



Survey

Self-assessed Competence of Nurses in Critical Care Units in Malawi: A Cross-sectional Survey

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ABSTRACT

Background: The delivery of nursing care in critical care settings is complex because of the patients' critical illness and the need to manage equipment that is used to treat, support, and monitor the patient. Despite the high disease burden, which increases the demand for critical care, there are no critical care nurse training programmes in most developing countries, including Malawi.

Aim: To determine the level of competence of nurses in critical care units in Malawi.

Methods: A cross-sectional survey was used. Nurses (n=79) in intensive care units and high dependency units at two tertiary hospitals self-assessed their competence on the Intensive and Critical Care Nursing Competence Scale (ICCN-CS-1) and a list of 10 additional competencies. Data were analysed using SPSS version 23.

Results: Nurses self-rated their competence on ICCN-CS-1 as good and excellent. However, the scores on ICCN-CS-1 were in contrast with nurses' responses to the additional competencies. Most nurses rated their competence as poor on basic interpretation of 3-lead ECG, and interpretation of arterial blood gases, and moderate on caring for a patient with an endotracheal tube, performing cardiopulmonary resuscitation, and recognition and management of electrolyte imbalance.

Conclusions: Findings show that nurses rated their knowledge, skill, and experience as moderate on some competencies and poor on others. The competence assessment tool used was developed for high-income countries, so a competence assessment tool appropriate for developing countries like Malawi is needed.

Keywords: Critical care nursing, critical illness, Malawi, nurses, tertiary care centres

INTRODUCTION

Critical care nurses play a significant role in the management of critically ill patients. Critically ill patients have actual or potentially life-threatening conditions requiring intensive level of care from highly skilled health professionals, including nurses (Häggströma et al. 2017; Australian College of Critical Care Nurses, 2017). Nursing care is complicated by the patient's critical illness, inability of nurses to understand the patient needs because of communication problems, and the presence of technology, which is used to treat, support, and monitor vital organs (Tunlind

et al., 2015; Bagherian et al., 2017). Therefore, it is expected that nurses who provide care to critically ill patients must possess appropriate knowledge and skills to ensure patient safety and that patients receive the best care possible (Häggströma et al. 2017; Perrie et al. 2014).

Given that patients admitted to critical care units (CCUs) are critically ill, critical care nursing in developed countries such as Sweden and Norway, is provided by registered nurses, prepared at degree level and by some with post-registration qualification in critical care nursing (Leonardsen et al., 2020; Häggströma et al., 2017). This is not the case with developing countries like Malawi, where most of the direct patient care, including critical care, is provided mainly by nurse-midwife technicians prepared at the diploma level (Mula et al., 2014). With regard to post-registration critical care courses, such courses are not available in most developing countries, including Malawi (Barnes and Paterson-Brown, 2017; Gundo et al., 2019). Despite the high disease burden of critical illness, which increases the demand for critical care, most nurses in CCUs rely on their basic nursing education to care for the critically ill in developing countries (Mula et al., 2014; Gundo et al. 2019).

The lack of critical care competence among nurses in Malawi has been reported in previous studies as contributing to suboptimal care of critically ill patients and their families (Mula, Ncama, and Maluwa 2014; Gundo et al. 2019). However, there has been no detailed investigation of the nurses' competence and focus areas for professional development. In the absence of critical care nurse training programs in the country, the assessment of the nurses' competence would inform educational programmes on the care of critically ill patients. This paper reports findings of the self-assessment of competence levels of nurses in critical care units as part of a larger mixed methods study on the development of an in-service training programme for the nurses in Malawi. In this study, the term nurses refer to nurse-midwife technicians and registered nurses.

METHODS

Design

A cross-sectional survey was used for the self-assessment of nurses' competence in intensive and critical care nursing.

Study Setting

The study was conducted at two hospitals (A and B), which were purposively selected because they are the biggest tertiary facilities with busy CCUs in Malawi. The hospitals offer specialised care and serve as teaching hospitals for medical doctors, nurses, clinical officers, anaesthetic clinical officers, and other cadres. At the time of data collection, there were two general intensive care units (ICUs), one in each hospital, and nine adult high dependency units (HDUs).

Population and Recruitment of Participants

The target population comprised nurses working in ICUs and adult HDUs. The first author presented the proposed study at the hospital departmental meetings to

create awareness about the study and invite potential participants. These meetings are routinely organised to discuss patient care, share good practice activities, and research findings, among other reasons. Nurses in-charge of the ICUs and HDUs were also briefed about the study and requested to share information with nurses in their departments. In addition, posters were placed in all ICUs and adult HDUs inviting nurses, who would be willing, to participate in the study.

Inclusion and Exclusion Criteria

Participants were nurses working full or part-time (locum) for at least three months in any of the CCUs. In Malawi, part time or locum nurses are nurses who belong to other departments or wards but provide cover for staff shortages in another department or ward including CCUs on a temporary basis. Those who expressed willingness to participate in the study were given an information letter with study details and were requested to provide written consent by signing the consent form.

Sample Size

Given that there was no similar research conducted in Malawi and that the Intensive and Critical Care Nursing Competence Scale (ICCN-CS-1) questionnaire had not been tested on a Malawi population of nurses before, it was difficult to find prior published research from which to appropriately calculate sample size. For the current study, there were 102 nurses working in two ICUs and nine adult HDUs at the two hospitals at the time of data collection. A decision was made to invite all nurses to participate because of the small population.

Data Collection Tools

The ICCN-CS-1 questionnaire and an additional list of competencies were used for the data collection. The ICCN-CS-1 is a self-assessment scale that was developed through literature review and a Delphi study in Finland. The scale comprises 144 items that relate to domains of competence in intensive and critical care nursing; namely knowledge, skill, attitude and value, and experience (Lakanmaa et al. 2014; Lakanmaa et al. 2012). The expected score on each item and total competence ranges from 1-5 and 144-720, respectively; a higher score means higher competence on the item or overall competence. The tool was chosen because it is a reliable and valid tool to assess nurses' competence in intensive and critical care nursing, and it is recommended for the identification of learning gaps in clinical practice (Shouryabi et al. 2017; Lakanmaa et al. 2012; Lakanmaa et al. 2014; Lakanmaa et al. 2015). The studies by Lakanmaa (2014) and Shouryabi (2017) reported good internal consistency reliability of the tool with Cronbach's alpha ranging from 0.83 to 0.98. In addition, the researcher did not find an instrument that is specifically designed for use in developing countries like Malawi. However, the ICCN-CS-1 is relatively new, and its content validity has never been assessed in developing countries like Malawi. For this reason, content validity was assessed prior to using the ICCN-CS-1 in a Malawian context.

For the current study, a content validity index (CVI) was calculated through expert assessment to determine the relevance of the ICCN-CS-1 in the Malawi context. The content validity of the ICCN-CS-1 was assessed by calculating two types of CVI, namely item-level CVI (I-CVI) and scale-level CVI (S-CVI). The I-CVI ranged from .5-1.0. The S-CVI/UA and S-CVI/Av were 0.97 and 0.99, respectively. A group of experts was requested to identify items or required competencies that are not included in the tool but relevant to Malawi's context. This process led to the identification of 10 additional items which were assessed separately as the copyright author of the ICCN-CS-1 did not permit alterations of the original tool. The additional items were meeting nutritional needs of patients; recognition and management of electrolyte imbalance; performing cardiopulmonary resuscitation (CPR); caring for a patient with endotracheal tube; caring for a patient with tracheostomy; basic interpretation of 3-lead electrocardiogram (ECG); preparation and management of emergency drugs; documentation of patient care; interpretation of arterial blood gases; and implementation of the discharge plan. These latter items were aggregated into Questionnaire 2 (Q2).

Ethical Approval

This study was reviewed and approved by the ethics committee at Auckland University of Technology in New Zealand (approval number 15/439) and by the National Health Sciences Research Committee in Malawi (reference number NHSRC #1533).

Data Collection Process

The nurses who returned their signed consent forms were invited to complete the ICCN-CS-1 (Q1) and a second tool with the additional items (Q2). The data collection tools were in English language because health professionals are fluent in English after a minimum of 12 years of formal education and a minimum of 3 years of nursing or health-related training. Completion of Q1 and Q2 took 20-30 minutes and 10-15 minutes, respectively.

Data Analysis

These data were entered into IBM SPSS (version 23) for analyses. The two questionnaires were analysed separately. Descriptive statistics were used to summarise demographic characteristics and scores on the questionnaires. Independent sample t-test, Mann-Whitney tests, and multiple regression were used to compare competence scores of different groups of nurses. The assumptions for each test were met before running the tests. Kolmogorov-Smirnov and Shapiro-Wilk tests were used to assess the normality of distribution of the data. The level of significance was set at 0.05.

RESULTS

Out of 102 nurses who received the questionnaire, 79 returned them (77% response rate). Most participants were female, nurse-midwife technicians and over 50%



had less than two years of experience in the unit. A summary of the demographic data is presented in Table 1.

Table 1: Demographic Profile of Study Participants

Demographic Variable		
Age, mean (SD)		32.29(8.32)
Age distribution, n(%)	23-32 years	51(64.55)
	33-42 years	19(24.05)
	43-52 years	6(7.59)
	53-62 years	3(3.8)
Gender, n(%)	Male	19(24.05)
	Female	60(75.94)
Professional Qualification, n(Nurse midwife technicians	45(56.96)
	Registered nurses	34(43.04)
Type of unit, n(%)	ICU	20(25.31)
	HDU	59(74.68)
Hospital, n(%)	Hospital A	26(32.91)
	Hospital B	53(67.08)
Nurses clinical experience by facility (months), n(%) ¹	Hospital A (Mean, SD)	45.65(29.61)
	Hospital B (Mean, SD)	25.08(22.47)

¹ p=0.12

Nurses' Competence on ICCN-CS-1 (Q1)

The item mean scores ranged from 2.22 (SD = 1.18) to 4.86 (SD = 0.35). Most of the items with high mean scores were related to the attitude and value domain of the questionnaire. The items with low mean scores are presented in Table 2.

Table 2. Items on the ICCN-CS-1 with Low Mean Scores

Item	Mean(SD)
I know how I adhere to economic efficiency ¹	2.99(1.06)
I am able to adhere to organ transplantation law ²	2.40(1.23)
I know how I adhere to organ transplantation law ³	2.22(1.13)
I have experience of adhering to organ transplantation law ⁴	2.22(1.18)

Note. These items relate to different domains of the questionnaire: ¹Knowledge domain; ² Skill domain; ³ Attitude and value domain; ⁴ Experience domain

The total competence score on the scale ranged from 475-708 (M = 604.97, SD = 55.08). Based on the score classification presented by the copyright author Lakanmaa et al. (2013a), the nurses' scores in the present study represent good or excellent

competence. As presented in Figure 1 the mean score on attitude and value was higher than the other domains.

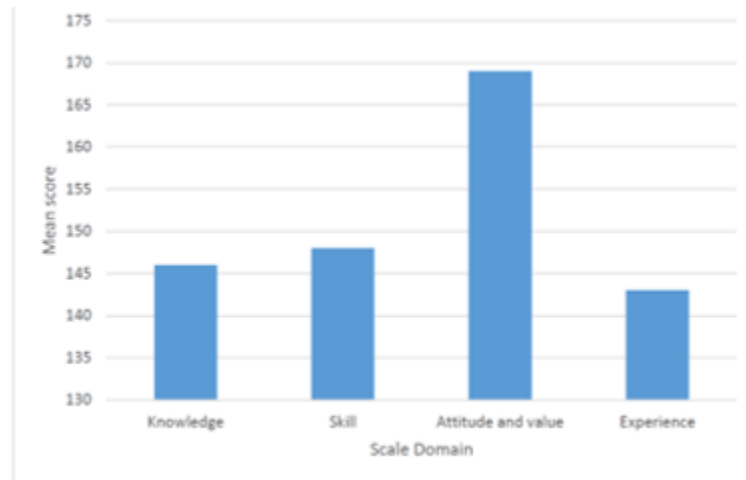


Figure 1. Mean Scores on the Scale Domains

Comparison of Nurses' Scores in Relation to Hospital

The mean competence score of the nurses at Hospital B ($M = 605.21$, $SD = 57.29$) was higher than the mean competence score of nurses at Hospital A ($M = 604.50$, $SD = 51.37$). However, the independent sample t-test was not significant, $t (-0.06)$, $p = 0.96$ (2-tailed), $d = 54.97$.

Comparison of Scores in Relation to Demographic Variables

The mean competence score of registered nurses was higher ($M = 609.74$, $SD = 60.28$) than the mean competence score of nurse midwife technicians ($M = 601.38$, $SD = 51.21$). The independent sample t-test was not significant, $t (-0.65)$, $p = 0.52$ (2-tailed), $d = 64.43$. Further analysis was done to explore the relationship between competence score and other variables including site, professional qualification, and work experience. Work experience was a significant predictor of competence when adjusted for site and professional qualification ($p < 0.05$).

Perceived Competence on Additional Competencies

Most nurses rated their competence as poor on basic interpretation of 3-lead ECG, and interpretation of arterial blood gases (ABGs), and moderate on caring for a patient with an endotracheal tube, performing CPR, and recognition and management of electrolyte imbalance. A summary of the proportions is presented in Table 3.

The proportion of registered nurses and nurse-midwife technicians across all levels of competence on the additional competencies was not statistically significant. The proportion of nurses with poor competence in caring for a patient with

tracheostomy at Hospital B was significantly higher than that of nurses with poor competence at Hospital A. It is worth noting that most of the participants were drawn from Hospital B as indicated in Table 1. In addition, the proportion of HDU nurses who rated their competence as poor was significantly higher than the proportion of nurses in ICU on two competencies: caring for a patient with tracheostomy and caring for a patient with endotracheal tube. Though not significant, $p = 0.55$, the nurses in HDU had more years of clinical experience than those in ICU. While all nurses demonstrated poor competence on certain areas, the difference in the proportion of nurses with poor competence between the two hospitals and units suggests that hospital and unit influenced the level of nursing competence.

Table 3. Nursing Scores on Additional Items of the ICCN-CS-1 Survey

Competence item	Frequency, n(%)	
	Poor	Moderate
Meeting nutritional needs of patients	5(6.3)	12(15.2)
Recognition and management of electrolyte imbalance	5(6.3)	29(36.7)
Performing Cardiopulmonary Resuscitation (CPR)	7(8.9)	31(39.2)
Caring for a patient with endotracheal tube	13(16.5)	33(41.8)
Caring for a patient with tracheostomy	8(10.1)	23(29.1)
Basic interpretation of 3-lead ECG	40(50.6)	26(32.9)
Preparation and management of emergency drugs	4(5.1)	19(24.1)
Documentation of patient care	1(1.3)	6(7.6)
Interpretation of ABGs	44(55.7)	22(27.8)
Implementation of discharge plan	3(3.8)	10(12.7)

DISCUSSION

This study aimed to assess the level of competence of nurses in critical care units in Malawi. The results of the study indicate that all nurses self-rated their basic competence in intensive and critical nursing on the ICCN-CS-1 as good and excellent. These results are consistent with those of Lakanmaa et al. (2015), who reported that most participants self-rated their competence on ICCN-CS-1 similarly. However, in the present study, nurses' responses to additional areas of competence contrasted with the results from the ICCN-CS-1. Most nurses rated their competence as poor on five of the ten additional areas of competence. This result may be explained by the fact that the ICCN-CS-1 was developed and previously used in a developed country with a different context from the present study.

The present study was conducted in a developing country in Africa with a high burden of illness and shortage of well-trained staff and resources in the CCUs (Maheswaran et al. 2018; Gundo et al. 2019a). Previous research has established that

nurses are pillars of critical care in developing countries such that they assume extended roles in the absence of well-trained professionals like physicians. For example, nurses intubate patients because of a lack of trained anaesthetists in some critical care units in Zambia, a developing African country (Carter and Snell 2016). Similarly, nurses and midwives in Malawi have a wider scope of practice, sometimes undertaking activities that physicians perform in developed countries, such as the commencement of intravenous infusions and care of mothers with complicated pregnancies (Malata 2013).

Another possible explanation for the inconsistency of the findings from the ICCN-CS-1 questionnaire and additional areas of competence is that competence in nursing is elusive and should be interpreted in relation to context and time (Garside and Nhemachena 2013; Zupanc and Beltran 2017). Most studies that explored the concept of competence in critical care nursing were conducted in developed countries (Lakanmaa et al. 2012; DeGrande et al. 2018). Therefore, it can be assumed that the extended parameters of nursing professional practice in developing countries are not integrated in the dimensions of the international tools used to assess nursing competence. Further research could explore the concept of competence in developing countries like Malawi to guide the development of competence assessment tools appropriate for such countries.

It is interesting to note that out of the four main domains of the ICCN-CS-1, the attitude and value domain had the highest score. The domain comprised 36 items that assessed the nurses' perception of the importance of specific skills in managing critically ill patients and their desire to master different skills. The high score in this domain suggests that the nurses appreciated the need to master certain aspects of critical care, such as adherence to evidence-based clinical guidelines and instructions for using technical equipment. This finding corroborates results of earlier studies which reported that CCU nurses in Malawi lack knowledge and skills in certain aspects of intensive and critical care nursing practice, such as checking gastric residual volume, daily inspection of nostrils, and documentation (Mula, Ncama, and Maluwa 2014; Gundo et al. 2019a).

In the current study, items with low mean scores on the ICCN-CS-1 were related to adherence to economic efficiency and organ transplantation. The low score on economic efficiency may be explained by the fact that the nurses who completed the questionnaire were bedside nurses who are not involved in managing finances at the two hospitals. It is also not surprising that the scores on organ transplantation were low. Organ transplantation is defined as a surgical intervention which is performed to replace a diseased organ in the body with a new one (Kumar and Mattoo 2015). Apart from South Africa where organ transplantation is performed in sub-Saharan Africa, numerous challenges limit the diffusion of organ transplantation to other African countries. The challenges include lack of expertise, the cost of the transplant procedure and long-term immunosuppression, and the absence of a legal framework on organ transplantation (Muller, White, and Delmonico 2014). These findings raise concerns regarding the care of patients who return to Malawi after organ transplantation in other countries.

Although some studies have been conducted on nurses' practice on specific nursing interventions, no single study exists which assessed nurses' competence on the additional areas of competence which experts in the current study identified. There are, however, possible explanations for the poor competence on the five additional areas of competence. In the absence of a critical care nursing course in Malawi, it can be assumed that basic interpretation of ECG, interpretation of ABGs and care of a patient with endotracheal tube are either not included in the curriculum for basic nursing education or they are not sufficiently discussed during the training. In addition, most participants were drawn from HDUs where ABG analysis and invasive procedures like intubation are rarely done because of the shortage of resources and lack of expertise. However, the poor competence on CPR and management of electrolyte imbalance raises intriguing questions because these areas are included in the curriculum for basic nursing education. This result may be explained by the fact that there is no mandatory retesting of nurse competence in Malawi. Furthermore, there is no policy for mandatory first aid training which includes CPR regardless of the profession, as is the case in some developed countries.

Contrary to expectations, the present study found a significant difference between the two hospitals in the proportion of nurses with poor competence in caring for a patient with tracheostomy. It is difficult to explain the considerable difference in the proportion of nurses with poor competence on caring for a patient with tracheostomy. However, it is important to bear in mind the possible bias because most of the participants were drawn from one hospital. Furthermore, the proportion of HDU nurses who rated their competence in tracheostomy and endotracheal care as poor was significantly higher than the proportion of nurses in ICU. This difference can be partly explained by the difference in the level of care rendered in the units. For example, invasive procedures and interventions like mechanical ventilation are only performed in ICUs. Further research should be undertaken to investigate the factors contributing to the differences in the level of nurses' competence.

One interesting finding is that there was no significant difference in the competence scores between registered nurses and nurse-midwife technicians. There are no previous studies to support this finding. Similar to previous studies in CCUs (Gundo et al. 2014a; Mula, Ncama, and Maluwa 2014), most participants in the present study were nurse-midwife technicians trained at the Diploma level. Nurse-midwife technicians are the largest nursing cadre in Malawi (Holman 2012). In most instances, nurse-midwife technicians work outside their scope of practice because of a shortage of registered nurses (Holman 2012; Jacob et al. 2015). This could be why differences in the competence scores on ICCN-CS-1 between registered nurses and nurse-midwife technicians were not statistically significant. It is also possible that the small number of registered nurses was not enough to detect statistical significance in the difference between the scores.

Lastly, work experience in a specific unit was critical for acquiring nursing competence in ICU and HDUs in this study. The nurses who had worked in a particular unit for some time had gained some knowledge and skills required to care for critically

ill patients and their family members. This finding is consistent with that of Häggströma et al. (2017), who reported that the more critical care nurses worked in a critical care unit, the more they learned how to perform certain skills. Surprisingly, the two hospitals have a policy on the annual rotation of nurses from one department to another every year. This finding was also reported by Harris, Fioratou, and Broadis (2016) who observed that competency gaps are aggravated by the annual rotation of nurses. As suggested in a previous study, there is need for the hospital authorities to revisit the annual rotation system and identify other strategies for retaining nurses in these units to ensure optimal care provision (Gundo et al. 2019a).

CONCLUSION

This study found out that nurses self-rated their basic competence in intensive and critical nursing on the ICCN-CS-1 as good and excellent. However, this was in contrast with scores on additional competencies which were suggested by a team of local nursing experts. Therefore, it can be assumed that the extended parameters of nursing professional practice in developing countries are not incorporated in the dimensions of the international tools used to assess nursing competence. A further study could explore the concept of critical care nursing competence in developing countries like Malawi to develop competence assessment tools appropriate for such countries.

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