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Brief report

Attitudes and beliefs, not just knowledge, influence the effectiveness of environmental cleaning by environmental service workers

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Background: Hospital environmental service workers (ESWs) play an important role in interrupting the chain of infection because the environment is a reservoir for nosocomial pathogens. Improving ESWs' knowledge through education has been shown to improve ESW cleaning, but the behavioral determinants of their work have not been studied. Understanding and targeting ESWs' attitudes and beliefs may inform strategies to improve environmental cleaning.

Methods: With the theory of planned behavior as framework, we used questionnaires and focus groups to examine intensive care unit ESWs' attitudes, beliefs [behavioral, normative, and control], and control) and intent about their job. Baseline quantitative microbial cultures of high-touch services were performed before and after cleaning. After an educational intervention addressing their attitudes, beliefs, and general infection control knowledge, attitudes, beliefs, and microbial contamination were reassessed.

Results: Beliefs were uniformly strong (4.5/5-5/5), and normative beliefs correlated best with intent to clean ($R^2 = 0.3$). Themes elicited from the focus groups included "me versus them," lack of appreciation, pride in work, and "if it were me." The rate of environmental contamination was significantly improved after the intervention ($P = .0074$ vs $P = .0023$, respectively); the measured relationship among attitudes, beliefs, and intent was not significantly changed.

Conclusion: ESWs' attitudes and beliefs about their job may impact their intent to clean and in turn the effectiveness of their efforts. Understanding and addressing these attitudes and beliefs can be used to inform strategies for sustained improvement of environmental cleaning.

The global agenda to reduce iatrogenic harm has highlighted health care-associated infections (HAIs). Hand hygiene is the single most effective method of preventing HAIs, and human behavioral theories are being used to elucidate and inform strategies to improve compliance.[1,2]

Improved environmental cleaning can reduce HAIs[3,4]; however, the attitudes and beliefs of environmental service workers (ESWs) regarding their work and their impact on the effectiveness of cleaning have not previously been explored. We hypothesized that these attitudes and beliefs might influence the effectiveness of their cleaning.

METHODS

SickKids is a 260-bed, quaternary care academic pediatric hospital. A prospective, mixed methods, pre-/posteducational intervention study with ESWs working in the 11-bed neonatal

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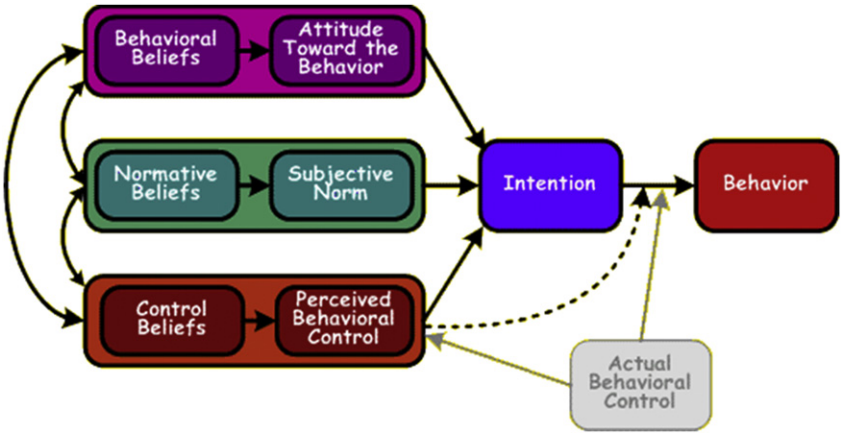

Fig 1. The theory of planned behavior (TPB,5) provides a framework for understanding what drive(s) behavior. According to the TPB, voluntary behavior is preceded by intent, which is influenced by 3 enabling variables: *attitude* toward the behavior (ie, the effectiveness of the behavior in achieving the desired outcome), *subjective norm* (ie, expectations of others), and perceived *behavioral control* (ie, how much control the individual has over the behavior and how easy or not it is to engage in that behavior). Each enabling variable is in turn influenced by the strength of a predictive variable: beliefs about outcomes (behavioral beliefs) normative beliefs and control beliefs.

intensive care unit (NICU) and the 18-bed pediatric intensive care unit (PICU) was carried out to examine ESWs' attitudes and beliefs about their job and their impact on cleaning effectiveness.

The theory of planned behavior (Fig 1) framed the development and analysis of a validated 20-statement survey tool designed to elicit perceptions and predictors of behavioral intentions associated with the ESW role[5] (Table 1). The tool was distributed to 30 ESWs working in the ICUs, who identified their degree of agreement using a 5-point Likert scale. Focus groups scheduled at the ESWs' convenience were facilitated by the primary investigator and a research assistant using a semistructured interview guide. Detailed notes were taken including verbatim quotations. Four sessions before and 3 after the educational intervention were attended voluntarily by a total of 18 participants. Purposive sampling ensured representation from both ICUs and all shifts.

Microbial contamination was assessed semiquantitatively before (phase 1) and after (phase 2) the intervention. In phases 1 and 2, 24 and 15 rooms, respectively, were sampled before and after terminal cleaning of the space, as they were vacated by patients. Up to 10 standardized high-touch, patient-specific surfaces (2-cm^2 surface area per site) were sampled using a premoistened (sterile saline) cotton swab; total aerobic bacterial colony counts (ACC) per unit area, without bacterial identification, were calculated after 48 hours incubation at 35°C on a 5% sheep blood agar plate (Columbia base; Oxoid, Nepean, Ontario). Surfaces were classified as adequately (ACC $< 2.5/cm^2$) or inadequately cleaned (contaminated), (ACC $\geq 2.5/cm^2$).[6] Sites were chosen from the literature[4] and local input and included the computer keyboard, space bar, and mouse; monitor silence button; thermometer; intravenous pump buttons; intercom buttons; room light switch and plate; patient lamp switch; and parent chair.

A 2-hour education session covered basic infection prevention and control principles and addressed issues raised through the survey and focus groups including time pressures and personal motivating factors. Factors predicting behavioral intent were grouped according to behavioral beliefs/attitudes toward behavior; normative beliefs (NB)/subjective norms; and control beliefs/perceived behavioral control. For the survey tool analysis, data were collapsed by taking the means within each subject and within each domain and analyzed using *t* tests, χ^2 tests, and analysis of variance/analysis of covariance with SAS (version 9.1; SAS Institute, Inc, Cary, NC; *P* value <.05 considered statistically significant). Focus group analysis followed grounded-theory methodology[7]; microbiology results were analyzed descriptively. Local Research Ethics Board approval was obtained.

Table 1
Questionnaire administered to housekeeping staff with 5-point Likert scale for evaluation, where 1 is completely disagree, and 5 is completely agree

	1	2	3	4	5
My cleaning work is important for the safety of patients.					
I sometimes take shortcuts in cleaning.					
Cleaning is the most important part of my job.					
I worry about being harmed by cleaning products.					
I worry about getting sick from infected patients when cleaning.					
Other ESWs expect me to do a good job cleaning.					
Nurses and doctors expect me to do a good job cleaning.					
It matters to patients and families that I do a good job cleaning.					
My supervisor knows when I do a good job cleaning.					
I do a good job with cleaning to please myself.					
I usually have enough time to clean the way I should.					
I have been taught how to clean properly.					
Interruptions prevent me from doing a good job cleaning.					
I usually have the equipment and supplies to clean well.					
There is too much clutter to allow me to clean well.					
I try to always follow cleaning policies and procedures.					
I always try to do my best at cleaning.					
I try to clean the way I was taught.					
I focus on cleaning even when I'm interrupted.					
I intend to clean well.					

RESULTS

Fifty-three percent (16/30) of questionnaires were returned and analyzed. ESWs' intentions were consistent at approximately 4.5 out of 5. NB had the strongest relation to intent ($R^2 = 0.3$) versus behavioral beliefs ($R^2 = 0.014$) and control beliefs ($R^2 = 0.03$). ESWs' beliefs about behavioral control were significantly less than their other enabling beliefs.

The major themes elicited were "me/us versus them," lack of appreciation, pride, and "if it were me" (Table 2). Before the educational intervention, a mean of 8.4 surfaces were sampled per room precleaning (range, 6-10) versus 8.7 (range, 5-10) post-cleaning. A significant decrease in environmental contamination followed cleaning and was more significantly reduced after the intervention ($P = .0023$ vs $P = .0074$ before). Before cleaning, the most contaminated surfaces included the parents' chair, thermometer, computer keyboard and mouse, and patient light switch.

Table 2
Quotations are presented supporting the themes identified in the focus groups

Focus group theme	Subtheme	Quotation
"Me/us versus them"	Within the ESW group	"Some people don't care and do the minimum."
	According to shift worked	"Impossible for day shift to get everything clean."
	Length of employment	"When new ESWs come to the unit, we have to reclean after they do their work oh so many times."
	Across job descriptions within the housekeeping department	"Supervisor needs to have more involvement and oversee what's being done."
	Between job classifications	"New CCU nurses call for everything, they have attitude: throw garbage on floor in front of you."
	Between employees and patients/parents	"Sometimes, parents order you, think you are a maid."
Lack of appreciation		"Who knows when you do a good job? Supervisors know, but they don't say anything, just blame you for [work] not done."
Pride		"Treat your job like you treat your home. Your job represents you at home."
"If it were me"		"You put yourself in the parent's place having a sick child in the hospital, and you would like to know that, if it was your child, a proper job was done before occupying the bed."

NOTE. Of note, the "me/us versus them" theme was identified at many levels of interaction, which are presented as subthemes.
CCU, critical care unit; ESW, environmental service workers.

After cleaning, over one third of sites on parent chairs remained contaminated.

DISCUSSION

Our results support previous reports that hospital cleaning is improved by educating ESWs on the contribution of the environment to HAIs.[8,9] Only 1 study has reported 100% improvement, and that involved research staff cleaning after ESWs' efforts.[10] The gap between ESWs' and researchers' cleaning effectiveness is consistent with our hypothesis that personal drivers impact cleaning efforts; researchers are likely more motivated by personal gain than ESWs to achieve excellent results.

The rich qualitative data from the focus groups demonstrate that ESWs intend to do a good job; they take pride in their work and are committed to patients and families. This is grounded mainly in NBs and subjective norms, ie, the perceived social pressure to perform. Despite the intent to do their job well, however, they perceive little behavioral control. Positive feedback might lessen their frustration and in turn reduce their perceived helplessness.

Environmental cleaning after patient discharge significantly reduced contamination of high-touch patient items both before and after the intervention. The number of rooms and surfaces sampled was subject to patient turnover and was thus not consistent in the 2 phases of the study. Persistence of contamination of items such as parent chairs may also have been due to movement and handling.

The semiquantitative method of evaluating total ACCs was simple, inexpensive, and reproducible. The microbial burden of each spot sampled served as a control for the effectiveness of cleaning both before and after the intervention; thus, the study methodology and its results are robust. Because the focus of the study was to measure the effectiveness of cleaning, specific bacteria isolated were not identified but rather the overall microbial burden.

There are a number of limitations to this study. Managerial and supervisory staff changes within the department and evaluation of new cleaning techniques at the time are important potential confounders because they could impact ESWs' perceptions, intents, and efforts. Unfortunately, we were not aware of these changes in advance nor could we defer the study once begun. In addition, the Hawthorne effect may have been at play because the research assistant was visible to the ESWs. Efforts to minimize such "lurking" were not always successful given the rapid turnover of beds for new admissions.

Beliefs and attitudes change over time and are influenced at conscious and subconscious levels. Although protocols, products, and elbow grease all contribute to the effectiveness of hospital cleaning, the impact of ESWs' attitudes and beliefs on their performance cannot be ignored. Hospital housekeeping is a complex task, and understanding the behavioral determinants of cleaning by ESWs is essential to informing the development of interventions that can influence ESWs' beliefs and attitudes and, in turn, improve the effectiveness of environmental cleaning in a sustained way.

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