The critical care nursing role in low and lower-middle income settings: A scoping review

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Key words:

- Critical Care
- Low- and Middle-Income Countries
- Nursing
- Delivery of Healthcare
- Health Care Facilities, Manpower, and Services

Abstract

Objectives

A scoping review was conducted to answer the question: How is critical care nursing (CCN) performed in low-income and lower-middle income countries (LICs/LMICs)?

Design

Scoping review guided by the JBI Manual for Evidence Synthesis

Data sources

Six electronic databases and five web-based resources were systematically searched to identify relevant literature published between 2010 - April 2021.

Review methods

The search results received two stage screening: 1) Title and abstract 2) Full text screening. For sources of evidence to progress, agreement needed to be reached by two reviewers. Data were extracted and cross checked. Data were analysed, sorted by themes, and mapped to region and country.

Results

Literature was reported across five geo-regions. Nurses with a range formal and informal training were identified as providing critical care. Availability of staff was frequently reported as a problem. No reports provided a comprehensive description of CCN in LICs/LMICs. However, a variety of nursing practices and non-clinical responsibilities were highlighted. Availability of equipment to fulfil the nursing role were widely discussed. Perceptions of inadequate resourcing were common. Under- and post-graduate level preparation were poorly described but frequently reported. The delivery of short format

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critical care courses was more fully described. There were reports of educational evaluation, especially regarding internationally supported initiatives.

Conclusions

Despite commonalities, CCN is unique to regional and socio-economic contexts. Nurses work within a complex team, yet the structure and skill levels of such teams will vary according to patient population, resources, and treatments available. Therefore, a universal definition of the CCN role in LIC/LMIC health systems is likely unhelpful. Research to elucidate current assets, capacity and needs of nurses providing critical care in specific LIC/LMIC contexts is needed. Outputs from such research would be invaluable in supporting contextually appropriate capacity development programs.

Strengths and limitations of this review

- This is the first review to explore and map the evidence related to how CCN is performed in LICs/LMICs
- Literature from all geo-regions where LICs/LMICs are situated was considered for inclusion.
- The inability to translate non-English language documents, mean it is possible that some literature was not captured.
- A lack of literature from Latin American LICs/LMICs in English prevents an accurate picture of critical care nursing in these contexts to be drawn.

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Introduction

The development of critical care services in low-income and lower-middle-income countries (LICs/LMICs) is increasing.[1] However, little is known regarding capacity and resourcing of these services.[2] Nurses are key in the successful delivery of critical care in any health-system,[3] yet it is unclear what is currently known regarding their role in LIC/LMIC health systems.

Background

The burden of critical illness is substantial in LICs/LMICs[2, 4, 5] and outcomes are often reported as poorer than in high-resource contexts.[5] The availability of resources to manage critically ill patients in LICs/LMICs are commonly restricted when compared to high-income countries (HICs).[6] Access to high-cost technologies and highly trained, specialised teams of healthcare staff available in high-resource health-systems[1] are not always available in a resource-limited setting.[7] Therefore, the organisation of critical care services needs to be context-specific[8] and will vary across socio-economic and geo-regional situations.

Nurses are the largest occupational group of healthcare workers globally and are central to meeting the sustainable development goals (SDGs) and universal health coverage (UHC).[9] Positive associations between the numbers of nurses employed to provide patient care, their level of education, and improved patient outcomes is well documented in several HICs,[10] and may be amplified in critical care settings.[11] In response, standards recognising the need for nursing models specific to critical care, extended organisational supports, and specialised training to fulfil the critical care nursing (CCN) role are common in HIC's.[11, 12] Furthermore, the roles and responsibilities of critical care nurses are well described in many HICs. For example, in Australia, nurses routinely undertake all technical and non-technical care of the critically ill patient. They operate and manage therapies such as mechanical

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ventilation, extracorporeal therapy, and intra-aortic balloon pumps. Additionally, they might measure cardiac output from highly technical hemodynamic devices and titrate vasoactive drugs in a semi-autonomous fashion.[13] To date, little work comprehensively reporting the roles, practices, and training of critical care nurses in LICs/LMICs appears to be available. Therefore, a scoping review was conducted to map the available evidence, identify the main concepts, sources of data and knowledge gaps and answer the question: How is the CCN role performed in LICs/LMICs?

Objectives

To elucidate the role of nurses working in critical care contexts in LICs/LMICs the review aimed to address four sub-questions:

1) Who is involved in providing CCN in LICs/LMICs?
2) What are the day-to-day roles and responsibilities of nurses providing critical care in LICs/LMICs?
3) What professional scope of practice is reported for nurses providing critical care in LICs/LMICs?
4) What training and ongoing education are available to nurses providing critical care in LICs/LMICs?

Methods

The scoping review was guided by the JBI Manual for Evidence Synthesis[14] and the Preferred Reporting Items for Systematic Reviews extension for scoping reviews.[15] A protocol was developed *a priori*, published prospectively, and can be viewed on the Monash University repository for research data.[16]

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Search methods

A Population Concept Context (PCC) framework was used to define the evidence to be included in this review (Table 1).

Table 1: Population Concepts Context (PCC) framework used to define the evidence included in this review

	Inclusions	*Exclusions*
Population	Nurses providing critical care or their proxies*.	Visiting international nurses engaged in capacity development programs
Concepts	CCN roles, responsibilities, scope of practices, training, and education.	
Contexts	Low income and lower middle income countries (LICs/LMICs) as defined by the World Bank Country and Lending Groups.[1]	Military hospitals The pre-hospital setting or during the intra-hospital transport of patients

** Proxies for nurses providing critical care include health care workers and lay persons who are not nurses but provide care that might be associated with the nursing role. Examples might include respiratory therapists or healthcare assistants.*

*1. The World Bank Group. World Bank Country and Lending Groups 2020 [Available from: **https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups**.*

Preliminary searches of Ovid Medline, Embase, and Emcare were performed to test and refine the search strategy. Final searches were completed on the 30th of July 2020 and updated on the 7th of April 2021. Six databases were included: Medline, Embase, Emcare, Global Health, SCOPUS, and Web of Science. Limits set in all database searches were publications in the last 10 years (2010-current) and publications in English language. Full details of the search strings employed, additional limits in individual databases, and database versions can be found in the supplementary file 1. Results from all searches were exported to Endnote™ citation management software and then imported into Covidence™ review management software.

Web based searches were completed on 30th July 2020. Five resources were accessed: Google Scholar™, Google™, The World Health Organisation (WHO) website, The World Federation of Critical Care Nurses (WFCCN) website, and websites of CCN organisations listed as members of the WFCCN. The search in Google scholar™ was limited to results published in the last ten years. Consistent with the approach suggested by Pham et al[17] the first 100 search results were submitted to an initial two stage screening process: All titles considered relevant to the research questions were exported to Endnote™. Individual titles were resubmitted to Google Scholar™, accessed, and categorised by type. Evidence that was unrelated to the research questions was removed at this stage. The remaining sources of evidence were imported into Covidence™ for title and abstract screening.

Keyword searching within the WHO website was undertaken using Google™. The WFCCN website was accessed, and an additional 11 regional critical care nursing societies websites were identified for exploration and data extraction as tier-3 sources. The first 100 search results in google were screened for apparent relevance to the research questions. Duplicate website links and results already discovered through searches were ignored.

Search outcome

A total of 361 papers were retrieved from database and web-based searching. Two additional papers were added by hand searching the reference lists of included papers. 31 duplicates were removed. 17 web-based sources of evidence were identified.

Quality appraisal

Guided by Kepes' taxonomy of sources of samples,[18] two tiers of evidence were considered for inclusion in the screening process: Tier-1, the peer reviewed literature. Tier-2, grey literature produced by a range of bodies such as governments or non-commercial organisations, including conference papers, dissertations, and reports. Additionally, Tier-3

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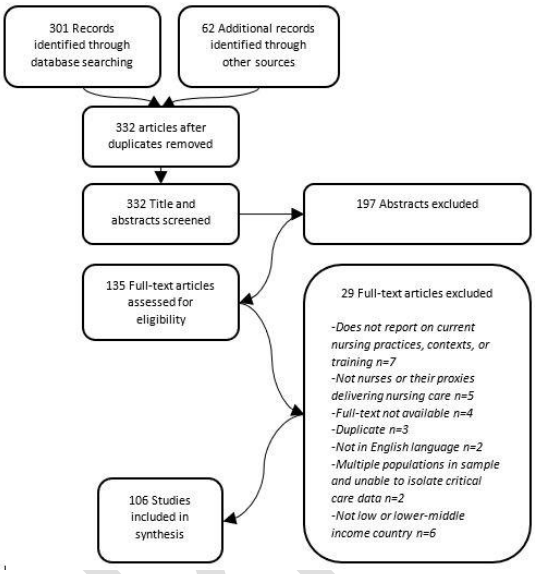
sources were considered for separate analysis. Tier-3 samples included commercial and personal websites, blogs, and social media. As is conventional in such a broad scoping review, no critical appraisal of the included literature was undertaken.[14]

Data abstraction

The search results received two stage screening: 1) Title and abstract 2) Full text screening. For sources of evidence to progress, agreement needed to be reached by two reviewers. A PRISMA flow diagram demonstrating the screening and selection of literature for inclusion is presented in figure 1.

Figure 1: PRISMA Flow chart



PRISMA Flow chart detailing the results from searching databases and other sources, the number of abstracts screened, the number of full texts accessed, and the number of papers included in the final synthesis

Synthesis

Initial extraction was undertaken using a data-charting instrument mapped to the research sub-questions. An iterative approach was taken. As new items or themes that provided useful data became apparent this was discussed by the team and added to the instrument if

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appropriate. Finally, three extractions were cross-checked by another member of the team to determine agreement that all relevant data had been charted.

Patient and public involvement

No patient involved.

Ethics approval

No ethics approval was required for this research

Results

Data were predominantly found within peer reviewed journal articles (85%). Other sources of data included conference papers (9%), books (3%), thesis (2%), and reports (1%). Half of the included literature reported quantitative research data. Descriptive or descriptive/correlational methods were the most reported methodologies. 16% of included papers reported qualitative results and a further 6% reported the results of mixed-methods research. The remaining literature encompassed reviews (13%), or expert opinion/editorial papers (15%). One book was identified which defied categorisation as it included aspects of narrative review, expert opinion, and case studies.

The literature focussed on countries within five of the seven geo-regions defined by the World Bank.[19] The literature distributed across the five geo-regions were: Sub-Saharan Africa (SSA) (45%), South Asia (SA) (24%), Middle East and North Africa (MENA) (13%), East Asia and the Pacific (EAP) (10%) and Latin America and the Caribbean (LAC) (2%). The remaining 6% of the literature spoke more broadly to CCN in resource limited settings, not specifically within a region.

Several clinical settings were reported as sites where CCN was practiced. The distribution is visualised in Figure 2.

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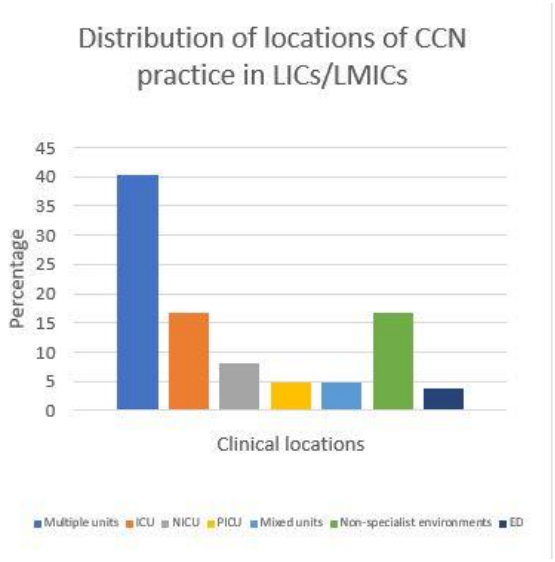
Figure 2: Distribution of locations of CCN practice in LICs/LMICs



The chart shows the distribution of clinical locations of CCN practice in LICs/LMICs found in the included literature

A large amount of the evidence discussed more than one unit within a health service, for example multiple Intensive Care Units (ICUs) or a combination of ICUs, Paediatric ICUs, Neonatal ICUs, and non-traditional critical care settings. The remaining literature provided evidence of practice within individual dedicated adult, paediatric, neonatal, or mixed units where several patient categories were admitted. A small amount of the literature discussed CCN in Emergency Departments. Finally, some papers spoke only to critical care undertaken in non-specialist environments such as wards or community health centres.

Tier-3 sources of data included three broad categories of website: 1) CCN society websites or social media pages (*n*=11), 2) Blogs (*n*=3), and 3) miscellaneous webpages (*n*=3). The websites of CCN societies and federations included local in-country (*n*=8), regional (*n*=2), and global (*n*=1) level groups.

Three regional CCN groups used Facebook™ groups as their online medium. The remaining critical care societies and federations utilised hosted websites. The blog entries proved to all be by one author, a CCN educator providing trainings in Nepal. A link was discovered in one

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of the blog entries to an NGO providing respiratory care education in LIC's/LMICs. All three miscellaneous websites provided evidence of a not-for-profit education company providing free CCN online educational content to LIC's/LMICs.

Literature providing answers to the research questions is displayed in tables 2-5. The corresponding references can be found in supplementary file 2. Both positive and negative results were extracted meaning that discussion of a concept being present or not being present were both captured.

Table 2 identifies sources of data related to who provides nursing care to critically ill patients in LICs/LMICs and maps them to region and countries.

Table 2: Literature providing evidence of who is involved in providing nursing care of critical care patients in low income and lower middle-income countries grouped thematically and mapped to region and country

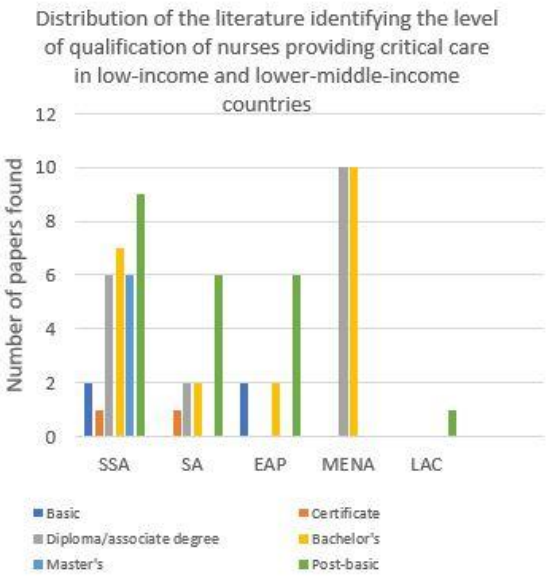
Data	Region	Citations by country
Qualified nurses with basic training or level of qualification identified	SSA	Ethiopia[1], Kenya[2, 3], Malawi[4, 5], Rwanda[6], Tanzania[7], Uganda[8], Zambia[9]
	SA	India[10-12], Nepal[13]
	EAP	Philippines[14-16], Solomon Islands[17], Vietnam[18]
	MENA	Egypt[19-28], Palestine[29]
	LAC	None
Qualified nurses with post-basic training or level of qualification identified	SSA	Ghana[30], Kenya[2, 3, 31-33], Malawi[4], Mozambique[34], Rwanda[6, 35], Tanzania[7, 36, 37], Uganda[38], Zambia[39], Zimbabwe[40]
	SA	India[10-12, 41], Sri Lanka[42-44]
	EAP	Cambodia[45], Philippines[14, 16]
	MENA	None
	LAC	Haiti [46]
Other nursing cadres*	SSA	Kenya[47], Malawi[4, 5, 48], Mozambique[40, 49], Zimbabwe[40, 49]
	SA	None
	EAP	Philippines[14, 15, 50], Solomon Islands[17]
	MENA	Egypt[28, 51]
	LAC	None
Non-nursing healthcare workers*	SSA	Kenya[32, 52], Tanzania[7, 36, 53, 54], Uganda[38]
	SA	India[41, 55], Pakistan[56], Sri Lanka[42]
	EAP	Philippines[16]

	MENA	Egypt[57]
	LAC	None
Non-healthcare trained persons[$]	SSA	Malawi[48], Rwanda[58], Tanzania[59], Zambia[39]
	SA	India[10]
	EAP	None
	MENA	None
	LAC	None

** Other nursing cadres may include but are not limited to student nurses or midwives.*
[#] Non-nursing healthcare workers may include but are not limited to clinical officers, respiratory therapists, or ancillary staff.
[$] Non-healthcare trained persons may include but are not limited to families and lay-persons
SSA: Sub Saharan Africa, SA: South Asia, EAP: East Asia and the Pacific, Mena: Middle East and North Africa, LAC: Latin America and the Caribbean
The corresponding references for this table are included in supplementary file 2

Most documents indicated that nurses identified as registered or qualified were engaged in the care of critically ill patients within each region. Many also referred to basic or post-basic qualifications. In several cases these were limited to identifying basic or post-basic trained nurses as being present. Whereas others provided the title of the qualifications (Fig 3).

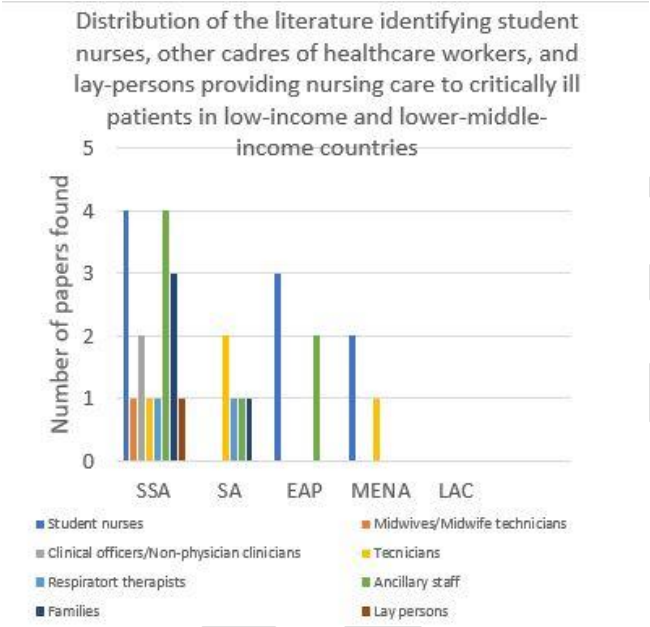
Figure 3: Distribution of the literature identifying the level of qualification of nurses providing critical care in LICs/LMICs



The chart shows the distribution of included papers that report on or discuss the levels of qualification of nurses providing critical care in LICs/LMICs

A variety of other cadres of healthcare workers and lay persons were also identified as providing aspects or the totality of what might be considered CCN for example midwives and respiratory therapists (Fig 4).

Figure 4: Distribution of the literature identifying student nurses, other cadres of healthcare workers, and lay-persons providing nursing care to critically ill patients in LICs/LMICs



The chart shows the distribution of included papers that report on or discuss student nurses, other cadres of healthcare workers, and lay-persons providing nursing care to critically ill patients in LICs/LMICs

Table 3 identifies sources of data related to the day-to-day roles and responsibilities of nurses caring for critically ill patients in LICs/LMICs and maps them to regions and countries.

Table 3: Literature providing evidence of the day-to-day roles and responsibilities providing nursing care of critical care patients in low income and lower middle-income countries grouped thematically and mapped to region and country

Data	Region	Citations by country
The critical care nursing role, practices, or tasks	SSA	Ethiopia [1], Kenya [2], Malawi [3, 4], Mozambique [5], Nigeria [6, 7], Rwanda [8], Tanzania [9-12], Uganda [13-16], Zambia [17-19]
	SA	India[20], Nepal[21, 22], Pakistan[23, 24], Sri Lanka[25]

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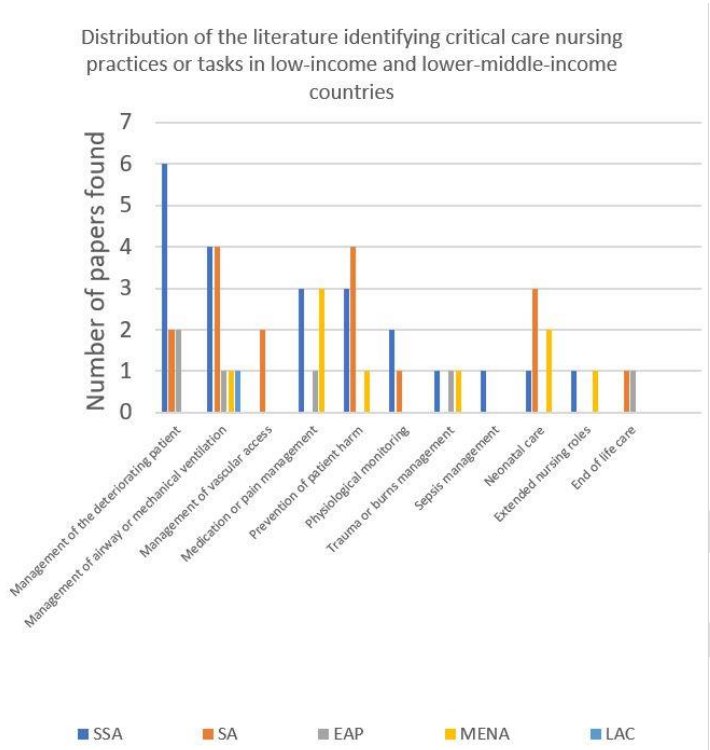
	EAP	Cambodia[26, 27], Myanmar[28], , Philippines[29, 30], Vietnam[30, 31], Unnamed EAP country[32]
	MENA	Egypt[33-39], Palestine[40]
	LAC	None
Critical care nursing systems/staffing/capacity	SSA	Kenya [2, 41-43], Malawi[3, 44], Rwanda[45], Tanzania[46], Uganda[14, 46], Zambia[17, 18, 47], Zimbabwe[48]
	SA	India[49-51], Nepal[52, 53], Pakistan[24, 54] Sri Lanka[55-57]
	EAP	Myanmar[28], Philippines[29, 30] Solomon Islands[58], Vietnam[29]
	MENA	Egypt[34-36, 39, 59, 60], Palestine[40]
	LAC	None
The availability and utilisation of physical resources or technologies to fulfil the critical care nursing role	SSA	Kenya[2, 41-43, 61], Malawi[3, 44], Nigeria[6], Rwanda[8, 45], Tanzania [9, 62, 63], Uganda[14, 46], Zambia[18, 47], Zimbabwe[48]
	SA	India[50, 51, 64, 65], Nepal[52, 53], Pakistan[24], Sri Lanka[54, 55]
	EAP	Philippines[30], Solomon Islands[58]
	MENA	Egypt[34, 36, 39], Multiple MENA countries[60]
	LAC	None
The availability of policies or guidelines to support evidence-based practice	SSA	Ethiopia[1], Kenya[42], Malawi[3], Nigeria[6, 7], Rwanda[45] Tanzania[9, 10, 63], Uganda[14-16], Zambia[17-19, 47], Zimbabwe[48]
	SA	India[64, 66-68], Nepal[21, 52], Pakistan[24], Sri Lanka[25]
	EAP	Philippines[29], Vietnam[31]
	MENA	Egypt[34, 35, 39], Multiple MENA countries[60]
	LAC	None

SSA: Sub Saharan Africa, SA: South Asia, EAP: East Asia and the Pacific, Mena: Middle East and North Africa, LAC: Latin America and the Caribbean
The corresponding references for this table are included in supplementary file 2

Several specific activities and roles performed by nurses providing critical care in LICs/LMICs were able to be extracted. Some examples included management of airways and mechanical ventilation, care of the septic patient and physiological monitoring. A full overview of the distribution of activities is presented in figure 5.

Figure 5: Distribution of the literature identifying CCN practices or tasks in LICs/LMICs



The chart shows the distribution of included papers that report on or discuss CCN practices or tasks in LICs/LMICs

Details relating to CCN systems, staffing, and capacity were able to be extracted from the literature. Thematically these grouped into four categories: 1) identification of nurse-patient ratios *n=17*, 2) national critical care workforce *n=7*, 3) structure, and staffing of unit-based workforce *n=18*, 4) perceptions of insufficient nursing workforce or poor working conditions *n=5*.

Data regarding the availability and utilisation of physical resources to fulfil the CCN role were also extracted and mapped to nine themes: 1) comprehensive lists of available or recommended equipment *n=10*, 2) mechanical ventilators *n=6*, 3) monitoring technologies *n=2*, 4) oxygen or electricity supply *n=1*, 5) neonatal equipment *n=2*, 6) personal protective equipment *n=1*, 7) other therapeutic devices *n=1*, 8) documentation of care *n=5*, 9) a perceived inadequacy of physical resources *n*=9.

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Finally, papers discussing the availability of policies or guidelines were extracted and mapped to themes of locally developed practice guidelines *n=14*, national standards, or recommendations for policy *n=4*, the utilisation of international practice guidelines *n=4*, or perceived unavailability or inadequacy of guidelines *n=11*.

Little data was able to be extracted to answer the question: "What professional scope of practice is reported for nurses providing critical care in LICs/LMICs?" (Table 4).

Table 4: Literature providing evidence information on registration and professional scope of nurses providing nursing care of critical care patients in low income and lower middle-income countries grouped thematically and mapped to region and country

Data	Region	Citations by country
Registration or professional standards	SSA	Malawi[1, 2], Mozambique [3], Rwanda[4, 5], Tanzania[6], Uganda[7, 8], Zambia[9], Multiple SSA countries[10]
	SA	Sri Lanka[11]
	EAP	Philippines[12]
	MENA	Egypt[13, 14], Palestine[15]
	LAC	None

SSA: Sub Saharan Africa, SA: South Asia, EAP: East Asia and the Pacific, Mena: Middle East and North Africa, LAC: Latin America and the Caribbean
The corresponding references for this table are included in supplementary file 2

The data that were extracted identified nursing registration boards and requirements *n=14*, or professional standards *n=1*.

Table 5 identifies sources of data related to the training and continuing education and development of nurses providing critical care in LICs/LMICs and maps them to regions and countries.

Table 5: Literature providing evidence of training and continuing education available to nurses providing critical care in low income and lower middle-income countries grouped thematically and mapped to region and country

Data	Region	Citations by country
Critical care training courses	SSA	Kenya[1-6], Liberia[7], Malawi[8], Mozambique[9, 10], Rwanda [11, 12],

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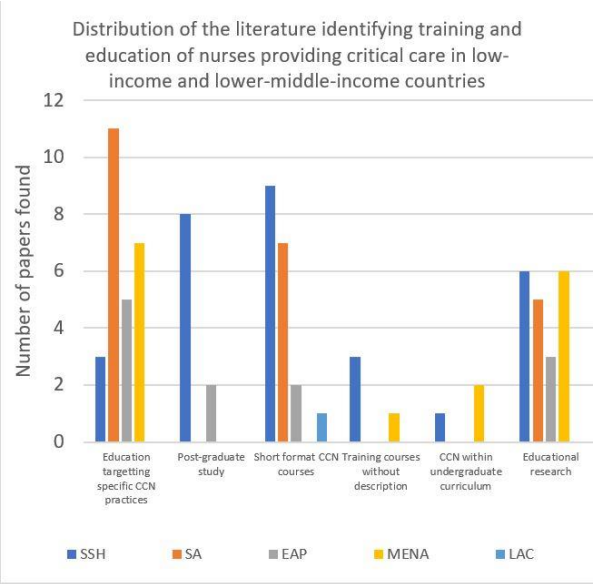
		Tanzania[13-15], Zambia[16], Multiple countries[17]
	SA	India[18], Nepal[19], Pakistan[20], Sri Lanka[21-24]
	EAP	Myanmar[25], Philippines[26], Vietnam[27]
	MENA	Egypt[28, 29], Palestine[30]
	LAC	Haiti[31]
Education activities targeting specific critical care nursing practices	SSA	Malawi[32], Rwanda[33], Zambia[34]
	SA	India[35-43], Nepal[44], Pakistan[45]
	EAP	Cambodia[46], Myanmar[25], Philippines[26], Vietnam[27], Unnamed EAP country[47]
	MENA	Egypt[29, 48-51], Palestine[30], Multiple MENA countries[52]
	LAC	None
Access to educational resources	SSA	Mozambique[10], Nigeria[53], Tanzania[13], Uganda[54, 55]
	SA	None
	EAP	Philippines[56, 57]
	MENA	Egypt[28, 48, 49, 58]
	LAC	Haiti[59]
Research reporting on before and after testing of educational interventions	SSA	Kenya[3, 60], Malawi[61], Tanzania[62], Uganda[63]
	SA	India[35, 38, 39, 41], Sri Lanka[21]
	EAP	Cambodia[46], Vietnam[27], Unnamed EAP country[47]
	MENA	Egypt[29, 49-51], Palestine[30], Multiple MENA countries[52]
	LAC	None
SSA: Sub Saharan Africa, SA: South Asia, EAP: East Asia and the Pacific, Mena: Middle East and North Africa, LAC: Latin America and the Caribbean *The corresponding references for this table are included in supplementary file 2*		

Data extracted that identified training could be mapped thematically to 1) Education targeting specific practices *n=26*, 2) formal post-graduate study *n=10*, 3) short format courses *n=19*, 4) training courses without a description *n=4*, 5), and critical care training within the undergraduate curriculum *n=3*. Figure 6 maps these themes to region.

Figure 6: Distribution of the literature identifying training and education of nurses providing critical care in LICs/LMICs



The chart shows the distribution of included papers that report on or discuss CCN training and education in LICs/LMICs

Finally, data were extracted identifying access to educational resources including the use of information technologies (IT). Themes included: 1) the availability of peer reviewed literature *n=4,* 2) access to locally generated learning materials or education teams *n=3,* 3) access to IT based education *n=2,* 4) perceived inadequacy of access to educational resources *n=3.*

Discussion

This is the first review to explore and map the evidence related to how the CCN role is performed in LICs/LMICs. Despite the large number of papers meeting inclusion criteria, few provided a comprehensive description of how CCN is performed in any individual LIC/LMICs or region. However, some themes were able to be synthesised from numerous sources and are discussed below.

Who is involved in providing CCN in LICs/LMICs?

Qualified nurses

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Documents indicating that registered or qualified nurses were engaged in the care of critically ill patients were found in all regions except LAC. Where details of basic qualifications of CCN's were provided, they included certificate, diploma, and bachelor's degrees with diploma and bachelor's being the most common in many settings. In a large observational study in European hospitals, it was found that for every 10% increase in nurses holding bachelor's degrees rather than a diploma, a 7% reduction in 30-day inpatient mortality was measured.[10] To our knowledge no similar study has been undertaken in resource-limited health systems offering an opportunity for future research.

Nurses with post basic qualification in critical care

The presence of nurses with post-basic training in critical care was reported in all regions but not all countries. Generally, post-basic preparation was reported in LMICs but absent in LICs. Most included literature did not identify the numbers or ratios of critical care trained nurses within each country or region. However, in a Kenyan paper 50% of nurses working in ICUs were reported as holding post-basic qualification.[20] Such a ratio achieves the minimum standards recommended in some HICs, for example, Australia.[11]

Guidelines from India recommend that all nurses working in critical care areas hold formal post-basic qualifications[3] yet even within India this level of preparation is inconsistent.[21] Literature from Sri Lanka and Zambia described situations where the overall percentage of nurses with post-basic qualification was low. However, it was more common that the nurse in charge held a post-basic qualification,[22, 23]. Another situation reported from Zambia suggested, that post-basic trained nurses have responsibilities to provide care to deteriorating patients in the wider hospital reducing the access to trained nurses within the units.[24]

Other cadres of nurses were identified as providing some or all the care commonly associated with the CCN role. Commonly, these included enrolled nurses,[25, 26] nurse-midwives, or

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midwife technicians.[27, 28] It was also noted that pre-registration student nurses were engaged in clinical placements within several ICUs and other critical care settings.[27-29]

Non-nursing cadres

Papers from SSA, EAP, and MENA provided evidence of non-nursing staff providing what might be considered aspects of CCN. Roles included technicians[20] and personnel described as clinical officers or non-physician clinicians. However, it was not clear in the included papers what constituted a non-physician clinician[30, 31] Additionally, nurse anaesthetists[32] and respiratory therapists[33] were involved in the care of mechanically ventilated patients. Less clearly defined roles such as healthcare assistants,[23] ancillary staff and caregivers[34-36] were also noted.

Non-healthcare trained carers

A small number of documents suggested that lay-persons provided nursing care. Some of these discussed the parents' roles in neonatal care[37, 38] and were similar to practices in HIC neonatal ICUs such as kangaroo care.[39] Others highlighted the role of lay persons when shortages of nursing staff existed.[22] A global shortage of healthcare workers, predominately in LMIC contexts is well recognised.[9] Urgent work to address this is required if UHC and the attainment of the SDGs[40] are to be met. Although driven by necessity in these examples, multi-directional benefits are reported when families are directly involved in patient care.[41] However, research in critical care environments is sparce, especially in LIC/LMIC settings.[42]

The day-to-day roles and responsibilities of those providing nursing care of critical care patients in LICs/LMICs

Critical care nursing role, practices, or tasks

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Although, specific tasks and roles such as care of the ventilated patient, medication management, and clinical education were common, comprehensive description of the role of those providing CCN within the targeted health systems was not well described. However, three papers presented information on required competencies for critical care nurses,[24, 30, 43] thus identifying their broad roles, tasks, and responsibilities. Further documents described the roles of sub-speciality nurses in cardiac-surgical and cardiac-medical units.[44]

CCN systems/staffing/capacity

Details including the numbers of CCNs in the workforce and nursing models of care were common. Two themes in particular stand out: 1) The heterogeneity in the nurse-to-patient ratios reported across regions, countries, and within countries. 2) The perceptions of nurses regarding the conditions they work within.

Reported nurse-to-patient ratios were inconsistent within the included literature. Many reported ratios equivalent to those recommended in many HIC standards for ICUs at 1:1 or 1:2.[11] However, evidence of ratios as low as 1:15 was noted[27] and a perceived inadequacy in the nurse-to-patient ratios to achieve patient care was common. It has been suggested that lower nurse-to-patient ratios is associated with higher mortality rates in ICU [45] although, this is not without controversy.[46] Associations between lower ratios and quality of care[47] and a negative impact on nurse wellbeing[48] have also been reported in HIC contexts.

It remains unclear what would constitute an appropriate nurse-to-patient ratio in resource limited ICUs and warrants further research. The heterogeneity of critical care in these contexts suggests that bespoke recommendations would be required. The use of validated instruments such as the Therapeutic Intervention Scoring System or Nursing Activities Score to assess workload on a unit-based scale may be useful in determining needs. However, even

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validated instruments such as these have limitations and do not capture non-clinical tasks or the role of the broader team in providing patient care.[49]

There is evidence that some nurses perceived themselves to be working in poor conditions.[50-52] In the Solomon Islands it was noted that no ICU existed, and nurses undertook all critical care of patients in wards or in non-hospital healthcare settings.[53] Data from a large international survey conducted by the World Federation of Critical Care Nurses found the most common theme, across all regions, was insufficient workforce numbers.[54] This has been highlighted as a priority area of development by the WHO.[9]

In addition to the workforce constraints already discussed, basic commodities including electricity, oxygen, and water may not be guaranteed.[55] Work to identify appropriate technologies to build critical care capacity in resource limited contexts is, therefore, important.[56]

Availability and utilisation of physical resources or technologies to fulfil CCN role

In literature from SSA, SA, and MENA, advanced critical care technologies like those found in high-resource health systems were reported. Examples included mechanical ventilators,[51, 57-60] invasive haemodynamic monitoring[61, 62], and renal replacement therapy.[36, 63]However, it was noted in an Indian paper that the available mechanical ventilation devices, modalities, and adjunctive therapies remained underutilised due to a lack of training on their use.[64] Similarly, where equipment was available, it may be old or poorly functioning in some contexts including Nepal and Sri Lanka.[51, 59]

It should be noted that although critical care is synonymous with high technology resources in HIC's, the associated high costs and need for highly trained staff may not be achievable in resource-limited settings.[8] Research into what constitutes appropriate critical care technologies in resource-limited settings is important.[56] However, critically ill patients

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exist in all hospitals, regardless of the availability of equipment and resources. Therefore, delivering critical care should not be predicated on the availability of technology or the ability to achieve all aspects of care in all settings. Instead, critical care should be based on what is appropriate and feasible in each setting.[65]

Availability of policies or guidelines to support evidence-based practice

Limited data spoke to policies, documentation, or practice guidelines in each region. However, a common theme was a perceived absence or inadequacy of these resources. For example in Nigeria, this absence was reported as leading to inadequate knowledge of evidence-based practices.[66] In a Zambian context it was highlighted that even when protocols existed, they were not able to be successfully implemented. However, the reasons for this were not described.[22]. In a review by the same author literature from SSA contexts suggested guidelines were often inappropriate having been developed in HIC's, where different presentations and challenges are experienced.[24]

Conversely, some documents demonstrated the presence of effective policies and practice guidelines, including the generation of locally developed documents. Examples included a comprehensive identification of key documents related to sepsis management in Uganda[67] and a combination of international and locally developed guidelines for care in Nepal.[61]

Registration and professional scope of nurses providing nursing care of critical care patients in LICs/LMICs

Nursing registration and professional standards

Little data were found relating to CCN scope of practice, standards, or registration requirements. Available data from SSA, SA, EAP, and MENA mostly identified the nursing boards that nurses registered under. A small number of papers from SSA offered extended details, such as the continuing professional development requirements for maintaining

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registration.[24, 43, 52] Research exploring CCN standards, requirements for registration; including CPD requirements and current scope of practices is needed to guide capacity and health service development in LICs/LMICs.

Training and continuing education available to nurses providing critical care in LICs/LMICs

Formal post-graduate courses

Speciality education in CCN is well documented in many HIC's. For example, in the Australian context a Master's degree program exists in many nursing faculties, with exit points at graduate certificate, post-graduate diploma and master's degree.[68] Where post-basic training was reported in resource-limited settings, only one paper from Zambia provided an overview of course structure or content and provided evidence that the available courses were validated to meet international standards.[24, 69]This lack of detail makes comparison between countries and assessment of the quality of post-basic qualifications difficult. Therefore, presenting an opportunity for research, benchmarking, and curriculum development.

A smaller sub-set of critical care courses were reported where nurses from low-income health systems travelled to other countries to undertake training. One example is found in Rwanda where nurses train in Kenya or South Africa.[70] Caution is required to ensure training attained in this way is contextually appropriate. It was noted by Bruce[71] that CCNs returning to Mozambique following clinical internship in South Africa felt disempowered. Technologies and practices they had experienced were not achievable in their home contexts. It is also evident that healthcare workers from resource-limited countries who are able to train in HIC's frequently stay in those countries once graduated.[72]

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It is widely noted that low-wages are both a cause of dissatisfaction and a barrier to nurses pursuing post-basic qualifications in LIC/LMICs.[73] Furthermore, a recent global survey of critical care nursing organisations highlights that credentialling is of great importance to critical care nurses in low income settings.[54] Strategies to make post-basic training accessible and attractive to nurses providing critical care in LICs/LMICs are, therefore, important and an area that deserves attention in research and capacity development agendas.

Short format critical care courses

Many short format courses were developed in-country or developed with support from international collaborators. Some were delivered by local faculty and others by visiting international educators. Among others, the Fundamental Critical Care Support/Paediatric Fundamental Critical Care Support courses in Haiti, Kenya, and Nepal,[30, 57, 74] the Sugar, Temperature, Airway, Blood pressure, Lab work, and Emotional support program,[27, 75] and the Paediatric Assessment of Illness, Recognition and Resuscitation courses[76] were identified in SSA. In SA courses included: The Facility Based Integrated Management of Neonatal and Childhood Illnesses program,[77] the Network for Improving Critical care Skills Training (NICST) program,[78-80] and the Basic Assessment and Support in Intensive Care course.[81, 82]

Educational activities promoted by CCN societies

Tier-3 evidence demonstrated that nursing organisations in SSA, SA, and EAP promoted locally delivered educational workshops or critical care short courses.[83-88] One course in Ghana was promoted as accredited and in partnership with a university nursing faculty.[84] Local and regional conferences were promoted or organised by most of the organisations.[83-90]

Educational activities targeting specific CCN practices

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A broad range of educational activities targeting specific CCN practices were noted. Some evidenced informal in-service type of education. However, some nurses in Tanzania and Egypt perceived there to be a gap in this type of job facility-based training.[91, 92] Literature from EAP and SA focussed on task or practice-specific training in areas as diverse as crisis resource management,[93] infection control practices,[94] or the use of physical restraints.[95]

Access to educational resources/Use of IT

Data regarding access to learning materials were extracted. A small number of documents from SSA suggested that access to open-source journals existed,[29] or that learning guides and reading materials were supplied as part of CCN courses.[35, 96] However, papers from Nigeria and Uganda highlighted that a lack of access to relevant evidence and materials was experienced by nurses.[66, 97] Where short-format CCN courses were discussed, it was suggested that the use of low-fidelity simulation[96] and using a train-the-trainer model to upskill clinical nurses in effective clinical teaching were useful strategies.[35] In Tanzania it was suggested that in-service trainings were not a usually practiced.[91] Whereas, in other SSA settings IT capabilities, including limited access to computers[29, 63] were perceived as constraints on the delivery of clinical education.

Educational research

Educational activities targeting specific CCN practices and broader critical care courses were both the subject of educational research in LICs/LMICs. Before and after testing of knowledge,[21] measures of satisfaction and acceptability of training,[77] practice change, and the impact of education on clinical outcomes[98, 99] were all noted. The broader literature suggests that continuing education for nurses in LICs/LMICs remains poorly researched. A recent narrative synthesis identified a range of strategies employed in general

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nurse education, not specifically CCN.[100] These included train-the-trainer models, low-dose/high-frequency models, and the use of multiple media; including web-based delivery for training that have been studied in LIC/LMIC contexts. However, they noted the quality of the evidence produced was low.

Great opportunity exists to undertake focussed research investigating the roles, capacity, and continuing education requirements of nurses providing critical care in LICs/LMICs. Research regarding the optimal strategies for delivery of continuing education in these contexts is also needed. Such work is vital in the ongoing development of critical care services in resource constrained health systems.

Addressing capacity development in LICs/LMICs is challenging. Perceived needs may be high but current assets and capacity variable. It is recommended by some that a hybrid approach should be taken where assets, capacity and needs are assessed simultaneously, driven by the local stakeholders.[101] The outcomes of such an assessment should inform contextually appropriate initiatives, that value and leverage current assets and capacity, understand the enablers and barriers to engaging in capacity development work, and clearly identify where needs exist and can be addressed.

Limitations

Although the search strategy was developed to be as comprehensive as possible. Resource constraints, not least the inability to translate non-English language documents, mean it is possible that some literature was not captured. Efforts to access the websites of national health departments and nursing councils or directly contact these organisations may elucidate registration requirements, scopes, and standards of practice. However, it remains unclear whether this would provide data specific to CCN. Finally, the lack of literature found in

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English from LICs/LMICs in LAC prevents an accurate picture of CCN in these contexts to be drawn.

Conclusion

Provision of critical care is a complex undertaking and despite commonalities, is unique to regional and socio-economic contexts. Multi-disciplinary teamwork is paramount. Yet the structure and skill levels of such teams will vary according to patient population, resources, and treatments available. The findings of this study documented care of critically ill patients in specialist and non-specialist environments. Human and physical resourcing was highly variable across regions but often reported as inadequate to meet demand within LIC/LMIC health systems. The descriptions of CCN training and skill levels were equally variable but often perceived as requiring development. Therefore, a universal definition of the CCN role in LIC/LMIC health systems is likely unhelpful. Research opportunities abound to elucidate current assets, capacity and needs of CCNs in specific LIC/LMIC contexts. Outputs from such research would be invaluable in supporting contextually appropriate capacity development programs.

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Involved in drafting the manuscript or revising it critically for important intellectual content: AM, GOR, GW, PC.

Given final approval of the version to be published. Each author should have participated sufficiently in the work to take public responsibility for appropriate portions of the content: AM, GOR, GW, PC.

Agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved: AM, GOR, GW, PC.

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No additional data available.

Figure captions

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Supplement 1: Search strings, additional limits, and database versions

Database versions accessed

1) Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Daily and Versions(R)
2) Embase Classic+Embase
3) Ovid Emcare
4) Global Health
5) SCOPUS
6) Web of Science.

Applied search limits

Limits set in all database searches were publications in the last 10 years (2010-2020) and publications in English language.
Additional limits in SCOPUS were imposed to results from 3 subject areas:
1) medical
2) nursing
3) health professions.
Additional limits in Web of science were the categories:
1) nursing
2) critical care medicine
3) education
4) educational research
5) education scientific disciplines
6) health care sciences services
7) health policy services

Ovid search strings

((nurs* or nurs* assistant* or Physician* assistant*or Multidisciplinary team* or Care giver* or Staff* or technician*) and (Intensive care or critical care or coronary care)).mp.	((((Role* or practice* or skill* or task* or Responsibilit* or ratio* or Scope of practice* or (Nurs* or profession*)) adj2 patient* relationship*) or education* or Prepar* or train* or development or (intensive care or critical care)) adj3 course*).mp	(((((Low or Develop*) adj3 (countr* or nation*)) or (limit* or restrict or poor or low)) adj3 resource*) or Third world or africa or maghreb or maghrib or sahara or algeria or egypt or morocco or tunisia or "africa south of the sahara" or sub-saharan or subsaharan or cameroon or central african republic or chad or comoros or congo or "democratic republic of the congo" or madagascar or "sao tome and principe" or british indian ocean territory or burundi or djibouti or eritrea or ethiopia or kenya or rwanda or somalia or south sudan or sudan or tanzania or uganda or angola or eswatini or lesotho or malawi or mozambique or zambia or zimbabwe or benin or burkina faso or cabo verde or cote

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		d'ivoire or gambia or ghana or guinea or guinea-bissau or liberia or mali or mauritania or niger or nigeria or senegal or sierra leone or togo or haiti or nicaragua or honduras or el salvador or Bolivia or kyrgyzstan or tajikistan or uzbekistan or kiribati or cambodia or laos or myanmar or philippines or timor-leste or vietnam or bangladesh or bhutan or india or nepal or pakistan or sri lanka or "democratic people's republic of korea" or Mongolia or west bank or gaza or afghanistan or syria or yemen or bosnia or moldova or Ukraine or pacific islands or papua new guinea or vanuatu or micronesia or solomon islands).mp.

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Supplement 2: Bibliographies for tables 2-5

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