TITLE

Beyond hand hygiene: a qualitative study of the everyday work of preventing cross-contamination in hospital wards.

ABSTRACT

Background

Hospital-acquired infections are the most common adverse event for inpatients worldwide. Efforts to prevent microbial cross-contamination currently focus on hand hygiene and use of personal protective equipment (PPE), with variable success. Better understanding is needed of infection prevention and control (IPC) in routine clinical practice.

Methods

We report on an interventionist video-reflexive ethnographic (VRE) study, that explored how healthcare workers performed IPC in three wards in two hospitals in New South Wales, Australia: an intensive care unit (ICU) and two general surgical wards. We conducted 46 semi-structured interviews, 24 weeks of fieldwork (observation and videoing), and 22 reflexive sessions with a total of 177 participants (medical, nursing, allied health, clerical and cleaning staff, and medical and nursing students). We performed a post-intervention analysis, using a modified grounded theory approach, to account for the range of IPC practices identified by participants.

Results

We found that healthcare workers' routine IPC work goes beyond hand hygiene and PPE. It also involves, for instance, the distribution of team members during rounds, the choreography of performing aseptic procedures; and moving 'from clean to dirty' when examining patients. We account for these practices as the logistical work of moving bodies and objects across boundaries, especially from contaminated to clean/vulnerable spaces, while restricting the movement of micro-organisms through cleaning, applying barriers and buffers, and trajectory-planning.

Conclusions

Attention to the logistics of moving people and objects around healthcare spaces, especially into vulnerable areas, allows for a more comprehensive approach to IPC through: better contextualisation of hand hygiene and PPE protocols; better identification of transmission risks; and the design and promotion of a wider range of preventive strategies and solutions.

INTRODUCTION

Healthcare-associated infections are the most frequent adverse event, affecting hundreds of millions of hospital inpatients worldwide, annually[1]. They are expensive for health services and pose significant dangers to patients, particularly with a growing prevalence of antimicrobial resistance. In acute-care settings, hand hygiene is of major concern, with healthcare workers' hands considered the primary vector of pathogen transmission between patients and the healthcare environment[2]. The framework adopted by the World Health Organisation (WHO) for hand hygiene is the 'Five Moments', which describe when healthcare workers should perform hand hygiene during patient care[3, 4]. The 'Five Moments' concept has been designed not only for hand hygiene training and practice, but also to allow standardised observation and performance reporting across healthcare settings worldwide[3].

Hand hygiene promotion and training have been pervasive, and yet audits of compliance suggest variable results, with average compliance hovering around 40%[5]. Reasons for noncompliance may be individual (lack of knowledge, skin sensitivity) or situational (heavy workload, overcrowding, complexity of care, and lack or inaccessibility of hand hygiene resources)[5-7]. Some suggest that 'perfect' hand hygiene compliance is impractical in certain contexts[8], although compliance rates as high as 80% have been recently reported[9]. While these audit data are useful for monitoring and comparisons, they reveal nothing about the workplace settings in which healthcare workers are audited, or how well they reflect overall infection prevention and control (IPC) practice. Salmon *et al*, for instance, describe how the 'five moments' should be altered when patients are located so close together that their 'patient zones' overlap[10]. Jumaa points out that hand hygiene, alone, is unlikely to be successful in the presence of other factors, such as overcrowding, or inadequate environmental hygiene, staffing levels, and education[11]. Cole argues that the emphasis on hand

hygiene auditing, without respect for situational factors, results in unreliable and inappropriate performance measures[12].

Proponents of hand hygiene are now calling for less emphasis on auditing and more on effecting practice change, whilst still keeping the five moments of hand hygiene as the focus[13]. Our study contributes to this call for practice change. However, we look instead at the *in situ* activities and local circumstances where hand hygiene *and* other precautions might be required.

We used video-reflexive ethnography (VRE), an interventionist method for learning and improvement, which provides participants with timely audio-visual feedback of work practices, and the opportunity to reflect on them together (outcomes of the intervention have been reported elsewhere[14]). During the intervention, we observed that the IPC practices of hospital staff primarily involved preventing microbial cross-contamination, and that this involved more than the "standard" or "transmission-based" precautions prescribed in IPC manuals[15]. In fact, these practices were often inseparable from routine clinical care, since any interaction with patients or their environment creates a risk of cross-contamination.

We therefore decided, post-intervention, to analyse the ways in which healthcare workers prevented cross-contamination in videoed and observed clinical interactions, and how they discussed IPC during interviews and reflexive sessions. Our aim was to discern any underlying principles that might apply to their IPC work. Our analysis was also guided by Mesman[16], who described how 'sterility' (asepsis) for procedures is produced and maintained in a neonatal intensive care unit through careful arrangement of the space (or 'spatial' dimensions) of the ward. These involved the mapping of the ward into clean/dirty domains, and open and restricted spaces, using folding screens and symbolic markers such as surgical drapes.

From this literature, we found it useful to consider IPC in terms of the movement of people and objects across healthcare spaces. Also, we borrow her term 'boundary work', to account for the mapping of different areas – such as the ward environment, patient rooms, patients' wounds etc. – as potentially or known-to-be contaminated, clean and/or vulnerable. As our study also included care practices in non-sterile spaces, we

extend her use of the term to address also the work involved in regularly moving bodies and objects *across* these boundaries without also moving harmful microbes. To note, 'boundary work' also has a long history as a term, used differently, to denote the discursive work of delineating disciplinary boundaries, especially around science[17] In this paper, we elaborate on our spatial conceptualisation of boundary work, following Mesman, and apply it to problems and solutions identified during the VRE process.

METHODS

This paper reports on a VRE study that was part of an ongoing 3-year multi-method project focusing on IPC in two hospitals in New South Wales, Australia. The broad aims of the project were to facilitate a reflexive learning process for staff to improve their IPC practices and thereby reduce rates of healthcare-associated infections in these units.

Video-reflexive ethnography (VRE)

VRE is an approach that engages frontline hospital staff in quality improvement, by combining ethnography (the observation and analysis of practice) with video feedback of clinical practice[18]. The method engages directly with participants to make sense of their own practices, beginning with ethnographic methods such as observation and interviews, followed by videoing of work practices and participants' accounts of their work. Selected footage is shown to participants and their colleagues in researcher-facilitated 'reflexive sessions', carried out as semi-structured focus groups designed to encourage discussion around issues elicited by the video footage.

The video feedback and reflexive discussions are designed to facilitate group learning[19, 20]. The video footage provides rich feedback about current ways of working, inviting participants to discuss their work 'as it really happens', and to devise solutions or strategies that work within these realities. VRE has been used successfully to facilitate improvements in multiple clinical settings[18, 21, 22].

In this study, fieldwork took place in three phases, over a period of three months in a 16-bed intensive care unit (ICU) in Hospital A and over six months in two adjacent general surgical wards (with 29 and 37 beds) in Hospital B. We recruited a total of 177 participants; their details and the overall study design is summarised in Table 1.

Table 1 Study design using video-reflexive ethnography

	Hospital A (ICU)	Hospital B (2 surgical wards)
Participants	90 participants were recruited, comprising 49 nurses, 8 nursing students, 20 doctors, 3 medical students, 5 allied health practitioners and 5 administrative or cleaning staff	87 participants were recruited, comprising 52 nurses, 2 nursing students, 20 doctors, 1 medical student, 2 allied health practitioners, 6 administrative or cleaning staff and 4 patients
Phase 1 Interviews and observations	30 semi-structured interviews with a range of staff were conducted, including 18 nurses, 7 doctors, 2 cleaners, 1 medical student, 1 nursing student, 1 wards-person and 1 dietician. Field observations were carried out and recorded in field notes by the researcher (SH), an experienced hospital ethnographer.	16 semi-structured interviews were conducted, with 12 nursing staff, 1 doctor, 1 cleaner and 2 senior general services staff. Phase 1 was abbreviated in Hospital B, due to the limited availability of staff for interviews. Instead, more informal field interviews were conducted, and more observations and field notes undertaken.
	Interviews and observations focused on identifying the routine activities of the ward and on how IPC was (or was not) part of them, according to participants. At each site, an initial content analysis of field notes and interview transcripts was undertaken to guide phase 2 of the study.	
Phase 2 Videoing and reflexive sessions	Videoing focused on routine activities of the ward, guided by interview data. Footage was then edited into clips, 2-10 minutes long, to be shown to stimulate discussion during reflexive sessions. Footage was chosen for feedback if: it showed a routine activity requiring attention to infection prevention and control; and/or if participants stated an interest in viewing particular footage. Reflexive sessions were facilitated to encourage discussion around IPC in the footage. Where cross-contamination risks were identified, participants were encouraged to consider how they might practically overcome these risks. Reflexive sessions were video- and/or audio-recorded and transcribed for analysis. Content and thematic analyses were carried out, to describe the main features of the reflexive discussions, as well as the themes that emerged in how clinicians discussed IPC issues. Both the content (problems identified, solutions offered, etc.) and and a selection of thematic findings from these analyses were presented to participants during feedback sessions in phase 3.	
	We facilitated a total of five reflexive sessions (3 with nurses, and 2 interdisciplinary sessions with both doctors and nurses).	We facilitated a total of 18 reflexive sessions (7 with nurses, 3 with infection control practitioners, and 3 with doctors).
Phase 3 Feedback sessions	One feedback session was conducted with the senior ICU doctors.	Two feedback sessions were conducted for the nurses, one for the doctors, and one for the infection control practitioners.

Post-intervention analysis	Following the completion of fieldwork, a post-hoc analysis using a modified constructivist grounded theory approach[23] was undertaken with the data created from all three phases and wards, to produce the findings presented in this paper. Additional thematic coding was undertaken of all interview and reflexive session transcripts, during which we developed initial codes relating to IPC practice such as 'crossing clean/dirty boundaries' and 'making clean/dirty distinctions'. Instead of collecting more data through theoretical sampling, we performed a process of abduction[24] though iterative comparison of our codes with each example of IPC work that was found in our data (especially drawing on the video data). Correspondingly, our reading of the literature[16,25] on the spatial dimension of IPC contributed the terms 'boundary work' and 'buffers', which we have adopted and extended in this paper to account for our data.

Ethics approvals for this study were obtained from the University [redacted] and [redacted] Local Health District Human Research Ethics Committees. Written consents for observation, interviews and videoing were obtained in person; verbal consent for the use of video footage was sought from participants after videoing and before edited clips were shown during reflexive sessions. Participants could ask for video recording to be stopped at any time.

FINDINGS

We found that the IPC work carried out by participants in our study included more than the standard and transmission-based precautions described in hospital guidelines. Following earlier work on the geography of patient safety[16, 25], we developed a logistical explanation to account for these wide-ranging activities as 'boundary work'. In the following sections, we illustrate this concept through descriptions of clinical activities that were videoed and discussed during reflexive sessions. As the VRE method is interventionist and focused on improving practices, participants were encouraged to identify good practices as well as problems, with a view to sharing or developing locally-meaningful solutions. We describe microbial transmission-prevention practices broadly at first, to illustrate the concept of boundary work, then apply the concept to examining two kinds of contamination risks and their solutions discussed during reflexive sessions.

Beyond hand hygiene and PPE

The recording of footage was designed to capture a broad range of clinical activities[18], enabling us to attend to behaviours beyond those usually audited for IPC compliance. The following vignette is taken from footage of a routine ward round by a team of junior doctors:

> The team gathers outside a single room. Contact precautions require staff entering the room to wear a gown and gloves. The registrar dons her PPE and enters the room to speak to the patient. She draws the curtains to give the patient privacy, potentially contaminating her gloves. She is aware of this risk and disinfects her gloves with alcohol-based hand rub, albeit potentially damaging the glove material.
>
> Subsequently, as she examines the patient, she calls for help from her team. Some don PPE to enter the room and assist her, as 'clean' hands compared to her now-contaminated ones; others leave to fetch equipment from other parts of the ward.

When reviewing this footage afterwards, team members suggest that they could also have assisted her at the start, preventing the potential contamination of her gloves.

> D2: We could have helped her. There's five of us there.
>
> D1: Yeah, we're just standing there doing nothing. We could have gone in and closed the curtains for her.
>
> (Reflexive session with doctors and infection control practitioner, 2 May 2013)

This 'routine' patient encounter demonstrates how hand hygiene and PPE are necessary but insufficient elements to describe how these doctors are trying to prevent cross-contamination. First, they organise themselves inside and outside the room as a team, which is already a departure from individually-focused guidelines. As a team, they assume different roles and physical positions, as well as using hand hygiene and PPE to maintain boundaries between the ward, the patient's environment (the curtains), and the patient herself.

Transmission-prevention as boundary work

Boundary work here refers to the logistical work involved in demarcating spaces, to limit transmission of pathogens from one to another, particularly from potentially-contaminated or colonised, to "clean" or "vulnerable" places, such as invasive devices

attached to patients. Boundaries can be physically demarcated, such as the doorways of single rooms, or materialised in the gowns and gloves used by staff to separate their bodies from patients and patients' environments. The integrity of these boundaries are however held in the minds of staff and maintained (or breached) by their behaviours – such as knowing whether or not their hands have touched potentially-contaminated objects, exemplified by the doctor who is aware her gloved hands are no longer 'clean' after touching the curtains.

Another example is when the doctors ask the infection control practitioner during the reflexive session about respecting the boundary of the single room (which usually requires contact precautions when entering), explaining why the rest of the team initially gathered in the doorway. The infection control practitioner (ICP) explains that the boundary would only be breached by their behaviour inside the room, rather than the act of entering the room.

> D3: So, we just sat out because as a precaution, just the person who's examining goes inside and the folder and anything… nothing goes inside.
>
> ICP: You can still bring [the patient's folder] in and stand inside the room but as long as the person who's holding it isn't actually leaning on anything.
>
> D1: So, for any infectious patient you don't have to just stand in the [doorway] because we all just stand in the doorway. So, you can go in as long as you don't…
>
> ICP: You can go in as long as you haven't physically touched anything. So, if you're someone who's a leaner, likes to lean on stuff, then glove and gown or stand at the door. But, you can walk in [and not touch anything].
>
> (Reflexive session with doctors and infection control practitioner, 2 May 2013)

This particular boundary is therefore not the doorway *per se*, but the distinction between the inside of the patient's room and outside (in the form of healthcare workers' bodies) that is breached if they touch anything in the room (or patient "zone"). Hand hygiene and PPE help to maintain this boundary. When gloves or gowns become contaminated through delivering care, they are removed and hand hygiene performed before they exit the room to prevent transmission of micro-organisms from within the room to the ward.

Hand hygiene and PPE are the main strategies for protecting healthcare workers' bodies from contamination; but as described above, hand hygiene alone is not enough when there are not enough hands. It can also be inefficient (and wasteful) to be repeatedly gowning, gloving and doing hand hygiene if entering and leaving the room frequently, which is why the infection control practitioner notes the acceptability of entering without PPE if not touching anything within the room. This is also why the distribution of tasks within the team (one person to handle contaminated surfaces so that another remains 'clean', another to fetch items from the ward etc.) is *also* IPC work.

PROBLEM 1: Things other than hands

Healthcare workers' bodies and hands are not the only things that cross boundaries. Other boundary-crossing items mentioned during reflexive sessions included: kidney dishes, patients' beds, patient charts and notes, trolleys, pens, scissors, vital-sign monitoring equipment, bags, food trays, bins (and rubbish) and surgical tape.

The care normally taken by healthcare workers to attend to these objects can be seen in videoed procedures, including routine wound dressings when nurses prepare their dressing trolleys carefully: cleaning the trolley before placing packets of dressing supplies on it, then opening those without touching the contents, demarcating a boundary between the (potentially) contaminated environment and the clean equipment. In setting up the clean space of the dressing trolley, nurses create a kind of working 'buffer zone' on the trolley, which extends to their hands, after they have performed hand hygiene and donned sterile gloves.

This buffer zone gives them access to another bounded area – the (now open) wound site – allowing nurses to move to and from the wound, cleaning it using aseptic technique without contamination from the surrounding environment. When the procedure is complete, the boundary between the wound and the environment is maintained by a clean dressing placed over the wound, after which the buffer zone of the trolley (and the nurse's hands) can be "decommissioned" or repurposed to contain contaminated rubbish and dressing items that have come into contact with the patient's wound. The trolley and its objects are then cleaned or discarded and hands washed, to prevent any pathogens from the wound contaminating the environment.

In our video footage, participants also observed that some objects regularly crossed otherwise well-maintained boundaries. First, they noticed how various items, such as doctors' bags, pens and papers, often crossed between patient zones, people and work surfaces, without cleaning. Second, they noticed that equipment such as rolls of surgical tape were often used by nurses with potentially-contaminated hands and left at the bedside to be used later for procedures involving vulnerable, clean sites, such as intravenous (IV) lines. Consider the following exchange between nurses at a reflexive session:

> N1: I've taken a dressing off… and I've poured some saline on and then I put a clean bit of combine or gauze or whatever, wrap it up in a clean bluey… then it's got to have tape on it and often I go, 'Oh, I need some tape. There's the tape.' And my hands are contaminated.
>
> N2: Like you just saw with me [in the video clip]. [N1] could have used that tape with dirty hands, which she's used to take down a dressing and then I've picked it up to put on that IV line.
>
> - Nurses (Reflexive session with nurses 15 April 2013)

In this case, the roll of surgical tape is potentially contaminated from being handled by a nurse who has just touched a patient's wound; it then crosses a boundary into a vulnerable area on (the same or another) patient's body. Ideally, objects that become contaminated are cleaned or discarded, but rolls of tape cannot practicably be cleaned, and nurses felt it would be wasteful to discard the unused portions. Alternative solutions were offered, including wall-mounted tape dispensers or single-use rolls of tape. The latter suggestion was later undertaken by a nurse unit manager.

PROBLEM 2: Unattended boundaries

Early in the fieldwork, participants frequently described boundaries that were ignored or unattended, such as by colleagues or visitors going into infectious patients' rooms without hand hygiene or PPE. During the reflexive sessions, other neglected boundaries were identified through reviewing the footage, such as a lack of distinction between the patient and his/her immediate environment (e.g. a nurse touching potentially contaminated curtains and then touching a patient to give an injection without hand hygiene). Particularly crucial was the failure to draw boundaries around different sites on a patient's body, particularly around catheters, IV lines, drains, wounds and other points of 'entry' into patients' bodies and bloodstreams. One example viewed and

discussed during the sessions involved a nurse dressing two wounds at the same time using the same equipment, risking transfer of pathogens between wounds.

> "Oops. The worst part is I used the same [forceps] for the other leg. […] I thought about it and then I thought, 'Oh, but it's the same patient so it's OK. It's not a different patient.' But then last time we were talking about it… it was on two different parts of the body. I probably should have [used different equipment]." - Nurse featured in clip (Reflexive session with nurses, 15 April 2013)

Drawing boundaries between different parts of the same body is important, as people can carry pathogens such as MRSA on their skin without being infected, and asymptomatic colonisation is a major risk factor for subsequent localised or systemic infection[26]. Apart from hand hygiene, other strategies that participants prescribed for managing this risk involved planning and preparation ahead of time, such as having extra equipment on hand (e.g. forceps) in order to have different equipment for different wounds. Interestingly, it was also suggested that healthcare workers could plan ahead the *order* in which they interacted with patients, in order to move 'from clean to dirty':

> [The registrar] was holding on to the {wound] drain… the drain looked like it was having pus dripping out of it… and then with the same pair of gloves she was [touching] the IV bags. We would ask that you do the clean [task] first and then the dirty. So, you know, if she didn't touch the IV bag, it would have been fine. - Infection control practitioner (Reflexive session with doctors and infection control practitioner, 2 May 2013)

Carrying out actions in a particular order also applied to gathering equipment and preparing trolleys for procedures. Thus, planning and preparing ahead, and moving 'from clean to dirty' meant that healthcare workers could navigate across boundaries more smoothly, performing hand hygiene, cleaning items or donning PPE efficiently and appropriately. This trajectory planning reflects healthcare workers' attention to the boundary-sensitivity of their IPC practices.

DISCUSSION

In this paper, we describe transmission-prevention practices as boundary work, inextricable from routine patient care. As defined here, boundary work involves the

logistics of safely moving bodies and objects across multiple, often invisible boundaries demarcating potentially or actually contaminated, from clean or protected spaces. These boundaries can be materialised using PPE or dressings (for example), but their integrity is primarily held in the mind, and maintained or breached through (in)attention and behaviour. In crossing these boundaries, moving from 'clean' to contaminated spaces is unproblematic, whereas moving in the other direction requires cleaning or application and removal of barriers such as drapes, gowns or gloves.

We found that healthcare workers also created buffer zones, giving them 'room to work in' when carrying out complicated patient-care, without having to constantly clean or discard items. Buffer zones are clean spaces, whose boundaries can be stabilised, maintained, and "decommissioned" when no longer needed. Examples include dressing trolleys and sterile set-ups for central line insertion. An assisting colleague's clean hands can also act as a buffer.

Both boundary work and buffers are terms we have taken from from Mesman's analysis of the spatial production of asepsis during intravenous line insertions[16]. We extend her work by applying these terms to non-sterile work, thus demonstrating the complexity of maintaining these buffers and boundaries whilst also needing to frequently cross from contaminated to clean/vulnerable areas.

What the concept of boundary work offers for healthcare professionals is, first of all, a broader perspective on what transmission-prevention can and *should* involve, extending beyond what is prescribed in current protocols. This includes the distribution of team members inside and outside an isolation room, or keeping track of items that cross boundaries and become contaminated, like rolls of surgical tape. Boundary work also accounts for strategies like planning ahead to have sufficient equipment, and streamlining work trajectories to minimise movement from contaminated to clean/vulnerable areas.

Boundary work can also aid in contextualising current hand hygiene and PPE guidelines, by revealing their underlying spatial logic. For instance, the 'five moments for hand hygiene' protocol was developed from the differentiation of healthcare settings into distinct geographical areas: the patient zone and the healthcare zone, as well as two

kinds of critical sites within the patient zone: 'clean' sites requiring protection from pathogens, and body fluids or sites which potentially carry them[3]. The five moments correspond to the points at which hands cross the boundaries between these zones.

Enacting the five moments would, therefore, be boundary work as we describe it. However, the WHO 'five moments' poster[4] blurs this underlying spatial logic, by numbering and naming these moments to correspond with typical workflow patterns – e.g. referring to before and after "a clean/aseptic procedure" (a broad category of aseptic or invasive tasks) rather than 'clean sites'. The problem with assuming the general applicability of these workflow patterns is that clinicians often find typical workflows interrupted and complicated by the constraints commonly reported as reasons for poor hand hygiene compliance.

In short, the spatial logic that underlies the five moments is not made explicit; this can be confusing for healthcare workers needing to apply them to scenarios that do not correspond to standard workflow patterns. The five moments do not seem to apply, for instance, to touching a 'clean site' on a patient, such as the seal on an IV bag, after having *already* touched the patient, when no clinical procedure is involved – such as when moving it out of the way in a crowded room.

In summary, boundary work provides healthcare professionals and educators with a logistical framework, to analyse their work for contamination risks, and improve efficiency. When preparing equipment for a procedure, or deciding in what order to examine a patient, clinicians might consider not only *what* boundaries they have to cross, and *how* (cleaning, using PPE, etc.), but also how to travel *more smoothly* across them, whether by preparing extra equipment, a trolley, asking a colleague for assistance, or mapping an alternative route. Furthermore, in drawing attention to often-overlooked boundaries (especially around invasive sites on patients asymptomatically-colonised with MRSA), healthcare workers might also become more sensitive to hidden cross-contamination risks, such as unclean objects other than hands, or gloved (but contaminated) hands that enter vulnerable areas.

The framework may be particularly helpful when policies are ambiguous, silent or seemingly inappropriate. It is possible, for instance, that the excessive hand-hygiene

demands described for healthcare workers in some circumstances[27] could be reduced if clinicians were able to develop trajectory-planning or buffer zone strategies such as those described above. An understanding of boundary work could also assist in the design of healthcare spaces, to include not only boundaries built for safety (e.g. isolation rooms), but also structures that could act as buffers across these boundaries, such as shelving or hooks outside of the rooms, for staff to place items (e.g. bags, kidney dishes, medical charts etc.), freeing their hands for hand hygiene and donning PPE when entering these rooms[14].

LIMITATIONS

This study was primarily interventionist, aimed at enabling participants to analyse their own IPC practices and develop solutions to problems they identified; it was not designed specifically to reconceptualise IPC work. Nevertheless, our constructivist, grounded theory approach to post-hoc data analysis allowed us to develop these arguments. Our findings are applicable to the sites where we conducted our research, and would benefit from being refined through testing and comparison in other acute-care or community-based healthcare settings.

CONCLUSION

The spread of pathogens is so much a part of everyday clinical practice, that an emphasis on compliance with current protocols for hand hygiene and PPE *alone* is insufficient to prevent healthcare-associated infections. Our study demonstrates the need to attend to the broader logistical work involved in moving bodies and objects into clean spaces and vulnerable patients bodies, without also moving harmful micro-organisms. Boundary work provides a framework to guide this logistical work in education and clinical practice..

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