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Research Paper

Nurses' perception on competency requirement and training demand for intensive care nurses

Yeray Gabriel Santana-Padilla ^{a,*}, María Desamparados Bernat-Adell ^b, Luciano Santana-Cabrera ^a^a Complejo Hospitalario Universitario Insular Materno Infantil, Las Palmas de Gran Canaria, Canary Islands, Spain^b Department of Nursing, University of Jaume I, Castellón, Valencian Community, Spain

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ABSTRACT

Objectives: Various authors have explored the combination of competencies necessary for ensuring safe and quality care carried out by nurses in Intensive Care Units (ICUs). Nurses' perception of training is an element that must be studied in order to adopt appropriate educational measures. This study aimed to evaluate nurses' perception of the importance of intensive care training in Spain.

Methods: A descriptive, cross-sectional, multicentre study was conducted on a national level in Spain. Totally 85 ICUs took part in the study. The questionnaire used was developed using the Delphi method and had 66 items to investigate nurses' perception on competency requirements and training needs. The evaluation was conducted by a 10-point Likert scale.

Results: The sample was 568 Spanish nurses. Significant differences were found on an academic level, in terms of gender and hospital type, and in the professional experience of the nurse when it comes to evaluating the different training items; the differences in overall questionnaire scores among these groups were statistically significant ($P < 0.05$). The nurses analyzed believe that previous training and professional experience in other care services are necessary before starting work in an ICU.

Conclusion: Implementation of training programs tailored to the needs of critical nurses had benefits for nurses and the health system. Nurses benefited from training focused on the skills and knowledge of each moment of their working life. Nurses have a different evaluation of their training needs throughout their professional cycle. Therefore, their training must be adapted to the professional stage of each nurse.

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What is known?

- Some studies have reported that adequate training for Intensive Care Unit (ICU) nurses influences healthcare outcomes.
- Adequate training for new nurses influences their permanence and retention in the organizations and in highly challenging health care services such as intensive care units.
- ICU nurses have always been very important professionals for healthcare systems. Nowadays, in the aftermath of a pandemic, there is no doubt that ICU nurses must be adequately trained to care for critically ill patients.

What is new?

- ICU nurses value their critical care training as a very important element of their development as professionals, besides job experience becomes essential to reflect on this reality.
- ICU nurses with postgraduate studies perceived training as a key element to work in an intensive care unit and they state that additional training beyond the university degree is needed when caring for critically ill patients.
- Seventy-five percent of the ICU nurses interviewed stated that postgraduate training must be regulated and accurate to the skills required to work with critical patients.

* Corresponding author.

E-mail addresses: yeraysantana@celip.es (Y.G. Santana-Padilla), bernatm@uji.es (M.D. Bernat-Adell), lsancabx@gmail.com (L. Santana-Cabrera).

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1. Introduction

Intensive Care Units (ICUs) are essential services where

multidisciplinary care is offered to critical patients [1]. To be able to provide quality care and safety in this environment, nurses need specific and comprehensive training [2]. Due to this reason, various authors have noted the need to create a construct which encompasses the competencies that ICU nurses develop in their professional work [3,4]. The assurance of appropriate training, guaranteeing cohesion and teamwork, is an element that health organizations must encourage [5]. Nurses perceive their self-efficacy in applying care to critically ill patients differently from other professionals [6]. In addition, the work dynamics induce the nurses themselves to detect that they are required to provide very specialised care that can only be understood from their own reality [7].

It is an established fact that the importance of care in ICUs is related to ensuring safety and, most of all quality, without forgetting at any time to achieve the best care results with the available scientific evidence. In this sense, besides collaboration among the professionals, it is necessary to have appropriate training that leads to an improvement in care outcomes [8]. This also guarantees an improvement in how patients and families regard the care they receive, as professionalism is shown through the patient care carried out in a specific environment, such as in ICUs [9].

Jensen et al. detected that communication, decision making, control of symptoms and nurses' empathy are key elements when it comes to evaluating care [10]. Furthermore, communication, skills and abilities in patient care, clinical safety and critical thinking are other aspects that were determined as being essential areas when it comes to developing a care process that is specific to critical care [11–14].

It was necessary to include the different aspects that comprise critical care, in order to become aware that the nurses, who carry out their professional work in ICUs, have specific knowledge and a way to deal with patient care, making them irreplaceable and indispensable in critical care [15].

The studies by Lakanmaa et al. bring us closer to a professional construct that identifies with a series of areas that must be developed through specific training [16]. By means of national analysis, they could elaborate that basic competencies were influenced by clinical and professional ones. Basic competencies are divided into clinical competency and professional competency. Clinical competency consists of principles of nursing care, clinical guidelines, and nursing interventions. Professional competency consists of ethical activity and familiarity with health care laws, decision-making, development work, and collaboration. For the development of these areas, nurses rely on their knowledge, attitudes, skills and work experiences [16].

The European Federation of Critical Care Nursing Associations (EfCCNa) designed a document for the progressive development of competencies for critical care nurses. The competencies are split into four domains, each having its own different sub-domains [17]. So, for example, Assessment and Nursing Diagnosis, Planning, Implementation and Evaluation must be incorporated into the Clinical domain; Complex Decision Making, Communication, Ethical and Legal Matters are part of the Professional domain; Unit Management, Team Management, Health and Safety, and Quality Assurance in the Management domain; and lastly, the Education and Development domain includes Personal Development, Development of Others and Evidence-Based Practice [17].

By taking the aforementioned information into account, we

have set an objective in order to evaluate the nurses' perception on the importance of intensive care training in Spain.

2. Methods

2.1. Design

This is a cross-sectional descriptive study, multi-centre survey through an electronic questionnaire.

2.2. Sample size

This research included 85 ICUs belonging to 79 hospital centres in 16 Autonomous Communities in Spain, which came to a total of 1,230 beds, and a total population of 2965 ICU nurses. Probabilistic sampling determined that there was a need for the completion of 500 questionnaires to reach a 95% significance level, with a margin of error being 4% for the population studied.

2.3. Data collection

The questionnaire was distributed among the collaborators in each participating centre. Therefore, chain sampling was used. Inclusion criteria were working as a nurse in one of the 85 participating ICUs and accepting informed consent to participate in the research. The questionnaire was developed through a Delphi technique based on the findings of previous studies [18,19]. This study conducted in Spanish allowed us to extract the relevant information that ICU nurses give to their own training. The final questionnaire was structured in two parts, 66 items (Appendix A in Spanish and Appendix B in English). Part A included the four EfCCNa domains: the Clinical domain (18 items); Professional domain (14 items); Management domain (16 items), and Education and Development domain (6 items). Part B consisted of a section on aspects and staff training for ICUs (12 items), including matters related to training new and veteran staff, in addition to specific training needs. All items in this questionnaire were scored on a Likert scale (1–10 points) on which the value of 1 represented “unimportant, or in disagreement with the statement given” and the value of 10 stood for “very important or totally in agreement with the statement given”. The questionnaire was pre-tested by experts.

Furthermore, sociodemographic variables were incorporated into the study such as age, gender, years of work experience, academic level; the characteristics of their hospital centres (type of management, relation with the university, number of hospital beds), and the characteristics of the ICU (type of ICU, number of beds in the ICU, and nurse-to-patient ratio). The questionnaire was carried out from October 31, 2017 to October 31, 2018. Only the questionnaires that were given affirmative consent to take part in the study were included. Moreover, as this was an electronic questionnaire, two control questions were included throughout it with the purpose of ensuring that no automatic answers were given.

2.4. Data analysis

A univariate, bivariate and multivariate analysis was conducted using the SPSS statistical package IBM® SPSS® Statistics version 20.

The perceived training needs of Spanish ICU nurses detected through the scores assigned to each item of the questionnaire were described as a result of the univariate analysis. The qualitative variables were expressed as frequencies and percentages. The Student *t*-test was used to compare numerical variables according to the sample size or the normality of the data. The Jonckheere-Terpstra test was used to confirm whether or not there had been a trend between a numerical variable and an ordinal one. The level of statistical significance was $P < 0.05$.

2.5. Reliability and validity

To ensure the reliability of the questionnaire, the questionnaire was pre-tested by 15 Spanish nurses with more than 3 years of experience in the ICU, chosen by convenience sampling among the nurses of a polyvalent ICU of a tertiary hospital. These nurses evaluated and completed the questionnaire to determine the validity of the instrument. Internal reliability was determined through this panel. Cronbach's α obtained a value of 0.91. This study was conducted in Spanish. To guarantee the quality of the content, the translation of this research was carried out with the collaboration of a professional translator.

2.6. Ethical considerations

The study was conducted following the legal and ethical principles of biomedical research (Declaration of Helsinki) and the EU regulation 2016/679 on confidentiality. The ethical committee of the main researcher authorised the study with the code Las Palmas: 2018-080-1/1016. In addition, 15 centres requested approval from their own ethical committees for the investigation. Each centre authorised the distribution of the questionnaire among their nurses by requesting their prior consent while ensuring the anonymity of the participants.

3. Results

3.1. The demographic and professional characteristics of the participants

Totally 630 responses were received, of which 62 were excluded due to failing some of the control questions. Therefore, the final sample consisted of 568 questionnaires. Women comprise the majority (81.3%), 72.0% being over 36 years old, 52.1% only have a nursing degree certificate, and the rest have different postgraduate studies. (see Table 1).

The organisation of the ICUs where they work was mainly of the adult - multipurpose type (71.3%), with a median of 14 beds (range 4–40). The ICU nurses included in this research cared for their critically ill patients with a most common nurse-to-patient ratio of 1:2 (one nurse cares for two critical patients), representing 62.5% of the nurses surveyed. The second most common ratio was 1:3 with 32.5% of the sample.

3.2. ICU nurses' perceptions of competency requirement and training demand

Only three of the 66 items examined in the univariate analysis did not obtain an average above 70% of the total score: "Monitoring of the quality indicators is carried out" (6.66 ± 2.21), "The workload for the ICU nurses is appropriately managed" (5.78 ± 2.13), and "The institution collaborates on specific ICU training" (5.56 ± 2.33).

On the other hand, the groupings in the questionnaire achieved an agreement rate above 85% in all the sections (Table 2). The highest scoring items in the clinical domain were (items 2, 14, 17): "ICU nurses need to develop specific skills for critical patient care" (9.63 ± 0.73), "Comprehensive care of a critically ill patient is part of the nurse's main area of action" (9.52 ± 0.87) and "The ability to prioritize is an essential skill" (9.52 ± 0.77). In the professional domain, the highest score was the statement (item 19): "The help

Table 1
Characteristics of participants ($n = 568$).

Variables	Groups	<i>n</i> (%)
Age, years	22–25	19 (3.3)
	26–35	140 (24.6)
	36–45	263 (46.3)
	> 45	146 (25.7)
Sex	Male	106 (18.7)
	Female	462 (81.3)
Highest academic level	University Degree	296 (52.1)
	Expert University Diploma	95 (16.7)
	University-specific Master's Degree	90 (15.8)
	Master's Degree	79 (13.9)
	Doctorate	8 (1.4)
Number of hospital beds	Less than 200	61 (10.7)
	200–500	220 (38.7)
	More than 500	287 (50.5)
University hospitals or not	University hospitals	491 (86.4)
	Non-university hospitals	77 (13.6)
Experience as a nurse, years	≤10	136 (23.9)
	11–15	130 (22.9)
	16–20	124 (21.8)
	>20	178 (31.3)
Experience as ICU nurse, years	≤10	330 (58.1)
	11–15	96 (16.9)
	16–20	61 (10.7)
	>20	81 (14.3)

Note: Expert University Diploma: academic training developed by Spanish universities for less than 1 year with 20–40 ECTS without official character (the student must previously have a university degree). University-specific Master's Degree: Academic training developed by Spanish universities for less than 1 year with 40–60 ECTS without official character and defence of final degree dissertation (the student must previously have a university degree. This master's degree does not give access to the doctorate). ECTS = European Credit Transfer and accumulation System.

Table 2
Scores of perception on competency requirements and training needs in Spain ICU nurses ($n = 568$).

Domain	Item numbers	Mean \pm SD
Part A: Items belonging to the EfCCNa domains	No. 1–54	467.53 \pm 29.21
Clinical Domain	No. 1–18	163.77 \pm 9.77
Professional Domain	No. 19–32	121.89 \pm 9.79
Management Domain	No. 33–48	135.35 \pm 11.50
Education and Development Domain	No. 49–54	46.50 \pm 5.88
Part B: Staff training for ICUs	No. 55–66	106.57 \pm 9.25
Overall questionnaire score		574.10 \pm 35.66

Note: EfCCNa = European Federation of Critical Care Nursing Associations.

and support from colleagues with more experience help to solve problems in complex situations” (9.42 \pm 0.90). In the management domain, three items got the best rating (items 36, 40, 42). These items were: “A good coordination of the health team is essential”, “Regular training is necessary to ensure clinical safety” and “ICU nurses must be able to act quickly in the event of patient deterioration and adverse events” with the following scores, respectively: 9.61 \pm 0.73, 9.34 \pm 0.94 and 9.48 \pm 0.87. In the education and development domain, “Training activities have a positive impact at the clinical level” (item 51) received the highest score in this domain with 9.32 \pm 1.01.

In part B of the questionnaire, the most important statements given by the ICU nurses consulted were (item 56, 58): “There should be a nurse tutor in the unit to help new nurses” (9.48 \pm 0.95) and “The first week, new nurses must be supervised at all times” (9.19 \pm 1.30).

By analysing their relationship with the sociodemographic variables, we found that women tend to rate all the items with a higher score than men, and the differences in Clinical domain, Management domain, total score of Part A and overall questionnaire score were statistically significant (Table 3). Some differences with statistical significance were found related to academic background, total professional experience and ICU experience. In Table 4, we can see the nurses with a higher level of academic training (official postgraduate certificate) gave a higher rating to training needs with statistical significance. The evaluation of the professional skill was also related to the working environment. In this sense, the non-university hospital centres had a higher rating for training needs, considering that they require some greater skills, abilities and knowledge than those who work in university hospitals (Table 5). Furthermore, the nurses who work in hospitals with fewer than 500 beds, multipurpose characteristics and an ICU with less than 16 beds, also produced a higher score for training needs.

By analysing the influence of the total work experience, significant differences were obtained in 39 of the 66 independent items, all domains except Education and Development domain, scores of the two parts and overall questionnaire score (Table 6). Nurses with greater professional experience were more interested in skill development and training related to care and the continuity of health care, whereas nurses with less experience were mainly

concerned about technical and technological aspects. This fact is also repeated when analysing the work experience of ICU nurses.

With regard to the need for having previous experience or training prior to starting work in an ICU, 65.4% (339/568) of the respondents considered it necessary to have at least one year of previous work experience in Accident and Emergency and/or operating theatre, and 71.8% (408/568) indicated that it is necessary to have at least two years of previous experience in hospitalisation.

As regards training, 92.1% (523/568) of respondents considered that specific ICU training is necessary to ensure some superior skills to those obtained through completion of the nursing degree certificate. Out of those respondents, 297 requested prior training in the appropriate healthcare institutions, which represented 56.7% of the answers, whereas 43.2% (226/568) nurses requested prior training in a university context. Another finding that supports this situation is that 75.0% (426/568) of the nurses who completed the questionnaire support specialised training in critical care through a specialised type of health training such as the Resident Nursing Intern (EIR), 7.4% (42/568) did not have an opinion on this, and only 17.6% (100/568) considered it as unnecessary.

Spain is made up of 19 Autonomous Communities with health liability, considering that 16 of them collaborated in the study; and with the previous outcomes indicating that 75.0% (426/568) of the interviewed nurses considered that EIR training in critical care is necessary. If we associate these answers to each territory, we can point out that this support is higher or equal to 60% of ICU nurses in all the autonomous communities studied.

4. Discussion

The competencies and training that ICU nurses require are currently still of interest to the scientific community [20,21]. These elements have come into focus lately due to the COVID-19 pandemic which required, and still requires, an exponential increase of trained nurses in these units, as healthcare systems were not prepared for it [22–24]. Our study detected the need for specific training required by ICU nurses, as discussed in previous studies [16,25]. ICU nurses need to discuss how to develop their own competencies, as commented by Lakanmaa et al. [16], in the same sense that our sample considers that “ICU nurses need to

Table 3
Differences in scores of domains and groups in terms of gender.

Domain	Men ($n = 106$)	Women ($n = 462$)	t	P
Clinical	161.29 \pm 10.03	164.34 \pm 9.63	2.922	0.004
Professional	120.35 \pm 9.96	122.25 \pm 9.73	1.800	0.072
Management	133.09 \pm 12.28	135.87 \pm 11.27	2.249	0.025
Education and Development	45.88 \pm 6.38	46.64 \pm 5.76	1.190	0.235
Total score of Part A	460.63 \pm 30.60	469.11 \pm 28.69	2.711	0.007
Total Score of Part B	105.65 \pm 10.13	106.78 \pm 9.03	1.137	0.257
Overall questionnaire score	566.28 \pm 38.41	575.89 \pm 34.79	2.512	0.012

Note: Data are Mean \pm SD.

Table 4
Trends in scores of domains and groups according to the academic level of nurses.

Domain	University Degree (n = 296)	Expert University Diploma (n = 95)	University-specific Master's degree (n = 90)	Official postgraduate (n = 87)	S test P
Clinical	163.62 ± 10.77	162.23 ± 8.69	163.83 ± 8.30	165.94 ± 8.39	2.380 0.017
Professional	122.84 ± 10.14	120.04 ± 8.97	119.37 ± 9.65	123.33 ± 8.92	0.811 0.418
Management	136.07 ± 11.39	132.51 ± 11.50	133.72 ± 10.76	137.67 ± 12.00	2.128 0.033
Education and Development	45.53 ± 6.08	47.12 ± 5.21	48.02 ± 5.07	47.52 ± 6.15	2.574 0.010
Total score of Part A	468.07 ± 30.75	461.91 ± 27.16	464.95 ± 25.70	474.48 ± 28.30	2.245 0.025
Total score of Part B	106.07 ± 9.92	104.62 ± 8.34	106.78 ± 7.94	110.17 ± 8.15	3.980 <0.001
Overall questionnaire score	574.14 ± 37.59	566.53 ± 33.35	571.54 ± 31.69	584.65 ± 33.18	2.885 0.004

Note: Data are Mean ± SD. Jonckheere-Terpstra test (S test) was performed.

Table 5
Differences in scores of domains and groups in terms of the hospital type.

Domain	University hospital centres (n = 491)	Non-university hospital centres (n = 77)	t	P
Clinical	163.46 ± 10.03	165.75 ± 7.69	2.315	0.022
Professional	121.52 ± 9.92	124.31 ± 8.62	2.333	0.020
Management	134.77 ± 11.55	139.05 ± 10.53	3.055	0.002
Education and Development	46.47 ± 5.92	46.66 ± 5.66	0.260	0.795
Total score of Part A	466.23 ± 29.64	475.77 ± 24.95	2.679	0.008
Total score of Part B	106.36 ± 9.34	107.88 ± 8.54	1.338	0.181
Overall questionnaire score	572.60 ± 36.23	583.66 ± 30.29	2.542	0.011

Note: Data are Mean ± SD.

Table 6
Trends in scores of domains and groups in terms of total work experience as nurses.

Domain	≤10 years (n = 136)	11–15 years (n = 130)	16–20 years (n = 124)	>20 years (n = 178)	S test	P
Clinical	165.52 ± 9.09	163.70 ± 9.18	164.14 ± 9.76	164.53 ± 10.65	2.144	0.032
Professional	120.09 ± 8.46	120.80 ± 9.37	121.48 ± 9.60	124.37 ± 10.72	4.203	<0.001
Management	133.50 ± 10.75	134.20 ± 10.74	133.52 ± 11.14	138.89 ± 12.13	4.340	<0.001
Education and Development	46.96 ± 5.78	46.10 ± 6.09	46.49 ± 5.69	46.43 ± 5.97	0.501	0.617
Total score of Part A	463.08 ± 26.01	464.81 ± 26.55	465.64 ± 28.10	474.23 ± 32.98	3.859	<0.001
Total score of Part B	105.95 ± 7.88	105.78 ± 9.83	105.92 ± 8.85	108.08 ± 9.93	2.682	0.007
Overall questionnaire score	569.03 ± 31.02	570.59 ± 33.45	571.56 ± 34.13	582.31 ± 40.17	3.810	<0.001

Note: Data are Mean ± SD. Jonckheere-Terpstra test (S test) was performed.

develop specific skills for critical patient care" with high value (9.63 ± 0.73). Requesting specific training has a direct impact on patient care, as several studies have shown [26–28]. Our nurses also clearly value this element as very important with a score (9.32 ± 1.01) for the next item: "training activities have a positive impact at the clinical level". This score may be influenced by the high awareness in avoiding critical incidents that ICU nurses possess such as Danielis et al. detected [29] and to achieve this prevention, adequate training for ICU nurses is essential. It can be seen that the nurses consulted score high values for almost all the items in the questionnaire. ICU nurses require specific training to develop their competencies in a regulated, safe and efficient way [30]; as DeGrande et al. note that nurses need to develop their own competency including the most technical aspects, in addition to comprehensive care [31]. This development must incorporate the domains of knowledge that critical care nurses need to be fully educated [19,30].

Our participants value as an important prerequisite for new nurses a training that ensures a minimum level of knowledge, as well as the presence of a tutor. In this regard, Chen et al. considered that a transition program is necessary for new graduate nurses to guarantee their competencies in the different health care services [32]. In addition, the figure of the mentor is a key element to guarantee a progressive and effective adaptation of nurses to the different healthcare settings; considering their presence as

necessary in healthcare institutions [32,33].

Factors such as clinical practice, management of health care situations, teamwork and decision making are considered as being fundamental in carrying out patient care in the critical environment. The development of our questionnaire has enabled us to observe all these aspects individually, item by item, in addition to the general context [17]. In this way, we can observe how academic training plays an extremely influential factor in the assessment of training requirements, and how official postgraduate training fosters critical evaluation of the nurses in training needs previously mentioned [34]. A study by Haegdorens et al. revealed how mortality may be influenced by both the quantity and the education of the nurses working in hospital wards [35]. Despite being different care domains, we cannot omit this data due to the fact that it may be symmetrical also to other fields of nursing. Our nurses with a higher level of academic achievement generate significant differences in their evaluation, which has an influence on their perspectives, as detected in other studies related to elements of clinical practice [36,37]. Therefore, academic level is a factor that positively influences the nurses' own perception of their training.

It is particularly worth noting that the organisation of ICUs has such an influence on the perspective of training needs. In this sense, the nurses who work in non-university hospitals value more positively the need for training in the studied domains such as Clinical, Professional and Management domains ($P < 0.05$). As a

result, and as observed in previous studies, it is valued that critical care nurses must adapt their knowledge to what is demanded from them, and this fact may influence the training required [30,38].

Our study also reveals that work experience, both in total and in ICUs, has an influence in the assessment of training demands. In this sense, and as indicated by Mortensen et al., the nurses with over 10 years of experience have a different assessment in aspects such as the sedation of ventilated patients due to their lived experiences [37]. Therefore, the areas of interest in training also vary according to professional experience. Starting from the idea expressed by some authors that ICU was more suited to those who had previous professional experience in other environments such as hospitalisation [18,38].

The nurses demanded specific ICU training, which they had to take on rapidly during the COVID-19 pandemic [24]. Baxter and Edvardsson demonstrated that postgraduate training improves nurses' confidence and competencies [39]. Therefore, specific training results in the acquisition of skills by nurses who do not feel prepared at the end of their degree studies to take on ICU care [18]. Furthermore, this specific professional training influences the application of evidence-based care, as demonstrated by Gigli et al. [40].

There is a similarity between the majority demand for specialised training and the assessment of training needs, which determine that critical care nurses require specific training [41], and that the current model is not effective [24]. Health care systems and scientific associations need to develop a framework that includes the skills, abilities and knowledge that ICU nurses require to effectively care for critically ill patients [17,19,42].

5. Limitations of the study

The main limitation of this research work is its cross-sectional nature; longitudinal studies are required to assess how nurses' training needs vary over time, and how to adapt each care environment to specific training. Other limitation is that the data were collected from 2017 to 2018, may not reflect the update situation, especially in the aftermath of a pandemic that has strained all health systems, including the Spanish healthcare system.

6. Conclusions

The data obtained from this study enables us to identify values that must be taken into account when it comes to developing training programmes for ICU nurses.

Despite using an international tool developed through a Delphi study and being adapted to a Spanish context, we have been able to observe how the items examined are highly supported by the nurses who were asked to complete the questionnaire. The Professional, Management, Education and Development care domains, in addition to that included in specific training and new staff, suggest the need with which nurses demand specific training.

The differences in the assessment, which focus on academic training and work experience, enable us to reaffirm that training needs are not the same during the years of professional practice, and that professional awareness, self-perspective and the concept of a disciplinary team are acquired through further experience and training.

Therefore, the current Spanish system for incorporating new ICU nurses must be assessed, as the nurses themselves demand prior requisites as safety criteria, in order to carry out their professional activities.

Declaration of competing interest

The authors have declared no conflict of interest.

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Nothing to declare.

Data availability statement

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

CRediT authorship contribution statement

Yeray Gabriel Santana-Padilla: Conceptualization, Methodology, Formal analysis, Project administration, Investigation, Writing – original draft. **María Desamparados Bernat-Adell:** Methodology, Data curation, Supervision, Writing – review & editing. **Luciano Santana-Cabrera:** Methodology, Data curation, Supervision, Writing – review & editing.

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Appendices. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ijnss.2022.06.015>.

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