



Short report

Relationship between healthcare worker surface contacts, care type and hand hygiene: an observational study in a single-bed hospital ward

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SUMMARY

This study quantifies the relationship between hand hygiene and the frequency with which healthcare workers (HCWs) touch surfaces in patient rooms. Surface contacts and hand hygiene were recorded in a single-bed UK hospital ward for six care types. Surface contacts often formed non-random patterns, but hygiene before or after patient contact depends significantly on care type ($P=0.001$). The likelihood of hygiene correlated with the number of surface contacts (95% confidence interval 1.1–5.8, $P=0.002$), but not with time spent in the room. This highlights that a potential subconscious need for hand hygiene may have developed in HCWs, which may support and help focus future hygiene education programmes.

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Introduction

The risk of acquiring nosocomial infections is a recognized problem in hospitals worldwide.¹ Recent studies have highlighted the importance of surface contamination and suggest a causal link to subsequent patient infection.^{2–4} Understanding which surfaces are touched by healthcare workers (HCWs) and how this relates to hand hygiene is therefore important in assessing patient risk. This paper reports an observational study to record the sequences of HCW surface contacts in

single-patient rooms, and quantifies the relationships with care type and hand hygiene frequency.

Methods

This observational study was conducted in 2012 at Ysbyty Aneurin Bevan, a National Health Service single-bed community hospital in Ebbw Vale, Wales, UK. The hospital opened in 2010 and deals with subacute patients. The ward was staffed at all times by seven or eight nurses divided between the two 'pods' of 16 beds, where at least two members were registered nurses (RNs), rotated in 8-h shifts. The complement of staff was completed by five or six auxiliary nurses (ANs) depending on the shift. One doctor made daily rounds, while a second consultant made biweekly rounds. HCWs carried out six types of care as described in [Table 1](#). The housekeeping observed was performed by nurses who had responsibility for cleaning high-

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Table I
Examples of procedures within each care type

Direct care	Housekeeping	Mealtimes	Medication rounds	Miscellaneous	Personal care
Blood pressure measurement	Equipment cleaning	Distribution of meals	Distributing medication	Call bell request	Toileting
Weighing patients	Cleaning 'high-touch surfaces'		Injections	Response to pressure mattress alarms	Patient changing
Blood sugar saturation					Minor procedures (e.g. cannula insertion)

touch surfaces, such as medical equipment and near-bed surfaces, with disposable chlorine wipes.⁵ Additional daily surface cleaning by domestic staff was performed using microfibre cloths and water, and terminal cleans included bleach. These activities were not included in this survey.

During each care episode, the surfaces touched by the HCW and the order in which this occurred were recorded. Surfaces were categorized following Smith *et al.*:⁶

- equipment (intravenous stand, hoist, blood pressure cuff, notes/medication trolley);
- patient;
- near-bed (bedrail, bedding tray, TV, chair, locker);
- far-bed (window, light switch, patient chart in a folder on a workstation in the room, door handles); and
- hygiene items (soap, tap, alcohol gel, sink, paper towel dispenser).

Observations took place from outside the patient room through a window in order to avoid disrupting the care; in all cases, data were only recorded where there was a clear line of sight. Each observation period began when a HCW entered a patient room, and concluded once they left the room at the end of the care episode. Interruptions in a care episode (i.e. leaving the room) occurred on a small number of occasions, and were recorded as an integral part. The majority of care activities observed involved a single HCW; however, if more than one HCW was present, both sets of surface contacts were recorded as separate episodes. Hand hygiene was recorded each time it occurred, with the observation noting the type of antiseptic (soap and water or alcohol gel) and whether or not gloves were worn. Separate hand antiseptic events were recorded if the HCW donned gloves and also washed their

hands. In total, 431 care episodes were observed over 8-h periods during two visits of three and four days by one observer. Ward occupancy was 100%; however, data were not recorded on specific patients or rooms.

Results

Hand hygiene

Care type influenced the choice of hand antiseptic ($P=0.0003$), with personal care being dominated by hand-washing with soap and water (60% handwashing, 43% alcohol gel). For all other care types, the choice of antiseptic method was almost equal between soap and water or alcohol gel. Gloves were only worn for a small number of care episodes (6%); antiseptic before donning gloves and after their removal occurred on 50% of occasions.

RNs and ANs were involved in 47% and 41% of observations, respectively. On average, ANs performed hand hygiene 17% more often than RNs in equivalent care types (54% vs 37%). ANs performed hand hygiene on 51% of occasions for procedural care, such as direct care, compared with 27% for RNs. However, in care types with a higher level of variability, such as miscellaneous or personal care, this trend was reversed (30% vs 40% and 62% vs 80%, respectively).

The likelihood of any type of hand antiseptic following care increased proportionally with the number of surface contacts (Figure 1). Strong positive correlation by means of logistic regression upheld this observation in all cases [odds ratio (OR) 1.5, 95% confidence interval (CI) 1.1–5.8; $P=0.002$]. However, time spent in the room did not correlate with number of surface contacts or hand hygiene.

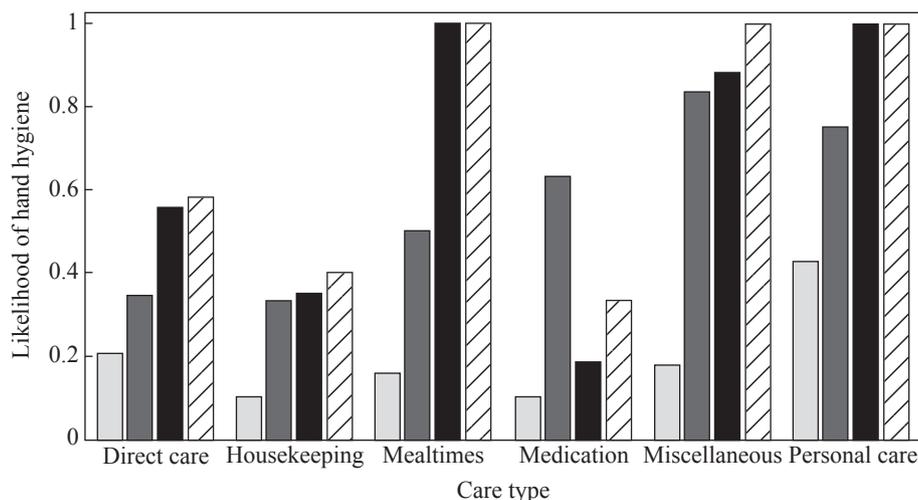


Figure 1. Likelihood of hand hygiene plotted against surface contact count. Light grey bars, one to five contacts; dark grey bars, six to 10 contacts; black bars, 11 to 15 contacts; striped bars, more than 15 contacts.

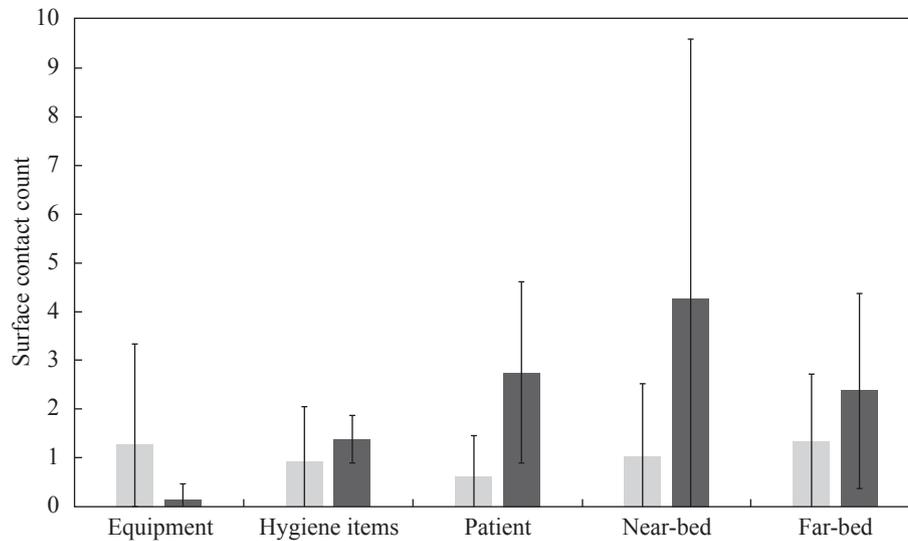


Figure 2. Surface contacts for direct care (grey bars) and personal care (black bars). Error bars show one standard deviation either side of the mean.

Influence of patient contact on hand hygiene

Hand hygiene before patient contact occurred on 0–62% of occasions (direct care 1%, $N=1/197$; housekeeping 11%, $N=2/17$; mealtimes 0%, $N=0/21$; medication rounds 10%, $N=11/111$; miscellaneous care 1.5%, $N=1/72$; personal care 62%, $N=8/13$). The likelihood of hand antisepsis after patient contact was only significant in the cases of direct care (OR 3.8, 95% CI 2.1–7.1; $P=0.001$) and personal care (OR 3.8, 95% CI 0.1–7.8; $P=0.03$), with likelihood of hygiene following contact of 73% and 80%, respectively. In all other care types, the likelihood of hand hygiene was close to 50%. For all care types where antisepsis occurred after patient contact, HCWs preferred handwashing with soap and water to alcohol gel ($P=0.0003$).

Surface contact sequences

Surface contacts during direct care show a regular non-random ($P\sim 0.04$) pattern of movement. Medication rounds exhibit peaks for near-bed and far-bed surface contacts due to nurses always touching the workstation and patient notes (on the workstation). Near-bed surfaces and medical equipment fall into the category of 'high-touch surfaces' and were cleaned by HCWs, but the patient's chart and workstation which were touched in almost every care episode were never cleaned by HCWs. Surface contact sequences tended to be less ordered in personal care or housekeeping, both exhibiting a higher number of contacts during an episode. Although the likelihood of hand hygiene increased with contacts (Figure 1), it was under 50% for housekeeping, which may allow for a wider spread of pathogens.

Figure 2 shows average surface contact counts for direct care and personal care. It can be seen that near-bed surfaces dominated in personal care, followed by patient contacts and far-bed surfaces. However, equipment was touched more frequently during direct care. On average, it was found that even if hand hygiene occurred, the patient was often touched again before the HCW left the room.

Discussion and conclusion

This observational study investigated the relationship between surface contacts, patient contact and hand hygiene. The Hawthorne effect⁷ is known to improve hygiene compliance, so this report is probably a best-case scenario. The study measured surface contacts and frequency of hand hygiene, but did not measure the effectiveness of hand hygiene or whether or not HCWs were compliant. The results suggest the following.

- The likelihood of hand hygiene increased with surface contacts for all care types. A subconscious need for hand hygiene may have developed, possibly as a result of HCW hygiene education programmes.
- No correlation was found between the time spent in the room by HCWs and the likelihood of hand hygiene.
- Hand hygiene before or after patient contact depended highly on care type. A notion of perceived risk appears to correlate with personal care where patient contact is likely, but this is less clear in care episodes where patient contact occurs unpredictably, such as direct care.
- Surface contacts were non-random. The sequence of hand-to-surface contacts by staff during clinical activities provides a theoretical demonstration of how hospital organisms could spread from one environmental site to another. Research also suggests that how and when surfaces are cleaned may be influential in its overall effectiveness.⁸ This has potentially important implications for the strategic planning of surface cleaning, particularly when and by whom the surfaces should be cleaned, ultimately impacting on hospital costings and patient care.¹

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Conflict of interest statement

None declared.

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