American Journal of Infection Control 41 (2013) 2-7

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major article

Health care workers' perceptions predicts uptake of personal protective equipment

Jan Gralton BSc, PhD [a,b], William D. Rawlinson BSc, MBBS, PhD [b,c], Mary-Louise McLaws DipTropPHlth, MPH, PhD [a,*]

[a] School of Public Health and Community Medicine, The University of New South Wales, Sydney, Australia
[b] Virology, UNSW and POWH Research Laboratories, Prince of Wales Hospital, Sydney, Australia
[c] School of Medicine, The University of New South Wales, Sydney, Australia

Key Words:
Infection control
Airborne transmission
Droplet transmission
Mask

Background: Health care workers' (HCW) compliance with infection control measures is influenced by organizational, environmental and individual factors. However, it is unknown whether HCWs' perceptions of transmission risk and protectiveness of infection control measures influences the uptake of infection control measures.

Methods: A questionnaire of perceptions and intentions to use infection control measures was completed by 74 HCWs at 2 hospitals. HCWs also indicated a 1-m transmission risk zone and their perceived transmission risk zone. Responses were used in logistic regression models to predict intended behaviors.

Results: Poor recognition of the importance of employing a 1-m transmission risk zone predicted intention not to don a mask in single rooms where patient contact was unexpected (adjusted odds ratio [AOR], 0.5; $P = .032$). When contact was expected, perceived protectiveness of pre-exposure prophylaxis (AOR, 7.9; $P < .001$), vaccination (AOR, 3.6; $P = .023$), and a minimum 1-m risk zone (AOR, 9.8; $P = .022$) predicted mask use. HCWs perceived transmission risk zones within 2.45 m from attending an adult and 1.12 m from attending pediatric patients.

Conclusion: Intention to use a facemask was poor for care in single rooms but improved if patient contact was expected and in multibed rooms. HCWs attending pediatric patients measured a smaller transmission risk zone than what is currently recommended under droplet precautions.

Global infection control policies for the containment of respiratory viruses in health care facilities endeavor to ensure the safety of health care workers (HCWs). Currently, the World Health Organization advises for multiple infection control measures to protect HCWs against occupationally acquired respiratory viruses.[1,2] This includes the prescription of *droplet precautions*, including the use of respiratory protection at the start of a 1-m transmission risk zone from an infectious patient, to counter droplet transmission and the prescription of *airborne precautions,* including the use of respiratory protection at room entry under *airborne precautions*, to counter airborne transmission. The concept of a transmission risk zone of 1 m around an infectious patient emerged from observations early last century of droplet transmission of bacterial pathogens.[3] This work suggested that the risk of infection acquisition is heightened within a 1-m distance. Droplet transmission is reliant on pathogens being carried in expelled particles sized $\geq$5 μm in diameter and making subsequent contact with susceptible respiratory mucosa within a 1-m distance.[4] However, more recent evidence suggests that respiratory viruses may also avail the airborne transmission route,[5] meaning viruses can be carried in expelled particles sized $<$5 μm in diameter that may make subsequent contact with susceptible respiratory mucosa at distances greater than 1 m. This evidence challenges the currently used 1-m transmission risk zone with an increased zone of greater than 1 m from an infectious patient.

Adherence to infection control policy is driven in part by the individual HCW's belief in the recommended effectiveness of the infection control measures.[6] Specifically, self-protective infection control behaviors are cognitively driven by experience, knowledge, subjective norms, and risk appraisal by the individual,[6] whereas noncompliance is driven by a perception that infection control measures hinder task performance.[7] Individual factors however

* Address correspondence to Mary-Louise McLaws, DipTropPHlth, MPH, PhD, professor, Third Floor Samuels Building, School of Public Health & Community Medicine, The University of New South Wales, Sydney NSW 2052, Australia.
E-mail address: m.mclaws@unsw.edu.au (M.-L. McLaws).

Conflicts of interest: None to report.

0196-6553/$36.00 - Crown Copyright © 2013 by Association for Professionals in Infection Control and Epidemiology, Inc. Published by Elsevier Inc. All rights reserved.
doi:10.1016/j.ajic.2012.01.019

require further consideration. First, it is unknown whether the uptake of individual infection control measures is influenced by the HCW's perception of protection/nonprotection conferred by other infection control measures. Second, does the expectation of patient contact, proximity, and room type (single room vs multibed room) affect the HCW's perceptions of risk and safety and influence their choice of infection control measure(s)? Knowing which infection control measures are used by HCWs when confronted with patients with respiratory viral infections and what drives this choice is critical knowledge because it highlights potential targets for infection control improvement interventions.

In this study, we aimed to (1) determine the predictors of intended and actual infection control behavior in the context of an unknown respiratory virus setting, (2) determine the accuracy of identifying the recommended 1-m transmission risk zone (recommended under *droplet precautions*), and (3) identify the distance at which HCWs perceive the transmission risk zone commences.

METHODS

The study was approved by the relevant institutional human research ethics committee. HCWs from the infectious diseases wards of an adult tertiary teaching hospital and a pediatric tertiary teaching hospital were invited to participate in the study. HCWs were enrolled between September 2009 and October 2010 to complete a self-administered questionnaire and measurement tasks; measurement observations were collected by 1 researcher (J.G.). Questionnaires were returned to the researcher before the measurement tasks were undertaken; measurement responses were also recorded onto the questionnaire.

Questionnaire: Intended behaviors

A 29-statement questionnaire regarding infection control beliefs and intended infection control behaviors for the control of novel respiratory viruses was developed by the investigators and completed by HCWs. Statements encompassed perceptions and behavioral intentions related to the employment of infection control measures such as mask use, hand hygiene, antiviral prophylaxis, and distance of the transmission risk zones for masking in multibed and single rooms. Given that the hospital wards in this study comprised both single and multibed rooms, and, in the absence of cohort nursing, a suspected or confirmed infectious patient may be admitted to either room type, it was important to frame statements to test whether HCWs' risk and safety perceptions were also influenced by room type. Statements queried HCWs' perceptions to risk and safety if a 1-m transmission zone was to be employed (in line with *droplet precautions*) and if a 2-m transmission zone was to be employed (assuming the potential for possible airborne transmission). Statements were also framed to consider whether HCWs' perceptions were influenced by their expectation of patient contact.

Responses to each statement were recorded on a 5-point Likert-type scale (1, strongly agree; 2, agree; 3, have no opinion; 4, disagree; and 5, strongly disagree). Statements were developed to measure belief constructs (n = 19) and intended behavior constructs (n = 8). Individual statements were either single constructs or were used in a composite construct to represent the bundling of infection control measures.

Measurement: Actual behaviors

On questionnaire completion, HCWs were asked to enter the room of a fictitious patient with an unknown respiratory viral infection and mark out 2 distances. The first distance was where the HCW estimated 1 m to be from the patient as they entered the room (because this distance is recommended in the current policy for aerosolized droplet transmission of typical respiratory viruses[1]). The second distance was the closest distance the HCW would come to the patient before donning respiratory protection, such as masks, if they were to deliver patient care (ie, the border of their perceived transmission risk zone). Current *droplet precautions* recommend a 1-m transmission risk zone be employed around an infectious patient, and, although it is likely that the majority of infectious particles is produced from the nasopharyngeal region and will facilitate infection via droplet routes, there is also a potential risk of transmission via airborne particles, fomites, and hands. Furthermore, bedding configurations in this hospital ensured that, on entry to the patient's room, the first point of contact was always the patient's feet. Therefore, both distances were measured and recorded by the investigator with reference to both the foot and head of the patient's bed. Identification of the perceived transmission risk zone as either inside or outside the patient's room was also considered as an actual behavioral outcome construct and defined dichotomously.

Table 1
Participant demographics

	Number of participating health care workers (%)		
	Adult hospital	Pediatric hospital	Total
Total participants	34 (46)	40 (54)	74
Sex			
Female	30 (46)	35 (54)	65
Male	4 (44)	5 (56)	9
Location			
Ward based	27 (41)	39 (59)	66
Clinic based	4 (100)	0 (0)	4
Administration based	3 (75)	1 (25)	4
Occupation			
Nursing student	4 (44)	5 (56)	9
Registered nurse	22 (50)	22 (50)	44
Senior registered nurse	4 (40)	6 (60)	10
Medical	1 (20)	4 (80)	5
Allied health	0 (0)	3 (100)	3
Infection control professional	3 (3)	0 (0)	3
Completed survey	32 (44)	40 (56)	72
Completed measurements	31 (44)	40 (56)	71

Statistical analysis

Composite constructs were tested for internal consistency using Cronbach α test. Strong internal consistency was indicated by Cronbach test statistic $\alpha > .8$. Responses to statements in composite constructs were summed and then divided by the number of statements in the composite to regain an original score on the 1 to 5 scale. Scores were reclassified into a binary scale for intended behavioral outcomes; scores 1 to 3 were recoded as 0 (agreement), and scores 4 and 5 were recoded as 1 (disagreement). Nineteen belief constructs were entered separately in a backward logistic regression model and tested against 9 behavioral outcomes to identify significant predictors of behavior. As the interquartile ranges (IQR) differed for each predictor, the odds ratios (OR) and 95% confidence intervals (95% CI) for significant predictors were adjusted by the IQR. Adjusted odds ratios (AORs) were calculated by multiplying the β coefficient of the predictor by the IQR of its scale and expressing it by its exponential. Adjusted 95% CIs were calculated from AOR $\pm$ 1.96 multiplied by the standard error of the mean of the scale. If the adjusted 95% CIs included unity, the predictor was deemed insignificant.