Significant reductions in methicillin-resistant *Staphylococcus aureus* bacteraemia and clinical isolates associated with a multisite, hand hygiene culture-change program and subsequent successful statewide roll-out

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ABSTRACT

Objective: To assess the efficacy of a multimodal, centrally coordinated, multisite hand hygiene culture-change program (HHCCP) for reducing rates of methicillin-resistant *Staphylococcus aureus* (MRSA) bacteraemia and disease in Victorian hospitals.

Design, participants and setting: A pilot HHCCP was conducted over a 24-month period (October 2004 to September 2006) in six Victorian health care institutions (4 urban, 2 rural; total beds, 2379). Subsequently, we assessed the efficacy of an identical program implemented throughout Victorian public hospitals over a 12-month period (beginning between March 2006 and July 2006).

Main outcome measures: Rates of hand hygiene (HH) compliance; rates of MRSA disease (patients with bacteraemia and number of clinical isolates per 100 patient discharges [PD]).

Results: Mean HH compliance improved significantly at all pilot program sites, from 21% (95% CI, 20%–22%) at baseline to 48% (95% CI, 47%–49%) at 12 months and 47% (95% CI, 46%–48%; range, 31%–75%) at 24 months. Mean baseline rates for the number of patients with MRSA bacteraemia and the number of clinical MRSA isolates were 0.05/100 PD per month (range, 0.00–0.13) and 1.39/100 PD per month (range, 0.16–2.39), respectively. These were significantly reduced after 24 months to 0.02/100 PD per month for bacteraemia ($P = 0.035$ for trend; 65 fewer patients with bacteraemia) and 0.73/100 PD per month for MRSA isolates ($P = 0.003$; 716 fewer isolates). Similar findings were noted 12 months after the statewide roll-out, with an increase in mean HH compliance (from 20% to 53%; $P < 0.001$) and reductions in the rates of MRSA isolates ($P = 0.043$) and bacteraemias ($P = 0.09$).

Conclusions: Pilot and subsequent statewide implementation of a multimodal HHCCP was effective in significantly improving HH compliance and reducing rates of MRSA infection.

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Multimodal programs to change hand hygiene (HH) culture have achieved significant sustained improvements in HH compliance by health care workers and reductions in rates of infection with methicillin-resistant *Staphylococcus aureus* (MRSA) and other nosocomial pathogens in individual institutions in Australia and elsewhere.[1-5] Although the World Health Organization and other bodies have advocated large-scale roll-outs of such programs, there are currently no data to support the efficacy of such system-wide initiatives or to describe an optimal approach.[6,7] In fact, some researchers have expressed doubts about whether such programs can be effectively introduced across a range of institutions or as a statewide policy initiative, owing to their perceived dependence on enthusiastic individual champions and the complexity of developing a generic culture-change template that is suitable for multiple disparate institutions.[8]

After the success of a recent single-site HH culture-change program (HHCCP),[1] we assessed the efficacy of a similar, but more focused, centrally coordinated 2-year pilot program in six Victorian health care institutions, and then of a 1-year program in all Victorian public hospitals ("statewide roll-out").

METHODS

The HHCCP was sponsored, funded and coordinated by the Victorian Quality Council (VQC). A project coordination and data analysis centre was established in the Infectious Diseases Department at Austin Health, Melbourne, to provide training for project officers at each site; standardisation of HH compliance assessment; data collection and analysis (rates of HH compliance and MRSA); education and promotional support; and liaison between participating institutions and the VQC.

Pilot program

Central coordination and site selection

Pilot sites were chosen by expressions of interest, with the aim of selecting four urban and two regional sites. Criteria for selection included institutional executive support for the HHCCP; summary of hospital activity (monthly hospital bed-days and patient discharges); assistance from the site's infection control department; commitment from the institution's pathology provider to provide monthly MRSA bacteraemia and isolate data for 24 months before the project (October 2002 to September 2004) and for the 24-month project (October 2004 to September 2006); and institutional agreement to allow public presentation and publication of de-identified data from the project.

Development of a generic hand hygiene culture-change program

Unlike previous Australian studies,[1] our project focused primarily on the health care culture of compliance with appropriate HH, especially the increased use of alcohol-based hand-rub solutions (ABHRSs). After an extensive literature review, the project staff agreed that all sites should use an ABHRS product that contained at least 70% alcohol (ethanol or isopropanol), 0.5% chlorhexidine and skin emollient. Individual sites were free to choose the specific product and supplier. In addition, sites were encouraged to implement the use of alcohol-impreg-

nated wipes for cleaning hospital equipment that was routinely shared between patients.

A generic HH culture-change training program was developed, including slide presentations, lectures, practical workshops and a training DVD explaining the standardised HH compliance tool.[9] All medical and nursing leaders attended a 2-day workshop aimed at standardising and validating their accurate implementation of the tool.[9] The coordination centre developed a generic guide for the stepwise introduction of the HHCCP to participating sites, which were encouraged to modify it to suit site-specific requirements and conditions.

The VQC developed a central HHCCP website, where important information, generic promotional and educational materials (eg, posters, information, brochures), VQC reports and de-identified interim results were made available. The VQC project officer coordinated regular project meetings, including monthly teleconferences and face-to-face meetings every 3–6 months. During these meetings, personnel at each site discussed their HHCCP problems and successes, shared ideas and discussed possible site-to-site collaborations. A regular schedule for data reporting and feedback was developed and agreed on by all sites.

The project required each site to introduce the HHCCP in two or three "pilot wards", where HH compliance was assessed. Health services were encouraged to expand the initiative across the entire institution thereafter. Pilot wards were chosen on the basis of their previous history of problems with MRSA infection, their priority in terms of restricting MRSA dissemination (eg, renal units), their management of patients at high risk (eg, intensive care units) and the willingness of ward staff to be involved in the program. The choice of pilot wards was left entirely to each site.

Details of the generic HHCCP, the training manual and promotional materials, the HH credentialling package, HHCCP policy and standards and recent media releases are available from the VQC HHCCP website at <http://www.health.vic.gov.au/qualitycouncil/activities/handhyg>.

Funding

Site funding covered a nurse project officer (1 equivalent full-time [EFT] at urban sites; 0.5 EFT at regional sites), a medical champion (0.1 EFT), ABHRS costs and promotional activities. Coordination funding covered a VQC project officer (1 EFT), a nurse coordinator (1 EFT) and a medical coordinator (0.7 EFT) at the coordination centre, and project running costs. The cost of ABHRS was borne about 50 : 50 by the VQC and each participating site.

Outcome measures

Three outcomes were measured:

1. HH compliance: This was measured in pilot wards by standardised assessors at baseline (before intervention) and then every 4–6 months during the 24-month project, as described previously.[1,9]

2. Rates of MRSA infection: This was defined in a similar way to the previous study:[1]

- *MRSA bacteraemia:* The number of patients with bacteraemia per 100 patient discharges (PD) per month in the entire institution was recorded. ("Discharges" include hospital discharges and deaths, and are referred to as "separations" in some states and territories.) A patient episode of bacteraemia was defined as a positive blood culture for MRSA, but only the first isolate for any individual patient was counted, unless at least 14 days had passed without a positive blood culture, after which any additional episode was recorded.[1]
- *MRSA isolates:* The number of non-blood-culture MRSA isolates identified from clinical (non-screening) specimens per 100 PD per month in the entire institution was recorded, as described previously.[1] Screening for MRSA colonisation was not a component of the HHCCP.

3. ABHRS supply data: This was defined, as previously, in terms of the number of litres of ABHRS ordered for each pilot ward per 1000 bed-days per month.[1]

Data collection fulfilled the National Health and Medical Research Council criteria for quality assurance in health care,[10] and the HHCCP was approved as a quality care initiative at each site. Statistical analyses were undertaken as previously described.[1]

Statewide roll-out

Central coordination and site selection

Seventy-seven eligible Victorian public hospitals were strongly encouraged to participate in the new program, apart from those that had participated in the pilot program or similar HHCCPs[1] (Austin Health, the Royal Women's Hospital and the Royal Children's Hospital in Melbourne). Participation requirements were identical to those for the pilot program. The HHCCP was rolled out in two stages (Stage 1: March 2006 to April 2007; Stage 2: July 2006 to June 2007), each involving at least two rural health regions and a number of urban hospitals.

Program implementation

As in the pilot program, the statewide roll-out required each urban and larger rural site (> 48 acute inpatient beds) to introduce the HHCCP into two or three pilot wards (where HH compliance was assessed) and to expand the initiative across the entire institution thereafter. Pilot wards were selected as in the pilot program, with selection left entirely to each site. Each site was required to provide monthly outcome data for the 24 months before the project initiation and for the 12 months of the project.

All sites used the generic HHCCP developed in the pilot program. Similarly, all sites were encouraged to use a similar ABHRS, as before, but this was not mandated and sites could choose alcohol-only products. All clinical leaders and relevant infection control staff attended a 2-day workshop, as in the pilot study. One-day workshops were also held in each of the five rural health regions, focusing on the education and roll-out initiatives to be used and on how to use the HH compliance tool. Outcome measures were identical to those used previously[1,9] and in the pilot program.

As for the pilot program, the VQC HHCCP website provided generic promotional and educational materials, VQC reports and de-identified interim results. The VQC project manager organised regular project meetings, including monthly teleconferences with the hospitals and face-to-face meetings with the Austin Health data analysis centre.

Data analysis

Statistical analyses were undertaken as previously described.[1] On the basis of our methodology and previous experience,[1] we did not expect statistically significant changes in MRSA infection rates to be identified until about 30 months after the start of each program.

Funding

Funding was provided for a project officer for each urban site and each larger rural site, and for medical officer payments and promotional activities. Each of the five rural health regions received funding for assistance (1 EFT person) to facilitate the roll-out of the program, especially among smaller sites that did not have specific project officer funding. Funding was also provided for a project manager (1 EFT) at VQC and for Austin Health data analysis centre staffing and expenses (1.5 EFT clinical project coordinator, 0.3 EFT medical coordinator and incidental project running costs). All sites in each stage received coordination

assistance via a VQC project link officer, who was previously an HH project officer in the pilot program. Thus, each site had support from the VQC-based manager, medical and nursing project officers at Austin Health, and an experienced VQC link officer.

Three regions used their funding to appoint a full-time project officer to assist all hospitals in the region, and two divided the role (and attached funding) across three of their larger centres. As link officer support could not be provided in one region as initially planned, this role was undertaken by staff at Austin Health.

RESULTS

Pilot program

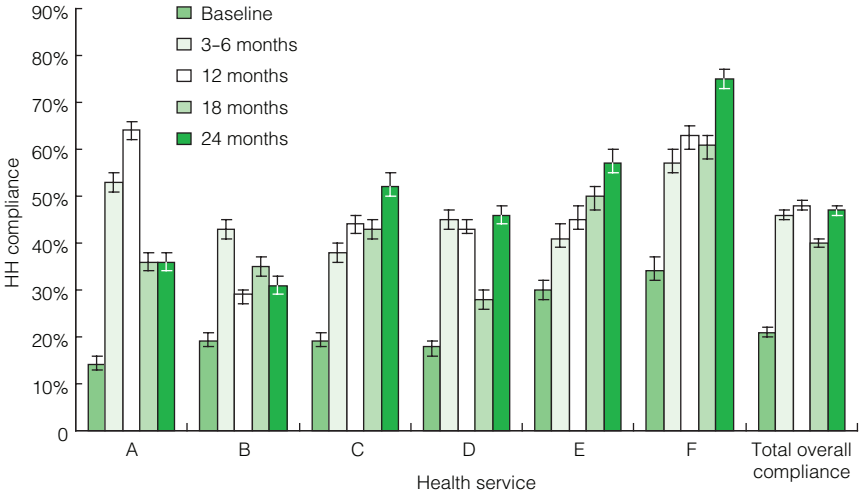
Of 22 institutions that applied to participate, six were selected: four urban sites (Melbourne Health, 482 beds; St Vincent's Health, 471 beds; Western Health, 632 beds; Peninsula Health, 403 beds) and two regional sites (Bendigo Health, 271 beds; Northeast Health, Wangaratta, 120 beds). The HHCCP was conducted over 24 months (October 2004 to September 2006), and pre-intervention data covering the 24 months before this (October 2002 to September 2004) were collected.

All sites selected one of two ABHRS products: Avagard (3M Pharmaceuticals, Sydney) (70% ethanol, 0.5% chlorhexidine, skin emollient [two sites]) and DeBug (Orion Laboratories, Perth) (70% isopropanol, 0.5% chlorhexidine, skin emollient [four sites]).

Overall, HH compliance increased significantly during the study period, from a mean of 21% (95% CI, 20%–22%) at baseline to 47% (95% CI, 46%–48%; range, 31%–75%) at the final assessment ($P < 0.001$) (Box 1). After an initial increase in HH compliance, three sites (A, B and D) showed some transient declines in compliance rates. In each case, these were related to changes in project officers. Sites with unchanged project officers experienced the most robust and sustained improvement in HH compliance. The type of ABHRS used did not influence the rates of HH compliance achieved or their sustainability.

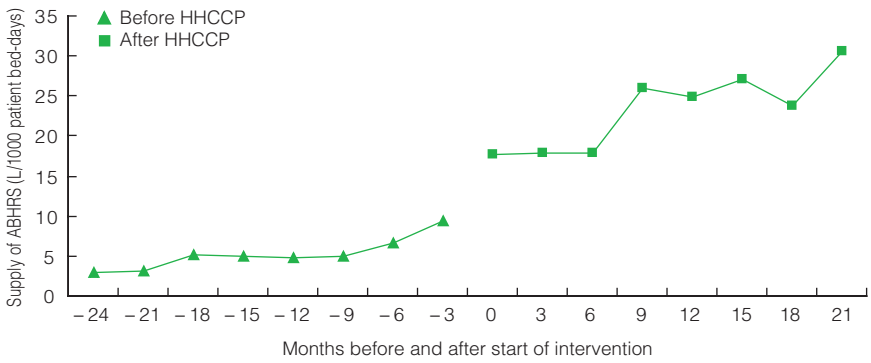
ABHRS supply increased from a mean of 5.3 L/1000 bed-days during the 24-month pre-intervention period to a mean of 27.6 L/1000 bed-days in the final 6 months of the project, but correlated poorly with HH compliance rates, owing to marked variations in supply ordering patterns and stockpiling (Box 2).

1 Pilot program: hand hygiene (HH) compliance at each of the six pilot program hospitals before and after introduction of the HHCCP*



HHCCP = hand hygiene culture-change program. * Mean HH compliance increased significantly over the 24 months of the pilot study ($P < 0.001$). ◆

2 Pilot program: supply of alcohol-based hand-rub solution (ABHRS) on pilot wards before and after introduction of the HHCCP*



HHCCP = hand hygiene culture-change program. * Overall, poor correlation was noted between supply data and hand hygiene compliance rates, owing to seasonal and episodic ordering of ABHRS supplies. ◆

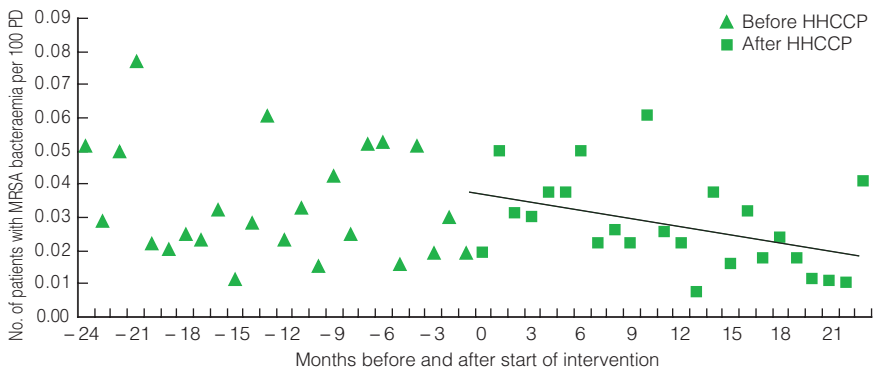
The number of patients with MRSA bacteraemia fell significantly from a mean baseline rate of 0.05/100 PD per month (range at individual sites, 0.00–0.13) 24 months before the intervention to 0.02/100 PD per month in the last 3 months of the intervention period ($P = 0.035$ for trend) (Box 3). This represents a total of 65 (95% CI, 5–126) fewer patients developing MRSA bacteraemia in the six participating hospitals during the 24-month intervention period than would have been expected before the intervention.

Similarly, the total number of clinical MRSA isolates fell significantly from a mean baseline rate of 1.39/100 PD per month (range, 0.16–2.39) 24 months before the intervention to 0.73/100 PD per month 24 months after the start of the intervention ($P = 0.003$ for trend) (Box 4). This represents a total of 716 (95% CI, 269–1162) fewer clinical MRSA isolates identified in the six participating hospitals during the 24-month intervention period than would have been expected before the intervention. These reductions reached statistical significance 23 months after the start of the HHCCP (ie, 1 month before project completion).

Statewide roll-out

All but two of the 77 eligible Victorian hospitals agreed to participate in the statewide roll-out — about half in each Stage (Box 5). Overall, the project involved sites with a total capacity of about 6154 beds.

3 Pilot program: number of patients with MRSA bacteraemia per 100 patient discharges (PD) per month before and after introduction of the HHCCP*



HHCCP = hand hygiene culture-change program. MRSA = methicillin-resistant *Staphylococcus aureus*.
* A statistically significant reduction in bacteraemias was noted at 24 months after the start of the intervention ($P = 0.035$ for trend). ◆

Most sites selected Avagard or DeBug, with only a few choosing an alcohol-only ABHRS.

Overall, HH compliance increased significantly during the study period, from a mean rate of 20% (95% CI, 19%–20%; range, 10%–44%) at baseline to 49% (95% CI, 48%–49%; range, 25%–72%) after 4 months, to 53% (95% CI, 52%–53%; range, 26%–83%) after 11–12 months ($P < 0.001$ for each comparison) (Box 6). Results for Stage I and Stage II hospitals were similar (Box 7). Large rural sites demonstrated the most dramatic results: five health services achieved HH compliance rates of > 70%, with one of these achieving 83% compliance.

Mean ABHRS supply increased from 6.0 L/1000 bed-days before the intervention to 20.9 L/1000 bed-days in the final month of the project. However, overall month-to-month ABHRS supply data correlated only roughly with HH compliance rates (data not shown).

Overall, the number of patients with MRSA bacteraemia fell from a mean baseline rate of 0.03/100 PD per month to 0.01/100 PD per month 12 months after the start of the intervention ($P = 0.09$ for trend) (Box 8).

The total number of clinical MRSA isolates per month fell significantly from a mean baseline rate of 0.54 per 100 PD to 0.30 per 100 PD 12 months after the start of the intervention ($P = 0.043$ for trend) (Box 9). Notably, the rate of clinical MRSA isolates was declining significantly statewide before the HHCCP ($P = 0.0003$ for trend), and this decline continued with introduction of the HHCCP.

DISCUSSION

This is the largest multisite HHCCP both in Australia and worldwide to describe the implementation and efficacy of a generic program with hard endpoints such as HH compliance and rates of MRSA infection. As in the previous single-site study,[1] we found that the pilot program resulted in significant sustained increases in overall HH compliance and significant reductions in both the number of patients with MRSA bacteraemia and the number of clinical MRSA isolates identified, standardised for hospital activity (ie, per 100 PD per month). These results are particularly notable, as the HHCCP was conducted in only two or three wards, yet significant reductions in rates of MRSA disease occurred throughout each institution. We were encouraged that these reductions in MRSA disease reached significance 23 months after the start of the HHCCP, as we had expected from our previous study[1] that such improvements would not be evident until about 30 months after the start.

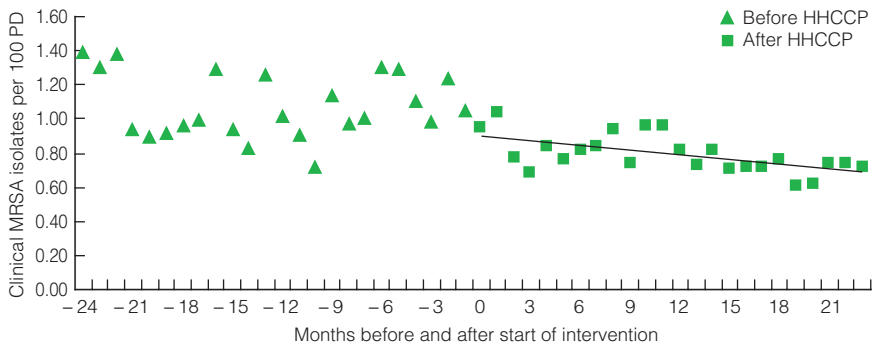
Similarly, the statewide roll-out, which involved all but two of the eligible public hospitals in the entire state, resulted in significant sustained increases in overall HH compliance and reductions in both the number of patients with MRSA bacteraemia and the number of clinical MRSA isolates identified.

We believe our data demonstrate that generic multisite HHCCPs, including statewide initiatives, can be highly effective if they are carefully planned and implemented, and that previously expressed scepticism is unfounded.[8] Nevertheless, the fact that some sites demonstrated a temporary reduction in their rates of HH compliance (albeit not to baseline levels) when there were delays in replacing nurse project officers highlights the fragility of such early initiatives and the difficulty in totally embedding HH culture change in organisations in short time periods. As in other culture-change initiatives, such as the wearing of seatbelts in vehicles or drink-driving campaigns, ongoing education, constant message re-enforcement and data feedback are necessary to bring about sustained change.[5,6,8]

Long-term sustainability of improved HH compliance is likely to require that such programs become a permanent feature of the way each hospital does business, probably by including responsibility (and funding) for the HHCCP in the routine work portfolio of the quality or infection control team at each institution.

Unlike the previous single-site study, we did not screen for nasal or cutaneous MRSA colonisation, as it had previously proved extremely costly, did not generally affect the management of patients (unless they were

4 Pilot program: number of clinical MRSA isolates per 100 patient discharges (PD) per month before and after introduction of the HHCCP*



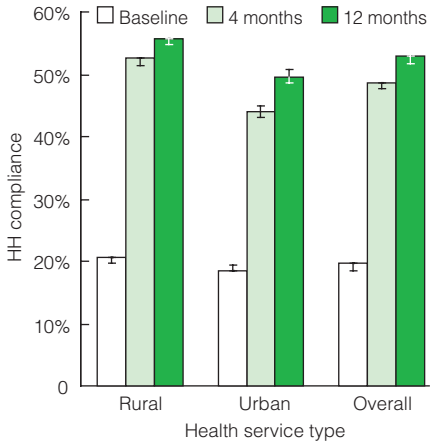
HHCCP = hand hygiene culture-change program. MRSA = methicillin-resistant *Staphylococcus aureus*.
* A statistically significant reduction in clinical MRSA isolates was noted at 24 months after the start of the intervention ($P = 0.003$ for trend). ◆

5 Statewide roll-out: list of health services by roll-out stage

Hospital	Stage*	No. of inpatient beds	No. of pilot wards	EFT†
Urban				
Southern Health‡	I	1002	3	1.0
Eastern Health‡	I	817	3	1.0
Royal Victorian Eye and Ear Hospital‡	I	30	2	0.5
Bayside Health‡	II	610	3	1.0
Northern Health‡	II	405	3	1.0
Mercy Hospital for Women‡	II	276	3	0.5
Calvary Health‡	II	70	2	0.4
Rural: Loddon Mallee region				
Echuca Regional Health‡	I	48	2	0.2
Mt Alexander Hospital‡	I	56	2	0.2
Maldon HS	I	4		
Manangatang and District Hospital	I	6		
Inglewood and District HS	I	9		
Boort District Hospital	I	9		
McIvor Health and Community Services	I	10		
Mallee Track Health	I	10		
Robinvale District HS	I	14		
Rochester and Elmore District HS	I	16		
Cohuna Health Service	I	16		
Kerang District Health	I	24		
Kyneton District HS	I	32		
Swan Hill District Hospital	I	35		
Kyabram and District HS	I	39		
Maryborough District HS	I	41		
Rural: Hume Region				
Goulburn Valley Health‡	I	147	3	0.4
Wodonga Regional HS‡	I	80	3	0.4
Yea and District Memorial Hospital	I	10		
Upper Murray Health and Community HS	I	10		
Nathalia District Hospital	I	10		
Beechworth HS	I	13		
Tallangatta Hospital	I	15		
Numurkah and District HS	I	15		
Cobram District Hospital	I	17		
Yarrawonga District HS	I	27		
Mansfield District Hospital	I	28		
Alexandra District Hospital	I	28		
Kilmore and District Hospital	I	30		
Alpine Health	I	32		
Seymour District Memorial Hospital	I	34		
Benalla and District Memorial Hospital	I	41		
Rural: Grampians Region				
Ballarat HS‡	I	264	3	0.5
Wimmera Health Care Group‡	I	68	2	0.5
East Wimmera HS‡	II	64	2	0.4
East Grampians Health	II	44		
West Wimmera HS	II	38		
Djerriwarrh HS	II	34		
Stawell Regional Health	II	29		
Hepburn HS	II	28		
Rural North West Health	II	24		
Beaufort and Skipton HS	II	20		
Edenhope and District Hospital	II	20		
Dunmunkle HS	II	4		
Rural: Barwon South Western Region				
Barwon Health‡	I	396	3	1.0
South West Healthcare‡	II	180	3	0.5
Western District HS‡	II	83	2	0.4
Colac Area Health	II	43		
Portland District HS	II	39		
Terang and Mortlake HS	II	27		
Moyne HS	II	15		
Casterton Memorial Hospital	II	15		
Timboon and District Healthcare Service	II	14		
Lorne Community Hospital	II	8		
Heywood Rural Health	II	5		
Otway Health and Community Services	II	4		
Hesse Rural HS	II	4		
Rural: Gippsland Region				
West Gippsland Health Care Group‡	I	69	3	0.5
Latrobe Regional Hospital‡	II	167	3	0.5
Central Gippsland HS‡	II	86	3	0.4
Bairnsdale Regional HS‡	II	84	3	0.4
Gippsland Southern HS	II	46		
Bass Coast Regional Health	II	43		
Yarram and District HS	II	20		
Kooweerup Regional HS	II	19		
South Gippsland Hospital	II	16		
Orbost Regional Health	II	14		
Omeo District Health	II	4		

EFT = equivalent full-time. HS = health service. * The hand hygiene program was rolled out in two stages: Stage I (Mar 2006 to Apr 2007) and Stage 2 (Jul 2006 to Jun 2007). † Equivalent full-time commitment of a hand hygiene project officer. ‡ Hospital was required to undertake hand hygiene compliance assessment. ◆

6 Statewide roll-out: hand hygiene (HH) compliance before and after introduction of the HHCCP, by health service type*

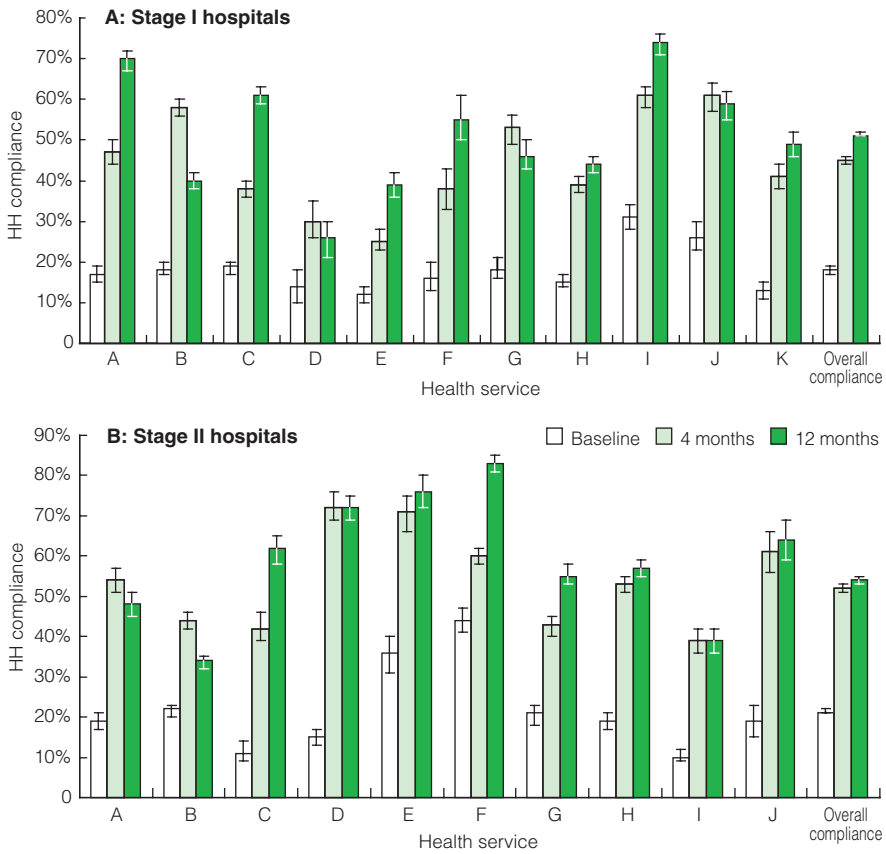


HHCCP = hand hygiene culture-change program. * Overall HH compliance (for all hospitals [Stages I and II]) increased from 20% at baseline to 53% at 11–12 months. Increases in overall HH compliance were significant for both baseline to 4 months ($P < 0.001$) and 4 to 12 months ($P < 0.001$). ◆

about to undergo complex surgery) and did not correlate with demonstrated reductions in MRSA infections.[1] We believe our findings justify this approach, as we were able to focus the majority of funding on the intervention and collect outcome data solely on endpoints that had clear practical relevance. One exception was the recording of ABHRS supply data, which we had initially believed might be a simple surrogate for HH compliance. In fact, supply data correlated poorly with HH compliance in both the pilot program and the statewide roll-out, owing to irregular ordering patterns and stockpiling. Our experience suggests that it is unlikely to be a useful indicator. This is notable, given that some European countries plan to use rates of ABHRS usage at public hospitals as a quality and funding performance measure (Didier Pittet, Director, WHO Global Safety Challenge, Geneva, personal communication).

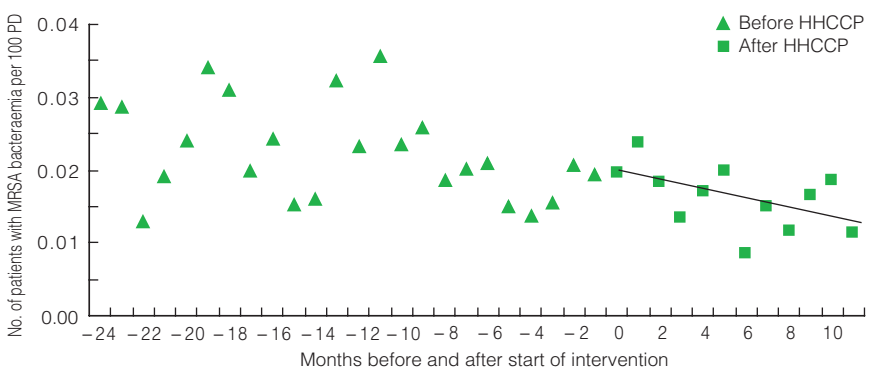
As we expected during the design of the HHCCP, considerable effort was expended on staff education. Although we did not formally assess this, it soon became evident that HH was not a routine component of the educational curricula for most medical or nursing staff, with even very recent graduates being unaware of the importance of HH or the use of ABHRS. We believe this issue should receive more attention among educa-

7 Statewide roll-out: hand hygiene (HH) compliance before and after introduction of the HHCCP, by stage of roll-out and individual health service*



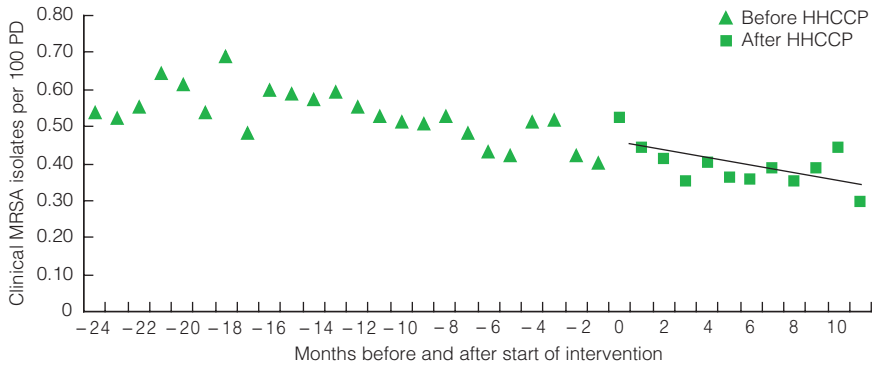
HHCCP = hand hygiene culture-change program. * In Stage I hospitals, HH compliance increased from 18% (95% CI, 17%–19%; range, 13%–31%) at baseline to 51% (95% CI, 51%–52%; range, 26%–74%) after 11–12 months. In Stage II hospitals, HH compliance increased from 21% (95% CI, 21%–22%; range, 10%–44%) at baseline to 54% (95% CI, 53%–55%; range, 34%–83%) after 11–12 months. For Both Stage I and Stage II hospitals, increases in overall HH compliance were significant for both baseline to 4 months ($P < 0.001$) and 4 to 12 months ($P < 0.001$). ◆

8 Statewide roll-out: patients with MRSA bacteraemia per 100 patient discharges (PD) per month before and after introduction of the HHCCP*



HHCCP = hand hygiene culture-change program. MRSA = methicillin-resistant *Staphylococcus aureus*. * The number of patients with MRSA bacteraemia per 100 PD fell from 0.029 at 24 months before the intervention to 0.012 at 12 months after the start of the intervention ($P = 0.09$ for trend). ◆

9 Statewide roll-out: total clinical MRSA isolates per 100 patient discharges (PD) per month before and after introduction of the HHCCP*



HHCCP = hand hygiene culture-change program. MRSA = methicillin-resistant *Staphylococcus aureus*.
* During the 24 months before the introduction of the HHCCP there was a significant reduction in rate of MRSA isolates per 100 PD per month ($P = 0.0003$ for trend). After the start of the intervention, the rate continued to decline, falling to a rate of 0.30/100 PD per month after 12 months ($P = 0.043$ for trend). ◆

tors of health care workers. A national standard approach may be worthwhile.

Our study has some limitations. Firstly, only sites that were clearly interested in participating in the HHCCP were enrolled in the pilot program, and the hospital administrations at each site gave unqualified commitment — a crucial feature of successful HHCCPs.[1,2,6] Thus, we cannot be certain that similar results would be achieved in institutions in which the commitment was less enthusiastic, although the results of the statewide roll-out are encouraging. Secondly, the financial model used in our project provided clearly identified salary and incidental funds so that participating institutions could be certain about which costs were covered and which required additional institutional support. Whether other, less transparent funding models would be equally effective is uncertain. Thirdly, all but one of our pilot sites were relatively large (> 250 beds), and all had established infection control departments with full-time staff. Thus, the efficacy of HHCCPs in smaller institutions without such infection control support remains less certain — although, once again, the success of the statewide roll-out is encouraging. Fourthly, although HH compliance auditing was required only on pilot wards in both the pilot program and the statewide roll-out, it is likely that the initiatives undertaken in these areas had a beneficial effect in other wards. Finally, we cannot be certain that the improvements we observed in the statewide roll-out are related entirely to our HHCCP. For instance, on 6 September 2006 (3–6 months after the start of the statewide roll-out), the Victorian minister for health announced that all visitors to hospitals would be encouraged to use ABHRS on entry and departure. This announcement appeared to increase the public profile of the HHCCP and may have influenced the behaviour of some health care workers and visitors.

As in previous studies,[1,2] our results suggest that an active HHCCP, in combination with widespread availability of ABHRS in clinical areas and targeted education of health care workers, can produce dramatic and sustained improvement in HH compliance and statistically significant reductions in MRSA disease after only 1–2 years. Our data suggest that such HHCCPs represent the single most effective means of reducing the burden of MRSA disease in Australian hospitals. Consideration of a national roll-out of such HHCCPs is likely to be worthwhile.

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COMPETING INTERESTS

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