Measuring handwashing performance in health service audits and research studies

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Summary Handwashing is regarded as the most effective way of controlling healthcare-associated infection. A search of the literature identified 42 intervention studies seeking to increase compliance in which the data were collected by directly observing practice. The methods used to undertake observation were so poorly described in most studies that it is difficult to accept the findings as reliable or as valid indicators of health worker behaviour. Most studies were limited in scope, assessing the frequency of handwashing in critical care units. The ethical implications of watching health workers during close patient contact were not considered, especially when observation was covert or health workers were misinformed about the purpose of the study. Future studies should take place in a range of clinical settings to increase the generalizability of findings. Observation should be timed to capture a complete picture of 24 h activity and should include all health workers in contact with patients because all have the potential to contribute to cross-infection. Reported details of observation should include: vantage of data collectors; inter-rater reliability when more than one individual is involved; and attempts to overcome the impact of observation on usual health worker behaviour. Ideally an additional data collection method should be used to corroborate or refute the findings of observation, but no well-validated method is presently available.

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Introduction

Hospital-acquired infection (HAI) is a major problem in modern health care and a source of concern to health workers and the public. 1 Handwashing is considered the single most effective and cost-effective means of reducing HAI. 2 However, health
workers wash hands too seldom, not always at the most appropriate times and technique is suboptimal. Numerous approaches have been used to increase hand hygiene compliance. Intervention studies have been systematically reviewed by Naikoba and Hayward. Critique was offered about study design and there was detailed comparison between the different types of interventions and their success. In all but two of the 21 studies reviewed, direct observation was the main method of data collection. However, the rigour of observation as a method of data collection was not discussed. This omission is surprising as the validity and reliability of the findings obtained in behavioural studies depend on the appropriateness of the method used to collect data. The extent to which participants were aware they were being watched and the impact on their usual behaviour is a key issue, especially in studies where handwashing is the activity of interest.

**Methods**

A literature review was conducted to describe and evaluate direct observation used as the main method of obtaining data in studies seeking to increase hand hygiene compliance. Papers were identified from the following computerized databases: MEDLINE, CINAHL, EMBASE, and the Cochrane Library. Additional search strategies included: searching the internet with a general browser; screening the reference lists of papers already retrieved; and handsearching key journals (British Medical Journal; Journal of Hospital Infection; American Journal of Infection Control). Attempts were made to locate material in the ‘grey’ literature. Key words used were: handwashing and hand hygiene. To meet the inclusion criteria for review, papers had to be empirical studies undertaken to increase compliance with handwashing for health workers using aqueous solutions and/or alcohol-based products. Studies designed to increase compliance by individuals other than health workers were excluded. Also excluded were opinion pieces and general reviews. Data collection had to include direct observation of handwashing, although it was permissible for additional methods to be employed (consumption of soap/alcohol handrubs, monitoring devices attached to taps).

All abstracts were inspected to ensure that they met the inclusion criteria. Eligible papers were downloaded, read and scrutinized by at least two readers. The data were extracted onto a template developed especially for the review.

**Results**

The searches identified 41 300 papers. Forty-two met the inclusion criteria. Eighteen of the 21 studies reviewed by Naikoba and Hayward were eligible. Two were discounted because handwashing compliance had not been assessed by direct observation. A third paper was dismissed because, on careful reading, it proved not to report an intervention. Twenty-four new intervention studies using observation as a method of data collection were identified in addition to a report by Pittet et al. which had been discussed in an annex attached to the review by Naikoba and Hayward. One paper appeared to be a follow-up of the original work in Geneva and was not included.

**What was observed**

All the studies examined frequency of handwashing and/or use of alcohol products. The hand hygiene event was clearly defined in half the papers, usually with reference to the Association for Professionals in Infection Control and Epidemiology (APIC) or other published guidelines. In 13 papers handwashing was considered to be essential before and after patient contacts and/or when moving from one patient to another. In nine papers compliance was considered in relation to the number of opportunities for handwashing. The others did not offer clearly defined criteria for when hands should be washed. Nine studies assessed handwashing technique each using a different method of evaluation.

**Who was observed**

In seven studies, data were collected for all personnel visiting a ward or unit. In others, observation was restricted to particular occupational groups: doctors, nurses, occupational therapists, technicians, and preclinical medical students. The remaining studies appeared to include professionally qualified staff (doctors, nurses, therapists) but not ancillary staff. Six studies involved an entire hospital. Of those studies not performed on a hospital-wide basis, only five took place outside critical care units.

**How observation was conducted**

Non-participant observation was employed in 41 studies. In six studies, a supporting method of data
collection was also employed (consumption of soap/alcohol, monitoring devices attached to taps). Rates of HAI were included as an outcome measure in six studies. In one study the method of observation was unclear. One research team employed participant observation in which the data collector was a member of the usual nursing team.

Detailed information about the data-collecting instrument was provided in two studies. Failure of the data collector to document episodes of hand-washing through lapses in observation ('missing observations') was considered in only one study.

Who collected data

Data collection was undertaken by a range of staff with varying levels of expertise in infection control and skill as observers: graduate nursing students; research assistants; infection control nurses; and in one case by a commercial team. Ten studies described the training they received. Where more than one individual collected data, inter-rater agreement (inter-rater reliability) was an issue and was assessed in nine studies; acceptable levels of concordance were reported in each. In other studies, discussion of inter-rater reliability suggested that data collectors had received training, although this was not mentioned explicitly.

Duration and timing of observation

Observation generally took place for short periods (30 min–2 h) usually during early shifts on weekdays. Only a few research teams conducted observation at night. The rationale for the time and length of observation was provided in 14 studies. The decision to restrict observation to day shifts was usually justified on the grounds that most patient contacts take place at these times because clinical areas are at their busiest.

Vantage

Seven studies revealed the vantage of data collectors. They were generally positioned to monitor health workers entering the unit and entering and leaving single rooms. Very little information was provided about the number of health workers observed by a given number of data collectors at any one time. Often observation appeared to take place in relation to all heath workers belonging to the occupational group of interest present on a ward or unit over the period of data collection. In one study, health workers were 'shad-owed' individually to avoid loss of data.

The impact of observation on usual handwashing practice

The effects of observation on the activity being investigated were first documented during a series of productivity experiments at the Hawthorne Electrical Plant in the USA in the 1930s. Researchers found that productivity increased regardless of the variable being manipulated. They concluded that the increase was a direct result of employees being watched. This finding, now described as the 'Hawthorne effect' has clear implications for observation studies in which handwashing is being documented, especially in the present climate where health workers know that handwashing is being promoted.

In half the studies the authors considered the possible effect of direct observation on handwashing compliance, but detailed discussion of its impact on health-worker behaviour was offered only by Pittet et al. During follow-up data collection, these authors deliberately fostered the 'Hawthorne effect' to promote increased compliance.

In four studies the purpose of research was known to staff from the outset. In five studies health workers were deliberately misinformed about the real purpose of the research throughout. In the remainder, observation was covert at least during baseline data collection or the authors did not state whether staff were informed. In one study, the data collector spent time in the clinical area before documenting handwashing to acclimatize staff to her presence.

Ethical issues

Six authors mentioned obtaining ethical clearance, but none considered the ethical implications associated with intervention studies involving health workers or conducting close observation involving patients.

Discussion

Most studies were narrow in scope. Few contained enough information about the method of observation to permit satisfactory evaluation of the validity and reliability of findings. Overall, inadequate consideration was given to ethical issues.
Scope

Less than a quarter of the studies evaluated handwashing technique, presumably because frequency is much easier to document. Technique was assessed according to different criteria in each of the studies in which it was considered, reflecting the inadequacy of current standards to measure it. Drying hands is important because bacteria are transferred more readily between damp surfaces than dry ones but none of the studies addressed this issue. Many studies were restricted to a single clinical setting. This was usually a critical care unit. These were also the studies in which HAI rates were most likely to be included as outcome measures. However, the critical care setting may not be the best location to examine the effectiveness of hand hygiene compliance in reducing rates of HAI because many nosocomial infections are endogenous rather than exogenous in such units. A number of studies involved a single occupational group or restricted observation to clinical staff, although all health workers, including ancillary staff, handle objects in the near-patient environment and thus have the potential to contribute to cross-infection.

Validity and reliability

From the limited information about the process of data collection included in the studies, problems were apparent in relation to the accuracy of data collection, the reliability of findings and the extent to which they are generalizable to other clinical settings and occupational groups. Observation is a skilled activity which cannot be maintained for any length of time without fatigue and data loss. However, information about the preparation received by data collectors was scant, and in many papers no mention of training was included. Particular care to observe accurately is needed in busy clinical areas when vantage is poor (e.g. restricted by bedside curtains), especially when several people are watched simultaneously. When observing a highly specific activity such as handwashing compliance, the very accurate, detailed information required demands a highly structured method of observing and documenting data, but this issue was poorly addressed in the majority of studies. The possibility of failing to document episodes of handwashing was not mentioned except for one account, where health workers were ‘shadowed’ individually. Limited information was offered concerning the numbers of health workers observed simultaneously, although watching several people closely at the same time is likely to reduce the accuracy of what is seen and therefore documented. Interrater reliability was discussed in relatively few studies where it was an issue and glossed over in every case except for the initiative in Geneva.

The rationale used to justify the timing and length of the observation period was generally inadequate. Morning shifts during weekdays were held as the busiest times, when greatest opportunity for patient handling and cross-infection would occur. However, the majority of studies took place in critical care units, where nursing care (pressure area care, changing position) should be performed regularly over 24 h.

In half the studies researchers acknowledged that obvious documentation of handwashing can result in a Hawthorne effect. Some authors argued that handwashing is such an ingrained activity that it would not be possible for health workers to maintain any changes in usual practice throughout the period of observation. This may have been true in early studies, but is no longer likely to be the case. Today health workers know that handwashing forms an important element in quality of care and are likely to become aware when it is being monitored, whether or not the attempt is intended to be unobtrusive. The most frequently used method of trying to avoid the Hawthorne effect was to undertake observation covertly. However, it is difficult to accept that secrecy was effectively maintained once intervention had taken place, especially when it involved feedback on performance or poster campaigns. Even attempts to mislead health workers may have had limited success in avoiding the Hawthorne effect as the mere presence of an outsider in the research setting can influence usual activity.

Threats to the validity of direct observation can be overcome by employing additional methods of data collection to corroborate or refute findings. In the case of handwashing there are three possibilities: unobtrusive methods (monitoring devices, consumption of soap and/or alcohol products); rates of HAI; and transmission rates of nosocomial pathogens. The value of unobtrusive methods is open to debate. Monitoring devices assess only frequency of handwashing: other important aspects such as technique and appropriateness of the hand hygiene event cannot be assessed. Monitoring devices need to be fitted especially for the study with resource implications when research budgets are tight and they sometimes break down. Van de Mortel and Murgo compared the results of alcohol uptake with direct observation of hand-cleansing activity. Throughout the period of observation, use of alcohol products doubled, but direct observation indicated marked decline in the frequency of hand cleansing. These authors suggest that
consumption of alcohol products is a better indicator of compliance than direct observation. However, spillage, use of some products for purposes other than hand hygiene and ‘borrowing’ between wards has been noted during observation studies.\(^{71}\) Eckmanns et al. identified a positive correlation between consumption of hand hygiene products and hand hygiene compliance.\(^{72}\) However, neither of these measures correlated with the incidence of transmission for ten of the most frequently reported nosocomial pathogens on abraded skin.\(^{70}\)

Few of the studies reviewed incorporated additional methods of data collection to corroborate direct observation. Most authors appeared to assume that increasing compliance with handwashing is a desirable outcome in its own right without taking into account resource implications such as the cost of consumables, the time-consuming nature of traditional washing;\(^{72}\) the deleterious effect of repeated washing on skin already in poor condition;\(^{73,74}\) or the increased carriage of potentially nosocomial pathogens.\(^{75}\)

**Ethical issues**

Where participants in a research study have not been accurately informed, have been misled or have not given consent, potentially serious ethical questions are raised.\(^{76,77}\) There were numerous examples of poor practice in which researchers deliberately provided false information to health workers or provided incomplete or inaccurate information, especially during baseline data collection. Many infection control teams now regularly document handwashing as part of routine infection control audits,\(^{78}\) promoting the Hawthorne effect to increase compliance.\(^{79}\) If the accuracy and hence the validity of the methods used to evaluate handwashing activity in these initiatives are open to criticism, ethical issues are raised, because health workers are being encouraged to change practice on the basis of faulty and incomplete information.

None of the studies considered the possible invasion of privacy for patients during observation, even when non-nursing and medical personnel collected data.

**Recommendations for future research**

Handwashing is receiving considerable emphasis as a straightforward and cost-effective way of reducing HAI.\(^2\) The number of studies designed to enhance compliance has doubled since the publication of the last systematic review.\(^8\) Pittet’s work in Geneva has yielded the most promising results and is described in the greatest detail.\(^{16}\) It includes some discussion of methodological issues used to obtain observational information. Other accounts suffer from potentially serious flaws in relation to observation as the method of data collection and fail to address ethical issues, reducing the value of the data obtained and the faith that can be placed in their findings.

Future studies evaluating the effectiveness of approaches to increase handwashing compliance should take place in a range of settings to increase external validity. Observation in inpatient settings should be timed to capture a complete picture of 24 h activity and should include all health workers having close contact with the immediate patient environment (bedside, objects frequently handled by patients or touching them) because all contribute to cross-infection.\(^{63}\) Reported details of data collection should include: vantage; who collected data; training received; inter-rater reliability where more than one person was involved; an indication of how the data were documented; and mechanisms for coping with lost data. Well-conducted studies will involve more than one method of data collection in order to corroborate findings. This is not possible at present: more research is needed to establish the most effective approaches. However, the greatest challenge will be to design intervention studies which eradicate the Hawthorne effect, yet avoid violating the rights of health workers and patients: they should be fully informed about the purpose of the research.

**References**


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