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Research of current postgraduate nursing training courses in ICU: a systematic review.

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ABSTRACT

INTRODUCTION

Critical care nurses need the ability to integrate advanced theoretical knowledge and practical skills to meet the needs of critical patient care.

OBJECTIVE

The study presented in this paper wants to research the postgraduate training courses for critical care nurses the techniques that improve more their knowledge and skills.

METHODS

The authors conducted a systematic review lasting 7 months on three different databases. A search string was placed, based on the selected PICO. A PRISMA flow chart was drawn up. The inclusion and exclusion criteria were established. Several quality assessment tools were used. Results: the search string yielded 506 articles. After the removal of duplicates, the selection with the inclusion and exclusion criteria and the qualitative evaluation; the review included 41 studies.

DISCUSSION AND CONCLUSIONS

The survey affirms the importance to continuously update the knowledge and skills of the staff who give assistance in high care complexity situations. A lack of uniformity in the definition of standardized training courses emerged from the study. Australian research has given the possibility to develop a tool to evaluate the expected practice level after a training program. Simulation is identified as the best teaching strategy for postgraduate courses in the critical area.

Keywords: critical care, nurse, education, postgraduate.

INTRODUCTION

The technological development and the recent progress in medicine give the possibility to a greater number of patients to survive in critical conditions, which implies an intensive nursing care [1][2].

The intensive care unit (ICU) of the hospitals is the context where these critical patients are treated. In effect, the availability of modern technologies permits a continuous supervision of vital signs, the mechanical ventilation and advanced procedures of cardiopulmonary resuscitation [3]. Even though most patients are assisted in ICU, others can be treated in different specialized units, not necessarily in urban hospitals, but also in rural zones.

Consequently, it is fundamental that nurses working in critical care context have a suitable level of knowledge, skills and competences in regard to the assistance complexity. International recommendations suggest the proportion between specialized nurses in intensive care should be at least the 50% and the optimal value is set at 75% of the staff [6].

The practical realization of that standard depends on many factors: a professional culture oriented to the postgraduate education, the accessibility to appropriate programs, the nurse turnover, the individual self-confidence and the support of the institutional leadership. For these reasons, many educational programs have been realized over the past few years, both at national and international level.

At the international level, the ICU are different with respect to the other hospital units, since they generally need a greater nurse-patient rapport, as well as the advanced equipment and medical resources that are normally not available in other units.

Nurses who choose to work in ICU usually take up a postgraduate training program [7].

Specialization courses and postgraduate program trainings work as a professionalization, to gain a standard level of clinical competence [8]. They also provide the necessary experience to develop the ability of clinical judgement, in order to identify and to treat ethic issues in the context of intensive care [9].

As Blake et al. suggest, the training in this setting should promote the role of the efficient communication, in order to ensure a positive work and care environment both for professionals and assisted [10]. To be a specialized nurse does not only mean having knowledge and skills, but also the quality of emotional intelligence, i.e. to be able to reduce the own sensitivity, and hence the psychological weight [11][12].

As of today, there has not been an organized uniform nursing education for intensive care, all attempts of standardization in many countries and regions turned out to be ineffective. The research of Endacott et al. suggests that the lack of homogenization of postgraduate training programs is a consequence of the difficulty to recognize them as a specialized area all over the Europe [13].

It is actually true that in many European countries, such as in Italy, the critical care area has been identified as postgraduate education area (DM 743/94), since 1994. The same was made by the "Canadian Association of Critical Care Nurses", which carried out a fundamental role in the formal recognition of nursing care in the intensive care as a specialization area [14].

Endacott et al. also pointed out additional challenges: the need to organize a European post-graduate program, and the need to implement tools to regulate and recognize advanced practical positions in the ICU. Nursing organizations all over the world have taken different official stances, which give general principle and recommend topics for educational programs15.

The principal aim of this study is the research of postgraduate programs for nurse in critical care areas inside the scientific literature. The second goal is to identify ways and educational

techniques that could improve knowledge and skills of nurses in line with the scientific and technological progress.

METHODS

The investigation was conducted between January 2020 and August 2020.

Research conditions were selected through the PIO framework, in order to gain the objectives of this systematic review.

- **Participants**: Nurses working in ICU context, both for adults and paediatric-neonatal patients.
- **Interventions**: Postgraduate training for intensive care nurses in adult and paediatric-neonatal setting.
- **Outcomes**: The primary result was the evaluation of the need of postgraduate training program, of different levels, for nurses working in critical area. We focused in particular on the quality and the effectiveness. The second outcomes included the educational manner and the principal knowledge and skills to be developed, and to be increased, during the training.

The research string, based on the selected PIO, is:

((nurs*[Title]) AND (education[Title]) AND ((icu[Title]) OR (critical care[Title]) OR ((intensive care unit)[Title]))

Every term was researched in the title. It was realized in a table using Word, which included all the selected articles we used for the study. The table included many columns: the first for authors, publication date and the study type; the second included the title, the journal and the setting; finally, the third column included the principal results of the paper. Tables were organized as in Table 1.

The papers to be reviewed were selected from medical-scientific databases, as Pub Med, Scopus, Cinhal.

We took into consideration articles published in the period July 2010 and July 2020. We only considered papers regarding "human being", without age limits, in English and with full-text available. We adopted the methodology PRISMA, based on a flow-chart to define the number of articles identified by the research, the results of the screening, the number of studies which fulfil admissibility criteria and the studies included for the complete review.

The different terms were combined to carry out different searches, defining for each one the following limits. The first regarded the article type: we only included systematic reviews, reviews, randomized controlled trial (RCT), quasi-experimental trial, observational and editorial trials.

We used many different evaluation tools to estimate the quality of the studies to be included: the AMSTAR II for systematic reviews, the STROBE for observational studies and the "Joanna Briggs Institute Checklist" (JBI) for the publishing.

Because of the variety of articles, we adopted a pragmatic approach to the problem of quality: quality points were converted in percentage through the Methodological Quality Summary, and publications with a quality rate under 50% were excluded. The search string gave 506 papers. After eliminating the duplicates, there were 405 remaining papers; 287 of these did not overcome filters of inclusion and exclusion criteria; finally, 148 articles of the remaining 163 have a full-text available.

The title review and the content review excluded another 107 papers: in particular, 103 because the title and the abstract were not pertinent to the goals of the research, and the others 4 because of the quality level (a total score lower than 50%). Therefore, 41 studies were submitted to the evaluation of the quality and they were included in the qualitative summary (Figure 1).

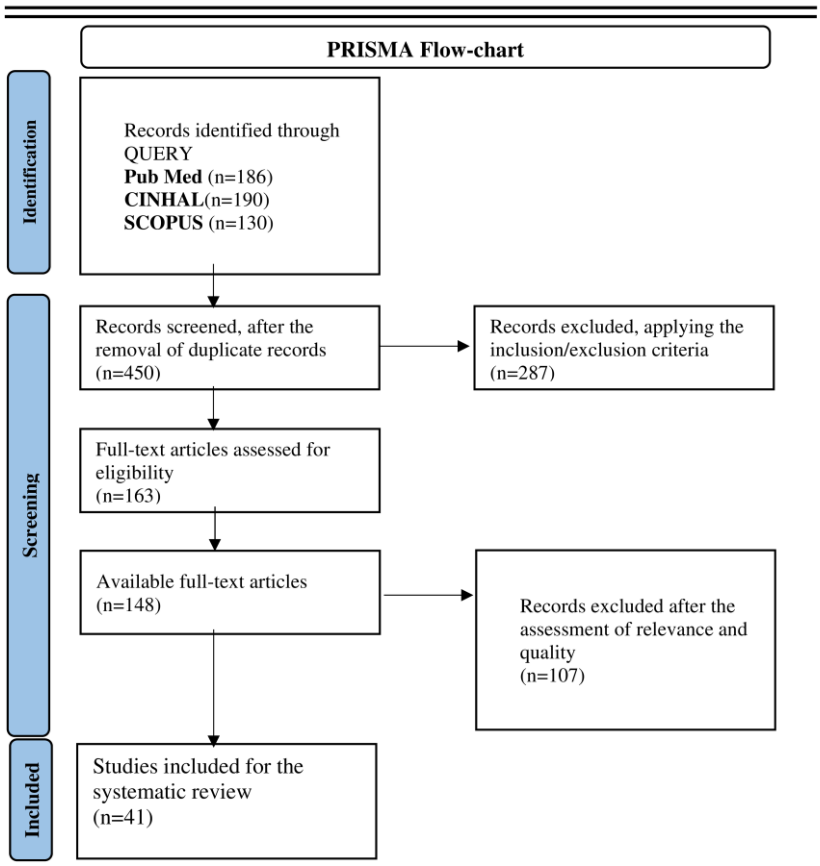

Figure 1: Flowchart PRISMA of the methodology for the identification, selection and review of papers regarding postgraduate education of nurses in critical care area.

In regard to the selected articles for the study plan, we included 8 systematic reviews, 3 randomized controlled studies, 2 quasi-experimental studies, 20 observational studies and 8 editorials.

RESULTS

Articles included in the review are collected in Table 1 which describes and summarizes the principal features and results of the study. The table consists in three columns: the authors, the dare, study type and bibliographic references; the title, the journal, and the setting; overview and results.

AUTHORS, DATE, TYPE OF STUDY, REFERENCES	TITLE	JOURNAL	SETTING
	OVERVIEW AND RESULTS OF THE STUDY		
Guilhermino MC, Inder KJ, Sundin D 2018 A Systematic Review Nurs Crit Care 2018 Sep;23(5):245-255. doi: 10.1111/nicc.1234. Epub 2018 Mar 26.	"Education on Invasive Mechanical Ventilation Involving Intensive Care Nurses: A Systematic Review."	Nursing in Critical Care	Australia
	A systematic review has been carried out to assess whether the continuing programmes for intensive care nurses on mechanical invasive ventilation are effective in improving patient outcomes. Twelve studies met the inclusion criteria for full review: 11 pre- and post-intervention observational and 1 quasi-experimental design. Studies reported statistically significant reductions in hospital length of stay, length of intubation, ventilator-associated pneumonia rates, failed weaning trials and improvements in lung-protective ventilation compliance. Non-statistically significant results were reported for in-hospital and intensive care unit mortality, re-intubation and intensive care unit length of stay.		
Saab MM, McCarthy B, Andrews T, Savage E, Drummond FJ, Walshe N, Forde M, Breen D, Henn P, Drennan J, Hegarty J 2017 A systematic review J Adv Nurs. 2017 Nov;73(11):2506-2521. doi: 10.1111/jan.13322. Epub 2017 May 22.	"The Effect of Adult Early Warning Systems Education on Nurses' Knowledge, Confidence and Clinical Performance: A Systematic Review."	Journal of Advanced Nursing	
	It is a systematic quantitative review using Cochrane methods. Studies published between January 2011 - November 2015 in English were sought. This review aims to determine the effect of adult Early Warning Systems education on nurses' knowledge, confidence and clinical performance. This review highlights the importance of measuring outcomes using standardized tools and valid and reliable instruments. Using longitudinal designs, researchers are encouraged to investigate the effect of Early Warning Systems educa-		

	tional programmes. These can include interactive e-learning, on-site interdisciplinary Early Warning Scoring systems training sessions and simulated scenarios.		
Jansson M, Kääriäinen M, Kyngäs H 2013 A systematic Review Clin Sim Nurs. 2013 Sep; 9 (9): 355-360. doi: 10.1016/j.ecns.2012.07.003	"Effectiveness of simulation-based education in critical care nurses' continuing education: A systematic review."	Clinical Simulation in Nursing	
	Only one study is included in the review, due to the lack of available studies. According to the results of this study, the simulation-based education increases adherence of intensive care nurses to recommendations on the safe administration of drugs and, therefore, improves patient safety and the quality of care. The effectiveness of simulation-based education on critical care nurses' knowledge and skills remained uncertain because of a lack of published studies and robust evidence. Further multicentric and randomised and controlled follow-up studies are needed to assess the effectiveness of simulation-based education, compared to other training programs, as well as develop a universal method of measuring the quality of results.		
Gullick J, Lin F, Massey D, Wilson L, Greenwood M, Skylas K, Woodard M, Tembo AC, Mitchell M, Gill FJ 2019 An integrative review Aust Crit Care. 2019 Jul;32(4):331-345. doi: 10.1016/j.aucc.2018.09.007. Epub 2018 Dec 6.	"Structures, processes and outcomes of specialist critical care nurse education: An integrative review."	Australian Critical Care	Australia
	The study aims to review and synthesise international literature to reveal the contemporary structures, processes, and outcomes of critical care nurse education. Structural expectations included a standard core curriculum, clinically credible academic staff, and courses compliant with a higher education framework. Processes included incremental exposure to increasing patient acuity; consistent and appropriately supported and competent hospital-based preceptors/assessors; courses delivered with a flexible, modular approach; curricula that support nontechnical skills and patient- and family-centred care; stakeholder engagement between the education provider and the clinical setting to guide course planning, evaluation and revalidation; and evidence-based measurement of clinical capabilities/competence. Outcomes included articulation of the scope and levels of graduate attributes and professional activities associated with each level. The role of higher degree research programs for knowledge creation and critical care academic leadership was noted. Provision of high-quality critical care education is multifaceted and complex. These findings provide information for healthcare organisations and education providers.		
Vanderspank-Wright B 2014 A peer-reviewed	"Intensive Care Nursing in Canada, 1960-2002: Historical Perspectives on Education, Knowledge Development, Technology and Identity...Dynamics of	Dynamics	Canada

Dynamics. 2014 Sep; 25(2): 40-40	Critical Care 2014, Quebec City, Quebec, September 21-23, 2014"		
	The peer review examined the specialist characteristics of the nurses in intensive care units in Canada from 1960 to 2002. ntensive care units (ICUs) began to emerge across Canada during the early 1960s, significantly contributing to the image of Western hospitals as places of scientific advancement that predominated over much of the twentieth century. ICUs quickly flourished, growing in size and number to accommodate diverse patient populations and treatment options. Early ICU nurses played a pivotal role in socially constructing a new and specialized practice identity. The experiences of these early nurses influenced ICU nursing in important and lasting ways. Over time, the development of their knowledge, skills, and, ultimately, expert nursing practice helped to reconcile contemporary debates such as how nurses working in such a highly technological environment could provide a humanized type of care. From a historical perspective, there is limited research on the development of Canadian ICUs and the nature of nurses' work in this context of care. Therefore, this study used a social history approach with primary sources including oral history interviews, published professional literature, and photographs, to build on previous work specific to the history of ICU nursing. Berger and Luckmann's Social Construction of Reality provided a lens for analysis and interpretation of primary sources (Berger & Luckmann, 1966). Analysis of the data identified three main themes: ICU nurses' education and learning in the context of developing ICUs, situating technology in ICU nursing practice, and ICU nursing as individual, as well as national identity. Canadian ICU nurses' national identity culminated in the establishment of the Canadian Association of Critical Care Nurses, which played an integral role in the formal recognition of ICU nursing as a specialty practice area.		
Gill FJ, Leslie GD, Grech C, Latour JM 2012 A review Aust Crit Care. 2012 Nov;25(4):224-37. doi: 10.1016/j.aucc.2011.12.056. Epub 2012 Feb 4.	"A Review of Critical Care Nursing Staffing, Education and Practice Standards."	Australian Critical Care	Australia
	The aim of this paper is to review the differences and similarities in critical care nursing staffing, education and practice standards in the US, Canada, UK, New Zealand and Australia. The review shows a general consensus on the importance of a graduate nursing staff with with high-level clinical skills and knowledge. For this reason, it is essential that nurses continue post-basic training courses with specialization courses. To date, however, there is a disparity in the definition of the level and characteristics of the training courses for a specialized intensive care nurse.		
Munyiginya P, Brysiewicz P, Mill J 2016 A review Southern African Journal of Critical Care. 32(2), pp. 55-57	"Critical care nursing practice and education in Rwanda."	Southern African Journal of Critical Care	Ruanda
	Critical care nursing in Rwanda is facing multiple challenges related to this country's history, fast-paced economic development and the rapid urbanisation occurring in the country. This article is based on a review of the published and grey literature relevant to the healthcare system. Two levels of adult ICUs exist in Rwanda.		

	The first is the HDU, which is an intermediate unit, between the ICU and the general wards, where patients are closely monitored. The second is the general ICU, which has mechanical ventilators and limited invasive monitoring devices. In Rwanda, concurrent with the economic growth and urbanisation, there has been a steep increase in the utilisation of motorcycles as a mean of transport. This rapid expansion and utilisation of motorcycles, coupled with the expansion of industrial production without adequate safety measures and appropriate infrastructure, is likely to increase the incidence of injuries. Injuries that are critical and life threatening require rapid management and close monitoring, and therefore necessitate admission to an HDU or ICU. More than 83% of Rwandans live in a rural setting and individuals from these areas use ingobyi (a traditional wooden bed) as a method to transport injured or ill patients in emergency situations when a car is not available. Consequently, these patients take more time to reach the health facility, and when they do arrive, they are often in advanced stages of illness. Critical care nursing in Rwanda is still a developing specialty. Although there have been exciting developments that may serve as cornerstones, various challenges remain. These include inadequate preparation of personnel to work in critical care and limited availability of standards and policies regulating this profession.		
Carter C, Mukonka PS, Sitwala LJ, Howard-Hunt B, Notter J 2020 A review Br J Nurs. 2020 May 14;29(9):499-505. doi: 10.12968/bjon.2020.29.9.499.	"The development of critical care nursing education in Zambia."	British Journal of Nursing	Zambia
	The literature review analyses the critical care nursing in sub-Saharan Africa. Critical care provision in Zambia has changed and advanced both academically and clinically since the initial introduction of critical care nursing as a specialty in 2012. A new training programme for nurses working in the ICU, starting from the 2020. This project has had an impact on improving critical care nurses' knowledge and skills and provided the foundations for the Bachelor of Science (BSc) in critical care nursing. The development of this training programme helps to improve and enhance the care of critical patients in Zambia and it is an important achievement for the country.		
Mohamadi M, Namnabati M, Aarabi A 2019 A Randomized Controlled Trial Iran J Nurs Midwifery Res. Jan-Feb 2019;24(1):50-55. doi: 10.4103/ijnmr.IJNMR_83_17.	"Reduced Mental Workload of Neonatal Intensive Care Unit Nurses through a Self-designed Education Class: A Randomized Controlled Trial."	Iranian Journal of Nursing and Midwifery Research	Iran
	One of the complex care environments in hospitals is neonatal intensive care unit (NICU). Caring for infants and premature babies requires high dedication and accuracy and is usually accompanied by high accountability, which totally increases mental workload. This study aimed to evaluate the effect of two conventional education and self-designed education classes prepared to improve a part of emotional intelligence that affects the mental workload of the nurses in NICUs. It is an RCT conducted on 68 nurses, divided into two groups of intervention and control This study was conducted on 68 nurses, divided into two intervention and control groups. Subjects of the intervention group attended a social awareness reinforcement class, in which one of		

	the dimensions of emotional intelligence was introduced and covered. Research tool was the mental workload questionnaire of National Aeronautics and Space Administration Task Load Index (NASA-TLX). According to the results of the study, the conventional education class had no impact on the mental workload, whereas the self-designed class significantly decreased mental workload. Therefore, it is suggested that education programs be conducted for NICU nurses to improve their emotional intelligence, which leads to decreased level of mental workload.		
Jansson MM, Ala-Kokko TI, Ohtonen PP, Meriläinen MH, Syrjälä HP, Kyngäs HA 2014 A randomized controlled trial Am J Infect Control. 2014 Mar;42(3):271-6. doi: 10.1016/j.ajic.2013.11.023.	"Human patient simulation education in the nursing management of patients requiring mechanical ventilation: A randomized, controlled trial."	American Journal of Infection Control	Oulu, Finlandia
	The aim of our study was to evaluate how knowledge about and skills for managing patients requiring mechanical ventilation differ between randomly allocated intervention and control groups before and after HPS education in both the simulation environment and clinical setting. The primary outcomes measured between randomly allocated intervention and control groups were participant knowledge and skill in adhering to ventilator bundles (VBs), a package of evidence-based interventions to prevent VAP. The hypothesis was that in the intervention group, knowledge and skills in adhering to VBs might increase compared with a control group after the HPS education. This study is a randomized controlled trial with repeated measurements, conducted in a single academic centre in a 22-bed adult mixed medical-surgical ICU in Finland between February and October 2012. Participant knowledge and skills in adhering to VBs were evaluated through the validated 49-item multiple-choice Ventilator Bundle Questionnaire (VBQ) and 86-item Ventilator Bundle Observation Schedule (VBOS). According to the linear mixed model, average knowledge scores (VBQ) within either group did not change statistically (Table 2). However, the intervention group had higher scores (Pg ¼ .05) over the whole study period. In the intervention group, the average skill scores (VBOS) increased significantly after HPS education from 46.8% to 60.0% of the total score in the final postintervention observation. HPS education significantly improved skills among critical care nurses in managing patients requiring mechanical ventilation, an improvement that persisted at 6 months' follow-up.		
Salehi Z, Nouri JM, Khademolhoseyni SM, Ebadi A 2014 A randomized controlled trial Glob J Health Sci. 2014 Oct 9;7(2):148-53. doi: 10.5539/gjhs.v7n2p148.	"The effect of education and implementation of evidence-based nursing guidelines on infants' weight gaining in NICU."	Global journal of health science	Tehran, Iran
	The research is conducted with the aim of surveying the effect of education and implementation of educating evidence-based guidelines on infants' weight gaining in NICU. Results of the present study showed that implementation of evidence-based instruction an effective and economical method regarding infants' weight gaining. Therefore it is recommended to the authorities and managers of the hospitals and educational centres of the healthcare		

	services to put education and implementation of educating evidence-based instruction the priority of their work plans.		
Goldsworthy S 2017 A quasi-experimental design Crit Care Nurs Clin North Am. 2016 Dec;28(4):399-412. doi: 10.1016/j.cnc.2016.07.001.	"Mechanical Ventilation Education and Transition of Critical Care Nurses Into Practice."	Critical Care Nursing Clinics of North America	Canada
	Simulation has emerged in recent years as an educational strategy for nurses and has been shown to increase levels of self-efficacy, competence, and performance. This quasi-experimental study describes the integration of mechanical ventilation training into case-based simulations and the results of a study that measuring self-efficacy and the transfer of learning before and after the implementation of the simulation intervention.		
Han MJ, Lee JR, Shin YJ, Son JS, Choi EJ, Oh YH, Lee SH, Choi HR 2018 A quasi-experimental study. Jpn J Nurs Sci. 2018 Jul;15(3):258-266. doi: 10.1111/jjns.12195. Epub 2017 Dec 21.	"Effects of a Simulated Emergency Airway Management Education Program on the Self-Efficacy and Clinical Performance of Intensive Care Unit Nurses."	Japan Journal of Nursing Science	Corea del Sud
	The aim of the research was to examine the effects of a simulated emergency airway management education program on the self-efficacy and clinical performance among nurses in intensive care units. Thirty-five nurses who were working in adult intensive care units participated in this study. The simulation education program included lectures, skill demonstration, skill training, team-based practice, and debriefing. Self-efficacy and clinical performance questionnaires were completed before the program and 1 week after its completion. The scores before and after education were compared. After education, there was a significant improvement in the nurses' self-efficacy and clinical performance in emergency airway management situations. Simulation education effectively improved the self-efficacy and clinical performance of the nurses who were working in intensive care units.		
Haegdorens F, Van Bogaert P, De Meester K, Monsieurs KG 2019 An observational multicentre study. BMC Health Serv Res. 2019 Nov 21;19(1):864. doi: 10.1186/s12913-019-4688-7.	"The Impact of Nurse Staffing Levels and Nurse's Education on Patient Mortality in Medical and Surgical Wards: An Observational Multicentre Study."	BMC Health Services Research	Belgio
	In this observational study we analysed retrospectively the control group of a stepped wedge randomised controlled trial concerning 14 medical and 14 surgical wards in seven Belgian hospitals. The amount of nursing hours per patient days (NHPPD) were calculated every day for 15 days, once every 4 months. Data were aggregated to the ward level resulting in 68 estimates across wards and time. The unexpected death rate was 1.80 per 1000 patients. Up to 0.76 per 1000 patients died after CPR and 0.62 per 1000 patients died after unplanned admission to the ICU. The mean composite mortality was 3.18 per 1000 patients. The mean NHPPD and proportion of nurse Bachelor hours were respectively 2.48 and 0.59. We found a negative association between the nursing hours		

	per patient day and the composite mortality rate adjusted for possible confounders (B = – 2.771, p = 0.002). The proportion of nurse Bachelor hours was negatively correlated with the composite mortality rate in the same analysis (B = – 8.845, p = 0.023).		
Price DM, Strodtman L, Montagnini M, Smith HM, Miller J, Zybert J, Oldfield J, Policht T, Ghosh B 2017 A descriptive and correlational study J Contin Educ Nurs. 2017 Jul 1;48(7):329-336. doi: 10.3928/00220124-20170616-10po	"Palliative and End-of-Life Care Education Needs of Nurses Across Inpatient Care Settings."	The Journal of Continuing Education in Nursing	Michigan (Stati Uniti)
	The purpose of this study was to assess nurses' perceived competency regarding the provision of palliative and EOL care to hospitalized patients. This study surveyed nurses from 25 paediatric and adult acute and intensive care units (ICU; N = 583) . Data analysis revealed that perceived competency in palliative and EOL care is significantly higher in the ICU nurses. Mean scores were significantly higher when nurses had more than 10 years of experience. Open-ended responses indicated concerns regarding improved communication behaviors, decision making, and facilitation of continuity of care.		
Powers KA 2018 A cross-sectional study Dimens Crit Care Nurs. Jul/Aug 2018;37(4):210-216. doi: 10.1097/DCC.0000000000000304.	"Family Presence During Resuscitation: The Education Needs of Critical Care Nurse."	Dimensions of Critical Care Nursing	Social Network
	The aim of this study was to explore the FPDR education needs of critical care nurses to provide recommendations for future educational interventions. One-third of the participants had received FPDR education, and 83% desired to receive education on FPDR. Qualitative data revealed 4 themes: "nurses need education," "team training is important," "focus on implementation of FPDR," and "a variety of preferences." Critical care nurses' reported needs for FPDR education are currently not being met.		
Baid H, Hargreaves J 2015 A descriptive study Nurs Crit Care. 2015 Jul;20(4):174-82. doi: 10.1111/nicc.1218. Epub 2015 May 10.	"Quality and Safety: Reflection on the Implications for Critical Care Nursing Education."	Nursing in Critical Care	Stati Uniti
	The purpose of this paper is to reflect upon how a post-registration, degree-level critical care nursing course provided by an English university facilitates nurses to deliver high quality, safe nursing care for critically ill patients and their families. Critical care nursing education can incorporate informed practice, simulation and non-technical skills into post-registration critical-care nursing courses as a way of promoting high-quality, safe clinical practice in the critical care setting.		
Gill FJ, Leslie GD, Grech C, Boldy D, Latour JM	"An Analysis of Australian Graduate Critical Care Nurse Education."	Collegian	Australia

2015 A descriptive study Collegian. 2015;22(1):71-81. doi: 10.1016/j.colegn.2013.11.006.	The study is used to analyse existing critical care courses; The findings of our study indicate variations between courses and subsequent graduate practice outcomes. It is therefore timely to establish national critical care education graduate practice standards. It is timely to establish national course practice standards for each specialty, aligning with the AQF qualification learning outcome descriptors. Achieving national adoption of graduate practice standards will then require a regulatory process that ideally will fit within a framework for specialty nurse education.		
Gill FJ, Leslie GD, Grech C, Boldy D, Latour JM 2013 An observational study Nurs Crit Care. Mar-Apr 2013;18(2):93-102. doi: 10.1111/j.1478-5153.2012.00543.x.	"Health Consumers' Experiences in Australian Critical Care Units: Postgraduate Nurse Education Implications."	Nursing in Critical Care	Australia
	The study analyses the views of the patients and families about the importance of the critical care nurses' postgraduate educational preparation and practice outcomes The use of focus groups and individual interviews captured the views of a variety of participants (both patients and family members) across several Australian cities. The study found that consumers of critical care value physical care and socio-emotional support equally in care provided by nurses. The level of socio-emotional support provided was reported to be inconsistent, which could result in patient and families' feeling stressed by their relationships with nurses. The implications of the study findings are for Educators to consider how the design and delivery of postgraduate critical care nurse curricula, including assessment activities, can best assist course graduates to value and subsequently provide patient and family centred care.		
Lawrence LA 2011 A descriptive correlational study Nurs Forum. Oct-Dec 2011;46(4):256-68. doi: 10.1111/j.1744-6198.2011.00237.x.	"Work Engagement, Moral Distress, Education Level, and Critical Reflective Practice in Intensive Care Nurses."	Nursing Forum	
	A correlational design was used to examine the relationships among four variables: moral distress, education level, CRP, and work engagement. There was a positive direct relationship between CRP and work engagement, a negative direct relationship between moral distress and work engagement, and CRP and moral distress, together, explained 47% of the variance in work engagement. Additionally, in the neonatal intensive care unit, a positive direct relationship between increased educational level and CRP was identified, with a suggested negative relationship between increased education level and moral distress. Strategies to promote CRP and reduce moral distress are recommended, to promote RN work engagement.		
Campbell JM 2015	"Education and Simulation Training of Pediatric Intensive Care Unit Nurses to Care for Open Heart Surgery Patients"	Critical Care Nurse	Portland (Columbia)

An exploratory and descriptive study. Crit Care Nurse. 2015 Jun;35(3):76-81. doi: 10.4037/ccn2015312.	The study aims to describe the training program based on simulation implemented in in a paediatric UTI (UTIP) in Portland (Columbia). Simulations were made, as realistic as possible on the basis of requests and questions from less experienced nurses, held by qualified and experienced colleagues. This education program allowed nurses working in the UTIP to begin developing some "muscle memory" required to build a skill set foundation. The skill sets needed to react in critical and stressful situations correctly are developed through practiced experiences such as those described in this article.		
Guilhermino MC, Inder KJ, Sundin D, Kuzmiuk L 2014	"Education of ICU nurses regarding invasive mechanical ventilation: Findings from a cross-sectional survey."	Australian Critical Care	Australia
A cross-sectional study Aust Crit Care. 2014 Aug;27(3):126-32. doi: 10.1016/j.aucc.2013.10.064. Epub 2013 Dec 2.	A cross-sectional, 30-item, self-administered and semi-structured survey on invasive mechanical ventilation (MV) education was distributed to 160 intensive care nurses. The study shows that registered nurses are commencing their ICU experience with limited knowledge of invasive MV therefore the education provided within the ICU workplace becomes fundamental to safe and effective practice. The perception of continuing education by ICU nurses from this research is positive regardless of level of ICU experience.		
Gill FJ, Leslie GD, Grech C, Boldy D, Latour JM 2015	"Development of Australian Clinical Practice Outcome Standards for Graduates of Critical Care Nurse Education."	Journal of Clinical Nursing	Australia
A descriptive observational study J Clin Nurs. 2015 Feb;24(3-4):486-99. doi: 10.1111/jocn.1263. Epub 2014 May 10.	An eDelphi technique was used to identify critical care nurse education graduate practice standards in Australia. The process resulted in the development of 98 practice standards, categorised into three levels, indicating a practice outcome level by the practitioner who can independently provide nursing care for a variety of critically ill patients in most contexts, using a patient- and family-focused approach. Critical care nurse education graduates are expected to be able to independently care for critically ill patients in the majority of contexts, with a number of contexts explicitly identified as being beyond the graduate scope of practice. In particular, in this study we found it is beyond the scope of Australian graduates to take on distinct leadership roles in the critical care environment, which differs from the UK and European expectations of graduates. The Australian practice standards reflect the views of health consumers and critical care nursing stakeholders. Inclusion of health consumer views to inform the standards development distinguishes these critical care nurse education practice standards from the UK and European critical care competencies.		
Long DA, Young J, Rickard CM, Mitchell ML 2013	"Analysing the role of the PICU nurse to guide education of new graduate nurses."	Nurse Education Today	Australia, Nuova Zelanda

A cross-sectional study Nurse Educ Today. 2013 Apr;33(4):388-95. doi: 10.1016/j.nedt.2013.01.016.	A practice analysis survey of 15 nurse educators was conducted in all eight Australian and New Zealand PICUs during 2008. The conclusions of the study are as follows: cardiac and respiratory activities were therefore also ranked as the most important activities. Respondents identified that competency domains of teamwork and professional practice are performed with minimal supervision, whereas clinical problem solving requires supervision and assistance. PICU nurses are performing activities and caring for a breadth of complex patients within a year of entering the workforce. Using a practice analysis to define actual practice and expectations can assist in the identification and prioritisation of content for graduate and other educational programs.		
Abe Y, Kawahara C, Yamashina A, Tsuboi R 2013	"Repeated scenario simulation to improve competency in critical care: a new approach for nursing education."	American Journal of Critical Care	Giappone
A qualitative descriptive study Am J Crit Care. 2013 Jan;22(1):33-40. doi: 10.4037/ajcc2013229.	A training program that consisted of lectures, training in cardiovascular procedures, and scenario simulations was conducted with 24 Japanese nurses working at a university hospital. Before and after the simulations, participants also completed a survey that used the Teamwork Activity Inventory in Nursing Scale (TAINS) to assess their nontechnical skills. Our new educational approach of using repeated scenario simulations and TAINS seemed not only to enhance individual nurses' technical skills in critical care nursing but also to improve their nontechnical skills somewhat.		
Macedo APMC, Padilha KG, Püschel VAA 2019	"Professional practices of education/training of nurses in an intensive care unit."	Revista Brasileira de Enfermagem	San Paolo, Brasile
A qualitative-descriptive study Rev Bras Enferm. Mar-Apr 2019;72(2):321-328. doi: 10.1590/0034-7167-2017-0793.	The study is aimed to understand the education/training of nurses working in an intensive care unit. Data collection and analysis used different research techniques, mainly document analysis, interview and field observation The data highlights feelings of well-being, satisfaction and motivation as important for education and training in a work context. Some organizational practices seem to promote interpersonal relationships and, consequently, increase the willingness of these professionals to adopt a reward perspective regarding continuing education and training, establishing a close relationship between the formal, the non-formal and the informal. There is a reciprocity between a hospital that endorses up-to-date care and professionals who seek scientific evidence.		
Guilhermino MC, Inder KJ, Sundin D, Kuzmiuk L 2014	"Nurses' perceptions of education on invasive mechanical ventilation."	The Journal of Continuing Education in Nursing	Australia
A descriptive study J Contin Educ Nurs. 2014 May;45(5):225-32. doi:	This study examined nurses' perceptions of current education on invasive mechanical ventilation in an Australian ICU. Qualitative data were obtained from five optional open-ended questions as part of a larger 30-item cross-sectional survey of 160 ICU nurses. Content analysis was used to code the data, developing concepts and themes.		

10.3928/00220124-20140417-01. Epub 2014 Apr 17.	Respondents recognized the need for interactive, practical, bedside education sessions to transfer learning into the everyday work environment.		
Gosselin M, Perron A, Lacasse A 2020 A descriptive study J Contin Educ Nurs . 2020 Jul 1;51(7):322-330. doi: 10.3928/00220124-20200611-08.	"Assessment of continuing education needs among critical care nurses in remote Québec, Canada"	Journal of Continuing Education in Nursing	Quebec
	A cross-sectional survey was conducted, through the administration of a web-based questionnaire. It is aimed at assessing the needs of critical care nurses in remote regions of Québec regarding continuing education (CE). A total of 78 nurses completed the survey and reported their CE needs were not being met. Only 21.9% of participants reported a satisfaction level ≥ 6 on a scale of 1 to 10 regarding the offering of CE activities in their region. The most common factors identified as barriers to participation in CE activities were working hours (68.2%), distance and travel time (68.2%), released time to attend CE activities (65.2%), costs of CE activities (57.6%), and financial support (51.5%). This study provides insights into CE needs among critical care nurses. Shortcomings could be addressed by increasing CE activities in remote regions as well as the proportion of critical care-specific CE activities. Moreover, time and expense coverage should be offered by employers.		
Straka K, Burkett M, Capan M, Eswein J 2012 A pilot study J Nurses Staff Dev. Nov-Dec 2012;28(6):E5-8. doi: 10.1097/NND.0b013e3182732db5.	"The impact of education and simulation on pediatric novice nurses' response and recognition to deteriorating."	Journal for Nurses in Staff Development	Pennsylvania
	Adverse patient events related to preventable errors while hospitalized resulted in need for interventions to improve outcomes. One identified error is the lack of symptom recognition during patient deterioration. Paediatric patients' symptoms during deterioration vary from their adult counterparts and often go unrecognized. A Paediatric Crisis Recognition and Management course was designed to assist the novice paediatric nurse to recognize and respond appropriately through the use of high-fidelity simulation enhancing their clinical skills and improving patient outcomes during a crisis.		
Koharchik L, Jakub K, Witsberger C, Brooks K, Petras D, Weideman Y, Antonich MG 2016 A descriptive study Teaching and Learning in Nursing. 12(1), pp. 17-20.	"Staff Nurses' Perception of Their Role in a Dedicated Education Unit Within the Intensive Care Unit."	Teaching and Learning in Nursing	Pittsburgh (Stati Uniti)
	The dedicated education unit (DEU), a model for clinical nursing education, is a partnership in which professional nurses are trained to participate in the clinical education of nursing students. This study evaluated the perceptions of staff nurses who acted as clinical teaching associates to senior nursing students in an intensive care unit setting using the DEU model. Other nursing programs may benefit from the outcomes experienced in this application of the DEU model.		
Endacott R, Jones C, Bloomer MJ, Boulanger C, Ben Nun M, Lliopoulou KK, Egerod I, Blot S	"The state of critical care nursing education in Europe: an international survey."	Intensive Care Medicine	Australia, Belgio, Cipro, Danimarca, Finlandia, Grecia, Islanda, Irlanda; Lituania,

2015 A descriptive study Intensive Care Med. 2015 Dec;41(12):2237-40. doi: 10.1007/s00134-015-4072-y. Epub 2015 Oct 1.			Olanda, Norvegia, Spagna, Svezia, Svizzera, Turchia
	The purposes of this study were to map adult CCN education programmes; examine existing educational structures, processes and outcomes; and identify the barriers to advancing CCN education programmes across Europe, through the use of a descriptive survey of registered nurses in leadership roles within CCN organisations. The survey was completed via telephone, online and in hard copy in order to optimise recruitment. Our results indicate that the first challenge is the recognition of CCN as a specialty area across Europe. The second challenge is the development of a Europe-wide specialist education programme that results in nurses with the knowledge, skills and expertise fit-for-purpose for the increasing patient acuity in critical care. The third challenge is to ensure changes to the nursing workforce across Europe, such as implementing a framework that enables advanced practice roles in CCN to be recognised and regulated and enable suitably qualified critical care nurses to work freely across country borders. In conclusion, there are significant barriers impeding the development and advancement of CCN education across Europe. A Europe-wide approach to addressing these is imperative before CCN can advance as an area of specialty practice and meet the increasing needs of the critically ill patient.		
Gill FJ, Leslie GD, Grech C, Boldy D, Latour JM 2014 A descriptive study J Contin Educ Nurs. 2014 Jul;45(7):312-20. doi: 10.3928/00220124-20140620-02. Epub 2014 Jun 20.	"Developing and Testing the Standard of Practice and Evaluation of Critical-Care-Nursing Tool (SPECT) for Critical Care Nursing Practice."	The Journal of Continuing Education in Nursing	Australia
	Nurses working in critical care often undertake specialty education. There are no uniform practice outcomes for critical care programs, and consumer input to practice standards has been lacking. A structured multiphase project was undertaken to develop practice standards and an assessment tool informed by critical care nursing stakeholders as well as patients and families-the Standards of Practice and Evaluation of Critical-Care-Nursing Tool (SPECT). The SPECT appears to have clinical feasibility, preliminary validity and reliability, and provides a clear definition for the expected practice level for graduates of a critical care education program.		
Paim CC, Ilha S,Backes S, Backers DS 2015 An esplorative desctiptive study Rev. de Pesq.: cuidado é fundamental. 2015 jan-mar; 7(1): 2001-2010. doi: 10.9789/2175-5361.2015.v7i1.2001-2010	"Permanent education in health in an intensive care unit: the perception of the nurses."	Revista de Pesquisa: Cuidado e Fundamental	Rio grande do Sul, Brasile
	The article presents a qualitative study to identify the perception of the acting nurses in the Intensive Care Unit about the process of Permanent Education aiming at its later application in the service. Data collection was through a questionnaire containing open questions, and data treatment was through content analysis. It was possible to conclude that the Permanent Education is a slow and progressive process that must not lose the focus, which addresses care quality, because it presents a meaningful transformation result.		

Gill FJ, Lin F, Massey D, Wilson L, Greenwood M, Skylas K, Woodard M, Tembo A, Mitchell M, Gullick J 2019 An editorial article Aust Crit Care. 2019 Jul;32(4):346-350. doi: 10.1016/j.aucc.2018.08.001. Epub 2018 Sep 6.	"Development of a position statement for Australian critical care nurse education."	Australian Critical Care	Australia
	This article describes a structured approach used to develop a position statement for the Australian critical care nursing education. The formation of an expert advisory panel, synthesis of available evidence using Whittemore and Knafl's integrative review methodology, use of Donabedian's structure-process-outcomes quality framework as a theoretical approach, and multiple layers of consensus building, and consultation enabled the development of an important critical care document and informed an implementation plan. The framework and processes we have outlined in this discussion article may provide a useful starting point for other professional organisations wishing to develop similar position statements.		
Skees J 2010 An editorial article Crit Care Nurs Q. 2010 Apr; 33 (2):104-116. doi: 10.1097/CNQ.0b013e3181d913a1	"Continuing education: A bridge to excellence in critical care nursing."	Critical Care Nursing Quarterly	
	This article will discuss perspectives in continuing education (CE) for the nurse. Research findings to illustrate the significance of professional development will be presented. The integration of passion for learning that provides a foundation for excellence in practice will be addressed. Finally, a variety of strategies that can be used to participate in and develop interactive CE programs to meet the needs of savvy professional nurse consumers will be explored.		
Hendrickx L, Winters C 2017 An editorial article Crit Care Nurse. 2017 Apr;37(2):66-71. doi: 10.4037/ccn2017999.	"Access to Continuing Education for Critical Care Nurses in Rural or Remote Settings."	Critical Care Nurse	Minnesota (Stati Uniti)
	Caring for critically ill patients occurs not only in urban medical centres but in rural and remote areas as well. Nurses are expected to work in medical, surgical, maternity, emergency, and long-term care areas, with patients ranging from the newborn to the geriatric. Rural patients are as complex as those presenting in more urban health care settings, but often the volume of critically ill patients is less; therefore, critical care nurses working in rural or remote areas may not have the opportunity to hone these more advanced skills or practice them as frequently. There is often a small or no distinct critical care unit, so nurses must care for the critically ill when the situation warrants, making all nurses working in rural or remote areas critical care nurses at some point in their practice. It is essential that critical care nurses in these areas stay abreast of current knowledge to care for these complex patients. Continuing education (CE) for nurses has long been supported as being crucial in maintaining skills and competence in the practice setting. For nurses working in rural and remote areas, access to CE continues to be a challenge, despite advancements in technology and recognition of the difficulties obtaining CE that face nurses practicing in rural health care settings. The barriers recognised for the CE of nurses working in rural contexts are identifiable as work-related obstacles (lack of perceived administrative, financial, and/or technological resources and support; lack of time due to workload, inadequate staffing, and/ or excessive travel/distance; lack of		

	relevance of CE topics; and lack of a dedicated onsite nurse educator) and barriers related to travel (geographic isolation, distance and travel time required, limited transportation options, smaller airports with limited flight schedules, increased cost of airfare).		
Gill FJ 2018 An editorial article Pediatr Crit Care Med. 2018 Aug;19(8):779-780. doi: 10.1097/PCC.0000000000001632.	"Pediatric Critical Care Nursing Education and Certification Really Matters."	Pediatric Critical Care Medicine	Australia
	In paediatric critical care, Hickey et al, showed the association between Registered Nurse Bachelor level education, years of experience, and patient complications. n adult and paediatric critical care, ratios of one Registered Nurse to one patient have been shown to both reduce costs and improve patient outcomes. International recommendations on the proportion of critical care–qualified Registered Nurses working in critical care settings have directed this should be as high as a minimum of 50% and optimally 75% of the workforce. The practical achievement of such standards is dependent on many factors such as a professional culture of postgraduation education, accessibility of appropriate programs, nurse turnover, individual nurse self-motivation as well as institutional leadership support.		
Vandijck D, Hellings J 2014 An editorial article Nurs Crit Care. 2014 Mar;19(2):59-60. doi: 10.1111/nicc.1208.	"Innovation in Critical Care Nursing Education."	Nursing in Critical Care	
	The editorial article emphasizes the rule of the innovation in the postgraduate nursing education. Yet the world has evolved, largely because of widely accessible and versatile technologies. However, much of the current nurse education system is still based on the Tylerian model particularly emphasizing content, structure and measurable, behavioural outcomes. Objectives for learning focused mainly on 'what' to teach, rather than 'how' to teach. In this contest, nurse educators find themselves pulled toward an alignment to 'content' to be taught, rather than to the 'process' of learning. Contrary, innovation implies a significant reorganization in how undergraduates, and nurse professionals, are educated and fit for practice. Current society demands new ways to learn and advancing understanding and require new 'innovative' ways of developing depth of learning through stimulating, reflective, interactive and engaging teaching strategies. Transforming how nurse professionals are educated and trained, not only at the entry level but also throughout their careers, will become critically important if we (also) want to ensure the highest quality patient care in the future. The use of dynamically sophisticated simulation-based technologies (e.g. for cardiopulmonary resuscitation, triage/disaster-, fluid-, pain management, etc.) will become one of the hottest trends in nursing education. This kind of technological innovations is what will change the way today's (undergraduate) nurse professionals learn. The classroom of the future will be very interactive and technologically well equipped.		
Pfrimmer DM, Roslien JJ. 2011	"The Tele-ICU: A New Dimension in Critical Care	The Journal of Continuing	Stati Uniti

An editorial article J Contin Educ Nurs. 2011 Aug;42(8):342-3. doi: 10.3928/00220124-20110722-03.	Nursing Education and Practice."	Education in Nursing	
	The study concerns the development of tele-intensive care units(tele-ICUs). Because many hospitals do not have the patient volume or financial resources to support board certified intensive care physicians and nurses for 24/7 ICU coverage, tele-ICUs are increasingly being viewed as an attractive alternative care model. Tele-ICUs involve the remote care of critically ill patients by health care teams leveraging IT and clinical resources. Tele-ICUs use state-of-the-art equipment to connect patients with the tele-ICU team. In-room two-way, nonrecordable audio-video is used to view patients and equipment and communicate with bedside staff. Systems must relay all available patient information. Nursing must be involved in the implementation of and education for this transformative initiative. Tele-ICUs will be a key element of the future of critical care in the United States. Tele-ICU challenges such as reimbursement and IT interoperability must be resolved. Nursing input, leadership, and commitment is necessary for effective tele-ICUs. The tele-ICU is a new model of critical care delivery. Nursing must have a vision for educating nurses to succeed in this environment.		
Labeau S, Chiche JD, Blot S 2012 An editorial article Int J Nurs Stud. 2012 Feb;49(2):127-8. doi: 10.1016/j.ijnurstu.2011.07.014.	"Post-registration ICU nurses education: plea for a European curriculum."	International Journal of Nursing Studies	
	This article stresses how today's intensive care unit (UTI), due to fast evolving scientific and technological advances, has become an area of extreme specialisation and, as a result, a complex and at times stressful work environment. ICU nurses, since it has to deal with patients in critical condition, must have in-depth and advanced knowledge, which allows to face the different aspects of the personalized nursing: intellectual, physical, psychological and ethical. From literature, it emerges that UTI nurses had adequate basic knowledge of a broad range of global ICU domains, but lack in-depth knowledge of more specialised topics, as the mechanical ventilation or respiration. These findings have quite some practical implications as they are highly useful to help local and governmental bodies detect ICU nurses' specific educational needs and to determine tailored initiatives for their continuing professional development. The study also points out that throughout Europe there is a huge variety in the duration, level and content of the courses leading to a specialised degree in ICU nursing, as well as in the nature and level of the institutions providing this education. It emphasizes, therefore, the need to develop a pan-European curriculum for post-registration ICU nurses. This curriculum should also reflect the extraordinary challenges and opportunities available to the nursing profession to act as fully-fledged members of the multi-professional ICU team. Therefore, the design of such a curriculum should be supported, or even guided, by a professional organisation such as the European Society of Intensive Care Medicine (ESICM), that brings together all ICU team members: nurses, physicians, physiotherapists and other allied health professionals. A curriculum that aims to direct the next generation of		

	ICU nurses towards a holistic and patient-centred care will best be accomplished by adding to the specific professional issues unique to nursing a broader, multidisciplinary viewpoint.		
Blake N, Collins M 2017 An editorial article AACN Adv Crit Care. Fall 2017;28(3):289-290. doi: 10.4037/aacnacc2017511.	"Importance of Healthy Work Environment Education in Nursing Schools."	AACN Advanced Critical Care	
	The editorial article highlights the importance of ensuring a healthy working environment in high-complexity environments. Education on effective collaboration should start in undergraduate programs, with communication and conflict resolution techniques at the centre of nursing education. Novice nurses must have the correct tools needed to ensure success of the care provided. Such tools include healthy work environment (HWE) techniques like communication and collaboration. The sooner nursing students are able to master these skills, the more confident they will be in resolving stressful situations. Thus, these techniques need to be taught in nursing schools and reinforced and supported as nurses enter the workforce. Healthy work environments and good communication are tied to better patient outcomes and new nurse retention. Therefore, to empower nurses in clinical settings, these concepts and skills must be incorporated into nursing curricula.		

Table 1: Characteristics and main results of the studies included in the literature review

DISCUSSION

Thanks to the literature revision we were able to analyze the postgraduate education programs for ICU nurses.

The results underline the importance of very well-educated operators, so that they can keep up with the most modern technologies and health care guidelines [6][8][13][14][15][16]. Postgraduate training is necessary to allow nurses to specialize in intensive care unit treatments. Moreover, such courses should be necessary because of the high complexity care needed in ICU [17]. However, as underlined by Gill et al., there is no unanimity on the definition of standard practice on postgraduate courses about the different specialty [18]. The standards of necessity of nursing care in ICU recommend that at least the 50% of nurses working in ICU, both for adults and pediatric-neonatal units, should have a postgraduate qualification [19]. In order to fulfil this request, Australia offers many postgraduate courses, in an academic setting, although the nature of the level, contents, evaluation and results of the programs are very different. Many different kinds of courses, offered by different institutions, are available also in Europe and they develop new skills and knowledge in highly qualified nurses. Labeau et al. discuss the possibility to introduce a European uniform curriculum destined for nurses working in ICU [20].

This is possible through globalization, in order to gain a uniform level of nursing knowledge and skills; which can satisfy the needs of patients in equal and professional ways. The Australian research allows development of specific standards of practice for qualified ICU nurses and they

also developed an evaluation tool for these professionals which takes into account patients and nurses opinions [21].

The evaluation tool SPECT (Attachment 1), "Standard of Practice and Evaluation of Critical-Care- Nursing Tool", looks to have clinical feasibility, preliminary validity, reliability and gives a clear definition of the practical level of students of ICU programs [22]. This is in line with what was affirmed by Saab et al., which underlines the importance of measuring results using valid, standardized and reliable instruments [23]. Since we want to investigate the education strategies for postgraduate courses, it emerges a common accord in the use of simulation [24].

As affirmed by Jansson et al., in the last 10 years the awareness and the adoption of training based on simulation have rapidly increased. In effect, it improves the "safety culture", as well as knowledge and skills of health workers, which includes non-technical skills, teamwork, awareness, decision process, critical thinking and self-confidence [25]. Other results emerged about the management of patients with mechanical ventilation and the airway management in critical areas: it was observed that a great improvement of the self-efficiency and in the clinical practice of ICU nurses [26].

In the context of pediatric-neonatological ICU, Campbell presented an educational project base on simulation in critical area context which is as much as possible realistic, based on the requests and doubts of less expert nurses [27]. This program gave the opportunity to pediatric ICU nurses to acquire "muscular memory" needed to build the base of their skills.

Another model emerging from the literature is given by the Dedicated Education Unit (DEU), developed at the Flinders University (Australia) in 1997. It is described as a clinical educational environment, where academic nurses and professionals collaborate to teach inexperienced students.

This model is based on the educational partnership between students and nurses; the nursing education of students gives the possibility for professionals to be updated on the most recent nursing practices. At the same time, the nursing practice informs the nursing training, improving the professional practice and the education in health environment, which is in continuous evolution. The DEU allows to improve the health of many urban population, through the integration of teaching, targeted search, services, practice health policy, creating a strict collaboration between academic and hospital environment [28].

The DEU model transformed the assistance units in learning environments for student nurses and for professionals, giving the possibility for student to improve the practice and, at the same time, to give high quality assistance [29].

In particular, Koharchik et al. introduced the DEU model in ICU context for the first time. Many positive results emerged after this initiative. For example, the improvement of quality and a desirable learning environment [30].

Similar results are pointed out by Macedo et al., who outline the wellness feeling, satisfaction and relevant motivation about the importance of learning in a working context [31].

There exists a reciprocity between the hospital, which supports updated therapies, and professionals who look for scientific proofs. In this sense, the Lean Organization is a new style of management that aims to reduce wastefulness, in order to create excellent standard processes, with a low cost, and with the help of people [32][33]. "Lean" means the elimination of activities without value to dedicate resources to important activities for patients. The professional with a continuous training develops the skills to satisfy, with their characteristics and with their values, the variable needs of patients [34][35].

While developed countries look for innovative ways of teaching about critical care units, the developing countries, for example Rwanda or Gambia, find many difficulties and the role of ICU nurses is not well developed. Although the nursing education has been improved in the last years, the nurses' competence results are considered to be inadequate to work in ICU, and it is combined with limited standard and policies which regulate this job [36]. ICU in Zambia have been changed and made some progress, both at academic and clinical level, since 2012 due to the introduction of the nursing assistance in ICU. However, results are minimal, even if there is a potential improvement due to the investment in ICU nurses, in terms of knowledges and also professional opportunities [37].

The review has permitted the investigation of subjects and specific skills of specialized ICU nurses who need an education and advanced abilities.

ICUs host critical patients, that need a high level of care, because they are generally suffer from one or more severe organ failure that maybe potentially reversible. These problems entail risks for life or the birth of more dangerous complications.

In the specific case of mechanic ventilation, it is fundamental to be well-prepared [38][39], but, at the same time, it is important take care of psychologic and social aspects. In the context of ICU these aspects are represented by palliative care, end of life [40], or the presence of parents of patients during the resuscitation of patients in pediatric-neonatal environment [41]. In ICU context it is important to involve all the health workers that form a multiprofessional team.

The clinical and helpful decisions are based on experiences and clinical skills of the involved professionals, and on the scientific evidence. Moreover, these decisions take care of the preferences, the values, the patient's rights, as well as available resources in healthcare and organizational fields [42][43].

Critical care nurses must have an adequate emotional education, they must be able to carry out their job in a multiprofessional context, they must develop leadership competence, communication skills and they may assume a decisional role in a complex and advanced context [44].

Gill et al. conclude, after the analysis of health-workers opinions, that the ICU nursing education should emphasize the socioemotional support, which equals the physical assistance [45].

CONCLUSIONS

The main point that emerged from our review is the importance of an updated and qualifying practice during the nursing education. At the same time, it is fundamental to standardize the education, in order to even out skills and competence.

A European master program could be a possible solution, but it is also important to improve tools to regulate and recognize the different advanced roles in ICU.

This study gives a wide overview of postgraduate education programs for ICU nurses.

A limit of this investigation is given by the lack of uniformity on the types of papers (systematic reviews, RCT, quasi-experimental trial, observational and editorial trials). There could also be a bias of publication, because we only considered indexed databases.

Other considerations could come out from this review in order to develop new educational programs, which require a continuous evolution, due to the scientific and technological advance.

Some future analysis may be carried out in the future to examine in depth scientific aspects of the intensive care unit.

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ATTACHMENTS

Attachment 1

Standard of Practice and Evaluation of Critical-care-nursing Tool (SPECT)

A patient and family focused approach to care
The critical care course graduate can demonstrate independently • Promotes a compassionate and therapeutic environment for the wellbeing of the patient and family • Communicates effectively with the patient and family including with patients who are intubated/ nonverbal Involves patients and families in decisions about care and treatment • Assists families to adapt to the critical care environment • Acts as a patient & family advocate • Protects patient and family dignity • Protects patient and family privacy and confidentiality • Demonstrates respect of the patient and family's cultural and religious beliefs • Facilitates and supports family choices to be present at the patient bedside • Provides effective nursing management for the patient and family requiring end of life care
The critical care course graduate can demonstrate under supervision • Individualizes socio-emotional support for the patient and family Provides patient and family education • Addresses patient and family ethical concerns
Quality of care and patient safety
The critical care course graduate can demonstrate independently: • Identifies and reports unsafe, inappropriate, incompetent practice • Provides safe and effective practice in the administration of drugs and therapeutic interventions Identifies and minimizes risk of critical incidents and adverse events • Including measures to avoid iatrogenic injury/complications Including measures to maintain skin integrity • Complies with infection control measures Communicates effectively in the multidisciplinary team Participates in multidisciplinary ward round • Uses a systematic approach to provide effective handover of clinical information • Identifies and reports environmental hazards and promotes safety for patients, families and staff Demonstrates effective use and knowledge of technology / biomedical equipment
The critical care course graduate can demonstrate under supervision: • Incorporates research evidence into practice

- Ensures continuity of care from patient admission to discharge/ transfer Suggests changes to policy/protocols/guidelines
- Element: Demonstrates awareness of research findings

Resuscitation

The critical care course graduate can demonstrate independently:

- Anticipates, identifies and responds effectively to clinical deterioration
- Provides effective nursing management for the patient requiring airway management
- Provides effective nursing management for the patient requiring cardio-pulmonary resuscitation
- Element: Regular recertification of resuscitation skills
- Effectively participates as a member of the resuscitation team
- Provides effective nursing management for the patient post-resuscitation Safely transports the critically ill patient
- Element: Intra-facility (between departments)
- Element: Inter-facility (between health services / hospitals)

The critical care course graduate can demonstrate under supervision:

- Facilitates family presence during resuscitation

Assessment, monitoring and data interpretation

The critical care course graduate can demonstrate independently:

- Effectively prioritises patient care needs
- Anticipates, monitors, recognises and responds to trends in physiological variables Provides effective nursing management of invasive patient monitoring
- Gathers, analyses and integrates data from a variety of sources (technological and patient derived) to inform clinical decision making
- Undertakes a comprehensive physical, mental and socio-emotional patient assessment