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Major article

Use of hand-held computers to determine the relative contribution of different cognitive, attitudinal, social, and organizational factors on health care workers' decision to decontaminate hands

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Background: Observational and survey methods have limitations in measuring hand hygiene behavior. The ability of a personal digital assistant to anonymously gather data at the point of decision making could potentially address these.

Methods: Participants were provided with a personal digital assistant to be used for three 2-hour periods and asked to rate influential factors of the Health Belief Model (HBM). Participants were also required to enter what they thought they should do and what they actually did.

Results: A total of 741 hand hygiene opportunities was recorded. All HBM constructs were higher for hand hygiene opportunities where there was compliance versus noncompliance, with a significant difference for patient pressure, my risk, perceived benefits, perceived seriousness, and availability of good facilities. Only 20% of doctors, 28% of nurses, and 66% of physiotherapists always did what they thought they should. There was no correlation between self-reported and actual compliance.

Conclusion: The HBM appeared to be a useful theoretical framework. Surprisingly, participants rated their compliance as high despite having recorded instances where they did not do what they thought they should do. This suggests that staff may have a different definition of compliance than strict observation of the guidelines.

Good hand hygiene practice has been highlighted as the single most important measure for the prevention of cross infection.[1,2] However, despite continued efforts, health care professionals' compliance with hand hygiene guidance remains suboptimal.[3] Although the number of published studies concerning hand hygiene has increased considerably in recent years, many questions regarding improved adherence to recommended policies remain unanswered.[4] In 2005, as part of the World Health Organization's first Global Patient Safety Challenge "Clean Care is Safer Care," several areas for future research in the understanding of and compliance with hand hygiene protocols were identified.[5] These included the following:

- Identification of which predictor has the greatest impact on hand hygiene for all groups of health care workers; and
- confirmation that behavioral determinants of hand hygiene can be generalized to other health care occupational groups in addition to doctors and nurses and in varying ethnic and professional groups.

Many cognitive, attitudinal, and social/organizational factors have been identified as influencing the decision to decontaminate hands or wear gloves, but the relative contribution of each is unknown.[6] Specific factors identified to be influential include knowledge, workload, type, tolerance and accessibility of hand hygiene agents, awareness of personal and group performance,[3] gender, professional activity, and perceived social pressure.[7] A comprehensive list of these factors has been compiled by the Centers for Disease Control and Prevention.[4] An interdependence of individual factors, environmental constraints, and organizational

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climate in hand hygiene practice has been proposed to play a key role in the success of behavioral interventions.[3]

Pittet[3] argues that understanding the motivation behind a specific behavior in a specific situation is one of the first steps required in the design of an effective intervention strategy to modify that behavior. Although psychologic models have been used to predict behavior in many areas of health care, none have been successfully applied to explain behavior in the field of infection control. In a review of behavioral models, Kretzer and Larson[8] observed that many models share similar constructs that could be integrated into an intervention to improve infection control practices; self-efficacy, beliefs, perceived threat, cues, attitudes, subjective norms, and perceived behavioral control. Behavioral models were more recently reviewed by Pittet.[3] Pittet argued that the "Theory of Planned Behavior" and "Self-Efficacy Model" were better predictors of hand hygiene behavior than other sociocognitive models but that the lack of assessment of threat and social pressure, now known to be influential, were major drawbacks. These are included in the Health Belief Model (HBM),[9] which Pittet[3] proposes best summarizes the predictors influencing behavior at the level of an individual. The HBM was therefore employed in this study, and the constructs identified by Pittet formed the data collection measures.

Using survey, interview, and observational methods in hand hygiene research can result in biased outcomes.[3] A systematic review by NHS Quality Improvement Scotland[10] found many observational studies difficult to interpret because of the potential Hawthorne effect; small sample sizes because of the high time requirement, lack of blinding, and randomization of subjects; and effect of multiple confounding factors in the clinical environment.

Looking at surveys and interviews, hand hygiene research has found that intention to wash hands did not predict observed handwashing behavior and that the relationship between intention and self-reported estimates of compliance is weak.[5] For example, using the Theory of Planned Behaviour, O'Boyle et al[11] observed over 1,000 hand hygiene indications with 120 nurses, who completed a questionnaire and a self-report. There was a significant difference between self-reported adherence and the observed adherence rate (82% vs 70%, respectively). Intention to practice hand hygiene as shown by the questionnaire was related to the self-report but did not predict actual, observed hand hygiene.

Retrospective self-reports are recognized to be affected by mood, the time elapsed since the event, the format in which the responses are given, and other processes known to affect autobiographic memory.[12] Self-reports of personal handwashing frequency have been demonstrated not to match actual (observed) frequency, with staff tending to overestimate, by approximately 3 times, their actual frequency.[13] Watson and Myers[14] argue that innovative approaches based on theoretically driven interventions targeting actions, perceptions of risk, and decision making need to be explored if compliance is to improve. The use of personal digital assistants (PDAs) is one such innovative method that offers several advantages for data gathering. PDAs, by virtue of their compact size, low weight, and independent power supply, are cheap, unobtrusive, and easy to operate. They have been successfully used to report adverse advents by anesthetic trainees, with 99% reliability compared with retrospective chart review.[15] Their use can provide real-time data on factors influencing hand hygiene with minimum impact on the professionals' work. This has been termed *ecological momentary assessment*.[16] Furthermore, Piasecki et al[17] note that, by minimizing the need for recall, PDAs have the potential to yield a different perspective. In addition, a PDA allows the data contributor to remain anonymous and thus potentially more truthful, by acting as an anonymizing agent. PDAs have been successfully used by the researchers to measure work-related stress in nurses.[12]

METHODS

The aim of this study was to explore the use of a PDA to anonymously gather data at the point of decision making on whether to decontaminate hands and to determine the relative contribution of different cognitive, attitudinal, social, and organizational factors.

The research questions were as follows:

1. Are PDAs a feasible tool to anonymously gather real-time data on hand hygiene strategies of health professionals from different disciplines?
2. What self-reported cognitive, attitudinal, social, and organizational factors determine hand hygiene practice at the time of decision making?

Target population

To enable examination of factors influencing the decision-making process of different professional staff in a complex environment, 10 doctors, 25 nurses, and 5 physiotherapists were targeted from the 4 acute surgical wards that compose the orthopedic directorate of a teaching hospital. Data from the researchers' previous observational study[18] suggested an average of 15 hand hygiene opportunities (HHO) within this 2-hour period. It was anticipated that the collection of 10 to 15 hand hygiene entries on each of 3 shifts from these 40 practitioners would provide 1,200 to 1,800 data entry points over the whole data set, enabling the study to be sufficiently powered to detect variations within participants across the incident reports provided across the 3 shifts. Data collection would be confidential and anonymous. Ethical approval for the study was granted.

Training participants to use the PDAs

Two members of the research team were responsible for training the participants on the use of the PDAs throughout the course of data collection. The software used was "Pocket Interview."[19] A one-to-one demonstration of completing the "start" period, a HHO, and the "end" period on the PDA was given. A written standard operating procedure was provided to each participant that included contact telephone numbers of the researchers should any problems arise. Each participant was then provided with verbal and written guidance as to the appropriate decontamination of the PDA.[20]

Data entry

Participants were provided with a PDA to be used for 2-hour periods on 3 separate occasions when direct patient care took place and asked to rate influential factors on relevant hand hygiene decisions relating to all HHO that occur over these 2-hour periods. The factors presented on the PDA were chosen based on review of the literature and constructs of the HBM, as shown in Table 1.

At the point of choosing to, or not to, decontaminate hands, participants were asked to indicate their rating of the factors presented on a visual analogue scale from -5 to $+5$. Participants also had the option to input free text on additional factors influencing their hand hygiene decisions.

Participants were also required to enter WHO "hand hygiene moment" (before touching a patient, before clean/aseptic procedures, after body fluid exposure risk, after touching a patient, after touching a patient's immediate surroundings),[21] what they thought they should do, and what they actually did. At the end of their third shift, the data were uploaded to the project database. Contributor anonymity was maintained throughout.