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2009

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Publication details

van de Mortel, TF 2009, 'Development of a questionnaire to assess health care students' hand hygiene knowledge, beliefs and practices', *Australian Journal of Advanced Nursing*, vol. 26, no. 3, pp. 9-16.
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Development of a questionnaire to assess health care students' hand hygiene knowledge, beliefs and practices

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Acknowledgements
Thanks to the expert panel: Professor E Larson, Dr C O'Boyle and Ms A Lees for valuable advice

KEY WORDS

hand-hygiene, student, knowledge, beliefs, questionnaire, Marlowe-Crowne

ABSTRACT

Objective
To determine the reliability and validity of a hand hygiene questionnaire (HHQ) developed to examine health care students' hand hygiene knowledge, beliefs and practices.

Design
Pilot testing of the HHQ

Setting
Undergraduate students of nursing undergoing university education

Subjects
The HHQ was administered to 14 student nurse volunteers in the final year of their undergraduate degree and to another 45 volunteers following revision.

Main outcome measures
Main outcomes measures were test-retest coefficients, Cronbach's alpha values and mean inter-item correlations of the scale items.

Results
The face validity of the HHQ was high. Cronbach's alpha values of 0.80, 0.74 and 0.77 were obtained for the Hand Hygiene Beliefs scale (HBS), the Hand Hygiene Practices Inventory (HHPI), and the Hand Hygiene Importance Scale (HIS) following removal of items with low item-to-total correlations or zero variance. The mean item-to-total correlations of the HBS, HHPI and IS were 0.37, 0.33, and 0.61 respectively. The two-week test-retest coefficients for each scale were 0.85, 0.79 and 0.89 respectively. Socially desirable responding was identified in participants' responses to the HBS using the 11-item short form of the Marlowe-Crowne Social Desirability scale.

Conclusions
The HHQ demonstrated adequate reliability and validity and should be further tested on a wider sample of health care students.

INTRODUCTION

While a great deal of research has been conducted into health care workers' adherence to hand hygiene (HH) guidelines, a search of the MEDLINE, CINAHL and Google Scholar databases using the terms HH or handwash or handwashing or hand decontamination, and student showed scant research on the HH knowledge, beliefs and practices of health care students (HCS).

LITERATURE REVIEW

Karaffa (1989) developed a Handwashing Practices Inventory (HPI) based on the Health Belief Model (HBM) to assess general university students' knowledge of, and beliefs about handwashing. Her sample included 123 allied health education students. The HPI examined students' handwashing practices (17 items), perceptions of the benefits (18 items) and barriers to handwashing (18 items), the risk of contracting infectious diseases (8 items) and the seriousness of those diseases (8 items). Students' perceptions of handwashing benefits, barriers and severity of infectious diseases were significant predictors of self-reported handwashing. The applicability of the study is limited because the questionnaire was only administered to a small sample of health students and did not assess the students' handwashing practices in the health care setting. The Health Belief Model was developed for use in health promotion and it focuses on how an individual's perceptions of risks and benefits can influence the likelihood of behaviour change to protect the individual's health. In the health care setting, it is possible that a range of other factors influence students' HH including modelling the behaviour of others and altruistic behaviour to protect patients.

Sangkard (1991) examined student nurses' infection control knowledge with a questionnaire that contained a nine-item handwashing component. Responses to the handwashing items were correct 68 - 71% of the time, however, the majority of questions were very simple true/false questions. The students perceived clinical teaching as the most effective way to learn about infection control, and infection control knowledge increased significantly with increasing duration of clinical experience. The primary focus of this study was infection control knowledge in relation to HIV/AIDS infection. While this study offers some information on the handwashing knowledge of student nurses and the relationship between the teaching strategies and infection control knowledge the study did not examine whether the students' handwashing knowledge translated into better practices and more favourable beliefs about handwashing. This study was also completed prior to the introduction of alcohol-based handrubs.

In contrast to the findings of Sangkard (1991), Jenner and Watson (2000) found nursing students' attitudes toward HH deteriorated over time. No information was provided on students' HH knowledge or practices. Snow et al (2006) studied one group of nursing assistants with, and the other without, a previous history of medical employment or education. HH compliance improved over time for students without a previous medical background while those with a previous medical background performed HH significantly more frequently throughout the study. Students' HH compliance also improved when mentors performed HH. Students' self-reported mean HH compliance before and after various activities ranged from 80.4% - 95.3%. This study offers clues about the role of mentors in influencing the behaviour of students, however it is limited by a small sample (n=60); it was only conducted on students of one discipline; and did not address the effect of education, assessment, and knowledge on HH practices. Additionally, the data on compliance may be affected by observational bias (van de Mortel and Murgo 2006).

Several studies have examined aspects of medical students' HH behaviour and knowledge. Feather et al (2000) observed the handwashing behaviour of 187 medical students during their final clinical examination. Without a reminder, 8.5% of medical students washed their hands after patient examination while 18.3% handwashed when reminder notices were displayed. Other factors that influenced students' HH behaviour were not

examined. In a follow-up study, Hunt et al (2005) surveyed first year medical students to determine their HH attitudes after observing their behaviour during a clinical examination. Students substantially overestimated their compliance and reported that lack of time, insufficient sinks, and the perception that 'nobody else does it', were the most frequent barriers to HH. No attempt was made to examine the relationship between reported compliance and students' knowledge scores or their attitudes towards HH.

Mann and Wood (2006) examined the infection control knowledge of third year medical students using a semi-structured questionnaire which included a HH component. The mean HH knowledge score was 52.3%. Five percent of students reported receiving no instruction on HH and 58% did not know the correct indications for the use of alcohol-based hand gel. The studies conducted by Karaffa (1989), Sangkard (1991), and Mann and Wood (2006) all relied on self-report but did not use a means to detect socially desirable responding (van de Mortel 2008).

A comprehensive examination of the factors that influence the way HH knowledge and behaviour is learned and practiced across health disciplines is lacking. Thus a HH questionnaire (HHQ) was developed to examine health care students' (HCS) HH knowledge, beliefs and practices, and the influences of mode of HH education and assessment on those factors. The HHQ was designed to answer the following questions:

1. What knowledge do HCS have of the current HH guidelines and does knowledge influence beliefs and practices?
2. What is the self-reported HH practice of HCS?
3. What beliefs do HCS have about HH and do these beliefs influence practice?
4. Does the method or frequency of HH education and assessment influence HH knowledge, beliefs or practices?

The specific aim of this study was to determine the reliability and validity of the HHQ.

METHOD

Structure of the questionnaire

The HHQ contained five main sections:

- A demographics section that elicited information on age, gender, discipline and weeks of clinical practicum completed.
- A HH knowledge section that contained 15 multiple-choice questions based on the Centers for Disease Control (CDC) HH guidelines (Boyce and Pittet 2002).
- A teaching section that examined how students learned about HH during their course, how effective they felt the teaching strategies and resources were, and how frequently and in what manner their HH knowledge and skills were assessed. Students were also asked to assess the importance given to hand hygiene in the curriculum by their supervisors and in health-care facilities, on a five-point Likert scale named the Hand Hygiene Importance Scale (HIS).
- A 37-item HH Beliefs Scale (HBS) designed to determine students' HH beliefs on a 5-point Likert scale. The scale was developed using Social Cognitive Theory (SCT) (Bandura 1986) as a framework and contained four items modified from Karaffa (1989) and one developed by Larson et al (1997). While the HPI as a whole was originally developed using the HBM as a framework, these items focused on students' perceptions of barriers and rewards for handwashing, both of which are congruent with SCT.
- A 25-item HH Practices Inventory (HPI), which examined students' HH practices on a five-point Likert scale. Four statements in this section were from Larson et al (1997) and two were from Karaffa (1989).

In order to determine content validity, a panel of three infection control experts was asked to advise on the accuracy and comprehensiveness of the knowledge questions, relevance of the scale items, and readability of the questionnaire.

Theoretical framework of the questionnaire

Social Cognitive Theory (SCT) (Bandura 1989, 1986) was chosen as the framework for the Hand Hygiene Beliefs scale because it deals specifically with the process of learning behaviour and because it is considered the most comprehensive theory of human behaviour (Redding et al 2000; Bandura 1998). SCT explains how people acquire and maintain their behaviours and provides the basis for intervention strategies (Baranowski 1997). There is considerable overlap between SCT and the other health behaviour theories such as the Health Belief Model (HBM) (see Bandura 1998), but SCT measures additional constructs such as the effect of self-efficacy on behaviour change.

According to SCT, behaviour is influenced by rewards and punishments, by vicarious learning (which involves observing the behaviour of others and the consequences of that behaviour), and modelling other's behaviour. Reciprocal determinism is a key concept: personal factors such as cognition, affect, and biological events, interact with behaviour and environmental influences allowing each of these components to influence and be influenced by the other. According to Bandura (1989, 1986), variables that influence the process of learning behaviour include:

- Beliefs about the outcomes of the behaviour and the value of those outcomes. Do students believe that HH will prevent nosocomial infection and that this is a valuable outcome?
- Feelings of self-efficacy (confidence) about one's capacity to behave in a particular way. Do students believe they are capable of reminding a health professional to decontaminate their hands?
- Modelling others' behaviour. Modelling occurs more readily if the model is admired; hence junior staff often imitate the behaviour of senior staff (Lankford et al 2003; Muto et al 2000).
- Self-regulation of behaviour, ie when the person performs the behaviour in the absence of witnesses. People are more likely to perform HH when someone is watching (Drankiewicz et al 2003; Pedersen et al 1986).
- Reinforcing factors such as positive or negative feedback.

The effect of habit was an additional construct included in the beliefs scale (Aarts et al 1997; Baranowski et al 1997).

Ethics

Ethics approval was obtained from the relevant Human Research Ethics Committee.

Setting and subjects

Preliminary testing occurred using a convenience sample of 14 Australian undergraduate nurses in the final year of their degree. Students were informed of the study aim, that participation was voluntary, and that their responses were anonymous. Volunteers were asked to comment on items they found hard to understand or redundant and make suggestions on how to improve the readability of the questionnaire in order to determine and improve the face validity of the questionnaire. Volunteers were requested to complete the scales again two weeks after completing the questionnaire, in order to calculate test-retest stability. Completed questionnaires were returned using a locked box in reception.

Following analysis of the data, the 11-item short form of the Marlowe-Crowne Social Desirability (SD) scale (Reynolds 1982) was added and the questionnaire administered to a further 45 student nurses to determine if socially desirable responding (SDR) was occurring.

Final year students were chosen because:

- they are more likely to have received most of their HH education,
- the duration of courses differs between disciplines and countries; using final year students allows the results to be standardised across courses of different durations.

Statistical analyses

Descriptive statistics were calculated for the scales using the program SPSS (11.0 for MacOSX; Chicago, Ill). Homogeneity of the scales was assessed using

Cronbach's alpha and item-to-total score correlations. Reliability coefficients of 0.7 or above and item-to-total correlations above 0.25 indicate acceptable internal consistency (Jackson and Furnham 2000; Beanland et al 1999). A Pearson's correlation was used to determine the test-retest coefficient (Jackson and Furnham 2000). A Pearson's correlation was also used to determine if SDR was occurring (Pallant 2005).

FINDINGS

The age of participants ranged from 20-51 years (mean 29.7 ± 1.3). Nine participants (15.3%) were male and 50 (84.7%) were female. The face validity of the questionnaire was high following modification of the questionnaire. The criteria used to modify the questionnaire are listed in table 1 (Rattray et al 2004).

Table 1: Criteria used to modify the questionnaire.

Criteria	Rationale	No. of items
Scale items with a low item to total correlation	Items with an item to total correlation of <0.25 can contribute to poor internal consistency (Jackson and Furnham 2000).	23 items removed
Scale items with zero variance	High endorsement of an item suggests poor discriminatory power	5 items removed
Clarity and relevance of items	Items were considered for removal if participants suggested they were difficult to understand or redundant	21 items removed
Items considered theoretically important	Items considered theoretically important retained despite meeting one of the above criteria for removal	10 items retained

The scales

The reliability coefficients for the HBS, the HHPI and HIS are reported in table 2. The mean scores for each item of the scales are shown in Appendix 1.

DISCUSSION

The internal consistency and test-retest stability of the final scales were satisfactory. The alpha and test-retest coefficients of the HHPI were similar to those of the original HPI which were 0.76 and 0.81 respectively (Karaffa 1989). The mean score on the HHPI indicated that students 'mostly' performed HH in the situations described in the scale. The results of the HHPI are similar to the previous studies that have used versions of the HPI (Larson et al 1997; Karaffa 1989). The range of responses for the HBS and HIS were much wider with the mean score for the HBS, falling between 'not sure' and 'agree' and the mean score for the HIS falling in the 'agree' range.

A possible limitation of a self-report questionnaire is the reliability of participants' answers on items with a high social desirability value (van de Mortel 2008). Self-reported scores are susceptible to distortion due to self-deception or faking by participants on items that are linked to social approval (King and Bruner 2000).

Table 2: Reliability coefficients for the HBS, HHPI and IS

	HBS	HHPI	HIS
Cronbach's alpha (n=59)	0.80	0.74	0.77
Mean item-to-total correlation (n=59)	0.37	0.33	0.61
Two-week test-retest stability (n=14)	0.85	0.79	0.89
Range of scores (mean±sem) (n=59)	2.90-4.80 (3.88±0.06 sem)	3.69-5.00 (4.76±0.03)	1.00-5.00 (4.29±0.10)
Socially desirable responding (n=45)	Yes, moderate (r=0.33; p=0.01)	No (p=0.36)	No (p=0.90)

Various studies have examined the link between self-reported and observed HH practices with mixed results. For example, Tibballs (1996) found a substantial discrepancy between the self-reported and observed HH of medical staff in an intensive care unit, while O'Boyle (1998) found a moderate correlation between self-reported and observed HH practice in her study of critical care nurses. Larson et al (2004) found that overall self-reported HH frequency was not significantly different to observed frequency in their study, although some measures of HH differed significantly. Moret et al (2004) found self-reported HH practice was generally similar to observed practice in their comparison of the two methods. Some of the discrepancy between observed and self-reported behaviour may also be a function of bias in the observational method (van de Mortel and Murgo 2006).

One way to determine if SDR is occurring is to use a social desirability (SD) scale (Crowne and Marlowe 1960); participants answer true or false to a set of socially valued but improbable statements. The score on the scale can identify if data are contaminated by SDR. The HHQ did elicit SDR as there was a significant correlation between scores on the SD scale and scores on the HBS. Statistical methods are available to reduce the effect of the confounding variable on other variables (Pallant 2005).

The study was also limited by the small sample size and the fact that it was piloted on nursing students only.

CONCLUSIONS

The questionnaire demonstrated acceptable validity and reliability and may provide a means of better understanding the HH practices, beliefs and knowledge of health care students in order to inform curriculum design and adherence strategies. Any innovation that can improve health care professionals' HH practice has the potential to save money, lives and prevent suffering. Further testing on a larger sample size and a wider range of health care disciplines is needed. Statistical methods such as partial correlation should be used to control for the influence of SDR when analysing data from the Hand Hygiene Beliefs scale.

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APPENDIX 1

Table 3: Mean scores on items of the Hand Hygiene Beliefs Scale

Statement	Mean score on item (sem)
I have a duty to act as a role model for other health care workers	4.40 (± 0.12)
When busy it is more important to complete my tasks than to perform hand hygiene^	4.36 (± 0.10)
Performing hand hygiene in the recommended situations can reduce patient mortality	4.45 (± 0.08)
Performing hand hygiene in the recommended situations can reduce medical costs associated with hospital-acquired infections	4.48 (± 0.08)
I can't always perform hand hygiene in recommended situations because my patient's needs come first^	3.83 (± 0.14)
Prevention of hospital-acquired infection is a valuable part of a health care worker's role	4.45 (± 0.14)
I follow the example of senior health care workers when deciding whether or not to perform hand hygiene^	3.48 (± 0.17)
I believe I have the power to change poor practices in the workplace	3.77 (± 0.10)
Failure to perform hand hygiene in the recommended situations can be considered negligence	4.44 (± 0.07)
Hand hygiene is a habit for me in my personal life	3.79 (± 0.19)
I am confident I can effectively apply my knowledge of hand hygiene to my clinical practice	4.19 (± 0.14)
It is an effort to remember to perform hand hygiene in the recommended situations^	3.77 (± 0.15)
I would feel uncomfortable reminding a health professional to handwash^	2.60 (± 0.13)
If I disagree with a guideline I look for research findings to guide my practice	3.23 (± 0.15)
Performing hand hygiene slows down building immunity to disease*^	3.33 (± 0.15)
Dirty sinks can be a reason for not washing hands*^	3.12 (± 0.14)
Lack of an acceptable soap product can be a reason for not cleansing hands*^	3.50 (± 0.15)
Performing hand hygiene after caring for a wound can protect from infections#	4.62 (± 0.08)
Cleansing hands after going to the toilet can reduce transmission of infectious disease*	3.84 (± 0.22)

Scale: 1=strongly disagree to 5= strongly agree; ^ indicates the item is reverse coded
*modified from Karaffa (1989); #from Larson et al (1997)

Table 4: Mean scores on items of the modified Hand Hygiene Practices Inventory

I cleanse my hands:	Mean score on item (sem)
After going to the toilet	4.85 (± 0.06)
Before caring for a wound#	4.95 (± 0.03)
After caring for a wound#	4.97 (± 0.02)
After touching potentially contaminated objects#	4.76 (± 0.06)
If they look or feel dirty*	4.73 (± 0.09)
After contact with blood or body fluids*	4.98 (± 0.02)
After inserting an invasive device	4.98 (± 0.02)
Before entering an isolation room	4.53 (± 0.01)
After physical contact with a patient	4.54 (± 0.09)
After exiting an isolation room	4.86 (± 0.08)
Before endotracheal suctioning	4.78 (± 0.10)
After contact with a patient's secretions#	4.93 (± 0.07)
Before patient contact	4.14 (± 0.14)
After removing gloves	4.67 (± 0.10)

Scale: 1=strongly disagree to 5= strongly agree; modified from *Karaffa (1989) and #Larson et al (1997)

Table 5: Mean scores on items of the Hand Hygiene Importance Scale

Statement	Mean score on item (sem)
Hand hygiene is considered an important part of the curriculum	4.51 (± 0.11)
The facilities in which I do clinical practicum emphasise the importance of hand hygiene	4.17 (± 0.12)
The importance of hand hygiene is emphasised by my clinical supervisors	4.20 (± 0.13)