



City Research Online

City, University of London Institutional Repository

Citation: Gould, D. J., Drey, N. and Creedon, S. (2011). Routine hand hygiene audit by direct observation: has nemesis arrived?. *Journal of Hospital Infection*, 77(4), pp. 290-293. doi: 10.1016/j.jhin.2010.12.011

This is the accepted version of the paper.

This version of the publication may differ from the final published version.

Permanent repository link: <http://openaccess.city.ac.uk/13833/>

Link to published version: <http://dx.doi.org/10.1016/j.jhin.2010.12.011>

Copyright and reuse: City Research Online aims to make research outputs of City, University of London available to a wider audience. Copyright and Moral Rights remain with the author(s) and/or copyright holders. URLs from City Research Online may be freely distributed and linked to.

City Research Online:

<http://openaccess.city.ac.uk/>

publications@city.ac.uk

REVIEW

Routine hand hygiene audit by direct observation: has nemesis arrived?

D. J. Gould ^{a *}, N. S. Drey ^a, S. Creedon ^b

^a City University London, UK

^b University of Cork, Southern Ireland

KEYWORDS

Hand hygiene

Hand washing

Hand hygiene audit

Hand hygiene compliance

Health care-associated infection

Words in text = 2,071

* Corresponding author. Address: City University London, St Bartholomew's Close, London EC1A 7QN UK Tel: 0207 040 5449

Email address: d.gould@city.ac.uk

Summary

Infection prevention and control experts have expended valuable health service time developing and implementing tools to audit health workers' hand hygiene compliance by direct observation. Although described as the 'gold standard' approach to hand hygiene audit, this method is labour intensive and **may be** inaccurate unless performed by trained personnel who are regularly monitored to ensure quality control. New technological devices have been developed to generate 'real time' data, but the cost of installing them and using them during routine patient care has not been evaluated. Moreover, they do not provide as much information about the hand hygiene episode or the context in which hand hygiene has been performed as direct observation. Uptake of hand hygiene products offers an inexpensive alternative to direct observation. Although product uptake would not provide detailed information about the hand hygiene episode or local barriers to compliance, it could be used as a continuous monitoring tool. Regular inspection of the data by infection prevention and control teams **and clinical staff** would indicate when and where direct investigation of practice by direct observation and questioning of staff should be targeted by highly trained personnel to identify local problems and improve practice.

195 words

Introduction

Healthcare-associated infection (HAI) is a major source of anxiety to patients and the public and is very costly to health services¹. Most HAIs are spread by direct contact during patient care. Hand hygiene has traditionally been regarded as the single most important infection prevention and control measure and has been intensively promoted in the wake of influential work in Geneva^{2,3} which has indicated positive benefits following the introduction of alcohol products to cleanse hands, with an ongoing campaign of performance feedback and reminders to encourage uptake. Similar campaigns have since been introduced in other continental countries⁴, England, Wales⁵, **Scotland**⁶, Canada and the United States (US)⁷, Australia⁸ and many parts of the developing world⁹. In these campaigns the primary method of audit is by directly observing health workers' hand hygiene compliance.

Hand hygiene audit by direct observation

Direct observation has been described as the 'gold standard' method of auditing hand hygiene¹⁰. Auditors are able to document frequency, performance in relation to the total number of hand hygiene opportunities witnessed (giving a measure of appropriateness) and thoroughness (giving a measure of the excellence of technique). Auditors can see first hand which individuals are complying and failing to comply with hand hygiene protocols and intervene to encourage improved performance. They can also identify barriers to compliance and seek local solutions¹¹. However, a number of disadvantages have been identified with this method¹². Direct observation is labour intensive, time consuming and therefore expensive. Auditors need to be trained and monitored regularly to ensure quality control of the audit process. The accuracy of results is likely to be affected by the Hawthorne¹³ and observer effects¹⁴ because it is inevitably overt. The timing of observation has the potential to influence results¹². Few authors report auditing hand hygiene compliance at night and weekends or appear to have provided training to auditors during interventions intended to improve hand hygiene compliance²¹. Hand hygiene may be required during delivery of care to the same patient, not just between overall patient care episodes¹⁵ but observation is compromised when bedside curtains are drawn. Closely shadowing health workers during intimate procedures infringes patients' privacy and there are clear ethical dilemmas¹². Moreover, the potential advantages of direct observation are rarely capitalized upon. Most authors report frequency or the number of hand hygiene opportunities accepted, but only a few have attempted to document thoroughness¹⁶. There appear to be no published reports to testify the effectiveness of intervening and correcting practice while audit is taking place.

Alternatives to hand hygiene audit by direct observation

Self-reported hand hygiene compliance

Self-reported hand hygiene compliance is unlikely to be accurate in view of the emphasis currently placed on infection prevention in general and hand hygiene in particular. It is very

likely that rates of compliance collected by self-report will be inflated as few health workers can remain unaware that cleansing hands is important.

Peer reporting hand hygiene compliance

In some organisations hand hygiene compliance is audited by peers. Again, there is scope for distortion, through under or over-rating levels of compliance and the issue of training and monitoring peer auditors.

Product uptake

Product uptake is used as a measure of hand hygiene compliance in an increasing number of research reports. In some studies it has been taken as a secondary outcome measure to corroborate the results of audit by direct observation¹⁷⁻²² but in a growing number it has represented the main measure of hand hygiene behaviour²³⁻²⁶ replacing direct observation. An obvious disadvantage is the exaggerated uptake that will be reported in cases of wastage or if the product is used for some purpose other than hand hygiene, such as general cleaning. However alcohol-based antiseptics are now widely used as the main hand hygiene agents, replacing liquid soaps in many hospitals. The accuracy of audit by product uptake is thus likely to be increased: alcohol handrubs and gels incorporating emollients are far less likely to be used for general cleaning than soap. There is increasing interest in product uptake as the main measure of compliance during routine hand hygiene audit in some continental countries⁴ and a recent literature review has indicated that it might provide a more sensitive indicator of the impact of alcohol-based antiseptics on HAI rates than traditional audit by direct observation²⁷.

Sroka et al²⁸ evaluated the impact of alcohol handrub use on rates of meticillin-resistant *Staphylococcus aureus* (MRSA) by re-analyzing data from 12 studies which reported exact amounts of alcohol handrub consumed, and/or hand hygiene compliance by direct observation over time. Increased product uptake correlated significantly ($r = 0.78$) with improvement in hospital-acquired MRSA rates but there was no correlation between hand hygiene compliance and nosocomial MRSA. Sroka *et al*²⁷ also demonstrated that where consumption of alcohol handrub was comparatively high at the beginning of data collection, there was less improvement in MRSA rates over time than where level of consumption was low. It was not possible to establish the extent to which alcohol products were responsible for improvement in nosocomial MRSA, as a bundle of infection prevention and control measures was already in place in all the institutions where data were collected. A further limitation of the study pointed out by the authors was the lack of evidence of a causal relationship between alcohol consumption and MRSA. However, the analysis by Sroka *et al*²⁷ holds promise that product uptake as an indicator of compliance may be a feasible and valid measure, when the product in question is alcohol-based.

Clear advantages of product uptake to audit hand hygiene compliance are that it is inexpensive, avoids Hawthorne and observer effects because it does not disrupt usual clinical activity and generates data continuously at all times of day, every day. Product uptake cannot supply information about the level of compliance for individual members of staff or professional groups or help identify barriers to compliance, but it could be used as a general screening tool to indicate clinical areas where compliance appears to be problematic. Alcohol handrubs are now being used widely in the non-acute sector such as nursing homes²⁸. Hand hygiene compliance by direct observation is particularly challenging in these settings. Residents usually occupy single rooms and the total number of hand hygiene opportunities for many individuals is likely to be low as fewer clinical contacts are performed than for typical acute hospital patients. Considerable observation is thus required to generate little data. Nevertheless nursing home clients are elderly, frail, chronically ill and at risk of infection. Recent hospital admission increases the risk of MRSA carriage and homes may operate as reservoirs of infection for hospitals because of frequent patient transfers²⁹. As greater numbers of infirm older people receive care in nursing homes, hand hygiene compliance to prevent and control HAI will become of increasing importance.

Alternative methods of hand hygiene audit

Electronic monitoring devices attached to taps were first used in observational studies to document the frequency of hand hygiene³⁰. More sophisticated devices are now available. They can be attached to wall-mounted soap and alcohol dispensers which are battery powered and generate data downloadable to a computer. Feasibility studies indicate that such devices can provide information about fluctuations in product uptake throughout the day corresponding with times of greatest clinical activity when more hand hygiene opportunities occur and corroborate expectations that uptake will be greater in areas of high patient dependency³¹. Similar devices have been used to capture hand hygiene frequency in studies that evaluate the effectiveness of hand hygiene improvement interventions³²⁻³⁶ and in observational studies³⁷.

The advantage of electronic monitoring devices is that they provide real time data, but they share all the other disadvantages of product uptake plus the costs of installation, disruption in clinical areas while they are being installed and maintenance. So far the costs and cost-effectiveness of installing and using these systems do not appear to have been adequately described in feasibility studies. Results are less accurate than audit by product uptake because use from free-standing dispensers and the small, individual dispensers which staff may carry in some organisations is not accounted for³⁸, possibly explaining the lack of correlation between audit by product uptake and traditional observation that has been reported by some authors³⁸. The real time data is generated in very large amounts and is only of benefit if managers and infection prevention teams have sufficient time to analyse and interpret them³⁷.

Other possibilities involve the use of wearable devices³⁹ and intelligent computerized devices with video cameras to capture hand hygiene data. Wearable devices seem acceptable to patients and staff³⁹, but their cost does not appear to have been evaluated in published studies. Feasibility studies have been undertaken to explore the use of computerized video systems to encourage patients with dementia to wash hands⁴⁰. Their use in clinical settings to capture the routine hand hygiene activity of health workers remains to be reported and is fraught with problems. Careful placing would be necessary to avoid intruding on patients' privacy and as with electronic monitoring devices, the expense and disruption arising through installation would probably be prohibitive for everyday use, although such systems might possibly have something to offer in research studies.

A combined approach to hand hygiene audit

Laboratory studies have indicated the amount of alcohol product required to achieve adequate cover of the total hand surface and the optimal time required for antiseptics to be achieved^{41,42}. More work needs to be undertaken in clinical settings to validate product uptake as a measure of hand hygiene compliance during routine patient care in the acute and non-acute health care sector. There might be advantages to combining product uptake routinely as a screening tool with traditional auditing by direct observation. Regular inspection **and feedback** of data generated by ongoing product uptake would alert infection prevention teams to unexpected variations in use which should trigger visits to clinical areas. Marked increase or decrease in product uptake would both merit closer scrutiny: increase could indicate a change in patient dependency or clinical workload which if ongoing, would have implications for infection prevention and control long term. Decrease would require troubleshooting to explore problems. The more detailed information provided by traditional audit employing direct observation could be used to identify local barriers to practice or lack of compliance by particular members of staff. Discussion of possible problems with staff and managers is important to overcome local barriers to hand hygiene compliance^{11,43}. The need for accurate and detailed hand hygiene compliance data is of paramount importance in the growing number of NHS trusts which are announcing 'zero tolerance' to lack of compliance. In these hospitals failure to comply with hand hygiene protocols has become a matter for disciplinary action and if persistent, dismissal. Watertight evidence of failure to comply should be available if accusations of unfairness and appeals are to be avoided. **Failure to comply documented by timed and dated video footage could be used as evidence but would be unlikely to be available as part of regular audit in most institutions. However, failure to cleanse hands when requested to do so during audit could be regarded as evidence that might be used in disciplinary action.** Of greatest importance is the accuracy of information supplied to patients and their families, especially when it is used to help them make choices about the best hospital to receive safe care. Many NHS trusts have responded to mounting public concern about HAI by posting hand hygiene information on their websites. Some of the rates

of compliance quoted seem excessive: 80% and in some cases over 90%. However, there are reports of regular 90% compliance in some countries, notably Scotland. Information for lay people about this single (though important) activity should be placed in perspective within the whole context of infection prevention and control and where the results of audit are presented, readers should be supplied with information that is credible and trustworthy.

Conclusion

Infection prevention experts have expended much valuable health service time developing and implementing tools to audit hand hygiene by direct observation. Routine screening obtained from product uptake combined with the occasional, highly skilled expertise of infection prevention personnel appears to offer greater advantages than expensive technological solutions. The feasibility of a combined approach should be explored with further studies to refine the method and explore feasibility and acceptability.

References

1. Gould, D J, Drey, N S, Millar, M, Wilks, M, Chamney, M. Patients and public: knowledge, sources of information and perceptions about healthcare-associated infection *J Hosp Infect* 2009; **72**: 1-8.
2. Reybrouck G. The role of hands in the spread of nosocomial infections *J Hosp Infect* 1983; **4**: 103-111.
3. Pittet, D, Hugonnet, S, Mourouga, P *et al*. Effectiveness of a hospital-wide programme to improve compliance with hand hygiene 2000 *Lancet* **356** 1307-1312.
4. Reichart,C, Monch, N, Hansen, S, Geffers, C, Gastermeier, P. Alcohol-based hand rub usage – a surrogate and reference parameter of hand hygiene compliance. *Krankenhaus-Hygiene+Infektion* 2009;**31**: 4-7.
5. <http://www.hps.scot.nhs.uk/haic/ic/nationalhandhygienecampaign.aspx>
6. Storr, J. The effectiveness of the national cleanyourhandscampaign *Nur Times* 2005; **101**(8): 50-51.
7. Centers for Disease Control and Prevention: Association for Professionals in Infection Control and Epidemiology and Society for Healthcare Epidemiology of America. *'How to guide: Improving hand hygiene. A guide for improving practice among health care workers.'* 2006.
8. McLaws, M L, Pantle, A C, Fitzpatrick, K P, Hughes, C L. Improvements in hand hygiene across New South Wales public hospitals: Clean hands save lives. Part 111 *J Aust Med Assoc* 2009; **191** Supp S18-S25.
9. Rosenthal, V D, Guzman, S, Safdar, N. Reduction in nosocomial infection with improved hand hygiene in intensive care units of a tertiary care hospital in Argentina *Am J Infect Control* 2006; **34**: 467.
10. Haas, J P, Larson, E L. Measurement of compliance with hand hygiene *J Hosp. Infect* 2007; **66**: 6-14.
11. Thomas, M, Gillespie, W, Krauss, J *et al* Focus group data as a tool in assessing effectiveness of a hand hygiene campaign *Am J Infect Control*; 2006; **33**: 368-373.

12. Gould, D J, Chudleigh, J, Drey, N S, Moralejo, D. Measuring handwashing performance in health service audits and research studies *J Hosp. Infect* 2007; **66**: 109-115.
13. Kohli, E, Ptak, J, Smith, S *et al.* Variability in the Hawthorne Effect with regard to hand hygiene performance in high- and low-performing inpatient care units *Infect Control Hosp Epidemiol* 2009; **30**: 232-236.
14. Eckmanns, T, Bessert, J, Behnke, M, Gastmeier, P, Ruden, H. Compliance with antiseptic hand rub use in intensive care units: the Hawthorne effect *Inf Control and Hosp Epidemiol* 2006; **27**: 931-934.
15. Eveillard, M, Hitoto, H, Raymond, F *et al.* Measurement and interpretation of hand hygiene compliance rates: importance of monitoring entire care episodes. *J Hosp Infect* 2009; **72**: 211-217.
16. Widmer, A F, Conzelmann, M, Tomic, M *et al* 2007. Introducing alcohol-based rub for hand hygiene. The critical need for training. *Infect Control Hosp Epidemiol* 2007; **28**: 50-54.
17. Lee, T C, Moore, C, Raboud, J *et al.* Impact of a mandatory infection control surveillance program on noscomial acquisition of methicillin-resistant *Staphylococcus aureus*. *Infect Control Hosp Epidemiol* 2009; **30**: 249-256.
18. Ebnother, C, Tanner, B, Schmid, F, La Rocca, V, Heinzer, I, Bregenzer, T. Impact of an infection control program on the prevalence of nosocomial infections at a tertiary care center in Switzerland. *Infect Control and Hosp Epidemiol* 2008; **29**: 38-43.
19. Rose, L, Rogel, K, Redl, L, Cade, J F. Implementation of a multimodal infection control program during and Acinetobacter outbreak *Int Crit Care Nurs* 2009; **25**: 57-63.
20. Sanchez-Paya, J, Fuster-Perez, M, Garcia-Gonzalez, R M, Gracia-Rodriguez, P, Garcia-Shimizu, A, San Juan-Quiles, R, Casas-Fischer, A *et al.* Evaluation of a program for updating recommendations about hand hygiene *An Sist Sanit Navar* 2007;**30**:343-352.
21. Pessoa-Silva, C L, Hugonnet, S, Pfister, R, Touveneau, S, Dharan, S, Posfay-Barbe, K, Pittet, D. Reduction of health care associated infection risk in neonates by successful hand hygiene promotion *Pediatrics* 2007; **120**: 382-390.
22. Johnson, P D R, Martin, R, Burrell, L J, Grabsch, E A, Kirsa, S W, O'Keeffe, J, Mayall, B C *et al.* Efficacy of an alcohol/chlorhexidine hand hygiene program in a hospital with high

rates of nosocomial methicillin-resistant *Staphylococcus aureus* (MRSA) infection. *Med J Aust* 2005; **183**: 509-514.

23. McGuckin, M, Shubin, A, McBride, P, Lane, S, Strauss, K, Butler, D, Pitman, A. The effect of random voice hand hygiene messages delivered by medical, nursing and infection control staff on hand hygiene compliance in intensive care *Am J Infect Control* 2006; **34**: 673-675.

24. Miyachi, H, Furuya, H, Umezawa, K, Itoh, Y, Ohshima, T, Miyamoto, M, Asai, S. Controlling methicillin-resistant *Staphylococcus aureus* by stepwise implementation of preventive strategies in a university hospital: impact of a link-nurse system on the basis of multidisciplinary approaches *Am J Infect Control* 2007; **35**: 115-121.

25. Harrington, G, Watson, K, Bailey, M, Land, G, Borrell, S, Houston, L, Kehoe, R, *et al.* Reduction in hospitalwide incidence of infection or colonization with methicillin-resistant *Staphylococcus aureus* and use of antimicrobial hand-hygiene gel and statistical process control charts *Infect Control Hosp Epidemiol* 2007; **28**: 837-844.

26. Thomas, B W, Berg-Copas, G M, Vasquez, D G, Jackson, B L, Wetta-Hall, R 2009. Conspicuous vs customary location of hand hygiene agent dispensers on alcohol-based hand hygiene product usage in an intensive care unit *J Am Osteo Assoc* 2006; **109**:263-267.

27. Sroka, S, Gastermeier, P, Meyer, B 2010. Impact of alcohol hand rub use on methicillin-resistant *Staphylococcus aureus*: an analysis of the literature *J Hosp Infect* 2010; **74**: 204-210.

28. Roberts, C, Roberts, J, Roberts, R J. Investigation into the effect of an alcohol-based hand product on infection rate in a nursing home setting *J Infect Prev* 2009; **10**: 138-142.

29. Bradley, S F. Methicillin-resistant *Staphylococcus aureus* in nursing homes 1997 *Drugs Ag* 1997;**10**: 185-198.

30. Broughall J, Marshman C, Jackson B, Bird P. An automatic monitoring system for measuring handwashing frequency in hospital wards *J Hosp Infect* 1984; **5**: 447-453.

31. Kinsella, G, Thomas, A N, Taylor, R J. Electronic surveillance of wall-mounted soap and alcohol gel dispensers in an intensive care unit *J Hosp Infect* 2007; **66**:34-39.

32. Swoboda, S M, Earsing, K, Strauss, K *et al.* Isolation status and voice prompts to improve hand hygiene *Am J Infect Control* 2007; **35**: 470-476.

33. Larson, E L, Albrecht, S, O'Keefe, M. Hand hygiene behavior in a pediatric emergency department and a pediatric intensive care unit: comparison of use of 2 dispenser systems *Am J Crit Care* 2005; **14**: 304-311.
34. Marra, A R, D'Arco, C, Bravim, B A, Martino, M D, Correa, L, Silva, C V, Lamblet, L C *et al*. Controlled trial measuring the effect of a feedback intervention on hand hygiene compliance in a step-down unit *Infect Control and Hosp Epidemiol* 2007; **29**: 730-735.
35. Venkatesh, A K, Lankford, M G, Rooney, D M, Blachford, T, Watts, C M, Noskin, G A. The use of electronic alerts to enhance hand hygiene compliance and decrease transmission of vancomycin-resistant Enterococcus in a haematology unit *Am J Infect Control* 2008; **36**: 199-205.
36. Whitby, M, McLaws, M L, Slater, K, Tong, E, Johnson, Bl. Three successful interventions in health workers that improve compliance with hand hygiene: is sustained replication possible? *Am J Infect Control* 2008; **36**: 349-355.
37. Boyce, J M, Cooper, T, Dolan, J. Evaluation of an electronic device for real-time measurement of alcohol-based hand rub use *Infect Control and Hosp Epidemiol* 2009; **30**: 1090-1095.
38. Muller. A, Denizot, V, Mouillet, C, Blanchot, C, Bertrand, X, Bailly, P, Talon, D. Lack of correlation between consumption of alcohol-based solutions and adherence to guidelines for hand hygiene *J Hosp Infect* 2005; **59**:163-164.
39. Boscart, V M. McGilton, K S, Levchenko, A, Hufton, G, Holliday, P, Fernie, G R. Acceptability of a wearable hand hygiene device with monitoring capabilities *J Hosp Infect* 2008; **70**: 216-222.
40. Mihailidis, A, Barbenel, J C, Fernie, G. The efficacy of an intelligent cognitive orthosis to facilitate handwashing by persons with moderate to severe dementia *Neuro Rehab* 2004;**14**: 135-171.
41. Kampf, G, Reichel, M, Feil, Y, Eggerstedt, S, Kaulfers, P M. Influence of rub-in technique on required application time and hand coverage in hygienic hand disinfection *BMC Infect Dis* 2008;**8**:149-160.
42. Goroncy-Bermes, P, Koburger, T, Meyer, B. Impact of the amount of hand rub applied in hygienic hand disinfection on the reduction of microbial counts on hands *J Hosp Infect* 20010; **74**: 212-218.

43. Larson, E L, Early, E, Cloonan, P, Surgue, S, Parides, M. An organizational climate intervention associated with handwashing and decreased nosocomial infections *Behv Med* 2000; **26**: 14-22.

The referees have highlighted the text in several places, but these variously contain comments which clearly do not need action (e.g. referee is saying they agree or 'fair point'), where a change might be added or is definitely needed.

Where a change is obviously being requested (e.g. inclusion of reference to Scotland) this has been added and the numbers of the following refs have been altered accordingly.

Where a change might be indicated, it has been made with 2 exceptions:

Page 4: A ref to the work of Tibballs et al has not been added as it is now dated and the paper, which have reviewed before, is of doubtful methodological quality.

Page 5: It did not seem very relevant to discuss patient zones as in the WHO guidelines here as it would seem to be straying from the point. The point we were making was about nursing homes, which in England don't yet seemed to have moved towards thinking about zones (they are not mentioned in the Dept health infect control guidance for nursing homes, altho admitted these guidelines do need updating).

We have highlighted all our changes in blue and re-counted the words in the abstract and text.