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A quality improvement project to standardise decontamination procedures in a single NHS board in Scotland

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Abstract

Background: A project was designed to improve decontamination procedures in our hospitals. This included: improving skills with training provided within clinical areas, simplifying procedures to reduce variation and increasing access to decontamination products.

Aim: To make it easy for healthcare workers (HCWs) to do the right thing and for HCWs to be confident that they were doing the right thing.

Methods: A pre-intervention survey of 120 HCWs in 10 wards on three hospital sites identified variations in the products used, variations in precautions taken and deficits in HCWs' capabilities due to unmet training needs.

Intervention: We streamlined the available products, provided an education programme and then undertook a second survey involving 133 HCWs in 12 wards.

Results: Significant improvements were attained in the reported time taken to clean and disinfect ($P < 0.0001$) and in HCW capability ($P < 0.0001$) (reported training received); other improvements in the use of appropriate products and the use of personal protective equipment were evident. The key finding was that a large, previously unrecognised, unmet training need existed; only 44% of HCWs in the pre-intervention survey reported having received training on the topic.

Conclusion: The utility of a pre-intervention survey is critical to knowing whether any change becomes improvement and to set the priorities for change. By focusing on the process rather than the outcomes, greater improvements can be attained. The assumption that all nurses know how to clean is erroneous.

Keywords

Cross-infection, decontamination, quality improvement

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Introduction

Infection prevention and control (IPC) teams have difficulties in achieving reliable healthcare worker (HCW) performance with procedures such as hand hygiene, glove use and non-invasive care equipment/environmental decontamination (Mitchell et al., 2015; Moralejo et al., 2017; Wilson et al., 2017). This IPC team challenge is exacerbated as they are responsible for numerous clinical areas set in separate geographical locations. Essentially, IPC teams are blind to the day-to-day performance of these procedures. It is critical that HCWs prevent decontamination failures as these may result in cross-transmission and increase the risk of healthcare-acquired infection (HAI) (Otter et al., 2011; Suleyman

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et al., 2018). Therefore, it is also critical that IPC teams provide a system that facilitates optimal decontamination. Variations in decontamination procedures arise due to the perceived risk from the type of spillage and/or likely pathogen present, how the equipment will be next used and the tolerance of the materials to specific decontamination products (Curran et al., 2019). However, other practice differences may result from deficits in the knowledge and skills of HCWs, the urgency with which the equipment is required and the availability of resources. Michie et al. (2011) posit it is possible to bring about behaviour change by selecting interventions and policies through an understanding of current behaviour, i.e. by awareness of HCW capability, motivation and opportunity.

In Scotland there is a national infection prevention and control manual which should limit variations in practice (National Services Scotland, 2019). However, there are still difficulties in applying criteria that aim to differentiate risks based on a presumed knowledge of patients' carriage of specific pathogens (Curran et al., 2019). There had been no recent organisation-wide assessment of current decontamination performance in our hospitals. However, local audits had identified variations in practice. We set out to optimise procedures by first understanding the system as it currently operated, before standardising the process and then amending the system to facilitate improved practice. This project focussed on three common, large critical items (mattresses, commodes and lockers) as they take longer to clean, are in close proximity to the patient, subject to microbial contamination in use and/or have been found to be contaminated in studies that involved patient equipment sampling (Dancer, 2014; Webber et al., 2013).

Aims

The aims of the present study were as follows:

- to identify the barriers that HCWs experience in performing recommended decontamination procedures;
- to standardise the decontamination procedures;
- to improve the system of undertaking decontamination; and
- to achieve greater reliability in decontamination procedures.

Setting

Three main district general hospitals in Scotland under a single organisational structure.

Methods

Twelve wards/clinical units were selected and agreed to take part based on observations from previous IPC team visits, high-patient throughput and expressed difficulties in achieving decontamination. Staff in all 12 wards/clinical areas were asked to complete a questionnaire before the intervention on decontamination. These questionnaires were anonymous. Reminders were given on repeated IPC team visits.

Intervention

The intervention involved a product rationalisation to just two pre-impregnated wipes (a non-sporicidal combined detergent and disinfectant wipe and a sporicidal disinfectant wipe).

Staff in all areas were provided with education and training (repeated sessions) which allowed demonstrations and practice using the wipes and specifications on how and when to use each wipe. Working with the ward managers the products were placed ergonomically and strategically around the clinical areas to make it easy for HCWs to select the appropriate product. Instructional reminders on which wipe for which task were also strategically placed.

After three months, a second questionnaire was distributed as before. Permission was granted by the Control of Infection Committee.

Statistical analysis

An ordinal regression model was used for the probability for each time band dependent upon the item (mattress, commode or locker) and survey 1 or 2. A logistic regression model was used for the probability of training dependent upon the procedure (cleaning, disinfection or sporicidal disinfection) and survey 1 or 2. Both models involved post hoc Tukey contrasts with Holm's correction for multiple comparisons.

Ethical approval was not required as this process was aimed at improving existing services and did not involve patients directly or randomisation. The organisation's IPC committee approved the study.

Results

The surveys were completed on the three sites. As there was no difference between the site results, they are presented here cumulatively. The surveys comprised 29 questions, the key data from which are summarised in Table 1 and Figure 1. The two surveys were completed by 120 and 133 HCWs, respectively, of whom nurses comprised 99% and 97% in surveys 1 and 2, respectively.

The ordinal regression model found that survey 2 was associated with a decrease in decontamination time band for all the items compared to survey 1 ($P < 0.0001$). The logistic regression model found that survey 2 was also associated with a greater probability of training for all three processes (cleaning, disinfection and sporicidal disinfection) ($P < 0.0001$) (Table 1 and Figure 1).

Table 1. Summary of the responses to survey 1 and survey 2.

	Survey 1 (n = 120)	Survey 2 (n= 133)	*P* value
How many different products are listed for each decontamination procedure?			
Cleaning	4	1	Sig testing not done
Disinfection (non-sporicidal)	4	2	
Disinfection sporicidal	3	2	
How many HCWs had received training on the correct way to select and use a decontamination product?			
Cleaning	Yes 53 (44%), No 67 (56%)	Yes 118 (89%), No 15 (11%)	< 0.0001
Disinfection (non-sporicidal)	Yes 82 (68%), No 38 (32%)	Yes 120 (90%), No 13 (10%)	< 0.0001
Disinfection sporicidal	Yes 48 (40%), No 72 (60%)	Yes 119 (89%), No 14 (11%)	< 0.0001
Are decontamination products readily available?			
Cleaning	Yes 63%, No 6%, Not al 32%	Yes 99%, No 1%, Not al 0%	Sig testing not done
Disinfection (non-sporicidal)	Yes 72%, No 2%, Not al 27%	Yes 99%, No 1%, Not al 0%	
Disinfection sporicidal	Yes 47%, No 15%, Not al 38%	Yes 99%, No 0%, Not al 1%	
The total number of PPE items used per procedure, and the number of these items that were inappropriate for the procedure from all responses combined			
Cleaning	4 PPE items; 16 inappropriate	3 PPE items; 7 inappropriate	Sig testing not done
Disinfection (non-sporicidal)	4 PPE items; 18 inappropriate	2 PPE items; 0 inappropriate	
Disinfection sporicidal	4 PPE items; 19 inappropriate	3 PPE items; 2 inappropriate	
Median reported time to decontaminate (min)			
Mattress	> 10	6–10	< 0.0001
Locker	6–10	1–5	< 0.0001
Commode	6–10	1–5	< 0.0001

Not al, not always; PPE, personal protective equipment.

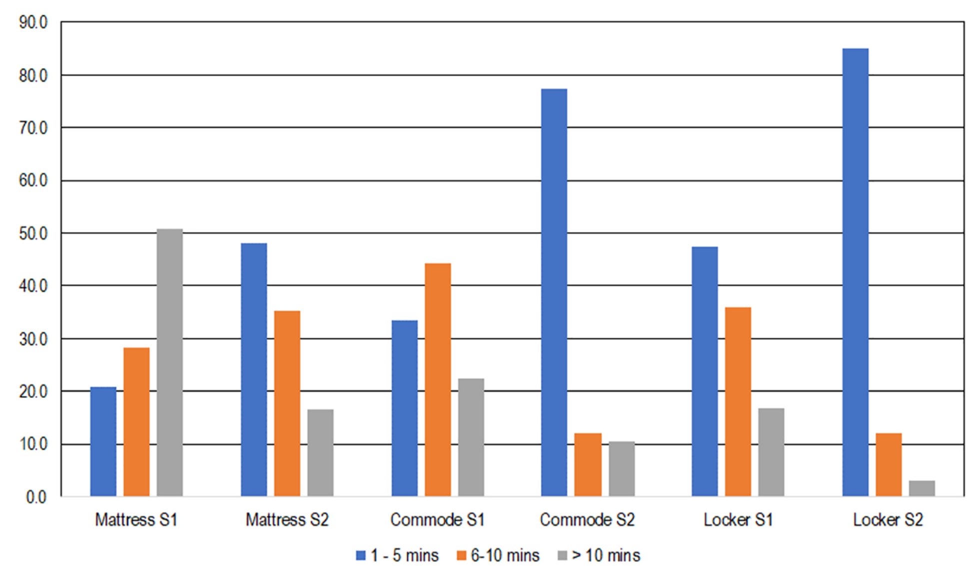
The logistic regression model suggests that holding all other factors constant, both disinfection and survey 2 were associated with an increased probability of having received training, compared to cleaning and survey 1 ($P = 0.0002$ and $P < 0.0001$, respectively). In addition, this model suggests that training was more likely to have been provided for disinfection rather than sporicidal disinfection during survey 1, but not in survey 2 ($P < 0.0001$). Thus, training needs were more comprehensively met in survey 2.

Table 1 also shows the number of products in use was reduced for cleaning and disinfection (sporicidal and non-sporicidal) in survey 2. There was also standardisation of personal protective equipment (PPE) and a reduction in the number of inappropriate items that were listed as used in survey 2. Notable other findings included the number of HCWs who stated that they had not received training in how to clean (n = 53, 44%). Other deficits in the system were manifest, e.g. an unacceptably low availability of the products for all decontamination procedures (in the range of 47%–72%).

Discussion

The aim of the present study was to identify the barriers to optimal decontamination procedures, standardise the procedures, improve the system and achieve greater reliability. This is vital because as stated, IPC teams are blind to day-to-day performance and decontamination failures increase the risk of HAI (Otter et al., 2011; Suleyman et al., 2018). Essentially, we were trying to make it easy for HCWs to do the right thing and for HCWs to be confident that they were doing the right thing. The study focused on what are considered low-risk items (commodes, mattresses and lockers) for which cleaning with detergent, rinsing and drying is considered 'usually sufficient' (Hoffman et al., 1984). However, it is important to note that current guidance lacks specificity as to precisely when cleaning and drying of these low-risk items is insufficient (Curran et al., 2019). In addition, two factors enhance the case for increased disinfectant usage. First, there are delays in recognising and isolating patients with alert organisms (Mody et al., 2019).

Figure 1. The reported time to decontaminate items in survey 1 (S1) (n = 120) and survey 2 (S2) (n = 133) as a three time periods (as a percentage).



Second, pathogens can be found outwith the bed spaces of patients who are known to be colonised with alert organisms (Faires et al., 2013).

Decontamination is defined as cleaning alone or cleaning combined with disinfection (or sterilisation) (Hoffman et al., 1984). Of note, cleaning is a necessity before the application of a disinfectant in order to achieve decontamination. Decontamination reduces the microbial load on an object to levels insufficient to generate harm (MHRA, 2010). In practice, it is difficult to determine whether the decontamination has been effective as the perceived risk (from the presence of specific microbial agents) is invisible and unknowable both before and after the process (Curran et al., 2019).

The first survey results provided evidence of a 'perfect storm' of factors that reduced the probability of optimal decontamination: there was a lack of opportunity to do the right thing with insufficient product availability (only 63% reporting that the right product was always available). There was a lack of capability (and motivation) as evidenced by only 44% of those surveyed having been taught how to clean correctly, and by the inappropriate use of PPE (Table 1 and Figure 1). Michie et al. (2011) suggests that what drives HCWs' behaviour is dependent on their capability, the opportunities afforded them and their motivation to undertake procedures correctly. This assessment, they argue, can identify interventions with the greatest opportunity to improve performance, as was found in this study. The interventions we undertook to improve decontamination involved: (1) a rationalisation of available products to just two pre-impregnated wipes (a non-sporicidal combined disinfectant and detergent wipe and a sporicidal disinfectant wipe; (2) training (and poster reminders) on both the importance of correct decontamination and which product to use; and (3) increasing and optimising product availability through placement throughout the clinical environments.

The second survey of practice demonstrated that the intervention had achieved the aims by making it easier for HCWs to do the right thing and for them to be sure what the right thing to do is. This was evidenced by only one type of product being used for decontamination when sporicidal contamination was unlikely – the selected colour-coded combined disinfectant and detergent wipe. Survey 2 demonstrated not just that HCWs knew what to use, but also that it was reliably available for use and that it was being used. Product availability increased to 99%, signifying that product placement had been optimised (Table 1). The number of inappropriate PPE products reduced for all three procedures (a further benefit of the education and training) (Table 1). The reported median time-to-clean and disinfect, and disinfect using a sporicidal disinfectant, all significantly reduced for each of the three most common decontamination procedures ($P < 0.0001$) (mattresses, commodes and patient lockers). Importantly, this provided evidence of increasing the time available to care. There were no unintended consequences reported from the product rationalisation. Hence, we conclude that the decontamination procedures in our NHS Board have become more efficient (as measured by reported time to complete procedure) and more reliability in the use and availability of suitable products.

All clinical care environments have a high-patient throughput and therefore also have high-decontamination needs – with at times a mismatch between resources available (time-to-perform) and thus the ability to complete decontamination procedures as required. Therefore, reducing the time needed to decontaminate aided the time resources available for effective decontamination. The ubiquitous presence, survival and easy cross-transmission of nosocomial pathogens add to the requirement for excellence in decontamination (Kramer et al., 2006; Otter et al., 2011; Mitchell et al., 2015). The interventions in this study involved the IPC team in assessing and intervening so that the decontamination needs of the HCWs within their systems are met. That is, to achieve excellence in decontamination necessitates that decontamination procedures were made: *easy to perform, effective at achieving decontamination, are known to and practised by all who must execute them*. HCWs need the capability and opportunity to effectively decontaminate, else decontamination procedures will fail and patients will be subject to increased risks. Furthermore, when opportunity and capability for decontamination are met, the procedures can (and as was demonstrated in this study) be optimised by the reduced time to perform them. IPCTs frequently audit the outcomes of procedures, e.g. *is it clean, is it there, is it done*. This intervention began with an assessment of the situation and then standardisation of process before improvement was attempted. This has been shown to be the essential first step in improvement (Lloyd, 2018). Indeed, without this step there would be no evidence of improvement. Rather than a focus on procedure outcomes, perhaps IPC teams should concentrate more on the procedures themselves and what is needed to enable the HCWs to optimise performance.

Visible cleanliness is the only immediate assurance with which to assess performance. Therefore, assurance that HCWs know what to do and have the resources to achieve is the first step in attaining optimal organisational capability. In procedures replete with many potential errors, it is important to state that the risk of cross-transmission may have significant impact on both patients who acquire infection or are just colonised (Public Health England, 2013). Additionally, the service itself can be affected when cross-transmission results in admission restrictions or specific bed placement requirements (Birgand et al., 2016). Such risks should be reduced by optimising decontamination procedures.

Making it easy for HCWs to do the right thing and having assurance they know what the right thing to do is, begins with identifying whether they know: what products to use; how to use the products; and whether the products are available when required. Thus, we measured this before planning our product rationalisation, education and product placement. We also monitored for satisfaction, improvement in process and unforeseen/unintended consequences.

Limitations

The present study has several limitations. First, the study is of reported practice, what people say they do rather than what is observed done. However, a high IPC team presence on the ward, ongoing discussions and favourable opinions on the selected products (data not shown) provide some evidence that this was a correct assessment. Precisely why the reported reduced time to decontaminate fell is unknown; this could have been because of the education input on the correct way to decontaminate or simply because pre-impregnated products are less time-consuming. Another reporting bias could be at play in that the respondents reported positively because they felt the researchers expected them to do so. This is less likely as the surveys were anonymously completed in the absence of the researchers. The surveys were convenience samples so the respondents in the first survey could have had different opinions to those in the second survey. Once again, the high level of IPCT presence and ongoing engagement suggests this was not the case. The study did not include costs. Further work on the impact on resistant micro-organisms is needed to add to the impact data already presented.

Conclusion

We conclude that decontamination procedures in our NHS Board have become more efficient – as measured by significant improvements in time taken to decontaminate and in the reported correct product being used. Performance in the use of PPE was also enhanced. A significant unmet, and previously unrecognised, training deficit has now been negated. The use of a pre-intervention survey before any improvement intervention proved vital and enabled us to focus on the most important issue (unmet training need). IPC teams who focus on the HCWs' perspective as to how a procedure should be done are likely to achieve more favourable results than those who focus only on the procedure's outcome. Finally, and most importantly, without evidence, it is erroneous to assume that nurses know how to clean.

Author's Note

Evonne Curran is an Independent Infection Prevention Control Nurse Consultant, Glasgow, UK.

Declaration of conflicting interests

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