



Review

Relationship between shared patient care items and healthcare-associated infections: A systematic review



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ABSTRACT

Background: Environmental surfaces may contribute to transmission of nosocomial pathogens. Noninvasive portable clinical items potentially shared among patients (NPIs) are part of the patient's immediate surroundings and may pose a threat of pathogen transmission.

Objective: To assess the body of literature describing the range of microorganisms found on NPIs and evaluate the evidence regarding the potential for cross-transmission of microorganisms between NPIs and hospitalized patients in non-outbreak conditions.

Design: A comprehensive list of NPIs was developed, and a systematic review of these items combined with healthcare-associated infection related keywords was performed.

Data sources: PubMed, Scopus, and Cochrane Library.

Review methods: A systematic review was performed using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist to identify and synthesize research reports published between January 1990 and July 2013 on studies regarding contamination of NPIs and association to infections in non-outbreak circumstances.

Results: 1498 records were scanned for eligibility. Thirteen studies met inclusion criteria. Overall, rates of NPI contamination ranged from 23% to 100%. Normal skin or environmental flora were found on almost all positive cultures. Potential pathogens, e.g., *Staphylococcus aureus*, were present on up to 86%, and *Pseudomonas* spp. and/or *Enterobacteriaceae* in 38% of positive cultures. Multi-drug resistant organisms were isolated from up to 25% of items. Three studies explored association between NPIs contamination and patient colonization and infection. One study reported 5 patients with healthcare-associated infections with pathogens found concurrently on NPIs, one found cross-transmission between patient skin bacteria and NPI contamination, and a third did not find any cross-transmission.

Conclusions: Potential pathogens and multiply resistant organisms present on NPIs in routine, non-outbreak conditions and in a variety of settings confirms the need to improve NPIs decontamination practices.

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What is already known about the topic?

- The hospital environment poses a risk of infection to susceptible patients.
- Pathogenic microorganisms are frequently found on non-invasive clinical items in an outbreak condition.
- Non-invasive portable clinical items are frequently shared among patients and often assumed to be clean unless visibly soiled.

What this paper adds

- This is the first systematic review to evaluate the evidence of the potential role of noninvasive portable clinical items potentially shared among patients (NPIs) in transmission of healthcare-associated infection in non-outbreak conditions.
- NPIs harbored a substantial percentage of potential pathogens and multiple resistant organisms, e.g., *Staphylococcus aureus*, were present on up to 86%, and Gram-negative organisms (*Pseudomonas* spp. and/or *Enterobacteriaceae*) were present on up to 38% items. Multi-drug resistant organisms were isolated from up to 25% of the items.
- Reevaluation of the current recommendations and practices for cleaning and decontamination of NPIs is clearly needed.

1. Background

The hospital environment poses a risk of infection to susceptible patients, as there are numerous reports of pathogens and multi-drug resistant organisms that contaminate patient care environmental surfaces (Boyce, 2007; Drees et al., 2008; Goodman et al., 2008; Rutala et al., 2006). In a recent literature review Otter et al. (2011) summarized the accumulating evidence that environmental surfaces contribute to the epidemic and endemic transmission of numerous nosocomial pathogens such as *Clostridium difficile*, vancomycin-resistant *Enterococci*, *Pseudomonas aeruginosa*, and *Norovirus*. There is agreement among infection control professionals, researchers, and policy makers that environmental factors play an important role in the risk of cross-infection (Weber and Rutala, 2013). Hence, environmental cleaning and decontamination of items used for noninvasive patient care (non-critical items) in the clinical setting are important measures to be taken in order to reduce the risk of healthcare-associated infections (Adams et al., 2008; Carling and Huang, 2013; Rutala et al., 2008; WHO, 2004).

Noninvasive portable clinical items potentially shared among patients (NPIs) such as blood pressure cuffs, glucometers, and thermometers, are part of a larger category of clinical items that come in contact with patients' intact skin or immediate surroundings and should be cleaned between patients (Rutala et al., 2008). Cleaning policies and procedures in various levels of detail are published in international, national, and local guidelines (Adams et al., 2008; Brady et al., 2011; Ministry of Health, 2006; National Patient Safety Agency, 2007; Rutala et al., 2008; Soroka University Medical Center, 2012; WHO,

2004). Yet, the environmental cleaning of noncritical items is far from optimal (Carling, 2013). The consequence of suboptimal cleaning or non-adequate decontamination of such "non-critical" equipment between patient contacts may still be unclear to many care providers. Furthermore, it is often unclear whose responsibility it is to clean and decontaminate the NPIs, given other priorities of the staff (Dancer, 2011). Unlike other non-critical items such as patient unit furniture, floors, and curtains, which are typically cleaned by environmental services/cleaning personnel or sent to a central location for cleaning, NPIs are typically expected to be cleaned at the point of care between patients (Rutala et al., 2008) by nursing aides or nurses.

The objective of this systematic review was to identify the potential role of NPIs on risk of healthcare-associated infections, in patient care settings. The specific aims were to assess the body of literature describing the range of microorganisms found on NPIs and to evaluate the evidence regarding the potential for cross-transmission of microorganisms between NPIs and hospitalized patients.

2. Methods

To accomplish these aims, it was first necessary to develop a comprehensive list of NPIs and then to conduct a systematic review which included these items.

2.1. Development of a comprehensive list of NPIs

To develop a comprehensive list of noninvasive portable items potentially shared among patients, the following inclusion criteria were used: (1) portable noninvasive clinical items that may contact patients or their immediate surroundings in the care setting; (2) cleaning process assumed to take place in the clinical unit/ward; (3) item not assigned to one particular patient during their hospitalization; and (4) item belongs to the unit/ward and not personally owned by the health care provider. Exclusion criteria were: (1) items allocated to a specific patient for the duration of their hospitalization; (2) furniture and items firmly fixed/installed in patient units; and (3) items processed for cleaning outside the clinical setting.

Nine healthcare professionals – eight registered nurses and infection preventionists, four of whom combined their work in infection control with part-time bedside nursing (medical ward, neonatal intensive care unit, and neurosurgery ward); and one physician hospital epidemiologist – were asked to respond to the following question: "What non-sterile portable items potentially shared among patients in a hospital setting can you identify?" Additionally, a literature search in PubMed for NPIs was performed with consultation of an information specialist. The following Medical Subject Headings (MeSH) were used: "Durable Medical Equipment" or "Electrical Equipment and Supplies" or "Equipment and Supplies, Hospital" under the "Equipment and Supplies" MeSH tree or "Fomites", combined with "Patient" and "Risk" and "infection" or "colonization", "noncritical item" or "non

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