REVIEW

Impact of observing hand hygiene in practice and research: a methodological reconsideration

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Summary

Healthcare-associated infection is spread by direct contact and the importance of hand hygiene to break the chain of infection is recognised internationally. In many countries hand hygiene is regularly audited as part of quality assurance based on recommendations issued by the World Health Organization (WHO). Direct observation is the recommended audit method but is associated with a number of disadvantages, including potential for being observed to alter usual behaviour. The Hawthorne effect in relation to hand hygiene is equated with productivity by increasing the frequency that hand hygiene is undertaken. Unobtrusive and/or frequent observation to accustom staff to the presence of observers are considered acceptable ways of reducing the Hawthorne effect but little has been written about how to implement these techniques or assess their effectiveness. There is evidence that awareness of being watched can disrupt the usual behaviour of individuals in complex and unpredictable ways other than simple productivity effect. Health workers might defer or avoid activities that require hand hygiene in the presence of auditors but these issues are not addressed in guidelines for practice or research studies. This is an important oversight with implications for the validity of hand hygiene audit findings. It needs to be considered if such findings are taken as indicators of quality of care and if the results of hand hygiene research are used to inform future policy and practice. Product uptake overcomes avoidance tactics. It is cheaper and generates data continuously to give a 24 hour picture of compliance for all clinicians without disrupting patient care. Disadvantages are the risk of over-estimating uptake through spillage, wastage or use by visitors and non-clinical staff entering patient care areas. Electronic devices can overcome Hawthorne and avoidance effects but are costly and are not widely used outside research studies.

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Introduction

Healthcare-associated infection (HCAI) is spread mainly by direct contact. Most cross-infection takes place via the hands of health workers [1, 2] and it is agreed that cleansing hands can break the chain of infection, thus reducing rates of HCAI [1]. The importance of hand hygiene is recognised internationally [3, 4] and guidelines developed by the World Health Organization (WHO) in 2009 [5]are credited with exerting considerable impact on hand hygiene policy and practice globally [6]. The WHO [5] emphasises the importance of regular monitoring to assess health workers' hand hygiene performance. Monitoring is now undertaken routinely in many countries as part of quality assurance and is regarded as a major contributor to patient safety. Rates of hand hygiene compliance are reported to National Health Service Trust Boards, at similarly senior level in other countries and are frequently presented on the websites of healthcare providers as an indicator that infection prevention procedures are operating effectively. High levels of hand hygiene compliance are difficult to sustain [2, 7] and testing new interventions to enhance practice are frequently reported [7]. Valid and reliable assessment is also essential to establish effectiveness when such interventions are evaluated [8]. The methodology of hand hygiene audit has thus become an important area of enquiry. Audit can be undertaken by direct observation, consumption of alcohol handrub/soap or with electronic/computerised devices [9].

Direct observation has been described as the 'gold standard' approach to hand hygiene audit [10] and is favoured by the WHO[5] because at the time the guidelines were published, it was the only method that could detect all hand hygiene opportunities, number of times an opportunity is acted on and appropriate timing of the hand hygiene event in the sequence of care. Observers witness which individuals are complying or failing to comply with hand hygiene protocols allowing them to intervene to improve performance in real time, identify barriers to compliance (e.g. poor availability of products or facilities) and make redress. Disadvantages are the time-consuming and resource-intensive nature of direct observation, need to train and periodically re-validate observers, need for reliability testing to ensure agreement between observers (inter-rater reliability), loss of data when bedside curtains are closed [8], assumption that hand hygiene opportunities and compliance are defined in the same way in all studies [8] and that audit captures only a small number of all hand hygiene opportunities that are occurring simultaneously [11]. Perhaps the most serious criticism is that the presence of observers has potential to influence health workers' usual behaviour

thus reducing the validity of audit findings [8]. These disadvantages are recognised by the WHO[5].

Impact of observation on usual behaviour: historical overview

The impact of observation on employees' usual behaviour was first documented during a series of experiments at the Hawthorne Electrical Plant in Michigan, US throughout the 1920s and 1930s [12]. Data collectors noticed that productivity increased regardless of the variable being manipulated and concluded that it resulted from employees' awareness that they were under scrutiny. Over the years this phenomenon has become known as the 'Hawthorne effect' and has attracted considerable attention from social scientists undertaking research in experimental and naturalistic settings [13, 14]. The results of the Hawthorne experiments have been re-analysed numerous times and the original conclusions questioned [13, 14] because of the large number of variables that could have affected behaviour but were not controlled [15]. There is confusion over a precise definition of the Hawthorne effect. It is described inconsistently with little understanding of how any resultant behaviour change is mediated or could be controlled [15]. Empirical research exploring association between observation and altered behaviour has been undertaken mainly in the field of education where some research teams have failed to detect systematic relationship between research participation and improved outcomes [16]. There is a consensus that individuals change behaviour when they are studied but not in a consistent or predictable manner [15, 17, 18]. Identifying the Hawthorne effect and other tactics of avoidance or deferred activity is important when undertaking and interpreting the findings of hand hygiene audit given the current emphasis on hand hygiene globally and the importance of health workers' compliance.

Behaviour change during hand hygiene observation: historical overview

Although hand hygiene has attracted a great deal of attention over the last twenty years, this has not always been the case. Like the rest of infection prevention and control it was a Cinderella subject and the earliest studies, lacking methodological sophistication, overlooked the possibility that being watched might alter health workers' usual behaviour [19, 20]. A study reported in 1994 [21] was one of the earliest to consider the Hawthorne effect. Participants were informed that hand hygiene was being observed but details of what was being documented (cleansing in relation to the activity undertaken and technique) were not disclosed in an attempt to reduce impact on usual behaviour. As hand hygiene research gained momentum the possibility that watching staff might alter usual

behaviour received greater consideration and the idea that a deliberately engineered Hawthorne effect might be used to improve compliance took shape. In the highly cited study by Pittet et al [22] in the Geneva University Hospital health workers were informed that hand hygiene would be observed but did not know when audit periods were scheduled. Performance feedback was then used as part of an intervention to encourage increased hand hygiene frequency and reduce rates of HCAI. The Geneva study stimulated interest in hand hygiene and strategies to promote it. Overt observation has been since used as part of other multimodal interventions to increase hand hygiene compliance [23, 24.25]. This focus on hand hygiene has in turn contributed to increased awareness of the Hawthorne effect. One study reported a 55% increase in use of alcohol handrub when health workers were aware that they were being watched compared to when they were unaware [26]. Compliance declined from 61% when doctors knew they were being observed to 44% when they were unaware [27] while in another study [28] hand hygiene compliance was reported to increase in the presence of data collectors known to staff compared to data collection by someone they did not recognise. The majority of these studies are associated with significant problems in relation to design and reporting of the audit method however. Only three studies in which overt observation with performance feedback formed part of a multifaceted intervention to enhance compliance reported adequate controls [23, 24.,25]. In the others, lacking randomisation, it is not clear whether factors other than awareness of scrutiny could have influenced compliance. In two intervention studies that included overt observation as part of the intervention [23, 25] data collectors did not know which centres were acting as controls and which were receiving the intervention but this information is not explicit in other studies. Lack of blinding to group allocation operates as an important source of observer bias.

Approaches to overcoming the Hawthorne effect during directly observed hand hygiene audits

Misleading health workers about the reason for observation is occasionally employed [29, 30, 31, 32]. Its effectiveness in these studies has been assumed, not formally tested and in one study it was unsuccessful because health workers became aware of the real purpose of data collection[33]. Misleading staff is not recommended by the WHO[5] because it could promote distrust between clinicians and managers and is impossible to maintain if audit forms part of an intervention to promote hand hygiene. Covert observation in which health workers are neither informed that observation is taking place or told that other information is being documented, is not recommended for the same reason but has been employed in

a number of studies [34, 35]. The WHO[5] recommends two approaches to behaviour change during hand hygiene audit: unobtrusive observation and/or frequent observation to accustom staff to the presence of observers.

Unobtrusive observation has been employed in a number of studies [23, 25, 36]. The authors do not provide details of how the procedure was undertaken or how its effectiveness was assessed, not surprisingly as the WHO guidelines[5] do not give advice on either issue. Acclimatising staff to the presence of observers is a recognised technique in social science called habituation [37, 38]. It is defined as decline in altered behaviour in response to repeatedly being observed [38]. Although regarded as effective [39], habituation is seldom used in hand hygiene research and the WHO[5] does not provide practical guidance on how it should be applied. Indication of its possible effectiveness can be traced to the work of Harbarth et al [40] in which compliance declined over a two week audit period in which staff appeared to forget about the presence of auditors. Cheng et al [41] attempted to acclimatise health workers to the presence of data collectors by visiting wards regularly before audit began but do not discuss its effectiveness or the duration of data collection required before habituation was achieved, an issue seldom addressed in research looking at the effect of habituation on usual behaviour more generally [38]. In another study [42] health workers were observed on five occasions each two hours long in an attempt to secure habituation. They were informed that the data collector would be present before audit commenced so they would become accustomed to her presence but the point at which hand hygiene audit began was not disclosed. Increased hand hygiene frequency was noted throughout the first three observation periods and then appeared to wane but as the early data were discarded it was impossible to determine whether habituation was effective or how long it took. Chen and colleagues [11] combined direct observation of hand hygiene by trained auditors with a wireless data system allowing real time data input to the hospital intranet. Compliance increased with length of time that auditors remained in the clinical area during an unannounced audit period. It was hypothesised that levels of compliance would decline with their continued presence and observers were instructed to habituate health workers by staying on the unit for a short period (ten minutes) after collecting a set number of observations. Resulting reduction in hand hygiene frequency was accepted as a valid indicator of usual behaviour because rates were similar to those obtained in studies employing video-camera, which was assumed to achieve high levels of validity. This may be a false premise. Health workers may become accustomed to continual presence of the equipment but

habituation does not remove other key aspects of the data collection process that can compromise validity. Authors [43] employing observation by video camera do not describe training and validation of data collectors, issues that are of particular importance when large amounts of video footage are analysed. In this study [43] data were incomplete as it was impossible to evaluate hand hygiene performance in relation to the sequence of care: cameras were placed outside patients' rooms to avoid breaching privacy.

Although social scientists acknowledge that presence of observers in a clinical area can disrupt practice in more complex ways than a simple productivity effect, the possibility of a wider impact on hand hygiene audit data does not appear to have been addressed in guidelines for practice or research studies. This is an important oversight with major implications for the validity of audit findings. Health workers can practice avoidance tactics by moving to a location that is out of the auditor's range of vision (e.g. treatment room) resulting in under-estimate of the number of hand hygiene opportunities available and whether or not they were acted on. They can also defer clinical procedures until observation is over, especially if the audit period is brief: in many studies it is 30 minutes or less [22, 25, 40]. Delaying activities that require multiple hand hygiene events throughout as well as before and afterwards (e.g. complex wound dressings, urinary catheterisation) results in failure to capture the full range of clinical procedures being undertaken, reducing completeness and validity of the data and compromising patient care because it is no longer delivered in a timely manner. Avoidance is less systematic than simple productivity effect, much harder to detect, allow for or overcome when hand hygiene audit is by direct observation.

Other approaches to hand hygiene monitoring

Product uptake

Product uptake has been used as an indicator of hand hygiene compliance in a number of studies either as a secondary outcome measure to corroborate the results of direct observation [44, 45, 46, 47, 48, 49] or as the main audit method [50, 51, 52, 53,]. There is some evidence [54] that it might be a more sensitive indicator of the impact of alcohol-based antiseptics on HCAI rates than direct observation providing that uptake can be restricted to health workers only. Product uptake overcomes avoidance tactics. It is cheaper and generates data continuously to give a 24 hour picture of compliance for all clinicians without disrupting patient care. Disadvantages are the risk of over-estimating uptake through spillage, wastage or use by visitors and non-clinical staff entering patient care areas [9].

Uptake can be under-estimated if staff use individual, portable dispensers [55, 56]. If organisations can estimate non-clinical consumption, take into account uptake from individual dispensers and adjust their calculations, this approach could offer a useful alternative to direct observation but with loss of information: most systems do not monitor compliance for individual members of staff, professional groups, provide data on the hand hygiene event in relation to the sequence of patient care however [57]. Product could be used to identify clinical areas where hand hygiene appears to be problematic [9], however.

Electronic and computerised devices

Hand hygiene can be monitored with electronic and computerised devices that employ infra-red detection and wireless networks [57]. It has been argued that staff become habituated to presence of the device when they are used continuously, [58] and there is evidence that they can overcome the Hawthorne effect. Srigley et al [59] established significantly higher hand hygiene compliance rates from alcohol handrub dispensers visible to data collectors compared to dispensers outside their field of vision. Electronic monitoring revealed significantly increased compliance rates when data collectors were present compared to 1-5 minutes immediately before their arrival. Another study [60] demonstrated strong positive correlation between the results of directly observed hand hygiene and electronic monitoring documented simultaneously. Hand hygiene was performed 24 times an hour in the presence of observers compared to eight times per hour in their absence suggesting that direct observation had a powerful Hawthorne effect. Electronic systems typically require each health worker to wear a detector. In one study where the detector was swapped between health workers instead of being worn continually by all staff all the time, compliance was lower [61]. From this finding it was inferred that wearing the detector resulted in a Hawthorne effect because staff were aware that individual behaviour could be identified. Again in this study there was good correlation between electronic and manual monitoring. The findings of these recent studies contrast with an earlier study by Marra [62] where there was poor concordance between the outcomes of direct observation and electronic monitoring. Direct observation was considered less accurate in this study because the results of electronic monitoring concurred with those simultaneously obtained from product uptake which was taken as a valid indicator of performance. Electronic devices are becoming more sophisticated. Some models can provide data relating to key moments of the Five Moments of Hand Hygiene [63] but they are expensive to purchase and install. The amount of real

time data generated is only of value if managers have sufficient time to analyse and interpret it [9].

Discussion

The impact of observation on usual behaviour is more complex and less consistent than currently recognised in hand hygiene audit and research because individuals react to the knowledge that they are being watched in different, sometimes unpredictable ways [15, 18]. Aware of the emphasis placed on hand hygiene by mangers and infection prevention teams, health workers may respond by cleansing hands more often but they may also adopt strategies to evade observation that are opportunistic and unsystematic. Findings can be context-specific making it difficult to compare audit results between different clinical settings or times of day. For example, there may be limited opportunity to improve hand hygiene performance in some hospital departments (e.g. the accident and emergency department) compared to wards through acuity of the work [64]. Repeated disillusionment at receiving unfavourable feedback could act as a disincentive to further attempts to improve performance. In these environments and perhaps more generally, direct observation should be questioned as the gold standard approach to hand hygiene audit. One of the most powerful arguments in favour of audit by direct observation, ability to intervene and correct poor practice in real time, appears to be rarely capitalised upon and there are only a few published examples [65]. Feedback is more often delayed while audit results are analysed while intervention at the point of care has the capacity to disrupt clinical practice and may be resented by staff as well as being impractical as it is likely to take place in front of patients. Finally a typical audit period can only ever capture a small number of the hand hygiene opportunities and events presented in a clinical area so it is not an efficient way of providing feedback. Although hand hygiene education and feedback are important they should not, therefore influence method of audit. Official guidelines [5] emphasise the importance of cleansing hands at appropriate times in the sequence of care and use of the correct product. The importance of thoroughly applying antiseptics to the entire hand surface to achieve disinfection is also recognised [66] but these elements of hand hygiene performance are seldom addressed and cannot be determined by product uptake or most electronic systems.

Accounts describing measurement of the Hawthorne or other effects of observation in hand hygiene and how to overcome them when monitoring takes place by direct observation are relatively unsophisticated and none of the

techniques presently suggested have been clearly described or evaluated. Habituation, which holds some promise, is more seldom used than unobtrusive observation. More and better quality methodological studies are required to explore how the impact of observation can be measured, allowed for and/or reduced and how to determine the effectiveness of these strategies if hand hygiene audit results are to be taken as serious and valid indicators of patient safety. Such work is important because of the imprecision of product uptake and the expense of electronic systems and their limitations. The need for such studies could be dismissed given the hallowed place occupied by hand hygiene as a key component of all infection prevention programmes: it could be argued that periodic observation is useful to infection prevention teams because it gives an idea of what is taking place in clinical areas and reminds staff of the importance of hand hygiene irrespective of results. However, there is scope for organisations to establish their own Hawthorne effect and use it to estimate 'real' hand hygiene frequency. At present it is not possible to use published figures because estimates vary between research studies and data are not collected in the same way. There is also need to explore the most helpful and meaningful audit strategies and ensure they are in place. The way that audit is undertaken tends to drift over time [65]. In some organisations it is undertaken by managers, in others by infection prevention teams or local staff. Little work has been done to assess possible differences in results when audit is undertaken by different staff. Healthcare providers frequently state that they operate zero tolerance to HCAI and promote 100% hand hygiene compliance throughout their organisations. Whether such high levels are achievable in practical terms and their relationship to rates of HCAI remains unknown.

Conclusion

The Hawthorne effect and possible avoidance and deferral tactics in the presence of observers have clear implications for the validity of audit and research findings. Attention has focused mainly on unsophisticated and untested ways of avoiding it or embracing it to drive performance feedback in interventions to improve compliance. The literature is replete with studies that purport to demonstrate that interventions can increase compliance [23, 34, 35, 50, , 67] and decrease rates of HCAI [22, 23, 24, 25, 40, 46, 48,49, 51,53] but many of these studies are poorly controlled [7] and repeat what has already been concluded: that if an intervention is introduced, practice will improve, at least while auditing is taking place. If the results are to be taken as a genuine reflection of quality of care, more thought should be given to the complex and under-estimated impact presented by the Hawthorne effect

given the amount of time and resources that are put into hand hygiene audits and campaigns.

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