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Predictors of missed infection control care: A tri-partite international study

Ian Blackman[1] | Olga Riklikiene[2] | Elena Gurkova[3] | Eileen Willis[1] | Julie Henderson[1]

[1]College of Nursing and Health Sciences, Flinders University, Adelaide, SA, Australia

[2]Department of Nursing and Care, Faculty of Nursing, Medical Academy, Lithuanian University of Health Sciences, Kaunas, Lithuania

[3]Department of Nursing, Faculty of Health Sciences, Palacký University Olomouc, Olomouc, Czech Republic

Correspondence
Ian Blackman, College of Nursing and Health Sciences, Flinders University, GPO Box 2100 Adelaide, SA, Australia.
Email: ian.blackman@flinders.edu.au

Abstract

Aim: This study aimed to quantify types and frequencies of missed infection control care and to develop a theoretical model for estimating nurses' consensus scores about this form of missed care.

Design: A non-experimental research design using self-audit data was selected to collect information about the types and frequencies of missed infection control care from nurses employed in hospitals located in three different countries. Data collection commenced mid-year 2018.

Methods: A multivariate approach was used to apply the consensus scores of 1.911 internationally based nurses in the missed opportunities for maintaining infection control.

Results/findings: Thirteen variables exert direct effects on the nurses' total scores underpinning missed infection control care. These include the methods used to prevent hospital-acquired infections, surveillance and hand hygiene practices. Significant nurses' demographic factors also included their countries of origin, employment status, employer type, job retention intentions, work intensity, length of clinical experience and staff development attendance.

Conclusion: In magnitude of importance and having the largest effect on missed infection control care is missed care related to reducing hospital-acquired infections followed closely by surveillance. Missed infection control care can be quantified, and variances in its practices can be accounted by exploring the nurses' differing demographic factors, including the nurses' country of origin.

Impact: Variations in missed infection control care can be accounted for across three countries. While ward hygiene is underestimated by staff as a mechanism to minimize nosocomial infections, infection control surveillance remains the key to reducing hospital-acquired infections. The study's outcomes invite the use of an ongoing, whole-of-organization approach to infection control with scrutiny being needed for improved staff adherence particularly with hand hygiene.

KEYWORDS
hand hygiene, infection control, missed care, modelling, nurses

1 | INTRODUCTION

Infection prevention and control programmes in healthcare at both international and local levels include surveillance programmes and networks to monitor infections. They also rely upon staff practising effective hand hygiene, maintaining a hygienic clinical environment (including the use of materials and equipment) to minimize both the spread of bacteria and hospital-acquired infections (HAIs) and having sufficiently educated personnel to take specific precautions (WHO, 2016). The major source of contamination and spread of infection between the nurse, patient and the clinical environment is through touch, which has implications for hand hygiene, given that nurses are chartered to maintain asepsis in their clinical practices (WHO, 2009, 2014). Further, in the face growing antibiotic resistance, hospital and ward environmental hygiene becomes crucial to minimize colonization of microbes (Dancer, 2016). Such hygiene strategies would include ensuring that medical equipment is cleaned before it touches the patient, the appropriate storage of sterile equipment to maintain asepsis and having prompt staff response to decontaminate spills of blood or other body fluids (Rampling et al., 2001). Recent evidence also suggests that patients develop a greater risk of becoming infected when they are admitted to a room/bed area that was previously used by a carrier of bacteria, especially if they were also antibiotic resistant. Subsequently, substantial room cleaning is required upon discharge or transfer of infected patients (Mitchell et al., 2015). The risk of patients contracting HAIs remains high with the bulk of infections arising from urinary tract infections, surgical wound site contamination and from respiratory infections (secondary to acute stroke patients) as well as hospital-onset Staphylococcus aureus bacteraemia (Mitchell et al., 2017; WHO, 2002).

2 | BACKGROUND

Missed, rationed and unfinished care negatively influences patient outcomes relating to patient safety and the quality of nursing care given (Kalánková et al., 2020); however, there is a lack of literature about what aspects of infection control may be missed by nursing staff and how such care may either be delayed or be omitted entirely (Kalisch et al., 2009). A comparative analysis of the frequencies and types of missed infection control care (MICC) and a comparative incidence across three different countries forms the major focus of this paper.

3 | THE STUDY

3.1 | Aim/s

The specific purposes of this study were threefold. Firstly, it seeks to identify whether aspects of MICC can be identified and quantified. Next, it sought to test if a theoretical (hypothetical) model for estimating nurses' consensus scores about missed care in the prevention of infection can be developed. This model includes practices such as hand hygiene, methods used to reduce bacterial counts, infection surveillance, preventing HAIs and the use of specific precautions to minimize infection spread. Lastly, the study establishes if missed infection control scores can be predicted against demographic variables including the nurses' country of origin.

3.2 | Design

This is a cross-sectional, non-experimental, descriptive study using data from an international survey of nurses employed in three countries, Australia, Lithuania and Slovakia, who had expressed an interest in being involved in an infection control survey. A convenience, stratified sample of 1191 hospital-employed qualified nurses was obtained for the study irrespective of their gender, age and type of clinical setting in which they worked but excluded any nurse who did not have recency in clinical practice (had not worked in the clinical area during the past month).

3.3 | Data collection

Participation in the survey was undertaken electronically in all three countries, with a follow-up period of a fortnight to capture as many participants as possible. Data were collected during April and September 2019 with MICC survey that was developed by Henderson, Blackman, Willis and Roderick at Flinders University (Henderson et al., 2020). The survey is composed of three sections, two of which use subscales. Part A seeks background and other demographic information about the respondents. Subscale B (37 ordinal variable items) seeks responses about the type and frequency of missed nursing care in infection prevention and control, and subscale C (24 ordinal variable items) asks the respondents to indicate why this care might be missed. For this paper, data from subscales A and B are reported on.

Adaptation of the language versions of the MICC survey consisted of standard phases of forward–backward translation to develop conceptually equivalent language versions (Gurková et al., 2020; Riklikiene et al., 2020; Wild et al., 2005).

3.4 | Development of a theoretical (hypothetical) model for estimating nurses' consensus about MICC

To ascertain if the nurses' views on MICC show variances according to the different countries they originated from (among other factors), the use of partial least squares-structural equation modelling was crucial to first construct a hypothetical model and then test it for accuracy (Hansmann & Ringle, 2014). Structural equation modelling uses a series of mathematical equations to identify, measure and then describe the relationships between the different variables and their strength, as proposed in a hypothetical model. Variances in the

total MICC scores serve to predict how MICC is manifested according to the respondents. Table 1 explains these latent variables in full, with their associated observable (or manifest) variables.

A hypothetical model explaining the relationships between the nurses' variables and the total MICC scores is then represented diagrammatically by the use of a path diagram (also called an arrow scheme), which shows how the various factors are thought to relate to one another. Figure 1 demonstrates this beginning model with latent variables (or constructs) portrayed as ellipses while their observable (or manifest) variables occur as rectangles. Based on the hypothetical model (portrayed as the path diagram in Figure 1), it is proposed that the 11 different nurse variables will exert a direct effect on the five domains of MICC (hand hygiene, minimizing bacterial colonization, surveillance, preventing HAIs and use of specific precautions), all of which are known to be paramount in preventing infections.

Figure 1 details which factors are thought to directly influence the frequencies and types of MICC, which is depicted as latent variable (LV) 17 (total missed infection control scores). The direction of the arrows hypothesizes the relationships between them. It is noted that this influence will occur directly, for example, as in LV 1 (Nurses' country of origin) arriving at LV 17, but also indirectly, where item 1 may also influence LV 12 (Hand Hygiene variable), which in turn may indirectly influence LV 17. This then forms the foundations of the hypothetical model that is used to predict variances in MICC scores of nurses from the different countries.

3.5 | Ethical considerations

The research protocols were approved by the Social Research and Ethics Committees of Flinders University in Australia (number 7614) and the Faculty of Health Sciences, Palacký University in Olomouc, Czech Republic (3 January 2019). The Kaunas Regional Biomedical Research Ethics Committee considered and approved ethical requirement for this study in Lithuania (3 June 2019).

3.6 | Data analysis

Data used in this study were analysed using partial least squares-structural equation modelling as developed by Hansman and Ringle in 2014. Missing data were moderated using the multiple imputation method to maximize reliability of the data set (Carpenter & Kenward, 2013).

3.7 | Validity, reliability and rigour

Face validity of the survey was undertaken by the Australian College of Infection Prevention and Control (ACIPC), which examined all items of the survey to ensure each item was a logical representation of the infection control principles as sought in the questionnaire (Henderson et al., 2020). Given the limitation offered by Cronbach alpha as a reliability index (Sitjsma, 2009), Rasch analysis was selected as the preferred method to determine if the survey items do measure nurses' consensus about MICC in a consistent manner (Bond & Fox, 2015). It should be noted that several survey items breached the unidimensional parameters of Rasch measurement and were measuring something different to what all the other survey items estimated (Boone et al., 2014). Survey item number 15 showed unreliable estimates for all nurses in this study and was removed from further analysis, while survey item numbers 7 and 10 were problematic for Australian nurses and item 11 for Slovakian nurses. Additionally, survey items 6, 14, 16, 21, 24, 29 and 33 were deemed to break the unidimensionality requirement for Lithuanian nurses and were removed from the initial analysis (Riklikiene et al., 2020). With these modifications, the separation index for the survey items was 7.7 (reliability of 0.97), and for the consistency of participants' responses, it was 4.28 (reliability 0.95). These indices confirm that the MICC survey items operate well individually and collectively, in estimating nursing staff's consensus (Bond & Fox, 2015; Boone et al., 2014). Factor structure and convergent validity of the hypothetical model were explored by examining the indicator (outer) weights (which are expressions of their underlying constructs) of the model, which should be of approximately equal value (Hair et al., 2017).

4 | RESULTS

Table 2 below outlines the demographic characteristics of the respondents that were surveyed. The bulk of the nurse respondents were female, aged between 40 and 59 years, employed full-time in the private sector from Slovakia, Australia and then Lithuania. Most have clinical experience of over 10 years and thought they would probably leave their current work in the next 2 years or so. The majority also thought there was adequate staffing 75% of the time to meet infection control requirements but were split, as to the number of times they had undertaken extra shifts of care over the past 3 months. One half indicated that this was not required of them at all with another large cohort indicating that they had completed an extra 10 h. Most nurses indicated that in any one shift, they may have up to six admissions and/or discharges to be completed. The majority indicated that they had not attended infection control staff development sessions over the past 12 months (Table 2).

4.1 | Predicting what infection control care is missed

Figure 2 shows the direct effects the different factors have on infection control missed care (LV 17). Thirteen variables have a direct effect on the total scores underpinning MICC as shown by the bold arrows arriving at that variable. In magnitude of importance and having the largest effect on MICC is missed care related to reducing HAIs (LV 15 with a coefficient of 41.3) followed closely by surveillance (LV 14 with 39.2). Missed care associated with hand hygiene is

TABLE 1 Description of the survey items and variable names predicted to influence frequencies and types of missed infection prevention and control care

Name and number of midwives' (latent) survey variables	Name and description number of observed/indicator variables (all variables are arising from the survey)
1. Nurses' country of origin	Australia, 1; Lithuania, 2; Slovakia, 3
2. Nurses' gender	Female, 1; Male, 2
3. Nurses' age	Years
4. Area of nurses' employment	Public hospital, 1; private hospital, 2
5. Nurses' employment type	Part-time work, 1; full-time employment, 2
6. Length of nurses' clinical experience	Years
7. Extra shifts of work required over past 3 months	No, 0; 1–4 h, 1; 5–10 h, 2; more than 10 h, 3
8. Intention to leave current job	Leave job, 1; stay with current role, 2
9. How often do you feel staffing is adequate in your area to deal with infection control issues?	100% of the time, 1; 75% of the time, 2; 50% of the time, 3; 25% of the time, 4; 0% of the time, 5
10. Work intensity: a. Number of patient admissions did you care for on your last shift? b. Number of patient discharges/ transfers out admissions did you care for on your last shift?	Number of patients cared for
11. Have you had attended yearly staff development training about infection control?	Yes, 1; No, 2
12. How frequently are aspects of hand hygiene missed by nursing staff in your place of work?	1. Hand hygiene is performed before touching a patient. 2. Hand hygiene is performed before a procedure is undertaken. 3. Hand hygiene is performed after a procedure has been performed. 4. Hand hygiene is performed after touching a patient. 5. Hand hygiene is completed before drug administration. 12. Hand hygiene is undertaken following gown removal. 17. Patients are invited or assisted to perform hand hygiene following the use of a bedpan or urinal in bed. 30. Cleaners/support staff wash hands after removal of personal protective equipment (PPE). 37. Hand hygiene is performed after exposure to body fluids. 38. Hand hygiene is completed after drug administration.
13. How frequently are aspects of care to reduce bacterial colonization missed by nursing staff in your place of work?	6. Equipment is cleaned before it touches each patient. 9. Gloves are changed when moving from a contaminated/dirty site to a clean site. 10. 'Touch contamination' is avoided, for example, not scratching your nose or adjusting your glasses. 13. Facial equipment is removed before hands are washed. 29. Cleaners/support staff wear appropriate PPE. 32. Cleaners/support staff fully clean rooms between patients. 33. Cleaners/support staff fully clean rooms when an infected patient is discharged or transferred. 34. Patient's over-way table is cleaned prior to food delivery. 35. Staff decontaminate spills of blood and other body substances/fluids. 36. Instruments and equipment are stored to ensure sterility prior to use.
14. How frequently are aspects of infection control surveillance missed by nursing staff in your place of work?	8. PPE is donned in the correct order, for example, putting on gown first and then gloves to ensure that they are pulled over the cuff of the gown so that no skin is exposed. 15. All new admissions are screened for multi-resistant organisms (MRO). 16. Appropriate signage informing staff and visitors of the need for transmission-based precautions is displayed when managing a patient with a MRO. 27. Nurse/midwives communicate patient's MRO status at handover.

(Continues)

TABLE 1 (Continued)

Name and number of midwives' (latent) survey variables	Name and description number of observed/indicator variables (all variables are arising from the survey)
15. How frequently are aspects of care related to preventing hospital-acquired infections missed by nursing staff in your place of work?	18. Patients are showered preoperatively. 19. Catheter toilet care is performed each shift. 20. Oral care/teeth are cleaned at least daily. 21. Intravenous cannulas are swabbed with alcohol for 15 s and allowed to dry for 15 s before flushing or administering medications. 22. Gloves are worn and/or hand hygiene performed for preparing and administration of antibiotics. 28. Nurses/midwives communicate patient's MRO status on transfer to other wards or to new department, for example, X-rays.
16. How frequently are aspects of care using specific precautions missed by nursing staff in your place of work?	7. Appropriate PPE (such as gloves and gowns) are used when providing direct care to patients/residents who have a transmissible disease including MRO. 11. Gloves are removed before taking of the gown. 14. Goggles and mask or mask face shield is worn when caring for patients on respiratory/droplet precautions. 24. Healthcare organization documentation specifies the MRO status of patients on admissions. 25. Documentation of patient's MRO status is completed when the patient is discharged. 27. Nurse/midwives communicate patient's MRO status at handover.
17. All infection control missed care	Total scores for all missed infection control care items

Frequency scale: 1, never missed; 2, rarely missed; 3, occasionally missed; 4, frequently missed; 5, always missed.

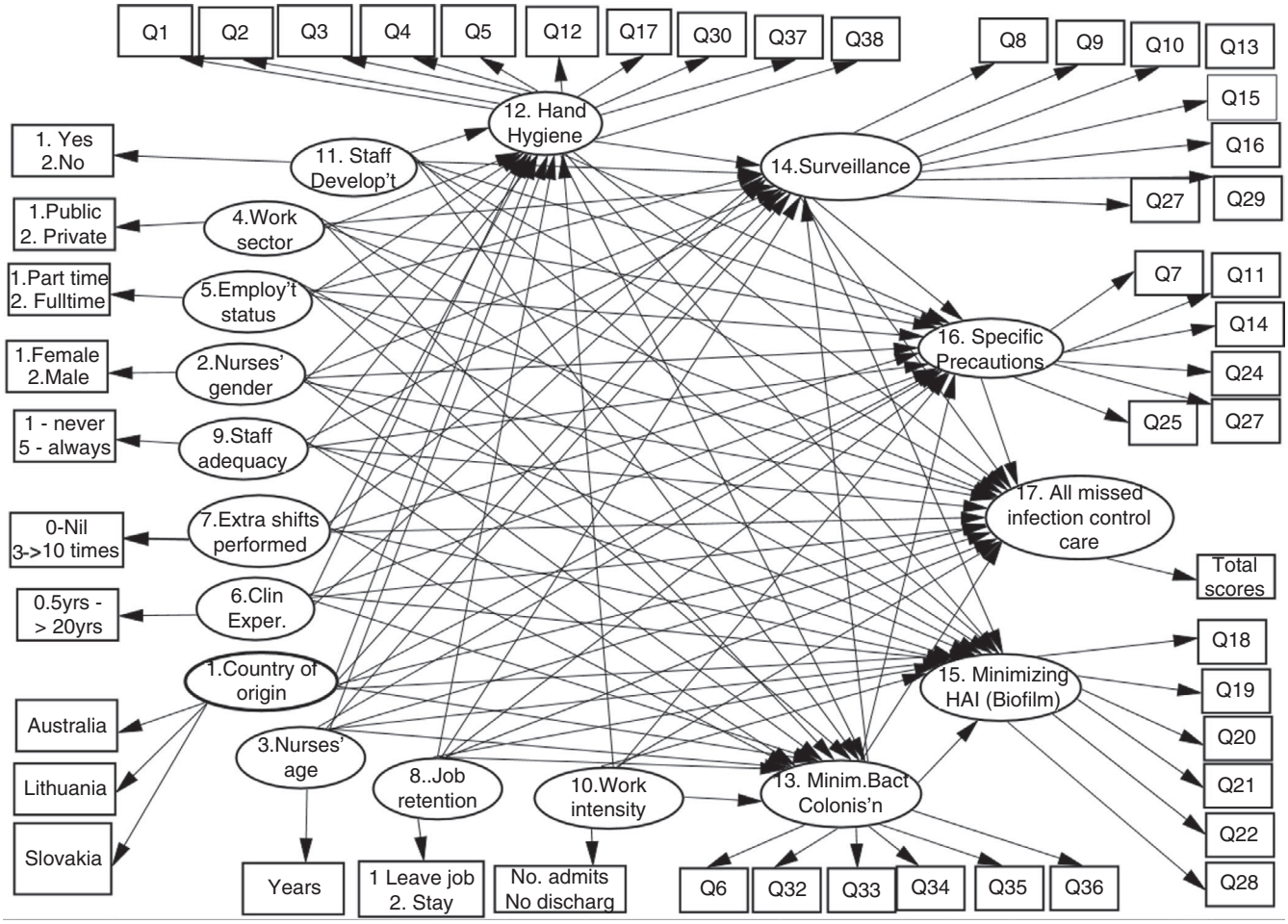

FIGURE 1 Theoretical model showing variables that predict types of infection control missed care

the third strongest factor (LV 12 with a coefficient of 36.6) followed by specific precautions (LV 16 with 34.6) and strategies to reduce bacterial colonization, which exert an effect on total score of MICC (LV 13 with a loading of 26.6).

TABLE 2 Descriptive statistics for demographic data used in the MICC survey (n = 1911 nurses)

Demographic variable	Sub-categories	Count	%
1. Nurses' country of origin	Australia	745	39
	Lithuania	210	11
	Slovakia	956	50
2, Nurses' gender	Female	1501	72
	Male	410	22
3. Nurses' age (years)	19–29	229	12
	30–39	306	16
	40–49	573	30
	50–59	535	28
	>50	268	14
4. Nurses' work sector	Public hospital	909	48
	Private hospital	1002	52
5. Nurses' employment status	Part-time	224	12
	Full-time	1687	88
6. Nurses' length of clinical experience	<6 months	93	6
	7 months to 2 years	299	15
	Greater than 2–5 years	317	16
	Greater than 5–10 years	243	13
	Greater than 10 years	959	50
7. Extra shifts performed	None	743	39
	1–4 h	201	11
	5–10 h	243	13
	More than 10 h	724	38
8. Nurses' job retention	Stay	426	22
	Leave (within 2 years)	1485	78
9. Adequacy of staff in clinical area	Never	192	11
	25% of the time	346	18
	50% of the time	490	26
	75% of the time	603	33
	All of the time	247	13
10. Work intensity			
A. patient admissions	1–3 pts	630	33
	4–6 pts	924	48
	7–10 pts	142	7
	More than 10 pts	225	11
B. patient discharges	1–3 pts	669	35
	4–6 pts	898	47
	7–10 pts	248	13
	More than 10 pts	96	5
11. Attends staff development	No	1061	55
	Yes	850	45

Abbreviation: MICC, missed infection control care.

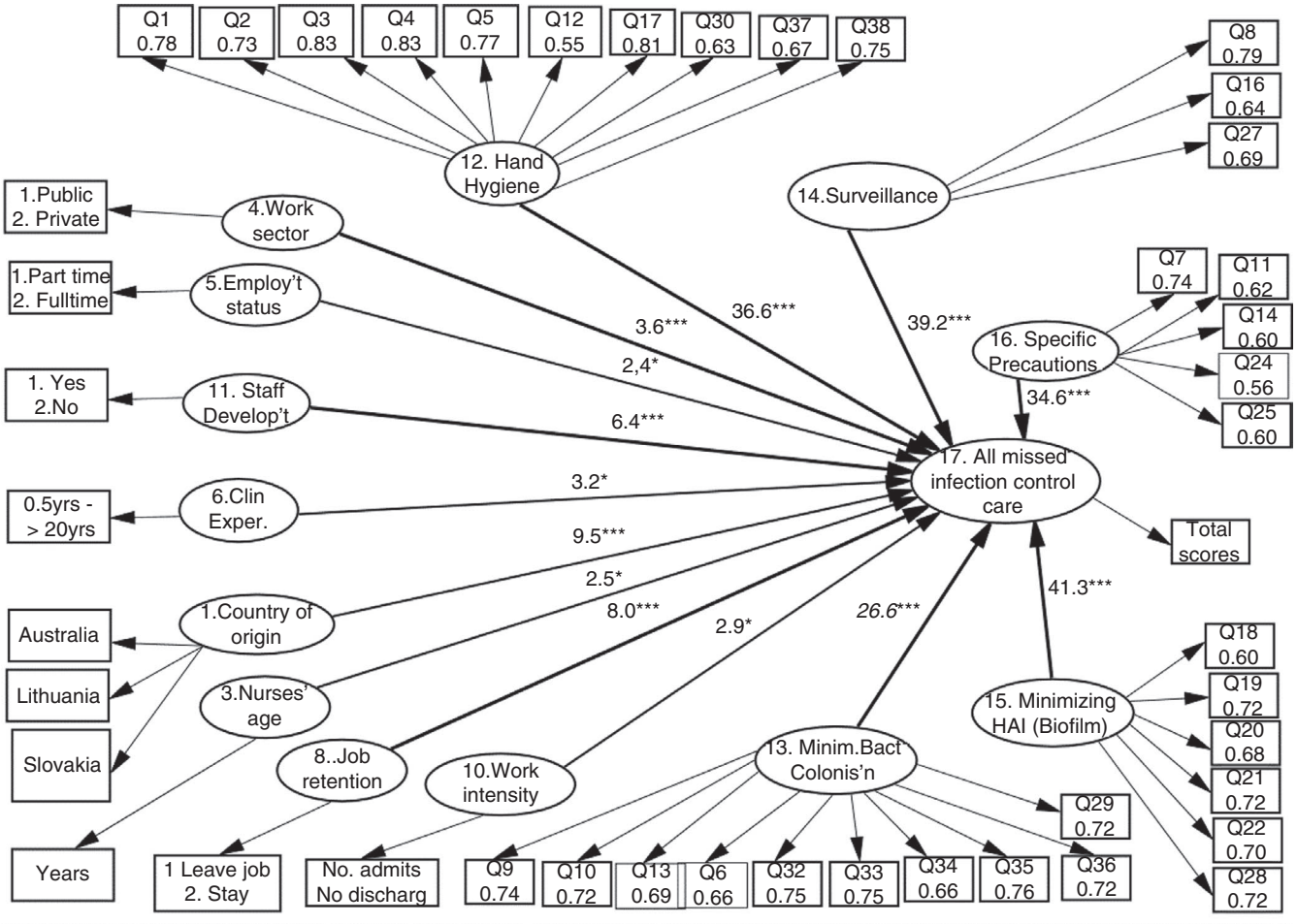

FIGURE 2 Final model predicting factors influencing frequencies and types of missed infection control care. ***$p < .001$; *$p < .05$

4.2 | Nurses' country of origin

Latent variable 1, the nurses' country of origin, also exerts a direct effect on the frequencies and types of MICC (coefficient of 9.5). Australian nurses identify all aspects of missed hand hygiene as being the most frequent aspect of MICC followed by Slovakian nurses and lastly staff from Lithuania. They rate washing of hands before doing a medication round and after touching patients as the most frequently missed items. Slovakian nurses claim that they are most likely to miss hand hygiene prior to giving medication, before touching a patient and after they have removed a gown. Lithuanian nurses identify less missed hand hygiene care than Australian nurses and indicate that if missed, it is most likely to before touching patients. In terms of minimizing incidences of HAI, nurses from both Slovakia and Australia indicate that preoperative patient showering, ongoing patient mouth care and sanitizing I/V sites adequately are most likely to be missed. Slovakian nurses indicate that gowning prior to preparing intravenous antibiotics is also missed. This was not a feature with Australian nor Lithuanian nurses.

4.3 | Staff retention and education

Staff retention (LV 8 with a loading of 8.0) also influences rates and types of MICC. Staff planning to leave their current work identify more instances of overall missed MICC compared with staff who wish to stay in their current roles. Staff development represented as LV 11 with a loading of 6.4 also directly effects MICC. Nurses who attend annual compulsory staff development witness more frequent MICC compared with staff who do not. They are more likely to identify missed care as it relates to minimizing HAI, taking specific precautions, surveillance and missed care overall.

4.4 | Site of employment and clinical experience

Hospital nurses in the public health sector (LV 4 with a coefficient of 3.6) identify greater frequencies of MICC overall compared with nurses employed in the private sector, particularly in all areas of hand hygiene surveyed, all aspects of surveillance and in all activities to minimize HAI (except performing catheter toilets) and in the use of

personal protective equipment (PPE) in surveillance. The length of clinical experience held by nurses (LV 6 with a loading of 3.2) also exerts a direct effect on types and frequencies of total MICC. As novice qualified nurses, the overall rate of MICC remains reasonably consistent for approximately 2 years but markedly increases according to nurses with 5–10 years of clinical experience, then diminishes in frequency as staff become more experienced. In relation to hand hygiene, there are significant numbers of novice nurses who identify most aspects of hand hygiene as missed, but it is clear that nurses with over 5–10 years of experience identify hand hygiene as being consistently missed.

4.5 | Work intensity

Latent variable 10, which represents intensity of patient admission and discharge rates, also impacts on MICC. As admission rates increase, so do the overall frequencies of MICC and notably all aspects of hand hygiene, with a loading of 0.29.

4.6 | Nurses' age

Older nurses (LV 3 with a loading of 2.5) describe greater instances of missing aspects of hand hygiene and strategies to reduce bacterial development (including ensuring equipment is cleaned prior to touching the patient and ensuring areas decontaminate after spills) compared with their younger cohort.

4.7 | Nurses' employment status

Part-time nursing staff also report more instances of infection control missed care overall LV 5 (with a coefficient of 0.24) than staff who work full-time, especially as related to all aspects of hand hygiene and all strategies to reduce HAIs (except completing documentation of patients with multi-resistant organisms status).

4.8 | Requirement to work extra shifts

The variable that indicates the number of extra shifts (LV 7) that were recently undertaken by nurses does not exert a direct effect on total MICC but does have an indirect effect, in that it simultaneously influences hand hygiene and surveillance missed care rates (LV 12 with a loading of 4.7 and LV 14 with a loading of 2.3, respectively) This in turn impacts on all MICC rates and types. All aspects of hand hygiene are impacted by the number of times staff are required to do extra shifts. The frequencies of missed hand care peaks as staff are required to work between one to four extra shifts.

4.9 | Staffing requirements

Staff adequacy represented by LV 9 influences missed frequencies in all aspects of hand hygiene, except in the instance when gowns are removed. Of note, was the rate of missed hand hygiene after they had contact with body fluids, which strongly increased when there were insufficient staff. Care to reduce incidences of HAIs (e.g. showering patients preoperatively, catheter care and preparing and giving I/V antibiotics) is rated as being missed more when there is minimal number of staff (sufficient staffing only 25% of the time).

5 | DISCUSSION

5.1 | Minimizing HAIs

The theoretical model anticipated that HAIs would be a significant inflame on all incidences of MICC, and indeed it was the case. Recent data from the United States suggested that 4% of all patient infections were HAIs (Magill et al., 2014) while the annual rate in Australia was approximately 175,000 cases (Russo et al., 2015) and increasing. While surveillance is a key infection control strategy to prevent urinary tract and vascular line infections, the gold standard for infection prevention is to not use such instrumentations in the first place. If this cannot be avoided, it is suggested that urinary and vascular devices should be used for short duration and changed frequently (Spelman, 2002).

With the recent trends of minimizing patients' post-operative hospital stay and use of day surgery, the incidences of surgical wound incision infection after hospital discharge are quite common, particularly with the complex surgical procedures (e.g. Coronary Artery Bypass Grafts) and with patients at greater risk (e.g. diabetes). Wound care as provided by nursing staff and operating theatre staff therefore needs to be thorough, and it is recommended using a non-touch technique if HAIs secondary to surgical site incisions are to be minimized.

5.2 | Surveillance

The failure of surveillance mechanisms is also hypothesized in this path model and also contributes to total MICC. This study indicates that it is those nurses who work in the public hospital systems who are most likely to miss screening patients for multi-resistant organisms and to communicate patient status to colleagues. This is despite surveillance systems being a cornerstone of not only infection prevention but also reducing antimicrobial resistance (WHO, 2016). The gold standard for monitoring for infection control is characterized as active, prospective and continuous (WHO, 2016). High-income countries such as Australia have coordinated surveillance at national or state level to provide quality data for effective monitoring and alert systems (Russo et al., 2015; WHO, 2011). This method, however, is not routinely implemented for

economic, staffing and technical performance reasons and only serves for reference purposes in other countries including those belonging to the EU. Instead, infection surveillance in countries such as Slovakia and Lithuania is monitored by the Healthcare-Associated Infections Surveillance Network, which is coordinated and guided by the European Centre for Disease Control and Prevention (Suetens et al., 2018). The most common form of surveillance is passive surveillance, which typically has low sensitivity (WHO, 2011), and the incidences of HAIs in acute care hospitals in some countries (e.g. Slovakia) are underreported because of passive surveillance (Nadova et al., 2016).

Each EU country may be best advised to establish their own national guidelines (of surveillance) for infection control programmes to provide systematic support and organization of HAIs surveillance systems at the facility-based and national levels, in close cooperation with the European Centre for Disease Control and Prevention. Healthcare facility guidelines may be better advised to establish priority areas for surveillance that are relevant to local conditions, particularly in terms of implications for patient safety, healthcare organization and economy (mortality, hospital prolongation and cost).

5.3 | Hand hygiene

Hand hygiene is the most underrated mechanism for minimizing infection and yet as a strategy it does this for less than 1% of the total cost of taking care of patients with HAIs (WHO, 2009, 2014). The World Health Organization is largely credited with the introduction of the 'Five Moments for Hand Hygiene' framework (Sax et al., 2007), but this study has shown that performing hand hygiene before touching a patient was missed most of all of the five moments, especially by Australian nurses although it was rarely overlooked by Lithuanian and Slovakian nurses. In another recent study, hand washing was the most missed aspect of all midwifery care as reported by Australian midwives (Blackman et al., 2020). Practising hand hygiene, which includes the use of alcohol-based hand rub and hand washing, is one example of a simple yet effective measure to prevent the spread of highly resistant bacteria and infections in healthcare settings. To improve staff hand compliance, particularly with the advent of coronavirus disease-19, nursing staff are recommended to have alcohol-based hand sanitizer at the point of care. Nursing supervisors may also need to audit hand hygiene programmes with the provision for performance feedback, to review and respond to identified gaps, barriers and resistors to adopting hand hygiene to maximize hand hygiene improvements (Australian Commission on Safety & Quality in Health Care, 2019; Brocket & Shaban, 2015; Grayson et al., 2011).

5.4 | Adopting specific precautions

In the context of greater incidences of antibiotic-resistant organisms occurring and the recent rise in coronavirus disease-19, greater emphasis on nursing staffs' preparedness to deal with airborne spread pathogens remains paramount, particularly among those staff employed in private hospitals and not attending staff development, as they are least likely to identify or acknowledge missed episodes of infection control care. It is suggested that staff need to be trained in how to use PPE and how to take infection control precautions. Ideally, another staff member can be identified who has the responsibility for observing workplace practices of others and providing feedback to them and members of the infection control team (WHO, 2002). In addition to these administrative controls, programmes involving bundles of compliance measures to maximize infection control including the use of specific precautions (PPE and staff communication) have been successfully used recently (Allen & Cronin, 2012).

5.5 | Strategies to reduce bacterial colonization

Methicillin-resistant staphylococcus organisms from patients and the clinical environment are generally quite widespread despite standard infection control measures (such as hand hygiene, isolation of affected patients and cleaning of ward areas) being used, leading to surgical wound infections (Rampling et al., 2001). What is implicated here is the adequacy of hospital hygiene practices, such as the frequency in which hospital, patient and staff contact surfaces are cleaned. Indeed, this current study has shown that across all three countries studied, the majority of nurses believe that the frequencies of missed hospital hygiene practices are very low, especially compared with hand hygiene compliance rates. In Rampling's study, in their bid to reduce bacterial colonization, domestic cleaning time was significantly increased with the focus on the removal of dust by vacuum cleaning and the routine cleaning of shared medical equipment. These actions yielded significant reductions in patient nosocomial infection rates. In another study where additional cleaning staff were mandated specifically for cleaning hand touch sites such as patients' lockers, over-bed tables and beds, dramatic reductions in levels of bacterial contamination at hand-touch sites were shown. Importantly, the re-emergence of clusters of new methicillin-resistant organisms infections re-occurred in just less than a fortnight after these cleaning roles were withdrawn (Dancer et al., 2009).

6 | LIMITATIONS

This study explored the responses of hospital-employed nurses from three participating countries; therefore, the study's outcomes needed to be considered in that context. The study did not identify whether MICC varies according to the status of nurses (i.e. registered nurses or minimally qualified nurses). Additionally, the outcomes of the study are reflective of the perceptions or understandings of responding nurses and may be subject to response bias.

7 | CONCLUSION

Evidence from this study suggests that infection control care is missed, its origins are multifactorial and the sources for potential infection are linked. Strongly implicated in this study is propensity for the risk HAIs related to MICC and hand hygiene and surveillance. Healthcare-acquired infections can be best minimized when invasive procedures (catheters and vascular lines) are deferred in favour of less intrusive treatment options. Hospital hygiene is underestimated by nursing staff across all countries as a mechanism to reduce nosocomial infections secondary to bacterial colonization.

The origins of reduced staff hand hygiene compliance rates (particularly amongst Australian nurses) require an ongoing, whole-of-organization approach with educational interventions for improved staff adherence. Infection control surveillance remains a key to reducing HAIs, but unless there is active and continuous scrutiny, the incidences of HAI may be underreported and untreated. While this study has explored the variations in the frequencies of different types of MICC, more research is needed to establish why such care is omitted.

CONFLICT OF INTEREST

No conflict of interest has been declared by the author(s).

AUTHOR CONTRIBUTIONS

Conception or design of the work: IB, EW and JH. Data collection: IB, OR and EG. Data analysis and interpretation: IB, OR, EG and JH. Drafting the article: IB, OR, EG and EW. Critical revision of the article: IB, OR, EG, EW and JH. Final approval of the version to be published: IB, OR, EG, EW and JH.

PEER REVIEW

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DATA AVAILABILITY STATEMENT

Authors do not wish to share the data.

ORCID

Ian Blackman https://orcid.org/0000-0002-9872-9427
Olga Riklikiene https://orcid.org/0000-0001-5143-4288
Elena Gurkova https://orcid.org/0000-0002-5629-9414
Eileen Willis https://orcid.org/0000-0001-7576-971X

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