The Role of Knowledge, Control Beliefs, and Surface Types on the Risk Judgments of Environmental Service Workers

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The hands of healthcare workers are the number one source of health care acquired infections. Every one of these infections could be prevented with proper hand hygiene, yet compliance rates are poor. Pathogens can be transmitted through touching contaminated skin or touching a contaminated surface -- missed hand hygiene is most common after touching a patient’s surroundings. We investigated the risk judgments of a sample of environmental service workers on touching skin versus surfaces and found that they judged touching surfaces as less likely to transmit pathogens than touching skin. Knowledge level concerning hand hygiene practices and perceived health competency were also assessed and related to risk judgments.

Over four million patients contract healthcare associated infections (HCAIs) each year in Europe alone – resulting in almost 40K directly attributable deaths and contributing to over 100K more (WHO, 2011). Contamination is transmitted to healthcare worker hands through patient contact and contact with contaminated surfaces, which has been shown to contaminate up to the next seven surfaces touched (Reynolds, Watt, Boone, & Gerba, 2005). Previous work has shown that U.S. healthcare workers do not believe touching such surfaces is as risky as touching patient skin (McLaughlin & Walsh, 2011). Though it may be less statistically likely for surfaces to transmit pathogens compared to patient, it is possible and common for them to do so.

The current research was motivated by two facts: first, most HCAIs are transmitted through the hands of healthcare workers, and second, healthcare workers have been found to be least likely to wash their hands after touching the surfaces that surround a patient, despite it being part of their training to do so (AIHW, 2011). There are multiple potential reasons for non-compliance, from being too busy to not having hand hygiene products available. We investigated some of the variables internal to the healthcare worker: their knowledge levels concerning hygiene, their control beliefs related to health, and their judgments about the riskiness of not performing hand hygiene after touching a surface compared to touching a person. We organize these findings through the theory of planned behavior (McLaughlin, Anxieter & Hemmer, 2010; McLaughlin & Walsh, 2011, in press).

Previous work has supported the claim that appealing to HCWs beliefs regarding hygiene may have more of an impact on compliance than improving knowledge alone (see Naikoba & Hayward, 2001, for a review). The health belief model (HBM) (Rosenstock, 1974) outlines the role beliefs may have in acting on or complying with hygiene standards. Perceived susceptibility (likelihood of contamination), perceived seriousness (likelihood of death/sickness and the impact on family or job), and cues (equipment, reminders) each influence the HCWs possible compliance.

The HBM has been used to identify HCW compliance with blood born pathogens (O’Boyle Williams, 1994) and has been cited in the literature as a possible solution to hygiene compliance, but little has been done to apply this approach. If belief structures are amenable to change as the HBM suggests, approaches to hygiene compliance may change in the near future to appeal to this model rather than instruction or education alone.

Our proposed solution lies in the beliefs associated with the judgments regarding the pathogen transfer of people versus surfaces. That is, if HCWs believe a surface or person to be contaminated, they are more likely to participate in proper hand hygiene protocol. This is likely because the perception of risk influences whether or not they believe self-contamination could occur. By approaching the problem in this way, we have the possibility of overriding noncompliance issues due
to busyness or the availability of hand hygiene products.

Overview of the Study

Similar to previous work done by McLaughlin and Walsh (2011, in press) environmental service workers (ESWs) were surveyed online as to their hand hygiene knowledge, and risk assessments. In addition perceived health competence was measured.

Hypothesis 1: Risk assessment will be different based on surface touched with touching a person judged as more risky than touching a surface.

Hypothesis 2: As hygiene knowledge increases, so also will accuracy for risk assessments.

Hypothesis 3: As personal health competency scores increase so also will accuracy for risk assessments.

METHOD

Participants

Participants were 29 Environmental service workers and Environmental service managers (ESWs) employed in acute care settings across Australia. Environmental service workers are responsible for cleaning patient rooms and common areas as well as keeping bathrooms stocked with hygiene products. Environmental service managers oversee these activities. ESWs commonly have interaction with patients, although their job is not to provide direct care. Participants were compensated for their time. Demographics for the sample can be seen in Table 1.

Materials

Hand Hygiene Knowledge Questionnaire. A 21 question assessment developed by the World Health Organization (WHO, 2009a) to assess knowledge of the basic aspects of hand hygiene as demonstrated by WHO training materials.

Perceived Health Competency Scale. The Perceived Health Competency (PHC) scale is an 8 question assessment formatted to measure ones perceived ability to manage their health (e.g., “I was generally able to accomplish my goals with respect to my health”). All questions formatted in a 5-point Likert scale (Smith, Wallston, & Smith, 1995).

Table 1.

<table>
<thead>
<tr>
<th>Participant Characteristics</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>General demographics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age in Years</td>
<td>48.48</td>
<td>8.18</td>
</tr>
<tr>
<td>Years in profession</td>
<td>13.07</td>
<td>9.00</td>
</tr>
<tr>
<td>Knowledge score1</td>
<td>23.41</td>
<td>3.85</td>
</tr>
<tr>
<td>Perceived Health Competence Score2</td>
<td>24.86</td>
<td>2.38</td>
</tr>
<tr>
<td>Frequency Demographics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>20 females, 9 males</td>
<td></td>
</tr>
<tr>
<td>Received formal hand hygiene training in the last 3 years</td>
<td>Yes = 26, No or did not remember = 3</td>
<td></td>
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</tbody>
</table>

Note: Knowledge score assessed by WHO, CDC, and other international testing materials (WHO, 2009 a, b, c)1 Perceived Health Competence Score was assessed using questions from Smith, Wallston, & Smith (1995).

Design

Unmarked, bipolar analogue scales were used to demonstrate different risk scenarios (See Figure 1). Each risk scenario represented one of four risk level manipulations of possible pathogen transfer; 1 = no risk, 2 = moderate risk, 3 = risk likely, 4 = risk certain. In addition, scenarios alternated between the actors touching patients or surfaces. Dependent variables include health knowledge (Knowledge score), and perceived health competence.

Procedure

ESWs followed a link via email. They provided informed consent and were taken to a survey that contained demographics, the factorial survey questions and PHC. After, they were debriefed and compensated.

During the course of the day, Lauren enters the room of a patient and adjusts their leg at their request. Before and after touching the patient, she vigorously washes her hands for 30 seconds with soap and warm water before continuing with her day. Mark your assessment of the risk of pathogen transfer to the next patient Lauren touches.
Anne touches the bedside table of a patient during flu season and then moves to another patient without performing hand hygiene in between visits. Mark your assessment of the risk of pathogen transfer between patients.

**Figure 1.** Example of factorial questions. Unmarked bipolar analoge scale with ‘no risk’ and ‘high risk’ anchors used to indicate risk for each scenario. ESW’s moved the slider to any point on the bar to indicate risk judgement. Manipulated risk levels progress from Level 1 to Level 4 and examples are shown alternating person vs. surface touching (person-person, person-object).

**RESULTS**

In general, ESWs were fairly unknowledgeable about hand hygiene practices (Table 1). To investigate the effects of knowledge and beliefs on risk assessment a multiple regression was performed using surface type, knowledge score, and PHC score as predictors. The interaction terms for these variables were entered as a second step. When hand hygiene was performed, PHC significantly predicted risk assessment, $R^2 = .176$, $F(3, 54) = 5.56$, $p = .015$, $\beta = - .31$, $p = .018$. ESWs with more PHC judged a lower risk of pathogen transmission than those with less PHC.

The predictors also explained a significant amount of the variance in risk judgments when hand hygiene was skipped and risk of transmission was fairly high, $R^2 = .301$, $F(3, 54) = 7.75$, $p = .001$. ESWs judged touching a surface as higher risk than touching a person, $\beta = - .45$, $p < .001$, those with more knowledge thought there was less risk, $\beta = - .31$, $p = .012$, and surface type interacted marginally with knowledge score such that those with high knowledge judged surfaces as less risky compared to those with low knowledge, but judged touching patient skin similarly as those with low knowledge, $\beta = - .76$, $p = .050$.

**DISCUSSION**

In general, ESWs judged touching surfaces as less likely to transmit pathogens than touching patient skin. Although the risk might indeed be lower, it is still high and compliance data show that health care workers are most likely to skip hand hygiene “after touching a patient’s surroundings” than any of the other 5 “moments” for hand hygiene (AIHW, 2011).

**Table 2.**

<table>
<thead>
<tr>
<th>Item</th>
<th>Percent Correct</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol-based hand rubs have good or excellent antimicrobial activity against all of the following except: A. Viruses, B. Fungi, C. Mycobacteria, D. Bacterial spores, E. Gram positive and gram negative bacteria</td>
<td>13.8</td>
<td></td>
</tr>
<tr>
<td>What is the minimum amount of hand sanitiser that should be used to effectively kill pathogens? A. a handful, B. 1 mL, C. .3 mL, D. .5 mL</td>
<td>27.6</td>
<td></td>
</tr>
<tr>
<td>What is the minimum time needed for alcohol-based hand rub to kill most pathogens on your hands? A. 3 seconds, B. 10 seconds, C. 20 seconds, D. 60 seconds</td>
<td>41.4</td>
<td></td>
</tr>
<tr>
<td>Hygiene before touching a patient will prevent transmission of pathogens to the health care worker. True/False</td>
<td>34.5</td>
<td></td>
</tr>
<tr>
<td>Hygiene after a procedure or risk of body fluid exposure will prevent transmission of pathogens to the patient. True/False</td>
<td>48.3</td>
<td></td>
</tr>
<tr>
<td>Hand rubbing is more effective against pathogens than hand washing. True/False</td>
<td>41.4</td>
<td></td>
</tr>
</tbody>
</table>

*Note: Table represents commonly missed knowledge of hand hygiene questions by ESWs. Correct answers are indicated in bold.*

The current study may provide insight into why this moment shows low compliance: ESWs perceived less risk after touching surfaces than touching a patient. This may interact with other barriers to hand hygiene such as personal health competency or perceived knowledge of health to produce the low compliance rate after touching a patient’s surroundings.

The current results were similar to the findings of McLaughlin and Walsh (2011) who studied a sample of U.S. healthcare workers in the three professions (Infection preventionists, nurses, and ESWs) using internal health locus of control as an indicator of health belief. This suggests that universal compliance in hand hygiene may be affected by appealing to HCWs belief structure as outlined by the theory of planned behavior and the HBM rather than...
by attempting to increase correct knowledge by instructional means. However, education about surfaces and their contamination capabilities may be improved.

Similarly, differences in health competency and risk assessment tell a great deal about the beliefs of pathogen transfer. Those with low health competency but high perceived competency may need materials that not only demonstrate proper precautions, such as instructions, but act as a reminder. By emphasizing the ability to control one's own hygiene there may be a difference in the perception of risk. For example, having signage that highlights the dangers that common surfaces pose and a reminder to engage in hand hygiene would emphasize the need for ESWs to assess those surfaces more accurately. This style would again appeal to attitudes, beliefs and personal health competency, rather than to intellect alone.

The differences observed between risk assessments of surfaces verses people are of particular interest in this sample. Focusing the pathogen transfer literacy on objects not commonly associated with risk (i.e., elevator buttons, door knobs, bedside tables, etc.) would bring a greater awareness to existing dangers.

ACKNOWLEDGEMENTS

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REFERENCES


