

Use of antiseptic hand rubs in the health and community services industry: an Australian population-based survey

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Summary

Background. The use of antiseptic hand rubs (AHRs), rather than washing with soap and water, is considered to be the gold standard for reducing the frequency of nosocomial infections, as well as being less damaging to the hands than washing with soap and water, but little is known at a population level about usage patterns for AHRs.

Objectives. To describe AHR use patterns among workers in the health and community services industry in Australia.

Methods. Using data from a population-based survey of Australian workers, we focused on health and community services workers' exposure to chemicals at work, including the use of AHRs. Data regarding the frequency of hand-washing were also collected.

Results. Nine hundred and fifty-six health and community service workers participated in the Australian National Hazard Exposure Worker Surveillance survey. Of these, 11% reported using AHRs, and 31% reported hand-washing >20 times per shift. According to an adjusted logistic regression model, professional workers [adjusted odds ratio (aOR) 2.29, 95% confidence interval (CI): 1.40–3.72] and frequent hand washers (aOR 3.08, 95%CI: 1.92–4.93) were more likely to use AHRs.

Conclusions. AHR use by health and community service workers was generally lower than expected. AHR use was most likely to be reported by professionals and frequent hand washers, suggesting that AHRs are used as an adjunct to conventional hand-washing.

Key words: antiseptic hand rubs; nurses; wet work.

According to a range of international guidelines, the use of antiseptic hand rubs (AHRs), rather than washing with soap and water, among healthcare workers (HCWs) is

considered to be the optimum method for reducing the frequency of nosocomial infections for hands that are not visibly soiled (1–5). The efficacy of AHR use in controlling nosocomial infections is well established (1), and the literature also indicates that AHR use is less irritating to the skin than the practice of repeated washing of the hands with soap and water (6–14). Thus AHR use is desirable in terms of both infection control and occupational skin disease prevention.

Although the use of AHRs is recognized as the gold standard, little is known at a population level about

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usage patterns for AHRs in the health and community services sector. The Australian National Hazard Exposure Worker Surveillance (NHEWS) Survey 2008 was a population-based cross-sectional survey undertaken to inform the development of exposure prevention initiatives for occupational disease. The main aim of the NHEWS Survey was to evaluate exposure to hazards and risk mitigation measures among Australian workers.

The objective of the present study was to describe the patterns of AHR use among workers in a population-based sample of health and community services workers in Australia, by using data collected in the NHEWS Survey. This information is important to guide efforts to increase the uptake of AHR in healthcare settings.

Methods

Study population and design

In 2008, Safe Work Australia conducted the NHEWS Survey, which collected occupational exposure data from 4500 Australian workers by computer-assisted telephone interviews (response rate of 42.3%; no further information is available about non-responders). The NHEWS Survey and sampling method are described elsewhere in detail (15, 16).

Health and community services industry

The analyses reported in this article are based on NHEWS respondents who reported having current jobs classified as being in the health and community services industry. These included a range of occupations, such as nurses, doctors, allied health practitioners, childcare workers, kitchen assistants, technicians, and administrative and clerical support workers.

Hand hygiene practices

Survey respondents were asked, in the context of skin contact with chemicals at work, to nominate 'the main types of chemical products/substances you worked with last week', and responses were recorded verbatim. The verbatim response data were coded by two of the authors (E.M. and T.K.) to identify AHRs. Respondents in healthcare jobs referred to AHRs in a number of different ways; for example, by chemical name (e.g. isopropanol), by commercial name (e.g. Hibiclens®), or by functional description (e.g. 'antiseptic hand rub', 'alcohol hand disinfectant', or 'disinfectant hand gel').

Survey respondents were also asked 'on a typical day at work last week, how many times did you wash your hands

with water, including when using the bathroom?' For analysis purposes, hand washers were classified into two groups according to reported hand-washing frequency (1–20 times or >20 times per work shift). The questions in the NHEWS Survey related to hand washing were drawn from internationally validated survey instruments, and the dichotomization of hand-washing frequency was based on the categorization used by Anveden Berglind et al. (17) and previous analyses of the NHEWS Survey data (15, 18).

Employment and demographic characteristics

Survey respondents were asked about their current job title, main tasks at work, industrial sector, employment arrangements, and the number of employees in the workplace. Respondents were classified into two occupational skill levels [derived from the Australian and New Zealand Standard Classification of Occupations (ANZSCO) job codes (19)]. Group 1 consisted of professionally trained personnel (ANZSCO skill level 1), including medical practitioners and state-registered nurses. Group 2 consisted of paraprofessionals and other lower-skilled workers (ANZSCO skill levels 2–5), including state-enrolled nurses and personal care attendants. Respondents' age and sex were also collected.

The NHEWS Survey was approved by the University of Sydney Human Research Ethics Committee, New South Wales, Australia (No. 02-2008/10506).

Statistical analyses

Analyses were based on univariate and multivariable regression models, and all analyses were performed with STATA® 11 (Stata Corporation, College Station, TX, USA).

Results

Nine hundred and fifty-six respondents reported working in the health and community services sector. The majority of respondents were female and aged >35 years, and approximately half had job titles that indicated professional-level or equivalent qualifications (Table 1). Among those in non-professional jobs, the majority were in jobs classified as ANZSCO skill level 4 (trades and related, *n* = 294) or skill level 2 (paraprofessionals, *n* = 121). Table 2 shows AHR use and hand-washing >20 times per day in ANZSCO classifications with ≥10 individuals.

The majority of respondents with health and community services jobs had permanent or fixed-term employment arrangements, and approximately one-third worked

Table 1. Use of antiseptic hand rubs (AHRs) (at least once per shift in the previous week) by demographic, employment and workplace characteristics and hand-washing frequency

	AHR use		Total N
	Yes n	%	
Sex			
Male	13	6.34	205
Female	73	9.72	751
Age group (years)			
15–24	5	14.3	35
25–34	13	10.74	121
35–44	26	11.3	230
45–54	25	7.5	335
≥55	85	9.0	296
Occupational skill level (ANZSCO-grouped)			
Non-professional	28	5.9	475
Professional	58	12.5	465
Employment status			
Permanent/fixed-term	69	9.4	738
Temporary/casual	7	5.5	128
Workplace size			
<200 workers	47	7.5	629
≥200 workers	37	11.8	314
Hand-washing			
≤20 times per day	37	5.6	656
>20 times per day	49	16.3	300

ANZSCO, Australian and New Zealand Standard Classification of Occupations.

in workplaces with >200 employees. Thirty-one per cent reported washing their hands >20 times per day at work, and 11% reported using AHRs. The youngest age group had the highest proportion of AHR users (15–24).

Table 3 shows the results of the univariate and multivariable logistic regression analyses. Univariate models showed that the highest-skilled workers were more than twice as likely to report use of AHRs as other workers. Workers in the largest workplaces (≥200 workers) were more likely than those in smaller workplaces to report use of AHRs. Antiseptic hand rub users were also more likely to report frequent hand-washing (>20 times per day).

Age, sex and employment status did not appear to be associated with use of AHRs in the univariate analyses.

The general pattern of associations seen in the univariate models was similar to that in the multivariable model. Occupational skill level remained predictive of AHR use, with professionals being more than twice as likely to report use as other workers. Large workplaces were associated with reporting AHR use in the univariate analysis, but this association was not significant in the early multivariable models (data not shown), and consequently this variable was removed from the multivariable model; the resulting parsimonious model is shown in Table 3.

Table 2. Self-reported jobs classified by Australian and New Zealand Standard Classification of Occupations (ANZSCO) (four-digit) by hand-washing and antiseptic hand rub (AHR) use (four-digit ANZSCO classifications with ≥10 individuals)

	AHR use		Hand-washing		Total N
	Yes %		>20 times per day %		
Professional jobs					
Health and welfare services managers	0		10		10
Education professionals not elsewhere classified	0		0		12
Medical imaging professionals	15		23		13
Physiotherapists	20		27		15
General and resident hospital medical practitioners	19		25		16
Midwives	10		55		20
Registered nurses	21		61		146
Social workers	0		0		17
Welfare, recreation and community arts workers	0		0		11
Non-professional jobs					
Medical technicians	7		36		14
Community/personal service workers	0		10		10
Enrolled/mothercraft nurses	23		92		13
Welfare support workers	0		18		34
Child carers	2		52		50
Aged and disabled carers	3		16		32
Nursing support and personal care workers	10		63		79
General clerks	6		0		17
Receptionists	3		16		32
Kitchen assistants	0		30		10

After other relevant variables had been controlled for, the multivariable model suggested that respondents reporting AHR use were approximately three times as likely to report frequent conventional hand-washing (>20 times per day).

Discussion

This study presents a first attempt to obtain information about the extent and characteristics of AHR use among HCWs by the use of population-based survey data. Data from the NHEWS Survey indicate that only 11% of respondents who worked in the health and community services sector reported using AHRs in the course of their work. Although this surprisingly low rate may be indicative of the number of non-clinical occupations that are included in the health and community industry, the apparently low uptake of AHR use for hand-cleansing in this sector may

Table 3. Results of univariate and multivariable logistic regression analyses: odds of antiseptic hand rub (AHR) use by demographic and employment characteristics and hand-washing frequency

	Univariate models		Multivariable model*	
	Odds ratio	95%CI	Odds ratio	95%CI
Sex				
Male	1.00	–	1.00	–
Female	1.59	0.86–2.93	1.24	0.65–2.38
Age group (years)				
15–24	1.00	–	1.00	–
25–34	0.72	0.24–2.19	0.54	0.17–1.72
35–44	0.76	0.27–2.14	0.66	0.22–1.93
45–54	0.48	0.17–1.36	0.44	0.15–1.28
≥55	0.45	0.16–1.33	0.43	0.14–1.31
Occupational skill level				
Non-professional	1.00	–	1.00	–
Professional	2.28	1.42–3.64	2.29	1.40–3.72
Workplace size				
<200 workers	1.00	–	–	–
≥200 workers	1.65	1.05–2.60	–	–
Hand-washing				
≤20 times per day	1.00	–	1.00	–
>20 times per day	3.27	2.08–5.13	3.08	1.92–4.93

CI, confidence interval.

*The multivariable model presented included skill level, workplace size, hand-washing, age, and sex. Workplace size was initially included in the multivariable model because it was significant in the univariate model. However, because workplace size was non-significant in the multivariable model, it was removed from the final model.

also indicate that promotion of AHRs is warranted both from the point of view of infection control and also in terms of reducing workers' dermatological risk.

Respondents with job titles coded to the highest occupational skill level (professionals), including registered nurses and doctors, were more than twice as likely to report use of AHR products as workers in lower-skilled jobs (non-professionals, such as enrolled nurses and care attendants). Previous research has shown that compliance with hand hygiene practices in general differs markedly between the different occupational groups in the healthcare environment (20), and our finding is consistent with a previously published study that reported differences in use of, beliefs about and knowledge about AHR use between nurses, doctors, and nursing assistants (21). Alternatively, the differences might be at least partly explained by factors such as differences in the availability of AHRs in the workplace or different expectations of supervisors regarding the use of AHRs.

Higher levels of training may affect hand hygiene behaviours through greater understanding of the efficacy and importance of these (7, 22). Recent research has shown that workers' perception of the dermal risk associated with AHR use may also be an important factor in the choice of hand-cleansing method (23), and it can be expected that more highly trained HCWs will be more informed about the advantages of AHR use (6). However,

it is important to note that greater understanding of the importance may also lead to over-reporting if respondents' answers are influenced by what they know should be done (social desirability bias). Although our results suggest that further promotion of AHR use in general is warranted, non-professional workers in this sector and workplaces predominantly employing lower-skilled workers may constitute a particularly worthwhile target for intervention (e.g. care facilities for the aged).

Large workplaces in the Australian healthcare sector include medium and large hospitals that have organized and professionally managed systems for managing infection control and occupational health and safety, including well-developed staff resources and training programmes. Smaller facilities, such as care homes for the aged, frequently lack a full-time infection control professional and well-developed occupational health and safety programmes (24). In the univariate analyses, workplace size was associated with AHR use; however, this association disappeared in the analysis adjusted for other variables, including occupational skill level. In the multivariable analysis, the association between AHR use and occupational skill level remained. Therefore, in our analysis, occupational skill level was a more influential factor than workplace size in predicting AHR use. However, because, in this industry, smaller workplaces, such as care homes for the aged, tend to predominantly employ lower-skilled

workers, targeting interventions at such workplaces may be a viable means of reaching the lower-skilled workforce to enhance the uptake of AHRs in this industry.

Because the NHEWS Survey was a cross-sectional survey, and no information was collected about the frequency of AHR use, we could not investigate the relationship between AHR use and conventional hand-washing in more detail. This would have been useful to know, and relevant to the issue of workers' risk associated with wet hand-washing (6, 18). The overall response rate for the NHEWS Survey was moderate (42%), and there was no follow-up of non-responders. Given that the NHEWS Survey was a telephone survey, it is likely that respondents were systematically different from non-responders. However, the information necessary to evaluate this is not available.

Self-reported data are inherently vulnerable to response bias, notwithstanding the questions about self-reported hand-washing having been validated internationally. It is possible that the findings may represent intentions to adopt or knowledge about proper hand hygiene practices, rather than actual behaviours. A previous study of 71 hospital healthcare professionals in the United Kingdom showed that self-reports of hand hygiene practices and observation of actual behaviours did not correlate well (25). This could imply that the findings of the present study should be interpreted as representing the respondents' intentions and/or knowledge regarding proper practice. In the same UK study, it was observed that, among professional clinical staff in a hospital setting, actual practice was poor, and, generally, professional health carers in the study self-reported significantly more hand hygiene activity than they actually practised, even under observation (25). If the present study is subject to the same effect, the implication might be that greater self-reported hand hygiene activity among healthcare professionals and health carers in larger healthcare establishments may be a reflection of greater levels of awareness of ideal hand hygiene behaviours among healthcare professionals and workers in large healthcare facilities.

Unlike surveys focused specifically on AHR use, the NHEWS Survey did not ask participants specifically about AHR products. Rather, AHR use was drawn from a broader question about skin exposure to chemicals at work. Also, NHEWS participants were interviewed by telephone at home, rather than at work. For both of these reasons, it may be less likely that AHR use was over-reported because of social desirability or observation bias in the NHEWS Survey.

A strength of our study is that the NHEWS data are population-based, rather than workplace-based, and as such provides information from workers across the health and community services sector in Australia. Another strength of the study is that the availability of information about both hand-washing and AHR use from the same individuals at the same time has enabled comparisons of usage patterns of both methods of hand-cleansing commonly used by Australian HCWs.

Our findings suggest that AHR use is additional to, and not a substitute for, frequent hand-washing, and that AHR use is higher among workers in higher occupational skill level positions, such as doctors and registered nurses. Targeted policies and interventions are required to encourage the uptake and use of AHRs in the health and community services sector, and particularly among lower-skilled workers.

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References

- 1 Boyce J M, Pittet D. Guidelines for hand hygiene in health-care settings: recommendations of the healthcare infection control practices advisory committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. *Morb Mortal Wkly Rep* 2002; **51**: 1–44.
- 2 Centers for Disease Control and Prevention. Guideline for hand hygiene in health-care settings: recommendations of the healthcare infection control practices advisory committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. *Infect Control Hosp Epidemiol* 2002; **23**: S3–S40.
- 3 Widmer A F. Replace hand washing with use of a waterless alcohol hand rub? *Clin Infect Dis* 2000; **31**: 136–143.
- 4 National Health and Medical Research Council. *Australian Guidelines for the Prevention and Control of Infection in Healthcare*: Commonwealth of Australia, Canberra, 2010.
- 5 Grayson L, Russo P, Ryan K, Havers S, Heard K. *Hand Hygiene Australia Manual*: Commonwealth of Australia, Canberra, 2013.

- 6 Kampf G, Löffler H. Dermatological aspects of a successful introduction and continuation of alcohol-based hand rubs for hygienic hand disinfection. *J Hosp Infect* 2003; **55**: 1–7.
- 7 Girard R, Amazion K, Fabry J. Better compliance and better tolerance in relation to a well-conducted introduction to rub-in hand disinfection. *J Hosp Infect* 2001; **47**: 131–137.
- 8 Lubbe J, Ruffieux C, van Melle G, Perrenoud D. Irritancy of the skin disinfectant n-propanol. *Contact Dermatitis* 2001; **45**: 226–231.
- 9 Pittet D. Improving adherence to hand hygiene practice: a multi-disciplinary approach. *Emerg Infect Dis* 2001; **7**: 234–340.
- 10 Kramer A, Bernig T, Kampf G. Clinical double-blind trial on the dermal tolerance and user acceptability of six alcohol-based hand disinfectants for hygienic hand disinfection. *J Hosp Infect* 2002; **51**: 114–120.
- 11 Winnefeld M, Richard M A, Drancourt M, Grob J J. Skin tolerance and effectiveness of two hand decontamination procedures in everyday hospital use. *Br J Dermatol* 2000; **143**: 546–550.
- 12 Pedersen L K, Held E, Johansen J D, Agner T. Less skin irritation from alcohol-based disinfectant than from detergent used for hand disinfection. *Br J Dermatol* 2005; **153**: 1142–1146.
- 13 Löffler H, Kampf G, Schermund D, Maibach H I. How irritant is alcohol? *Br J Dermatol* 2007; **157**: 74–81.
- 14 Slotsch C M, Kampf G, Löffler H. Effects of disinfectants and detergents on skin irritation. *Contact Dermatitis* 2007; **57**: 235–241.
- 15 Keegel T G, Nixon R L, LaMontagne A D. Exposure to wet work in working Australians. *Contact Dermatitis* 2012; **66**: 87–94.
- 16 Australian Safety and Compensation Council. *National Hazard Exposure Worker Surveillance (NHEWS) Survey Handbook*: Canberra, Australian Government, 2008.
- 17 Anveden Berglind I, Alderling M, Jarvholm B, Lidén C, Meding B. Occupational skin exposure to water: a population-based study. *Br J Dermatol* 2009; **160**: 616–621.
- 18 Keegel T, MacFarlane E, Nixon R L, LaMontagne A D. Provision of control measures for exposure of the hands to wet-working conditions in Australian workplaces. *Int J Occup Environ Health* 2012; **18**: 312–319.
- 19 Australian Bureau of Statistics/Statistics New Zealand. *Australian and New Zealand Standard Industrial Classification (ANZSIC)*: Canberra, Australian Bureau of Statistics, 2006.
- 20 Randle J, Arthur A, Vaughan N. Twenty-four-hour observational study of hospital hand hygiene compliance. *J Hosp Infect* 2010; **76**: 252–255.
- 21 Tivolacci M P, Merle V, Pitrou I, Thillard D, Serra V, Czernichow P. Alcohol-based hand rub: influence of healthcare workers' knowledge and perception on declared use. *J Hosp Infect* 2006; **64**: 149–155.
- 22 Gould D. Nurses' hand decontamination practice: results of a local study. *J Hosp Infect* 1994; **28**: 15–30.
- 23 Sloane T, Shaban R Z, Gillispe B. Barriers and enablers to the uptake of alcohol-based hand rubs for pre-operative hand antisepsis in the operating room: an Australian perspective. *Healthc Infect* 2012; **17**: 25–32.
- 24 Schween S J, Edmonds S L, Kirk J, Rowland D Y, Acosta C. Effectiveness of a comprehensive hand hygiene program for reduction of infection rates in a long-term care facility. *Am J Infect Control* 2013; **41**: 39–44.
- 25 Jenner E A, Fletcher B C, Watson P, Jones F A, Miller L, Scott G M. Discrepancy between self-reported and observed hand hygiene behaviour in healthcare professionals. *J Hosp Infect* 2006; **63**: 418–422.