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Research paper

Variation in hospital cleaning practice and process in Australian hospitals: A structured mapping exercise

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Abstract *Background:* The purpose of this paper is to highlight the range of cleaning practices and processes in 11 Australian hospitals and to discuss the challenges this variation poses to the implementation of clinical trials or changes to hospital cleaning practices.
Methods: A cross-sectional study design was used to determine cleaning practices and processes in hospitals participating in the 'Researching Effective Approaches to Cleaning in Hospitals' (REACH) study. A standardised template and approach was used to collect information. Data collection activities included structured on-site discussions, a review of hospital practices and a document review of policy and procedural documents related to

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cleaning.
Results: Variations in the auditing process used to evaluate environmental cleanliness, cleaning practices, product use, training and communication pathways available to cleaning staff were identified. There was also variation in workforce structure and responsibilities for cleaning.
Conclusion: This paper is the first to describe the differences in cleaning practices between Australian hospitals. The variations identified present a number of challenges for the conduct of research and have important implications for both monitoring of and standards for cleanliness. These challenges include implementing a practice change or cleaning study where hospitals have different processes, practices and structures.

Highlights

- There are variations in the auditing process used to evaluate environmental cleanliness.
- Different cleaning practices, product use and training for cleaning staff occur in Australian hospitals.
- These variations present a number of challenges for research and monitoring of and standards for cleanliness.

Introduction

Environmental cleanliness is an important component of any hospital infection control program. Pathogen transfer to a susceptible patient commonly occurs via the hands of healthcare workers, but can also take place directly or indirectly through other contaminated objects and air [1]. A number of factors affect the link between environmental contamination and risk of acquisition of pathogens. These include the pathogen's resilience, virulence, ease of trasfer, ability to colonise or infect patients, capacity for biofilm formation and tolerance to antiseptics and disinfectants or surface materials [2]. Additional factors include the methods, frequency and efficacy of cleaning practices to reduce environmental contamination; also, isolation practices and facilities, hand hygiene compliance, antimicrobial consumption, host or individual risk factors at patient level and colonisation pressure or pathogen reservoirs in a given environment [3—7]. Patients admitted to rooms previously occupied by patients with multidrug-resistant organisms are exposed to increased risk of infection or organism colonisation [8,9].

Although general cleanliness has been promoted in hospitals for over a century, the science of hospital cleaning is in its infancy, and avoidable/preventable risks remain for patients [10,11]. There are currently no accepted risk-based standards to verify whether a hospital is truly clean and safe. Furthermore, the methods used to evaluate both cleaning processes and surface cleanliness vary [12]. These methods include the use of ultraviolet (UV) solutions and fluorescent light assessment, visual inspections, microbiological surface sampling and adenosine triphosphate (ATP) bioluminometers [13,14]. Each of these methods has its own advantages and disadvantages [12,15,16]. Areas in the healthcare environment that are frequently touched by patients and healthcare workers, become contaminated and hence can act as a reservoir for pathogen transmission [1]. For these reasons, frequently touch points (FTPs) are often the focus for improvements in the thoroughness of cleaning and are commonly used in a both research and quality initiatives [14,18,19].

In Australia, national guidelines provide recommendations on minimum cleaning frequencies and when to use disinfectants [20]. There is, however, ongoing debate about the most effective ways to clean hospitals in terms of both the actual cleaning process and the choice of cleaning agent. New decontamination technologies such as biocidal gases, vapours, UV light-emitting devices, steam cleaners, disinfectants and a range of materials used in hospitals, e.g. antimicrobial surfaces, are being introduced in some settings. This adds further complexity about efficacy and method choice, with conflicting evidence of effectiveness [16,21]. Regardless of the cleaning method chosen, successful implementation and continued thoroughness in cleaning practices are important for reducing infection risk to patients and staff, in addition to aesthetic importance. Significant variation also exists in relation to who is actually responsible for cleaning in hospitals, what areas and items they are responsible for cleaning and when, and what other activities form part of their duties. This can lead to tension and misunderstanding between clinical and cleaning staff.

The National Health and Medical Research Council funded 'Researching Effective Approaches to Cleaning in Hospitals (REACH)' study uses a cleaning bundle approach to simultaneously evaluate multiple evidence-based cleaning interventions [22]. The study focuses on environmental cleaning staff with a role in hospital ward cleaning. The key study outcomes are the bundle's impact on the incidence of healthcare-associated infections and overall cost-effectiveness [23]. The interventions contained in the bundle are standardised for 11 hospitals participating in the stepped-wedge randomised trial.

The REACH study uses the integrated nPromoting Action on Research Implementation in Health Services (iPARIHS) framework to support a tailored implementation of the bundle in each hospital [24]. The first step in implementation is to complete a local context assessment using tools based on the iPARIHS framework. This assessment and subsequent mapping, aims to understand and document the current context impacting cleaning in study hospitals, including alignment of existing practices with the evidence-based cleaning bundle intervention.

The purpose of this paper is twofold. First, to highlight the variation of cleaning practices and processes in 11 Australian hospitals and, second to discuss the challenges this variation poses to the implementation of clinical trials in cleaning. The latter is especially important in the proposition of a standardised approach to cleaning practice and more importantly, to future attempts to improve patient safety through standardised cleaning practices.

Methods

Study design

This paper reports findings from a structured context assessment and mapping exercise that preceded the implementation of a randomised controlled trial of an environmental cleaning bundle [22]. The cross-sectional findings of the cleaning practices and processes at the completion of the mapping exercise in February 2017 are presented. The impact of the intervention on cleaning practices will be reported after follow-up data collection is completed in November 2017.

Setting

The focus of this paper is the eleven acute public and private Australian hospitals which enrolled in the REACH study. Each of these hospitals met the inclusion criteria of having a large training-accredited intensive care unit and being classified as a major hospital (public hospitals) or having more than 200 beds (private hospitals) [22]. Two hospitals were private and nine public. Hospital size ranged from 227 to 930 inpatient beds (median 500).

Data collection

A standardised template and approach was used for consistency and to ensure core information was collected. Specific data were collected regarding cleaning audits and feedback processes, cleaning products used, training, communication mechanisms, hospital structure and governance and staff roles and responsibilities for cleaning. This approach ensured information about context was included [24]. Researchers collected baseline data about the cleaning practices at each enrolled hospital during the establishment (4 weeks) and control (8 weeks) phases prior to the cleaning bundle implementation. The baseline data collection process, using a stepped-wedge design, commenced in May 2016 at the first hospital and finished in February 2017 at the eleventh hospital. Data collection activities included structured on-site discussions at each hospital with key infection control and cleaning staff. There was also a review of hospital practices and a document review of policy and procedural documents related to cleaning, as provided by the hospital. Where there was a gap in the data collection or clarification was required, the research team followed up with the individual hospital using email and telephone.

The structured context assessment and mapping exercise used in the REACH study aimed to identify structures and processes related to hospital cleaning in the enrolled hospitals. The approach taken was based upon the iPARIHS implementation framework. This supported a systematic assessment of an individual hospital's characteristics and allowed the research team to then tailor the cleaning bundle intervention in response to existing structure, cleaning practices, and staffing factors for each site. This approach was consistent with the Donabedian model for quality care, where information is sourced according to 'structure', 'process' and 'outcome' [25].

Data analysis

Data from discussions and the document review were collated by the research team in a hospital profile document. Descriptive statistics were performed to examine prevalence of cleaning practices. Qualitative data related to cleaning practices, product use, auditing practices, environmental cleaning staff training and communication pathways were extracted and synthesised in line with the essential elements of each of the environmental cleaning bundle components. The synthesis of data was undertaken by one researcher, then cross checked and validated by two other researchers. We did not specify hospital names, consistent with prior agreement with participating hospitals.

Results

We identified wide variation in the auditing process used to evaluate environmental cleanliness and cleaning practices, use of detergent and disinfectant products, training provided to cleaning staff and the communication pathways available to these staff. There were also differences in workforce structure and responsibilities for cleaning, cleaning methods and training in participating hospitals (Table 1). An overview of the different cleaning products used in hospitals before the commencement of the REACH study is provided in Table 2. More detailed results for auditing practice, product use, training, cleaning technique, communication and workforce are provided below. These themes align with the components of the REACH cleaning bundle [23].

Auditing

All of the hospitals used visual audit or inspection as the primary method for evaluating environmental cleanliness and cleaning practices. Three hospitals used a UV solution and fluorescent light assessments in addition to visual inspections (see Table 1). All hospitals provided feedback to their cleaning staff regarding the visual and UV assessments, where undertaken, although this was often done in an undocumented manner and processes varied.

Table 1 Overview of cleaning practices, training, communication and cleaning workforce.

Hospital	Type of audit performed[a]		Level of documentation of cleaning of FTPs[b]			Timing of infection control/cleaning training		Communication mechanisms		Cleaning workforce
	Visual	UV	None	Some	Full	Induction	Ongoing	Ward	Cleaning team	
1	✓			✓		✓	Ad hoc	Unclear	Established	Single workforce: cleaning duties only
2	✓		✓			✓	Regular	Established	Established	Single workforce: cleaning duties only
3	✓			✓		✓	Unclear	Unclear	Limited	Two workforces: one with cleaning duties only; one with clinical duties that include cleaning
4	✓			✓		✓	Unclear	Limited	Established	Single workforce: cleaning and patient related duties
5	✓			✓		✓	Regular	Limited	Limited	Two workforces: one with cleaning duties only; one with cleaning and patient related duties
6	✓	✓			✓	✓	Regular	Unclear	Limited	Two workforces: one with cleaning duties only; one with clinical duties that include cleaning
7	✓	✓			✓	✓	Unclear	Unclear	Limited	Single workforce: cleaning and patient related duties
8	✓	✓		✓		✓	Regular	Limited	Established	Two workforces: one with cleaning duties only; one with clinical duties that include cleaning
9	✓		✓			✓	Unclear	Unclear	Limited	Single workforce: cleaning duties only
10	✓		✓			✓	Regular	Limited	Established	Single workforce: cleaning duties only
11	✓			✓		✓	Ad hoc	Unclear	Limited	Two workforces: one with cleaning duties only; one with cleaning and patient related duties

Note: Ticked/shaded areas denote the current practice in the given hospital against each of the criteria. UV = use of an ultraviolet (UV) solution and light as a mechanism to assess cleaning. Induction = some form of infection control and cleaning training as part of commencing cleaning role for non-clinical staff. Ongoing = frequency of training activities post induction phase for non-clinical staff. Ad hoc = updates delivered as required. Unclear = unable to ascertain frequency and process for updates. Regular = scheduled, planned updates. The options listed in the communication column refer to established communication mechanisms. Ward = communication between cleaning staff and ward staff. Cleaning team = communication within the cleaning team. Cleaning: dedicated cleaning role e.g. Housekeeper, Environmental Support Officer, Domestic Assistant. Cleaning and patient related: some cleaning and some patient related duties e.g. Patient Services Assistant. Clinical: some cleaning duties as part of clinical role e.g. Hospital Aide, Registered nurse.

[a] Includes provision of individual feedback to cleaning staff.

[b] Aligns with the 'technique' element within the REACH cleaning bundle.

Product

Disinfectants were commonly used for cleaning where patients were under transmission-based precautions or isolation due to symptoms (e.g. diarrhoea and vomiting). The type of disinfectant used varied, with several hospitals using more than one disinfectant. The most common active ingredients in the disinfectants were hydrogen peroxide and sodium hypochlorite. Most hospitals used detergent under some conditions, although this use varied according

Table 2 Overview of product use in hospitals.

Hospital	Product use: daily cleaning of FTPs by environmental cleaning staff		Product use: discharge cleaning of FTPs by environmental cleaning staff		Use of point of care wipe products in hospital	Variation within hospital
	Non-precautions cleaning	Precautions cleaning	Non-precautions cleaning	Precautions cleaning		
1	Detergent	Disinfectant	Detergent	Disinfectant	Cleaning & clinical staff	No
2	No product used	Disinfectant	Disinfectant	Disinfectant	Clinical staff	Yes
3	Detergent	Detergent	Detergent	Disinfectant	Clinical staff	Yes
4	Detergent	Disinfectant	Disinfectant	Disinfectant	Clinical staff	Yes
5	Detergent	Disinfectant	Detergent	Disinfectant	Cleaning & clinical staff	Yes
6	Disinfectant	Disinfectant	Disinfectant	Disinfectant	Clinical staff	Yes
7	Disinfectant	Disinfectant	Disinfectant	Disinfectant	Cleaning & clinical staff	No
8	Disinfectant	Disinfectant	Disinfectant	Disinfectant	Cleaning & clinical staff	Yes
9	Detergent	Disinfectant	Disinfectant	Disinfectant	Clinical staff	Yes
10	Detergent	Detergent	Detergent	Disinfectant	Cleaning & clinical staff	No
11	Disinfectant	Disinfectant	Disinfectant	Disinfectant	Cleaning & clinical staff	Yes

Note: FTP = Frequent touch point. Precautions clean refers to a patient under transmission based precautions. Variation within hospital relates to different or multiple product use for particular ward(s), FTPS, workforce groups and/or organism type.

to whether a two-step cleaning process or 2-in-1 detergent/disinfectant product was used. Nine of the 11 hospitals used point-of-care wipes containing a disinfectant. The wipe composition and actual use varied: two hospitals used wipes for FTP cleaning; all used wipes for cleaning patient equipment.

Training

All hospitals provided training on infection control and cleaning for their cleaning staff upon induction or commencement of employment. This varied from a week long intensive course with hands on simulations and competency assessment by a certified trainer before being buddied up on the ward, to just being "shown the ropes" by a fellow staff member on the ward. After this initial period, the training provided varied in terms of frequency of delivery — from regular annual training to no additional training — and in content, with some providing training on cleaning equipment or processes, others on infection control, neither or both. For many sites training information was unclear and poorly documented, especially training delivery timings, content and staff involved.

Technique

Two hospitals clearly and consistently documented cleaning responsibility for each FTP. The FTPs were based on the Centres for Disease Control and Prevention environmental checklist recommendations [26]. The responsibility for cleaning specific FTPs also varied within some sites in relation to daily and discharge cleaning, standard and transmission based precautions rooms, and between ward types, e.g. intensive care unit. Some FTPs were not designated to be routinely cleaned each day for some hospitals, e.g. bed rails.

Communication and workforce

Major variations existed for communication mechanisms between environmental cleaning individuals and teams, their line managers and ward and hospital leaders. This ranged from twice weekly within the cleaning team, to cleaning staff participation in daily ward 'huddles', to monthly cleaning team meetings in others, to an infrequently updated noticeboard for one site as the primary communication tool.

Cleaning responsibilities, including the responsibility for cleaning specific areas/wards, specific items, when and with what frequency, were considerably mixed. For all hospitals, the job titles of those involved also encompassed a wide range of terminology: cleaner; patient services assistant; technical assistant; ward services assistant; domestic assistant; environmental support officer; patient support officer; housekeeper; hospital aide; and assistant nurse. Some sites had a single non-clinical workforce responsible for ward cleaning, others were split between two different non-clinical workforces; and others between clinical and non-clinical staff.

Each hospital employed different lines of management structure and governance. In nine hospitals, all environmental cleaning staff were employed in-house, i.e., they were not contracted by an outside company. Other hospitals contained a mix of partly or fully contracted out cleaning services.

Discussion

This paper is the first to describe variation in cleaning practices in Australian hospitals. The findings indicate considerable variation for many aspects of hospital cleaning. The included hospitals are from different Australian States and Territories, public and private hospitals and tertiary and non-tertiary hospitals. This variation presents a

number of challenges for the conduct of research and has important implications for both monitoring and standards for cleanliness. These challenges include implementing a practice change or cleaning study where hospitals have different processes, practices and structures. In turn, this has implications for improving patient safety through higher standards of cleaning.

Hospital cleaning serves to reduce the risk of infection or pathogen transmission between patients and hospital staff. Visual appearance of cleanliness also offers a more aesthetically pleasing environment for staff, potentially enhancing job satisfaction and better quality care in the workplace. For patients, a clean environment inspires a more comfortable stay and confidence in treatment. As such, hospital cleaning is an important element of improving the safety and quality of hospital care. Researchers must identify ways to improve the care and services provided in hospitals, though it is a challenge to do so given the complexity of the structures and processes within these organisations [27]. There are also personal and cultural issues to consider when improving patient safety [28].

Through the scoping exercise described in this paper, the researchers identified potential challenges and tailored specific solutions for implementing the cleaning intervention in each hospital prior to the intervention's introduction. Specific examples include tailored training to spend less time focussing on areas that have already been addressed (e.g. UV auditing), and more time on those that may be less clear (e.g. what items or sites are more important to clean). The goal of such an approach is to improve compliance with the intervention—in this case, the cleaning bundle. Compliance with the different sections of the cleaning bundle will be explored in future publications from the REACH study.

These findings also describe variation in the cleaning products used and the different roles and responsibilities involved. With respect to product use, there were different approaches on whether cleaning should involve a disinfectant or detergent, as well as variation in the types of disinfectants being used. These differences have several implications. First, the variation in products suggests a lack of clarity about what types of products are most efficient in reducing the risk of infection for patients. It is not within the scope of this paper to explore this, as its complexity has been demonstrated in other published works [16]. Second, using different or several products and assigning varying responsibilities for cleaning within a hospital can lead to confusion and inappropriate use of disinfectants, including under use, overuse and interaction of products that are not designed to be used concurrently. One way to reduce unwanted system variation is to reduce complexity, for example the number of choices, patterns of intervention, distracting tasks [29]. The use of checklists and bundles, such as those introduced in the REACH study, could be helpful in simplifying and consolidating choice of product for specific tasks [30,31,22].

An additional cause of variation in practice and inconsistent cleaning practice in several hospitals related to the extent that staff other than cleaners (e.g. nurses) had responsibility for cleaning FTPs and patient equipment. This finding is consistent with other literature [32]. Nursing staff were more likely to have cleaning responsibilities in high dependency areas. These findings are consistent with a previous report that found one to two thirds of nurses reported cleaning as part of the job [33]. There are important implications for this, for example, as to whether nurses undertaking cleaning duties are an effective use of resources. There may also be lower priority given to cleaning tasks when a clinical staff member has responsibility for both cleaning and for patient care activities. We also need to know whether nurses receive training on how to clean, as cleaning is a specific skill given the process involved [20,34]. This need is further supported by evidence of clinical staff failing to clean medical equipment properly [32,35]. The present study did not explore whether staff other than environmental cleaning staff receive the necessary cleaning training and feedback but this could be incorporated into future studies.

In Australia, national guidelines and a hospital accreditation framework exist to support the prevention and control of infection in healthcare [20,36]. Generating an evidence base to inform the national guidelines is one intended outcome of the REACH study [12]. Variation in cleaning practice is likely to continue until such evidence becomes available. This study highlights the need to engage in contextual mapping, given the large variation in practice and the subsequent need to implement policies and practices in a more standardised way.

The REACH cleaning bundle intervention aligns with current evidence about best cleaning practice [23]. By undertaking this review of cleaning practices, prior to implementing the cleaning bundle intervention, we were able to assess and map the enrolled hospital cleaning context. This information was used to develop a tailored hospital-specific implementation plan that responded to identified practice gaps to promote compliance with the evidence-based cleaning bundle for the trial. Should the REACH study demonstrate a reduction in healthcare-associated infections resultant from its intervention, this reduction will have been achieved in the context of a complicated and diverse practice environment. This may assist in furthering our understanding of what factors are important in promoting cleaning practice change to improve patient safety.

Ethical considerations

This project has received ethics approval from the Uniting Care Health Human Research Ethics Committee (approval number 1413) and the Queensland University of Technology Human Research Ethics Committee (approval number 1400000828). Local ethics approvals were also obtained for all participating hospital sites.

Authorship statement

The concept and initial drafting of this paper was undertaken by B.M., with critical input from A.F, A.G., and M.A. All authors made contributions to the subsequent drafts of this paper through critical revision. N.G. was the lead investigator for the REACH project. All authors have given their final approval regarding this manuscript.

Conflict of interest

Several authors (SD, NG, AG, TR and BM) have an editorial affiliation with the journal. These authors played no role in the peer review or decision-making process related to this paper. All other authors have no conflicts to declare.

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Provenance and peer review

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