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SAFE HANDS, SAFER CHILDREN: INFECTION-CONTROL KNOWLEDGE, ATTITUDES AND PRACTICES AMONG PAEDIATRIC NURSES

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ABSTRACT

Background: Healthcare-associated infections are a major patient-safety concern. Nursing officers' knowledge, attitudes and practices are central to infection prevention, particularly in paediatric care.

Methods: A hospital-based descriptive cross-sectional study was conducted among nursing officers in medical wards, surgical wards, intensive care units and operating theatres at Lady Ridgeway Hospital for Children, Sri Lanka. Of 317 selected nursing officers, 260 participated (82%). An expert-validated questionnaire assessed knowledge, attitudes and self-reported practices. Hand hygiene, cannulation, intravenous drug administration and personal protective equipment use were also assessed through structured participant observation.

Results: Mean knowledge was 0.71 (SD 0.08), mean attitude score was 3.95 (SD 0.58), and mean self-reported practice score was 3.81 (SD 0.56). Positive or very positive attitudes were reported by 85.4%, and positive or very positive practices by 72.5%. Knowledge varied by education, nursing grade and age; attitudes varied by marital status and age. Knowledge correlated weakly with attitude ($r = 0.187$), while attitude correlated moderately with practice ($r = 0.349$). Observed hand-hygiene compliance was 49% in surgical wards and 52% in medical wards; success rates were 60% for cannulation, 71% for intravenous drug administration and 83% for personal protective equipment use.

Conclusion: Knowledge, attitudes and self-reported practices were generally satisfactory, but direct observation revealed a substantial hand-hygiene gap. Targeted training, surveillance and institutional support are needed.

Keywords: Infection Prevention and Control; Knowledge; Attitudes; Practices; Hand Hygiene; Sri Lanka

1 INTRODUCTION

Healthcare-associated infections (HAIs) account for a substantial proportion of adverse events in healthcare delivery and contribute to morbidity, mortality and additional costs to patients and health systems [1-4]. The World Health Organization has emphasised infection prevention and control as an essential component of safe healthcare, particularly in settings where resource limitations can increase the risk of transmission [1,4].

Sri Lanka has adapted international infection-control guidance to the national context through the Hospital Infection Control Manual developed by the Sri Lanka College of Microbiologists in collaboration with the Ministry of Health [5]. Effective implementation of such guidance depends on the knowledge, attitudes and day-to-day practices of healthcare workers.

Nursing officers are particularly important because they spend prolonged periods in direct patient care, perform invasive and non-invasive procedures, handle equipment and waste, and influence the ward environment [6,7,9,10]. Their knowledge can shape attitudes towards infection prevention, while attitudes may influence whether recommended practices are followed consistently [11]. Previous reviews, guidance documents and studies in different settings have reported variable levels of infection-control knowledge and practice among nurses and other healthcare workers [12-19].

Lady Ridgeway Hospital for Children (LRH) is the largest tertiary paediatric hospital in Sri Lanka. Infection prevention is especially important in paediatric services, where staff knowledge, attitudes and hand-hygiene behaviours directly shape care [18,30]. At the time of the study, local evidence on knowledge, attitudes and practices of nursing officers at LRH was limited.

The study therefore aimed to assess knowledge, attitudes and practices on infection control among nursing officers at LRH and to determine factors associated with those three dimensions. A further strength of the study was the use of direct observation to compare real-time practice with self-reported practice.

2 MATERIALS AND METHODS

2.1 Study design, setting and population

A hospital-based descriptive cross-sectional study was conducted at Lady Ridgeway Hospital for Children, Colombo, from February to August 2019. The study population consisted of nursing officers working in medical wards, surgical wards, intensive care units and operating theatres. Nursing officers who had worked in the relevant unit for more than three months were eligible. Those on leave during data collection, those who did not consent, and those working outside the selected clinical areas were excluded.

2.2 Sample size and sampling

The required analytical sample was calculated using the standard single-proportion formula with a 95% confidence level, an expected satisfactory knowledge/practice proportion of 75%, based on a previous Sri Lankan study [22], and 5% precision. The calculated sample was 288 and was increased to 317 to allow for 10% non-response. Multistage sampling was used. Medical wards, surgical wards, intensive care units and operating theatres were represented proportionate to their eligible nursing populations, and nursing officers were selected systematically from unit-level sampling frames.

The planned allocation was 79 nursing officers from medical wards, 101 from surgical wards, 86 from intensive care units and 51 from operating theatres.

2.3 Development and validation of the questionnaire

A self-administered questionnaire was developed because a comprehensive validated instrument covering all required infection-control domains could not be identified. Its content was guided by the Sri Lankan Hospital Infection Control Manual and relevant literature. The draft instrument was reviewed by a multidisciplinary expert panel comprising consultant microbiologists, a virologist, a consultant community physician, a medical administrator and an infection-control nursing officer.

Face and content validity were assessed through expert consensus. Two modified-Delphi rounds were conducted until consensus was reached on item relevance, wording and scoring. The questionnaire was pre-tested among 25 nursing officers at the National Eye Hospital, Colombo. Cronbach's alpha during pre-testing was 0.845 for attitude and 0.742 for practice.

2.4 Measures

The final questionnaire had four sections. Section A collected sociodemographic and work-related information. Section B assessed knowledge using 40 true/false items across key areas: standard precautions, hand hygiene, personal protective equipment, disinfection and sterilisation, spillage management, handling of sharps, additional precautions, perioperative care, outbreak management, cannulation/catheterisation and hospital waste management. Correct responses were scored 1 and incorrect responses 0.

Attitudes and self-reported practices were each assessed using ten five-point Likert items. Composite scores ranged from 1 to 5. For descriptive interpretation, scores were grouped using equal intervals into very negative/negative, average, positive and very positive categories.

2.5 Participant observation

To reduce reliance on self-reporting, real-time practice was assessed through unannounced participant observation by a trained pre-intern medical graduate. Structured checklists were used for hand hygiene, cannulation, intravenous drug administration and personal protective equipment. Hand hygiene was assessed using the World Health Organization observation approach. A total of 555 hand-hygiene opportunities were observed across medical and surgical wards.

2.6 Data collection and analysis

Data were collected by the principal investigator and one trained data collector. Written informed consent was obtained before questionnaire administration. Data were analysed using SPSS version 21. Descriptive statistics were presented using percentages, means and standard deviations. Independent-sample t-tests, one-way ANOVA and Pearson correlation were used as appropriate. Statistical significance was set at $p < 0.05$.

2.7 Ethical considerations

Ethical approval was obtained from the Ethics Review Committee of Lady Ridgeway Hospital for Children. Administrative clearance was obtained from relevant hospital authorities. Participation was voluntary, written informed consent was obtained, and personal identifiers were not collected.

3 RESULTS

3.1 Participant characteristics and overall KAP

Of the 317 selected nursing officers, 260 participated, giving a response rate of 82%. The mean age was 34.64 years (SD 8.18; range 24–56 years). The mean duration in the current ward was 5.18 years (SD 6.42). Most participants had a nursing diploma (97.6%), 65.6% were married, and 67.1% were Grade III nursing officers.

Table 1. Participant characteristics and overall knowledge, attitude and practice findings.

Measure	Result
Participants	260 (82% response)
Age	Mean 34.64 years (SD 8.18)
Duration in current ward	Mean 5.18 years (SD 6.42)
Nursing diploma	97.6%
Currently married	65.6%
Grade III nursing officers	67.1%
Knowledge	Mean 0.71 (SD 0.08)
Attitude	Mean 3.95 (SD 0.58); 85.4% positive/very positive
Self-reported practice	Mean 3.81 (SD 0.56); 72.5% positive/very positive

3.2 Knowledge on infection control

Overall mean knowledge was 0.71, equivalent to 71% correct responses. Knowledge was high for several individual items, including the importance of hand hygiene in preventing HCAs (97%), avoiding recapping sharps (96%), avoiding

direct hand-to-hand passing of sharps (96%) and identifying the preferred upper-extremity site for peripheral venous cannulation in adults (95%).

Important knowledge gaps were also identified. Only 24% correctly answered the item on management of blood/body-fluid spillage with hypochlorite, 11% correctly answered the item relating to the use of additional precautions for every admitted patient, 39% correctly answered the item concerning doors and windows during procedures for isolated patients, and 40% correctly answered the item on duration of central venous catheter use. These findings identified specific areas for future training.

3.3 Attitudes and self-reported practices

The mean attitude score was 3.95 (SD 0.58). Of the 260 participants, 137 (52.7%) were categorised as having positive attitudes and 85 (32.7%) as having very positive attitudes, giving 85.4% with positive or very positive attitudes.

The mean self-reported practice score was 3.81 (SD 0.56). Practice-category data were available for 251 participants; 124 (49.4%) had positive practices and 58 (23.1%) had very positive practices, giving 72.5% with positive or very positive practices.

3.4 Factors associated with knowledge, attitudes and practices

Table 2: Associations of sociodemographic and work-related factors with knowledge, attitude and self-reported practice

Factor	Knowledge	Attitude	Practice
Marital status	Not significant (p=0.928)	Significant (p=0.022)	Not significant (p=0.215)
Educational level	Significant (p=0.01)	Not significant (p=0.34)	Not significant (p=0.77)
Nursing grade	Significant (p=0.04)	Not significant (p=0.51)	Not significant (p=0.71)
Age group	Significant (p=0.02)	Significant (p=0.02)	Not significant (p=0.31)
Duration in current ward	r=0.180, p=0.004	r=0.065, p=0.306	r=0.003, p=0.963

Educational level, nursing grade, age group and duration in the current ward were significantly associated with knowledge. Attitude differed significantly by marital status and age group. None of the assessed sociodemographic or work-related factors showed a statistically significant association with self-reported practice.

Knowledge showed a weak positive correlation with attitude (r=0.187, p=0.002; n=250). Attitude showed a moderate positive correlation with self-reported practice (r=0.349, p=0.001; n=241). These results support an association between knowledge and attitudes and between attitudes and practices, but do not establish causality.

3.5 Participant-observation findings

Table 3: Summary of direct participant-observation findings.

Observed area	Observed performance
Hand hygiene - surgical wards	49% correct (135/275 movements)
Hand hygiene - medical wards	52% correct (145/280 movements)
Cannulation	60% overall success (80/132 movements)
IV drug/fluid administration	71% overall success (30/42 movements)
Glove use	78% overall success (66/85 movements)
Face-mask use	90% overall success (65/72 movements)
Gown use	81% overall success (58/72 movements)
Overall PPE use	83%

The clearest discrepancy between self-reported and observed practice was seen in hand hygiene. Approximately half of observed hand-hygiene opportunities were performed correctly. Within specific procedures, hand hygiene was also low

during cannulation (18%) and intravenous drug administration (6%). By contrast, identification of the correct patient, drug, dose and time during intravenous drug administration was observed in 100% of the assessed movements.

4 DISCUSSION

This study found generally satisfactory knowledge, positive attitudes and positive self-reported infection-control practices among nursing officers at LRH. However, direct observation showed an important difference between reported practice and actual performance, particularly for hand hygiene. This contrast is one of the most useful findings of the study because self-reporting alone could have produced an overly favourable picture of infection-control practice.

The overall knowledge score of 71% was similar to the 72.5% reported in a local study on hand hygiene among intensive-care staff in Anuradhapura and to findings from a tertiary referral centre in north-western Nigeria [22,23]. Other international studies have reported variable infection-control knowledge or practice among nurses and healthcare workers [16,17,19,24,25]. The comparison suggests that overall knowledge at LRH was satisfactory, while the item-level analysis still identified specific deficiencies that require attention.

Knowledge of hand hygiene and sharps handling was relatively strong. In contrast, lower knowledge was identified for spillage management, additional precautions, patient isolation and central venous catheter-related issues. These are clinically important areas because infection prevention depends on consistent application of standard precautions, transmission-based precautions and device-related safeguards [4,5,20,21,26].

Attitudes towards infection control were favourable, with 85.4% of participants categorised as positive or very positive. This was higher than the proportion with favourable attitudes in the local hand-hygiene study at Teaching Hospital Anuradhapura [22] and broadly comparable with favourable attitude findings reported in a Nigerian nursing study [27]. The weak but statistically significant correlation between knowledge and attitude is consistent with the general KAP concept that knowledge may contribute to attitudes, although the cross-sectional design cannot demonstrate a causal pathway [11].

Self-reported practices were also favourable, with 72.5% of participants having positive or very positive practice scores. However, participant observation revealed only 49% hand-hygiene compliance in surgical wards and 52% in medical wards. Similar gaps in hand-hygiene performance have been reported internationally [27-29]. Studies from Italy and Canada have reported better compliance in some settings, showing that hand-hygiene performance can vary considerably according to context, workload, resources, supervision and local safety culture [29,30].

The direct observation findings also showed a more complex picture than a single overall practice score. Cannulation achieved 60% overall success, intravenous drug administration 71%, and PPE use 83%. Nevertheless, hand hygiene during these procedures remained weak. This indicates that technically correct completion of a procedure does not necessarily mean that all infection-control steps are consistently followed.

Knowledge differed by education, nursing grade and age, and was weakly related to duration in the current ward. Studies from Nigeria and Ethiopia have similarly reported relationships between experience or seniority and infection-control knowledge [17,23]. Attitude differed by age and marital status. In contrast, none of the measured sociodemographic factors was associated with self-reported practice. This may indicate that organisational factors, workload, resource availability, ward routines and supervision have greater influence on actual practice than personal characteristics alone.

The findings have direct relevance to medical administration. Knowledge gaps can be addressed through focused education, but the observed practice gap requires more than training. Continuous availability of hand-hygiene resources, manageable workload, visible supervision, routine infection-control audit and feedback, and active institutional leadership are likely to be important for translating knowledge and positive attitudes into reliable practice [4,5,7,8].

4.1 Recommendations for practice and management

Hand hygiene should be treated as the highest-priority area for improvement. Infection-control units should conduct regular surveillance using a standard observation checklist and provide feedback to wards. Visual reminders on hand-washing technique and the five moments of hand hygiene should be displayed at appropriate points of care.

In-service training and workshops should focus not only on hand hygiene but also on the knowledge gaps identified in standard precautions, personal protective equipment, spillage management, additional precautions, isolation practices and central venous catheter-related infection prevention.

Hospital management should ensure continuous availability of materials required for infection-control practice and review workload and staffing barriers that may prevent adherence. The national Hospital Infection Control Manual should be actively disseminated and updated as required. Further research should assess organisational and administrative factors such as leadership, supervision, staffing, resource availability and the expectations of nursing officers from medical administrators.

4.2 Limitations

The study was conducted in a single tertiary paediatric hospital and the findings may not be generalisable to all Sri Lankan hospitals. The self-administered questionnaire may have been affected by social-desirability and self-reporting bias. The hospital is a busy clinical setting and workload may have affected the attention given to questionnaire completion.

Although direct observation strengthened assessment of practice, observation itself may introduce behavioural change if participants become aware that they are being observed. The study also focused mainly on individual knowledge, attitudes and practices and did not comprehensively assess organisational determinants such as leadership, supervision, staffing and resource availability. These should be addressed in future research.

5 CONCLUSION

Nursing officers at Lady Ridgeway Hospital for Children demonstrated generally satisfactory knowledge, positive attitudes and positive self-reported practices on infection control. Knowledge was associated with educational level, nursing grade, age and duration in the current ward, while attitude was associated with age and marital status. No assessed sociodemographic factor was significantly associated with self-reported practice.

Knowledge was weakly correlated with attitude and attitude was moderately correlated with practice. Importantly, direct observation showed that hand-hygiene performance was substantially weaker than suggested by self-reported practice, with correct hand hygiene observed in only about half of opportunities. Strengthening hand hygiene through training, surveillance, resources and institutional support should therefore be a priority.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

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Disclosure of conflict of interest

The authors declare no competing interests.

Statement of ethical approval

Ethical approval was obtained from the Ethics Review Committee of Lady Ridgeway Hospital for Children.

Statement of informed consent

Written informed consent was obtained from participants.

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