format
Monitoring hand hygiene compliance and providing staff with feedback on their performance is strongly recommended in recent literature. There is a range of tools available for assisting staff in calculating hand hygiene compliance and a number are currently under development. The tool which is made available here was used in a UK campaign and will allow you to collect some baseline information on compliance in your organisation.

Nurse unit managers, facility directors of nursing or nurse managers are advised to identify staff on the ward who will undertake observations. This could be an infection control link practitioner. You will need to arrange for staff to be briefed on the practicalities of observation, using the tools here as a guide.

The hand hygiene observation tool is designed to assist staff in observing hand hygiene behaviour and allows for meaningful feedback to staff on the wards.

It is based on a tool used in one of the largest studies undertaken internationally on hand hygiene, which demonstrated that feedback was a key feature of improvement.

The basis of the tool is that it allows you to record over a 20-minute period whether health care workers who touch patients have adequately decontaminated their hands before and after patient care and to note whether the opportunity was high, medium or low risk. The model used here is a modified version of the one used by Pittet et al* and is used extensively internationally.

Hand hygiene opportunities
The chart provides examples of opportunities for high, medium and low risk contact. All hand hygiene opportunities should include hand washing or use of alcohol-based hand rub before and after patient contact.

The feedback form summarises the findings from the observation tool and compares hand hygiene opportunities with actual observed hand hygiene practice. Compliance can then be expressed as a percentage.

Compliance can be defined as either washing hands with soap and water or rubbing with an alcohol hand rub in accordance with a hand hygiene opportunity, so

\[
\text{Compliance rate} \times 100 = \frac{\text{Hand hygiene events observed}}{\text{Hand hygiene opportunities}} \times 100 (\%)
\]

The methods used to observe HCWs’ hand hygiene compliance will be overt observations and will undoubtedly result in a “Hawthorne effect” and an additional hand hygiene learning opportunity. All observational periods will use this method, comparing compliance rates with similar biases.

Instructions
1. The staff member undertaking observation should undertake a number of practice observations to get familiar with the tool to reduce reporting bias.
2. The overt observation technique will be used by just one person or with a partner.
3. Identify an area within your ward/department where you can comfortably observe staff. Stay in this place for 20 minutes and observe your ‘window’ of activity. If staff walk away without you seeing whether they perform hand hygiene, you are to assume hand hygiene has not been undertaken.
4. Observe for 20-minute periods.
5. Using the observation sheet, tally hand hygiene opportunities and hand hygiene events observed for before- and after-patient care. If hand hygiene does not take place, leave it blank.
6. The observation sheet offers you the chance to identify opportunities as low, medium or high and whether hand hygiene activity has taken place before and after patient contact.
7. When you have completed 20 minutes’ observation, give feedback to the staff — a feedback form is included in this pack. When you give verbal feedback, try to stress positive findings first, and if you give negative feedback, give examples and suggestions for improvement. Also, ask for feedback from the observed staff about why they did not comply — use this as a learning feedback opportunity.
8. Keep hold of the completed observations and hand them to the nurse unit manager.

Hand hygiene observation tool — feedback form

| Date: |
| Time: |
| Ward/unit: |
| Observer(s): |
| Score: |
| Compliance rate (%) = \frac{\text{Hand hygiene events observed}}{\text{Hand hygiene opportunities}} x 100 (\%) |
| Score by staff group (if requested): |
| Score compared with division/unit/directorate average: |
| Specific feedback: |
| Feedback given to: |
| Further action required: |
| Comments: |

9. While you are observing, you may identify issues which are barriers to hand hygiene, eg, no soap, obstructed sinks, no alcohol hand rub by the bed, alcohol hand rub dispensers not working, alcohol hand rub dispensers empty — include this in your feedback.
10. If you find activities which are not identified on the chart, add them and let the infection control team know.

Fulkerson risk scale for hand hygiene opportunities

Low risk
- Sterile or autoclaved materials
- Thoroughly cleaned or washed materials
- Materials that are not necessarily cleaned but are free from patient contact (ie, notes, papers, telephone and nurses’ desk area)
- Materials in contact with patients but with little contamination risk (ie, furniture in patient area)

Medium risk
- Objects or materials that have been in close contact with patients but are not contaminated with patient secretions or other sources of pathogenic bacteria (ie, relatively clean patient gowns, linen, used cutlery or plates, bed rails and tops of patient tables)
- A patient: minimal contact without touching excretions or secretions and for a limited period of time, such as shaking hands, taking a pulse or giving a back rub
- Materials and inanimate objects that have been in contact with, or bear, patient secretions such as saliva, not known to be contaminated
- Setting up and removing intravenous infusion and giving injections (eg, subcutaneous, intramuscular or intravenous injections)

High risk
- A patient: directly touching areas of secretions, such as mouth, nose and so forth
- Materials contaminated with patient urine
- Patient urine (direct contact)
- Materials bearing faecal soilage
- Faecal soilage (direct contact)
- Materials that have been in direct contact with known infected secretions or excretions
- Secretions or excretions known to be contaminated (direct contact)
- Handling urine, faeces, blood (eg, bed pans, commodes, catheter bags)
- Insertion and removal of intravenous cannulas
- Infected patient sites, such as infected wounds (direct contact)