

Barriers and bridges to infection prevention and control: results of a case study of a Canadian surgical unit

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ABSTRACT

Infection prevention and control (IP&C) of multidrug-resistant organisms is an increasing challenge in hospitals worldwide.

Objective

In this study, we attempt to identify the barriers and bridges for IP&C on a surgical unit at a large urban Canadian hospital.

Methods

A socio-ecological perspective on health systems was adapted from work in ecological restoration and healthcare to inform the use of multiple participatory research methods including unit observations (n=3), review of relevant policies and procedures, four practitioner-led photo walkabouts of the unit (n=6), three photo elicitation focus groups with practitioners (n=13), and the review of related IP&C data.

Results

The findings indicate that despite active management support for IP&C, many challenges exist in the hospital environment. Key barriers included high patient occupancy rate, hospital design, the use of workarounds to adapt to these challenges, several common problematic practices, and the culture of the team or organization.

Conclusions

These findings confirm many challenges for IP&C that have been outlined in other literature for contemporary acute care environments. For example, to reduce the use of problematic workarounds, staff must be engaged in health system and organizational decision-making processes that affect their workload, workflow, and daily practices on the unit. Yet, the existence of problematic gaps between

clinical, organizational, and health system governance has been identified as an issue for safety in healthcare. Additional research is needed to further our knowledge on how communities of researchers, practitioners, managers, and policy makers can collaboratively engage in studying and assessing their environments to design and implement meaningful, sustainable IP&C improvements.

KEY WORDS:

infection prevention and control, case study, socio-ecological thinking, visual research

INTRODUCTION

Healthcare-associated infections continue to pose formidable challenges to improving the safety of hospital care. In a 2002 point prevalence study of Canadian major teaching hospitals, 10.5% of hospitalized patients were experiencing an infection acquired while in hospital (1). Furthermore, the incidence rate of methicillin-resistant *Staphylococcus aureus* (MRSA) in Canadian hospitals increased from 0.46 to 8.04 per 1,000 admissions between 1995 and 2006 (CNISP, 2007). While MRSA infection rates decreased in US hospitals over a four-year period between 2005 and 2008 (2,3), healthcare-associated infections (HAI) continue to be a cause of increased morbidity, length of stay and cost to healthcare systems (4-6).

The evidence to date supports the use of multiple interventions to prevent and control methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant *Enterococci* (VRE) and other multidrug-resistant organisms (MDRO) (7). Recent reviews of hand hygiene interventions (8) and infection prevention and control (IP&C) programs

(9) support earlier calls for the use of a socio-ecological approach to improve our understanding of the system for IP&C as a whole (10,11). The socio-ecological approach invites greater examination of the routines and compromises made in the everyday work environment, as negotiated in a system of actors, policies, regulations, physical surroundings and culture within the hospital environment and within the wider health system and society. To advance the development of a socio-ecological perspective on hospital IP&C, two case studies were conducted, one in April 2008 at a Netherlands hospital, a facility reporting rates of MDRO below 1%, and a second study between September and December 2008 on a surgical unit at a Canadian hospital which reported higher rates of these pathogens. The aim of the research was to better understand the conditions for IP&C practices within this Canadian acute care environment.

OBJECTIVES

The specific objectives of this study were:

1. To observe the overall work environment including IP&C practices on the target surgical unit.
2. To analyze the policies and procedures aimed at the prevention and minimization of MDRO in the hospital and unit environments.
3. To analyze the barriers and bridges to IP&C that practitioners identified in visual narratives of their unit environment.
4. To collect monthly specific IP&C related data, and the acquisition rates of MRSA, VRE, extended spectrum beta-lactamases (ESBLs) and *Clostridium difficile* infections (CDI) on the unit and in the facility overall.

The quantitative data (Objective 4) were collected for further comparative case study work. The purpose of this paper is to discuss the qualitative aspects

(Objectives, 1, 2, 3) of the Canadian case study results.

METHODS

The socio-ecological perspective of this study draws on related work in the fields of ecosystems management and research (12), economics (13), restoration management (14-17) and health systems (18,19). A socio-ecological perspective provides “a framework for understanding the diverse personal and environmental factors and the interrelationships among these factors” (20, p.45). In the present study, this socio-ecological lens was applied to a participatory approach of citizen science aimed at fostering the reciprocal sharing of scientific and local indigenous knowledge, allowing scientists and communities to develop integrative knowledge about local places as well as about systems as a whole (18,21-23). This concept assumes a collaborative process

TABLE 1: Core elements of a proposed socio-ecological framework for studying IP&C (10,11,18,26)

Core Elements	Definitions
Citizen science	The notion of citizen science refers to individuals working collaboratively with communities, governing bodies and others to conduct research and generate evidence (16,18,19,22). This includes using a participatory and collaborative approach to the design, conduct and analysis of infection prevention and control research, involving members of the community in data collection, data analysis and knowledge translation wherever feasible and appropriate and seeking multiple sources of data (including sources of indigenous or local knowledge) and using a variety of methods to develop integrative knowledge about local places as well as the larger system (19,23-25).
Place ethic	According to Buell (51) and Higgs (16,17), a place ethic is “enacted in the ways that we treat each other and the places we share.” Place ethics refers to individuals’ respect for the history, culture, knowledge and rituals. In this research, thinking about place ethics includes inquiring about what people see as important in the care of each other and their environment, how they reinforce and support each other to value infection prevention and control, and whether respect for historical knowledge informs how a place functions over time.
Engaged practice	The concept of engaged practice refers to the creation, implementation and evaluation of sound practices that are evidence-informed (14-18). This includes self monitoring and adjustment of daily infection prevention and control practices (e.g.: audits, equipment checks), using local feedback processes to continually improve workflow, work design, and processes at the individual and team levels.
Adaptive learning and growth	The idea of adaptive learning and growth refers to the development and use of knowledge translation strategies that disseminate learnings across individuals, teams, organizations and system levels to drive sustainable changes (12,15,17,18,25,52). This includes evidenced-informed management of MDRO, screening policies, resource allocation decisions about patient care staffing, housekeeping, availability of equipment and supplies, staff and public education policies and funding.

between researchers and participants in conducting the research, including how the data is collected and analyzed and how research findings are shared (19,23-25). The core elements of a proposed socio-ecological framework for studying IP&C (10,11,18,26) that guided the research design and conduct of the study are described in Table 1.

Setting and case study selection

The hospital is a 1,174-bed multi-site urban tertiary hospital. In 2008, the population of the city where the study was conducted was 898,150. There were a total of 1,598 acute care beds amongst the adult acute care hospitals in the city. The case study was conducted on a 40-bed general surgical, ear, nose and throat (ENT) and ophthalmology unit that also included off service patients due to the overcapacity issues at the hospital.

Design

A case study approach (27,28) using a socio-ecological perspective on health systems was used. Multiple methods were used to explore the conditions for IP&C. The methods included unit observations, practitioner-led photo walkabouts (17,19) and communal photo elicitation forums (18,19,29), review of relevant organizational documents, and collection of other data such as MDRO incidence and prevalence rates, bed occupancy, staffing ratios and governance structure.

The photographic research methods consisted of practitioner-led audio-taped photo walkabouts with photo narration and communal photo elicitation forums. The photographic research methods helped to

engage the local participants to share their ecological knowledge of the unit.

Data collection

Following ethical review and approval, three unit observation sessions were performed to gain a perspective of the environment and the IP&C practices. Subsequently, four practitioner-led photo walkabouts were conducted with an IP&C professional and clinical manager, a senior nurse, a physician and two members of the housekeeping staff (n=6) to obtain individual perceptions of the infection control-related issues and strengths on their unit. Three separate photo elicitation focus groups were conducted to review and further comment on the photographs and narratives collected during the walkabout (n=13). The photo elicitation sessions were held with managers (n=4), health professionals (n=5) and clinical support staff (n=4). During these sessions, participants were asked to provide written comments and also to share with the group their thoughts as select walkabout photographs and related potential themes and issues were presented for discussion. Staff were informed about the unit observations. Field notes were recorded after each photo walkabout and each photo elicitation session to note researcher perceptions about the environment at these times of data collection as well as participant dynamics during data collection. The hospital's infection control policies and procedures were collected. Monthly IP&C surveillance data were collected for January to December 2008.

Data analysis

Data analysis was an iterative process. Atlas.ti version 5.3 software (ATLAS.ti Scientific Software Development GmbH, Berlin) was used to support the analysis. Once the themes were identified from the qualitative analysis, other IP&C findings were integrated. The core elements of the proposed socio-ecological framework for studying IP&C (Table 1) informed but did not limit the coding, categorization and theming of the qualitative data.

Multiple methods were used to minimize bias from the researchers' preconceptions. A researcher's journal was used to record reflections on research related activities. Local experts reviewed the data collected. Each photo walkabout and focus group session was audio-taped and transcribed. Study field notes and transcripts were compared with the other data sources where applicable, and commonalities and discrepancies were coded in the Atlas.ti software system.

RESULTS

The themes derived include: (1) Considerable IP&C challenges were inherent to the design of the clinical unit; (2) Nurses and other staff employed a wide variety of workarounds to try to adapt to the design of their care environment; (3) Participants viewed organizational and team cultures as integral to the way they enact IP&C practices in their workplaces; (4) Common practices posed barriers to sound IP&C; and (5) In the face of

FIGURE 1: Alcove outside patient rooms (HK-24)



FIGURE 2: Water splashing on side of sink (MG-59)



numerous system constraints, participants viewed engaged leadership as important for IP&C. Each theme with supporting data is discussed below.

Considerable IP&C challenges were inherent to the design of the clinical unit

Joseph (30), Joseph et al. (31) and Ulrich et al. (32) support the notion that the design of the acute care environment such as the workplace design (e.g. unit layout), the work design (e.g. the organization of work, workflow), and other attributes have an impact on the IP&C practices. On the study unit, an example of a positive workplace design was the location of the hand hygiene materials on the unit (Figure 1). In the alcove between two patient rooms, there was one sink for staff use which was stocked with a wall mounted soap dispenser, paper towels, a garbage container with no lid, and gloves on a rack in various sizes. A wall-mounted alcohol-based hand rub (ABHR) dispenser is located between the doors of two patient rooms. In addition, dispensers are also located near the two clean utility rooms, and elevators (Observations, P1, 30). There is also a container with hydrogen peroxide disinfectant wipes mounted on the wall outside each patient room to clean equipment and surfaces (Observations, P1, 31). During a walkabout, the physician participant explained that:

...we do have sinks outside each pair of rooms and we also have dispensers for ABHR for hand cleaning.

Obviously just looking around doesn't tell us how well they're used or not used, and my understanding from various people I know in the area is that to get good sterilization of your hands you need to wash or use the ABHR, but it would be interesting to see what the utilization of that is... (PW physician, P7, 49).

Based on the results of the hand hygiene observations between April 2008 and March 2009, the hand hygiene compliance rates were 50.3% before patient contact and 64% after patient contact in the hospital overall.

Another design issue on the unit is the shallow sink and gooseneck spout (Figure 2). As one participant identified:

...if you go to all the sinks, they'll have either face cloths or towels next to them because of the splashing... (FC management, P9, 405).

Overall, the unit design presented several inherent challenges to optimal IP&C. In turn, as the next theme illustrates, many of these design challenges appear to be linked to the development of workarounds.

Nurses employed a wide variety of workarounds to try to adapt to the design of their care environment

Amalberti et al. (33) define workarounds as the "adaptation of procedures by workers to deal with the demands of the work" (p. i67). They explain that staff naturally migrate to the boundaries of acceptable practice and deliberately deviate from standard procedures to adapt to deficiencies of complex, over-

burdened healthcare systems that cannot reliably respond to ongoing, competing demands. One relevant workaround at the study site is the storage of a mix of clean and dirty equipment in the hallway in response to the lack of appropriate storage space on the unit (Figure 3). The equipment includes walkers, wheelchairs, chairs, scales, lifts, blood pressure machines, oxygen tanks, bags of dirty linen, carts with pillows and gowns, isolation carts and linen carts in the hallway (Observations, P1, 21). During the walkabout with the physician, the participant explained that:

...as I walk down this corridor, one of the first things that strikes [me] is there's an awful lot of stuff stored in the corridor as opposed to in a discreet area. Some of that stuff is bed linen [that] is going to be used for patients and it's sitting here out in the breeze and I don't know if that's significant or not... (PW physician, P7, 15).

Similarly, another participant pointed out the following:

See all this clutter here? This is because of the lack of storage space that they have to put these carts and poles and pumps in the hallway. On a positive side at least it's all on one side (PW housekeeping manager, P5, 36).

During a focus group, a participant explained that there is:

...no label to say whether [the equipment is] clean or dirty. And usually you get a bad surprise when you pull up the seat and you see, I guess [this commode] has not been cleaned. It's just the general

FIGURE 3: Equipment stored in hallway (NS-04)



FIGURE 4: Isolation cart (MG-18)



principles of the clean should be put away somewhere as opposed to just out there [in the hallway] (FG management, P9, 443).

According to a key informant, housekeeping staff were to put a “clean” label on the equipment and nursing is then to remove it upon use. However, it was also shared that this process has not been audited to see how well this is followed.

Another workaround which participants highlighted was the use of hallway isolation carts on the unit which are not available for every room (Figure 4). During the focus group with management, a participant explained that:

...there are isolation carts for isolation rooms but we always have to come back to routine. You should have [personal protective equipment] available routinely for all patients in an ideal world... (FG management, P9, 359).

During the walkabout with the clinical manager and the infection control professional, the participant explained that:

...if your piece of [personal protective equipment] is not nearby it always makes it [less likely for] people [to] actually go into the main supply room to get [one] so it does seem like a really good idea, to have everything within easy reach because accessibility makes a difference in terms of whether or not it'll be used (PW clinical manager and ICP, P4, 65).

Many other workarounds were identified by participants including the storage of a mix of clean and dirty equipment in the hallway, the constraints of the work space, the access to supplies during the provision of patient care, and leaving equipment in patient rooms. The prevalence of these workarounds suggests that they are seen as inevitable within the overall culture of the unit. This has implications for the next theme, which is that participants see their team and unit cultures as closely linked with IP&C in their care environment.

Participants viewed organizational and team cultures as integral to the way they enact IP&C practices in their workplaces

Siegel et al. (34) argue that a culture of

safety refers to “a work environment in which a shared commitment to safety on the part of management and the workforce is understood and maintained” (p.594). In the Canadian framework of inter-professional safety competencies, Frank et al. (35) describe a culture of patient safety linked with “attitudes, activities and enduring ethical values that are conducive to the safe delivery of patient care” (p. 5). Several exemplars that potentially promote or hinder the organizational and team culture on the study unit are described below.

There was observable tendency of unit staff to congregate in apparent effort to promote teamwork. For example, although there were computers spread around the unit and in some areas outside patient rooms, nurses frequently migrated to the nursing station to chart and share information with each other and other team members (Observations, P1, 34). The first author also observed nurses socializing and eating chocolate received from a family at the nursing station (Observations, P1, 34). During the walkabout with the clinical manager and the infection control professional, the participant explained that:

What I tend to do 'cause I believe in team building...and recognition and things like that, I encourage the staff to use the conference room to have these type of things, either drinks or food and then clean up after please (PW clinical manager and ICP, P4, 712).

During the same walkabout, this participant added that:

Staff are also participating and making sure the environment is clean and welcoming, I mean it's a team effort right? (PW clinical manager and ICP, P4, 1272).

Examples of communication efforts to promote a safety culture were also demonstrated on the unit. For instance, when a patient is discharged, the isolation sign was left up until the housekeeper cleaned the room. The housekeeping manager explained that:

On the bottom of each sign, it says that only housekeeping staff can remove the sign...and then when the housekeeper removes it and he does all his checklists, he hands this in as proof that it was done using the

proper techniques (PW housekeeping P5, 638).

Just as sharing information could contribute to fostering a culture of safety, not sharing necessary information could hinder it. For example, it appeared that not all nurses were aware of the cleaning practices on the unit. During a photo walkabout with a nurse participant, it was noted that:

I think it's varied. I think if you talk to different nurses you're going to get a different impression but most nurses will wipe down their stuff in between patients for sure...but if you're using it just for one patient, I can't take it for granted that it's been done (PW nurse, P6, 487).

Overall, these examples suggest that while appropriate communication was used to promote a healthy team culture on the study unit; some inconsistencies in communicating about cleaning practices and appropriate personal behaviors (eating in certain areas, for example) in patient areas can pose barriers to sound IP&C, along with the following practices.

Common practices posed barriers to sound IP&C

Participants were concerned with some common practices that did not support infection control practices on the unit. For example, a participant explained that:

This is an example of a lift that's been cleaned...Housekeeping has cleaned it and tagged it that it's clean. Staff need to remove [the sign] if it's no longer clean because housekeeping will not re-clean it if that's still on there (PW clinical manager and ICP, P4, 1150) (Figure 5).

However, some participants questioned whether or not the practice of removing the sign before use was being followed.

For example, one participant asked:

Would somebody go out, use it and put it back not noticing that little piece of paper was there? [They should] use it, put it back, and now it's no longer clean and [the sign] stays there (FG health professionals, P10, 995).

Some participants were concerned that the equipment was not cleaned consistently before and after patient use. A nurse explained that:

FIGURE 5: Lift in hallway with clean sign (MG-52)



I do believe that it is housekeeping's responsibility to make sure that the equipment is clean but we don't have time to wait for housekeeping so we end up doing it...because we need that equipment for other patients relatively quick. But I don't believe that it is the nurses' responsibility to have that housekeeping duty (PW nurse, P6, 603).

One nurse observed that the vital signs machines are not always cleaned before use. The participant said:

I don't think that nurses consistently clean in between patients (PW nurse, P6, 505).

During the focus group with the support staff, a participant explained that:

The location of the [isolation] sign is not ideal. Sometimes I've seen [it] across the room, with tape... in the middle of the doorway. So you'll have the sign coming down and then the big piece of tape hanging there, then you can't miss it because it's in your face (FG support staff, P8, 231).

However, the isolation sign is not always in a consistent location. As illustrated in Figure 6:

The sign [is] not [always] visible enough, as a lay person may take it to be the same as other paper work (belonging to staff) and NOT read it (WC health professional, P14, 10).

Overall, many common practices were identified on the study unit as posing barriers to sound IP&C. The need to address these problematic practices relates to the next theme, which is that

participants found engaged leadership important for IP&C.

In the face of numerous system constraints, participants viewed engaged leadership as important for IP&C

Findings suggest a variety of perceived links between the quality of leadership across system levels and the quality of IP&C within the site. The need for responsive, engaged leadership pertained both to internal organizational and unit personnel, programs, and structures and to external health system decision-making and initiatives that are potentially critical to organizational and unit capacity to effectively manage IP&C.

In terms of relationships between overall health system leadership and internal organizational leadership, participant data confirms that system decision-making and organizational decisions with the potential to affect IP&C are linked. An issue that management struggles with is a mismatch between bed capacity and service demands.

The average occupancy rate in 2008 was 98.5%, with frequent occurrences of overcapacity. Bed management meetings are held daily. A clear policy and procedure has been developed to ensure communication and a consistent approach to the issues. Although there were no over-capacity or full-capacity patients admitted to the unit during the study period, when hallway admissions are needed, they have a great impact on the clutter in the hallway, patient crowding, and equipment sharing.

FIGURE 6: Isolation sign (NS-06)



Another IP&C concern that a participant elaborated on was the increased use of shared bathroom facilities in conditions of overcapacity, stating that:

Shared bathrooms which [are] another major issue for communicable or spread of infection; with the bed pressures we have ... a very mixed group of patients in one area, it's not as if we're able to segregate... particular groups of patients... there's a lot of overflow from one area to the other (PW physician, P7, 45).

On the unit, the patient-to-toilet ratio varied from 1:1 up to 4:1 ratio in the four bed rooms. This ratio is a key factor in VRE and CDI transmission (30,32). A participant explained that:

... the infection control recommendation, I know for any new renovations and building that we go on, there's always a cost issue associated with that. I think the cost, for the new parts that are being built, the hospital agreed with one bathroom for two patients, which is a huge improvement over four beds per bathroom (PW clinical manager and ICP, P4, 1384).

The importance of engaged leadership is illustrated in recent organizational decision-making regarding IP & C. Specifically, in 2008, the prevalence rates ranged between 3.9-7.1% for MRSA, 0-1.1% for VRE, 0.2-0.7% for ESBL and 2.0-4.6% for CDI, respectively. A local leadership decision supported the introduction of MRSA and VRE universal screening for all patients admitted at the hospital in that same year. All patients

admitted for an inpatient stay were tested at time of admission. Ongoing surveillance systems supported by management are also in place for other pathogens. In particular, there is ongoing clinical surveillance for new onset diarrhea where-upon patients are promptly put on isolation precautions without waiting for their results.

DISCUSSION

The findings indicate that despite active local leadership for IP&C and ongoing regional, provincial and national initiatives, many challenges exist in the hospital environment. Key barriers included high patient occupancy rate, hospital design, the use of workarounds to adapt to these challenges, several common problematic practices and the culture of the team or organization. At least some of these barriers require linked leadership across unit, organizational, and provincial levels, if not beyond.

The first barrier that transcends local leadership, the overcrowding of patients, is a significant issue in Canadian hospitals. This may be due to the number of hospital beds available for the population served. In 2008, there were 1.77 beds per 1,000 population in this city, virtually half the Canadian average of 3.5 beds per 1,000 population, and lower than the average in the Netherlands (4.3 beds/1,000 population) and in the United States (3.1 beds/1,000 population) (36). Lower occupancy rates for acute care beds should facilitate the control of HAI transmission, as research has shown that high occupancy rates are linked to higher infection rates (37-41). Adding more acute care beds to increase the total number of acute care beds per capita is one obvious but expensive response. However, the ongoing debate over emergency and hospital overcrowding suggests there is merit in exploring a more complex mix of measures that includes better access to public health and primary health care, community care, assisted living, and long term care to not only address hospital overcapacity issues in a more sustainable manner, but to also provide more effective IP&C.

Hospital design is another barrier

found in this study which crosses local and broader health system levels of leadership and decision-making, combining the effects of building codes, funding decisions, and other external requirements with local governance regarding specific environmental design issues and resource allocations, such as how much money will be spent on providing single rooms as opposed to other competing design features. The hospital's challenging design elements, including few single patient rooms, multi-bed rooms and sizes, low patient-toilet ratio, lack of storage, no housekeeping closet and no dirty utility room on the unit can have an impact on MDRO transmission.

The patient equipment stored in the hallway due to the lack of storage space on the unit can also have an influence on MDRO transmission. The evidence shows that "patient care devices may transmit pathogens if devices contaminated with blood or body fluids are shared between patients without cleaning and disinfecting between patients" (34, p. 578). Single-bed rooms with private washrooms and sinks and adequate storage space on the unit could help to reduce cross contamination (30,32).

Another barrier to IP&C at the hospital is the communication among members of the staff and family about patient on isolation precautions. The isolation signs are often found in different locations near the room door which may hinder its usefulness. Furthermore, porters or transport personnel are not always aware of the patient's precaution status until they reach the patient's room. Clear and effective communication is needed in order to foster a culture of safety. It is reasonable to question whether nationally or even provincially or regionally standardized signage and signage placement would assist practitioners and the public to collaboratively learn about and use appropriate precautions in a more consistently reliable manner. In addition, we do not currently know the impact of the limited availability of translated IP&C information in multi-cultural Canadian cities.

Despite the many barriers, some bridges to IP&C exist. In 2008, universal

MRSA and VRE screening strategies were implemented. All patients admitted for an inpatient stay were swabbed for MRSA and VRE on admission. Ideally, early identification of patients colonized with MDRO will facilitate prevention of transmission. Most MRSA and VRE guidelines recommend some form of universal (all patients) or targeted (high risk patients) screening on admission (7, 42-44) to identify patients who are colonized with MRSA or VRE.

Another bridge is the availability of hand washing sinks and ABHR on the unit. Hand hygiene is the most important practice to prevent healthcare-associated infections (45). Despite the importance of hand hygiene, research has shown poor compliance with hand hygiene practices among health professionals (46). One of the barriers to adherence with hand hygiene practices is the inaccessibility to hand hygiene products. Suresh and colleagues (47) have developed an ergonomic hand hygiene evaluation tool for organizations to assess their environment for appropriate structural characteristics. On the study unit of this Canadian hospital, sinks and ABHR are located outside of each patient room as well as other areas on the unit. Suresh et al. (47), Creedon (48), and Harbarth et al. (49) support the placement of ABHR in many convenient locations on the unit; however, according to WHO (50), ABHR dispensers should also be placed at point of care for each in-patient bed. At the same time, further research is required to determine the precise mix and dose of hand hygiene interventions that will be most effective for various specific hospital and unit contexts (8).


Clear communication and accountability processes that have been incorporated into the workflow for housekeeping and clinical staff are another bridge to IP&C. On the back of the isolation signs there are clear guidelines about the cleaning process for housekeeping staff. This not only provides instructions to the housekeeping staff, it also informs staff that as long as the sign is up, the room is not clean. Once the cleaning process is complete, the housekeeping staff removes the sign and submits it to their supervisor after completion providing accountability

for the work done. When the sign is removed, this also communicates to the staff that the room has now been cleaned. This novel, yet simple idea creates clear expectation and defines the responsibilities of the staff, thus, promoting a desirable safety competency, which is effective communication amongst team members to contribute to safe patient care (35).

Strengths of this study include the rich qualitative detail that was generated by the participatory visual approach, the active engagement of practitioners and managers in the research process and knowledge translation of the findings, and the consistency of responses and recurrence of themes between study participants with very different roles and backgrounds. A limitation to this research is that it is possible staff may have altered their behavior during the unit observations. Another limitation to the rigor of data collection is that the incidence and prevalence rates and the hand hygiene observations were collected by other hospital personnel not supervised by the researcher. Attempts were made to address these limitations by incorporating multiple methods of data collection, and checking for corroboration and discrepancy. In addition, the focus of this study was on a specific clinical unit of the hospital. While this last limitation was addressed by taking a broad socio-ecological system approach to study IP&C on the unit, future case studies involving entire organizations or perhaps even regions would provide a more comprehensive picture of some aspects of the complex phenomena of IP&C. In the absence of significant research funding, however, the larger contexts would necessarily yield less site-specific qualitative detail.

CONCLUSION

This in-depth case study provided findings related to existing socio-ecological conditions for IP&C on a surgical unit at a Canadian hospital. Many challenges to mounting an effective, sustainable IP&C program were evident in this acute care environment. Further research using a socio-ecological

perspective is needed to better understand IP&C practices as a whole, to meet the goals of improving clinical IP&C practices and reducing multidrug-resistant organism infections. Specifically, additional research is needed to further our knowledge on how communities of researchers, practitioners, managers, and policy makers can collaboratively engage in studying and assessing their environments to design and implement meaningful, sustainable IP&C improvements. 

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