

**ORIGINAL RESEARCH: EMPIRICAL
RESEARCH - QUANTITATIVE**

Defining competencies for nurse anaesthetists: A Delphi study

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Abstract

Aim: To define the competencies of nurse anaesthetists in the hospitals of Catalonia on the basis of their clinical practice through a consensus-building process.

Design: We used the Delphi method to determine consensus among a group of 16 nurse anaesthetists.

Methods: Between February and June 2020, we administered a questionnaire of 142 questions distributed among seven domains: expert, communicator, collaborator, manager, health advocate, scholar and professional. Two rounds were conducted.

Results: In round 1, 18 competencies were discarded and nine had inconclusive results. Eighteen competencies were proposed by participants. The nine competencies with inconclusive results and the 18 newly proposed competencies were considered in round 2. In round 2, three of these 27 competencies tested were discarded, and consensus was reached on the other 24.

Conclusion: Health education and the empowerment of the patient and family are fundamental pillars in the practice of nurse anaesthetists in Spain, especially in pre-anaesthetic assessment and pain care. These areas of practice can help define competencies in other countries where the profession of nurse anaesthetist is less developed.

Impact: The lack of regulation of the competencies of nurse anaesthetists leads to great variability in training and practice. The results can help in their standardization in Spain and in other countries lacking regulation. Our approach can also help policy-makers and hospital administrators in health systems that are undergoing the process of regulation. The regulation of the competencies of nurse anaesthetists will allow them to contribute their expertise to the health-illness continuum, increasing safety and improving the quality of care.

KEYWORDS

advance practice nursing, competencies, nurse anaesthetists

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1 | INTRODUCTION

The training that nurse anaesthetists receive and the regulation of their professional skills vary widely by country. Since its inception, the International Federation of Nurse Anaesthetists has aimed to define a conceptual framework for the practice of nurse anaesthetists and establish guidelines for their training, in accordance with safe practices in anaesthesia. In 1998, the International Federation of Nurse Anaesthetists conducted a study in 96 countries in which it was observed that nurse anaesthetists participated actively in 70–80% of anaesthesia procedures (Merry et al., 2010).

International Federation of Nurse Anaesthetists was founded in 1989 by two nurses, one from Switzerland and one from Denmark, initially bringing together 11 countries. Throughout its history, International Federation of Nurse Anaesthetists has been incorporated into institutions such as the International Council of Nurses and the World Federation of Societies of Anaesthesiologists (Meeusen et al., 2016). It is currently made up of associations of nurse anaesthetists in 43 countries, including Spain (International Federation of Nurse Anaesthetists, 2021).

The conceptual model of professional practice defined by the International Federation of Nurse Anaesthetists focuses on the training of nurse anaesthetists. Nursing competencies are the set of knowledge, abilities, attitudes and complex decision-making processes that make it possible for nurses to act according to the demands of the situation. To establish the competencies, the International Federation of Nurse Anaesthetists adapted the CanMEDS model of the Royal College of Physicians and Surgeons. CanMEDS is widely used for defining of competencies in the training of physicians and is also used by other health professionals. It is based on six cross-cutting competencies: professional, communicator, collaborator, health advocate, scholar and manager, which converge in a single central competency: expert. To adapt the CanMEDS model, the International Federation of Nurse Anaesthetists used the same set of seven competencies, centring them in the areas of care that NAs nurse anaesthetists provide (Herion et al., 2019; International Federation of Nurse Anaesthetists [IFNA], 2016). This conceptual framework was recognized in 2021 by the International Council of Nurses, which urged countries to regulate the training and practice of nurse anaesthetists (International Council of Nurses, 2021).

In countries such as the United States, Sweden and France, nurse anaesthesia is recognized as a specialized area of nursing, and the training and practice of nurse anaesthetists is regulated. In Spain, however, nurse anaesthetists are not considered specialists and their training and practice are unregulated (Meeusen et al., 2016). In 2005, seven nursing specialities were defined in Spain: obstetrics/gynaecology nursing, mental health nursing, occupational nursing, geriatric nursing, family and community nursing, paediatric nursing and medical-surgical care nursing, the last of which include nurse anaesthesia (Ministerio de la Presidencia, 2005). The General Council of Nursing has proposed to the Spanish Ministry of Health that medical-surgical care nursing be subdivided into two or three separate areas, but the definitive training programme for this speciality

has not been defined, and no specific certification is required for conducting clinical practice in this area (Ayuso Murillo et al., 2019).

In the first decade of the 2000s, postgraduate training programmes in nurse anaesthesia were established at Spanish universities. In 2007, nursing studies in Spain were restructured from a three-year university diploma to a four-year bachelor's degree. With this change, the postgraduate training programmes in nurse anaesthesia became master's degrees. This shift has made it possible to improve the quality and extend the duration of training. Currently, there are five such master's programmes (three of which are in the region of Catalonia) offering theoretical and practical training consisting of 60 European Credit Transfer System credits. In 2021, one of them was included in the International Federation of Nurse Anaesthetists list of Approved Non-Physician Anaesthesia Programmes/Schools at the level of registration (first level of acknowledgement).

In 2012, the Spanish Nursing Association of Anaesthesia, Recovery and Pain Therapeutics prepared a document listing the competencies of nurse anaesthetists (Peix Sagués & Pérez Castro, 2012). Nurse anaesthetists in Spain have added more activities to their clinical practice. However, their competencies remain unregulated.

2 | BACKGROUND

Anaesthesia first began to be used in surgical procedures at the end of the nineteenth century in the United States. It was administered by medical students or nurses. The need to treat pain in soldiers led to the generalization of the use of anaesthesia by Catholic nurses, such as Catherine S. Lawrence, under the supervision of surgeons, given that at the time there was no medical training in anaesthesia. Training in anaesthesia was carried out by nurses such as Alice Magaw and Agatha Hodgins. In the early 1900s, training programmes were established, first in hospitals and then as university postgraduate training ("Certified Registered Nurse Anaesthetist"). CRNAs have to have acquired a minimum of a master's degree focusing on anaesthesia, have completed extensive clinical training, and have passed the certification exam of the National Boards of Certification and Recertification of Nurse Anaesthetists (NBCRNA) (Ray & Desai, 2016). Beginning in 2022, nurse anaesthesia training in the United States will occur within a doctorate of nursing practice.

The American model of anaesthesia nursing was exported during World War II to Europe, and several countries began to train nurses to administer anaesthesia. Unlike in the United States and France, where nurse anaesthetists' contribution to the health system is well documented (Ray & Desai, 2016; Taland, 2017), in Spain, there is little documentation of the activities carried out by nurse anaesthetists (Canet & Monedero, 2007). We know that nurses administered anaesthesia during war times and that they worked with physicians trained in the administration of anaesthesia until the 1980s, when the medical specialities and the Resident Intern Physician (MIR) programmes were founded, including Anaesthesiology, Recovery and Pain Management (Tutosaus Gómez et al., 2018). Nurse

anaesthetists did not disappear, but they lost autonomy and their activities in surgical procedures became more varied.

In 2007, Canet proposed “anaesthesia teams” that would be formed by anaesthesiologists and nurse anaesthetists, based on the results of a study in Catalan hospitals that highlighted the need for the recognition and professionalization of nurse anaesthetists (Canet & Monedero, 2007). However, this proposal has not been adopted.

Since the beginning of this century, in Catalonia, the population over 65 years of age has increased by 19%, and this growth is expected to reach 22% by 2030 (Instituto de Estadística de Catalunya, 2021). Other factors such as the increase in life expectancy, the advancement of surgical technology, and the availability of early detection programmes have increased the demand for anaesthesia. The conceptual shift from “anaesthesiology” to “perioperative medicine” has led nurse anaesthetists to work in new areas such as pre-operative consultation, diagnostics/therapeutics and acute and chronic pain units. Nurse anaesthetists are present throughout the perioperative period, caring for the patient and his or her family while also engaging in health education and promotion. Nurse anaesthetists in Spain have gone from supporting the anaesthesiologist in anaesthesia procedures to playing an increasingly autonomous role inside the anaesthesia team, developing competencies that could lead them to be considered advanced practice nurses.

The advanced practice nurse has been studied by a range of authors, such as Benner and Hamrich, since the appearance of this category in the 1980s in the United States (Comellas Oliva, 2016). The International Council of Nurses defines an advanced practice nurse as a generalist or specialist nurse who has acquired at least a master's degree, a base of expert knowledge, the capacity to make complex decisions, and the clinical competencies necessary for expanded professional practice. The specific characteristics of this nurse depend on the context in which he or she is accredited to practice (International Council of Nurses, 2020).

The International Council of Nurses's 2021 Guidelines on Advanced Practice Nursing - Nurse Anaesthetists (ICN, 2021) define the nurse anaesthetists as an advanced practice nurse that has the training and competencies to provide care in the areas of anaesthesia and pain during all stages of the patient's life. The guidelines, which outline the competencies and requirements of the training programmes for nurse anaesthetists, have established a reference framework for the profession.

Turning to the situation of nurse anaesthetists around the world, in 2017, Hu et al. established the first educational programme in China for nurse anaesthetists, based on the 2016 International Federation of Nurse Anaesthetists standards (IFNA, 2016). In this programme, clinical practice, health education and research were the core competencies that allowed nurse anaesthetists to administer anaesthesia, perform airway management and practice in recovery units, always under the supervision of an anaesthesiologist, according to Chinese legislation (Hu et al., 2017). In Iran, Halakou et al. (2017) found that nurse anaesthetists participated in pre-anaesthetic assessments, care management and the treatment of acute and chronic pain, not only in the hospital setting but also at

home and at the end of life. The fact that Iranian nurse anaesthetists worked outside of hospital settings differentiates them from nurse anaesthetists in other countries. In France, the Syndicat National des Infirmier(e)s-Anesthésistes conducted a survey in 2018 among nurse anaesthetists to take a snapshot of the profession and identify possible areas for improvement. One finding was that most nurse anaesthetists worked in anaesthesia teams. Nurse anaesthetists performed expert management in general anaesthesia and airway management. In most cases, extubation in the recovery room was the responsibility of the nurse anaesthetists, as was the decision to discharge to another unit, although this required the anaesthesiologist's approval. Nurse anaesthetists were unlikely to perform as health educators, health advocates and communicators because they were generally not included in pre-anaesthesia visits. (Syndicat National des Infirmier(e)s-Anesthésistes [SYNA], 2019). In Switzerland, Herion et al. (2019) highlights among nurse anaesthetists the roles of expert, communicator, collaborator and professional. In this research, the roles of health manager and health promoter were less prominent. In Spain, the latest research from Comellas Oliva (2016) and Sevilla Guerra et al. (2017) demonstrates the existence of advanced practices among nurse anaesthetists. Even so, training, competencies and professional practices remain unregulated in the country.

As seen in this section, nurse anaesthetists' competencies vary greatly around the world because they depend on national history, training, regulation and legislation. Despite these differences in clinical practice, broad standards based on the International Federation of Nurse Anaesthetists criteria should be developed to ensure the quality of care.

We aim to define the competencies of nurse anaesthetists in Catalonia (Spain) to contribute to the development of the profession in Spain and serve as a potential model for other countries in which there are no nurse anaesthetists or in which the field is undergoing definition and regulation, like in Spain.

3 | THE STUDY

3.1 | Aim

To define the competencies of nurse anaesthetists in the hospitals of Catalonia on the basis of their clinical practice through a consensus-building process.

3.2 | Design

We used a modified conventional Delphi study, a valid method for exploring a question to which there is no absolute answer. In a Delphi study, a panel of experts arrives at a consensus (Keeney et al., 2011). “Consensus” has been defined in different ways. We followed von der Gracht (2012), using three consensus criteria for each question: 80% of participants answered “agree” or “strongly agree”, mean $> 4 \pm 0.5$

SD and interquartile range ≤ 1 . We agreed that we would consider consensus to have been met when all three criteria were fulfilled, to re-introduce in subsequent round competencies that met one or two criteria, and to discard competencies that met zero criteria.

3.3 | Participants

The selection of the panel members is the most important part of the Delphi method. The panel was composed of expert nurses, as defined by Benner (1987). The number of panel members was determined by the number of hospitals that agreed to interpret. Hospitals were selected to cover a range of organizational structures and geographical locations. We contacted 29 hospitals in Catalonia (24 public and five private). Nine hospitals did not respond to our invitation. Three answered but did not have any nurses who met the criteria. One hospital rejected the proposal, leaving 16 participating hospitals, each of which provided a participant. The 16 participants met the following inclusion criteria for consideration as expert nurses (Benner, 1987): having more than 5 years of experience as a nurse anaesthetist, having postgraduate training in anaesthesia, and being engaged in clinical practice at the time of the research. Hospitals of different care levels from all of the administrative health areas of Catalonia were included. Before administering the first questionnaire, we met with each participant to inform him or her about the research and obtain informed consent. We also explained that participation was voluntary and that he or she could withdraw at any time. None of the participants chose to withdraw.

3.4 | Data collection

The data was collected by questionnaire in two rounds. The questionnaires were sent via email with a link to the SurveyMonkey® platform. Participants received a reminder 10 days later. The two rounds were held between February and June 2020, which is in line with the timeframes for the Delphi method (Keeney et al., 2011).

3.4.1 | Questionnaire design

To develop the first questionnaire, we followed the existing literature on the modified Delphi method (Keeney et al., 2011). We conducted a review of the relevant literature appearing in the PUBMED, Scopus and Google Scholar databases. We used the key words “competencies” and “nurse anaesthetists” and limited our search to the previous 5 years. Of the 163 articles identified, we selected 11 in which an assessment of the competencies in nurse anaesthesia had been made and drew on them to build the questionnaire. We also used the results of a qualitative phenomenological study about nurse anaesthetists that we had conducted previously (Sanclemente Dalmau, 2017). Finally, the questionnaire was evaluated by a team of reviewers composed of an expert in advanced nursing practice, an

expert in Delphi technique (who is also one of the authors), two expert nurse anaesthetists and a nurse anaesthetist who was a member of the Catalan Association of Anaesthesia, Post-anaesthesia and Pain Management Nursing. These reviewers tested the questionnaire and proposed modifications in its organization. They also suggested adding eight questions inside the seven domains; they did not propose any changes to the domains.

The resulting questionnaire had a first part containing socio-demographic data and a second part containing 142 questions distributed across the seven competency domains defined by the International Federation of Nurse Anaesthetists (International Federation of Nurse Anesthetists, 2016): expert (pre-anaesthetic assessment, anaesthetic management, risk management, monitoring, post-anaesthesia, equipment management, advanced life support, post-operative care, pain management, infection control, documentation), communicator, collaborator, manager, health advocate, scholar and professional. The answers were given on a Likert-type scale ranging from 1 to 5 (1 “strongly disagree”, 2 “disagree”, 3 “neither agree nor disagree”, 4 “agree”, 5 “strongly agree”). At the end of round 1, participants were given the opportunity to incorporate any competencies that they believed were missing from the questionnaire. This technique is part of the Delphi method and aims to draw on participants' feedback (Keeney et al., 2011). Likewise, at the end of the questionnaire, there was a blank space for comments about perceptions of the organizational and legal structure of nurse anaesthetists in Spain. A second questionnaire of 27 items was developed for round 2, based on the outcomes of round 1, as explained in Results. The questionnaires were conducted in Catalan.

3.5 | Ethical considerations

This research received the approval of the Research Ethics Committee of the Fundació Unió Catalana d'Hospitals (CEI 18/87). Following the principles of the Helsinki Declaration (World Medical Association, 2013), all participants received information about the research and signed the informed consent form before participating in the study. Only the research team had access to participants' personal information. Data collection through SurveyMonkey® was anonymous.

3.6 | Data analysis

For the analysis, we used SurveyMonkey® and Excel®. The statistics used were descriptive, including mean, median, standard deviation and interquartile range.

3.7 | Validity, reliability and rigour

We developed the Delphi questionnaire for round 1 by drawing on the recent literature about nurse anaesthetists' competencies.

To translate the competencies identified to Catalan, we used the document provided by the Catalan Association of Anaesthesia, Post-anaesthesia and Pain Management Nursing, which was based on the original document of the International Federation of Nurse Anaesthetists. Once the questionnaire was developed, it was reviewed by four experts who made minor suggestions, which we incorporated. They agreed with the proposed domains and confirmed the validity and reliability of the questionnaire design.

4 | RESULTS

4.1 | Description of the participants

The total number of participants was 16 nurse anaesthetists. 93.8% were women and 6.25% were men. The mean age was 43.12 years \pm 11.06 SD. All had postgraduate training in anaesthesia, and one had completed a doctorate. The average years of experience as a nurse was 21 years \pm 5 SD and specifically in the field of anaesthesia it was 18 years \pm 8.42 SD. Most participants (81.25%) worked in more than one area in anaesthesia. Specifically, 50% participated in pre-anaesthetic assessment, 68.75% in surgery, 84% in post-operative care units, 56.25% in pain units and 43.75% in units outside the surgical area.

4.2 | Round 1

In round 1, participants reached consensus in 115 of the 142 competencies. Of the 27 competencies failing to reach consensus, those meeting none of the consensus criteria were discarded. These included 17 from the expert domain and one from the manager domain. Nine competencies that met one or two of the consensus criteria in round 1 were retested in round 2 (Table 1). In all cases, these were competencies that failed to meet the criterion of >80% of participants reporting "agree" or "strongly agree". Participants proposed 18 new competencies.

4.3 | Round 2

In round 2, in addition to retesting the nine competencies that had an inconclusive outcome in round 1, we added the 18 competencies proposed by the participants in round 1. Of these 27 items, consensus was reached on 24 competencies in round 2 (all three criteria met). Three competencies from the expert domain met none of the three consensus criteria and were discarded (Table 2). We did not conduct a third round because by the end of round 2, all items had been fully accepted (three consensus criteria met) or fully rejected (zero consensus criteria met), leaving no items for further consideration.

TABLE 1 Results round 1

Domain	Competencies from domain	Discarded (0 criteria met)	Retested in round 2 (1-2 criteria met)	Consensus (3 criteria met)
Expert	96	17	4	75
Pre-anaesthetic assessment	13	3	1	9
Preparing and administering anaesthesia	20	5	1	14
Patient safety	12	0	1	11
Monitoring	7	0	0	7
Termination of anaesthesia	5	1	0	4
Equipment	4	1	0	3
Advanced life support	6	1	0	5
Post-operative care	12	3	1	8
Pain management	12	3	0	9
Risk prevention	3	0	0	3
Documentation	2	0	0	2
Communicator	6	0	2	4
Collaborator	7	0	0	7
Manager	7	1	1	5
Health advocate	8	0	1	7
Scholar	10	0	1	9
Professional	8	0	0	8
Totally	142	18	9	115

Note: "Discarded" refers to the competencies that met none of the three consensus criteria and were therefore eliminated from further consideration. "Retested in round 2" refers to the competencies that met one or two consensus criteria and were considered again in the second round. "Consensus" refers to the competencies that met all three consensus criteria in round 1.

TABLE 2 Results round 2

Domain	Competencies from domain	Discarded (0 criteria met)	Consensus (3 criteria met)
Expert	21	3	18
Pre-anaesthetic assessment	7	1	6
Preparing and administering anaesthesia	4	1	3
Patient safety	2	0	2
Monitoring	3	0	3
Termination of anaesthesia	0	0	0
Equipment	2	0	2
Advanced life support	1	0	1
Post-operative care	2	1	1
Pain management	0	0	0
Risk prevention	0	0	0
Documentation	0	0	0
Communicator	2	0	2
Collaborator	0	0	0
Manager	1	0	1
Health advocate	1	0	1
Scholar	1	0	1
Professional	1	0	1
Finally	27	3	24

Note: "Discarded" refers to the competencies that met zero of the consensus criteria in round 2. "Consensus" refers to the competencies that met all three consensus criteria in round 2.

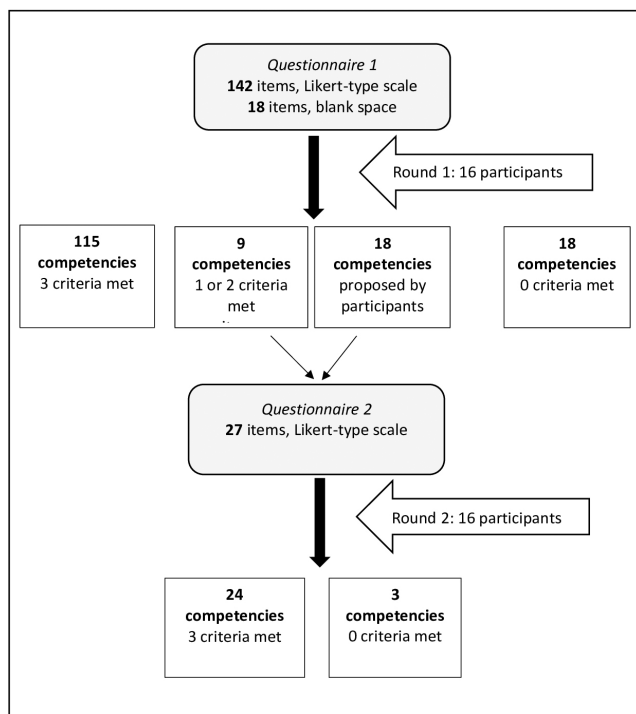


FIGURE 1 Description of the phases of the modified Delphi method

After completing the two rounds, the final set of competencies consisted of 139 items distributed across the seven domains corresponding to the conceptual framework of the International Federation of Nurse Anaesthetists (Figure 1). We did not have to discard any of the seven key domains because of a lack of consensus. (Table 3).

5 | DISCUSSION

The competencies and skills of nurse anaesthetists in Spain are increasing. In the last 13 years, university postgraduate training has been consolidated, making it possible to obtain the theoretical and practical training necessary to enter the field. However, of the existing programmes, only one has been included by the International Federation of Nurse Anaesthetists in its list of Approved Non-Physician Anaesthesia Programmes/Schools. Both the International Council of Nurses and the International Federation of Nurse Anaesthetists recommend a programme duration of at least 18–24 months to allow nurse anaesthetists to develop the necessary competencies (ICN, 2021), and none of the Spanish programmes have this minimum length. Perhaps the lack of adequate postgraduate training opportunities is one reason why nurse anaesthetists in

TABLE 3 Competencies and percentage of participants reporting "agree" or "strongly agree"

Domain	Competency	Participants reporting "agree" or "strongly agree" (%)	Mean \pm SD (1-5)	IR
Expert		86.99%		
Pre-anaesthetic assessment	Conduct pre-anaesthetic interview (with anaesthesiologist)	93.75%	4.43 \pm 0.62	1
	Conduct pre-anaesthetic interview (alone)	93.75%	4.56 \pm 0.62	1
	Assess medical and surgical history	93.75%	4.5 \pm 0.63	1
	Assess medications	93.75%	4.43 \pm 0.81	1
	Assess anaesthetic risk	93.75%	4.43 \pm 0.81	1
	Assess predictors of difficult airway	100.00%	4.68 \pm 0.47	1
	Request preoperative tests	68.75%	3.87 \pm 1.20	2
	Assess the results of pre-operative tests ^a	81.25%	4.25 \pm 1.12	1
	Request consultation with another department	50.00%	3.31 \pm 1.2	2
	Conduct diagnostic tests (electrocardiogram. Lab tests) ^a	93.75%	4.5 \pm 1.03	1
	Conduct pre-anaesthetic appointments virtually or by phone ^a	100.00%	4.81 \pm 0.40	0
	Formulate an anaesthetic plan based on knowledge and scientific evidence	81.25%	4.06 \pm 1.12	1
	Provide information about the anaesthetic plan	100.00%	4.62 \pm 0.5	1
	Inform patients about anaesthetic risks	87.50%	4.25 \pm 0.68	1
	Acquire informed consent from the patient	75.00%	3.87 \pm 0.95	1.5
	Coordinate patient scheduling with other departments ^a	81.25%	4.0 \pm 1.31	1
	Handle surgery scheduling problems^a	75.00%	3.93 \pm 1.28	1.75
	Make changes in medication according to protocol ^b	100.00%	4.68 \pm 0.47	1
	Provide pre-anaesthesia recommendations ^b	93.75%	4.62 \pm 1.02	0
	Preparation and administration of anaesthesia	Prepare anaesthetic medications according to one's knowledge, the patient's history, the technique and the surgical procedure	100.00%	4.75 \pm 0.44
Choose anaesthetic medications according to one's knowledge, the patient's history, the technique and the surgical procedure		87.70%	4.25 \pm 1.06	1
Administer anaesthetic medications according to one's knowledge, the patient's history, the technique and the surgical procedure		81.25%	4.18 \pm 0.91	1
Prepare anaesthetic procedures according to one's knowledge, the patient's history, the technique and the surgical procedure		100.00%	4.68 \pm 0.47	1
Conduct anaesthetic procedures according to one's knowledge, the patient's history, the technique and the surgical procedure		87.50%	4.31 \pm 0.87	1
Administer general anaesthesia according to protocol in different surgical procedures		68.75%	3.75 \pm 1.12	1.75
Collaborate with the anaesthesiologist in the administration of general anaesthesia		100.00%	4.87 \pm 0.34	0
Administer regional anaesthesia according to protocol in different surgical procedures		31.25%	2.87 \pm 1.08	2
Collaborate with the anaesthesiologist in the administration of regional anaesthesia		93.75%	4.75 \pm 0.57	0
Administer sedation according to protocol in different surgical procedures		100.00%	4.62 \pm 0.61	1
Collaborate with the anaesthesiologist in the administration of sedation		100.00%	4.81 \pm 0.40	0
Administer coadjunctive drugs to prevent complications ^b		93.75%	4.62 \pm 1.02	0
Conduct ventilation support in patients		100.00%	4.68 \pm 0.47	1
Insert airway maintenance devices: Nasal cannula		93.75%	4.68 \pm 0.60	0.75
Insert airway maintenance devices: Simple mask and reservoir mask		100.00%	4.81 \pm 0.40	0
Insert airway maintenance devices: Laryngeal mask		68.75%	3.87 \pm 1.14	2
Insert airway maintenance devices: Endotracheal intubation		50.00%	3.5 \pm 1.15	2.5

TABLE 3 (Continued)

Domain	Competency	Participants reporting "agree" or "strongly agree" (%)	Mean \pm SD (1–5)	IR
	Insert airway maintenance devices: Techniques for difficult intubation	25.00%	2.68 \pm 1.01	1.75
	Use ultrasound to carry out invasive techniques (airway canalisation, evaluation of bladder volume) ^b	81.25%	4.25 \pm 1.12	1
	Be present during the administration of anaesthesia	87.50%	4.56 \pm 0.25	0
	Be present when the patient wakes up ^a	87.50%	4.5 \pm 1.09	0.75
	Offer psychological support by using communication skills	100.00%	4.93 \pm 0.25	0
	Provide information to family members about the anaesthesia procedure^a	75.00%	3.93 \pm 0.99	1.75
Patient safety	Take adequate precautions to ensure safe administration of anaesthesia	93.75%	4.75 \pm 0.77	0
	Review patient records	100.00%	4.93 \pm 0.25	0
	Prepare equipment according to standards and checklists	100.00%	4.93 \pm 0.25	0
	Test anaesthesia equipment (respirator, monitors, aspiration)	100.00%	4.93 \pm 0.25	0
	Prepare anaesthetic plans according to standards and checklists	93.75%	4.75 \pm 0.57	0
	Prepare anaesthesia drugs according to standards and checklists	100.00%	4.87 \pm 0.34	0
	Participate in the administration of the Safe Surgical Checklist	93.75%	4.75 \pm 0.57	0
	Lead the administration of the Safe Surgical Checklist ^b	100.00%	4.75 \pm 0.44	0.75
	Participate in courses or conferences related to the topic ^a	93.75%	4.62 \pm 1.02	0
	Participate in the development of procedures/protocols for the use of equipment and drugs	100.00%	4.56 \pm 0.62	1
	Participate in the reporting of safety incidents	93.75%	4.68 \pm 0.60	0.75
	Participate in groups for safety improvement or the analysis of safety incidents	93.75%	4.62 \pm 0.61	1
	Participate in the prevention of risks to patients and health professionals	93.75%	4.56 \pm 0.62	1
Monitoring	Collaborate in set-up for monitoring	100.00%	5 \pm 0	0
	Monitor patient parameters during the anaesthesia procedure	100.00%	4.93 \pm 0.25	0
	Monitor patient's clinical status during the anaesthesia procedure ^a	93.75%	4.62 \pm 1.02	0
	Analyse data obtained from invasive and non-invasive monitoring techniques using critical thinking and clinical judgement.	100.00%	4.81 \pm 0.40	0
	Perform interventions based on the results of invasive and non-invasive monitoring using critical thinking and clinical judgement	87.50%	4.37 \pm 1.02	1
	Participate in changes to ventilation/pharmacological therapy in response to unexpected situations, following scientific knowledge ^a	87.50%	4.5 \pm 0.89	1
	Participate in changes to ventilation/pharmacological therapy in response to unexpected situations, according to guides/protocols ^a	100.00%	4.81 \pm 0.40	0
	Record data obtained from monitoring	87.50%	4.75 \pm 0.68	0
	Identify patient priorities and safety parameters	100.00%	4.81 \pm 0.40	0
	Respond constructively to unexpected or rapidly changing situations to manage the clinical situation	87.50%	4.56 \pm 0.72	1
Termination of anaesthesia	Assess the patient's condition before transferring care to the appropriate department	93.75%	4.75 \pm 0.57	0
	End ventilatory support if applicable	81.25%	4.31 \pm 0.94	1
	Conduct extubation autonomously	25.00%	2.81 \pm 1.26	1.75
	Accompany patient during transfer	100.00%	4.93 \pm 0.25	0
	Transfer information to the personnel of the post-operative care unit	93.75%	4.75 \pm 0.57	0

(Continues)

TABLE 3 (Continued)

Domain	Competency	Participants reporting "agree" or "strongly agree" (%)	Mean \pm SD (1–5)	IR
Equipment	Select appropriate equipment according to the procedure and the situation (planned or emergency)	93.75%	4.68 \pm 0.60	0.75
	Prepare appropriate equipment according to the procedure and the situation (planned or emergency)	100.00%	4.87 \pm 0.34	0
	Use appropriate equipment according to the procedure and the situation (planned or emergency)	100.00%	4.81 \pm 0.40	0
	Clean the appropriate equipment according to the procedure and the situation (planned or emergency)	68.75%	3.81 \pm 1.47	3
	Follow-up on equipment maintenance ^a	100.00%	4.75 \pm 0.44	0.75
	Check that equipment is functioning correctly before use ^a	100.00%	4.87 \pm 0.34	0
Advanced life support	Take action to maintain or stabilize the patient's condition and provide advanced life support care	93.75%	4.75 \pm 0.77	0
	Provide adequate advanced life support: use of equipment and medications, coordination with the rest of the team	100.00%	4.87 \pm 0.34	0
	Provide knowledge about basic and advanced life support to other health professionals	87.50%	4.56 \pm 0.72	1
	Maintain one's accreditation as a professional/instructor of advanced life support	87.50%	4.56 \pm 0.72	1
	Lead life support teams in institutions	62.50%	3.87 \pm 1.08	2
	Keep in mind non-technical skills (leadership, teamwork, situational awareness, communication) in urgent/emergency situations	93.75%	4.56 \pm 0.62	1
	Participate in simulations ^a	100.00%	4.62 \pm 0.61	1
Post-operative care	Serve as a resource person in immediate post-operative care	81.25%	4.31 \pm 1.07	1
	Decide when to discharge the patient from the post-anaesthesia recovery unit	62.50%	3.93 \pm 1.12	2
	Sign the discharge papers for a patient leaving the post-anaesthesia recovery unit	31.25%	3.06 \pm 1.18	1.75
	Decide when to discharge the patient from the major outpatient surgery unit^a	75.00%	3.93 \pm 1.28	1.75
	Demonstrate advanced knowledge in pharmacology and the pharmacokinetics of drugs, analgesics and anaesthetic medications	93.75%	4.81 \pm 0.54	0
	Assess all of the immediate post-operative complications in the recovery room/post-anaesthesia recovery unit: respiratory, neurological, hemodynamic, nausea, vomiting	93.75%	4.62 \pm 0.61	1
	Detect post-operative complications in all areas: respiratory, neurological, hemodynamic, nausea, vomiting	93.75%	4.68 \pm 0.60	0.75
	Administer appropriate drugs autonomously	62.50%	3.43 \pm 1.09	1.75
	Administer appropriate drugs according to protocol	100.00%	4.68 \pm 0.60	0.75
	Administer appropriate drugs by medical order	87.50%	4.37 \pm 0.71	1
	Perform drug management during weaning ^b	87.50%	4.31 \pm 0.87	1
	Develop personnel protocols in the post-anaesthesia recovery unit	81.25%	4.12 \pm 0.88	1
	Participate in carrying out personnel protocols in the post-anaesthesia recovery unit	93.75%	4.62 \pm 0.61	1

TABLE 3 (Continued)

Domain	Competency	Participants reporting "agree" or "strongly agree" (%)	Mean \pm SD (1–5)	IR
Pain management	Form part of institutional bodies for pain management	81.25%	4.25 \pm 0.93	1
	Serve as a resource person for nurses in pain units	81.25%	4.31 \pm 1.07	1
	Supervise invasive treatments for post-operative pain management in different departments (catheter, pain pump, etc.)	93.75%	4.56 \pm 0.62	1
	Inform the patient about pain treatments and their side effects	87.50%	4.5 \pm 0.73	1
	Educate patients about pain treatment	93.75%	4.81 \pm 0.54	0
	Lead control of and recording-keeping for opioids	80.00%	4.21 \pm 0.96	1
	Manage rotation of opioids in chronic patients	56.25%	3.87 \pm 1.02	2
	Apply transcutaneous electrical nerve stimulation autonomously in chronic pain units	56.25%	3.68 \pm 1.30	2
	Apply iontophoresis autonomously in chronic pain units	56.25%	3.62 \pm 1.25	2
	Conduct follow-up and monitoring of treatments applied in chronic pain units	93.75%	4.62 \pm 0.61	1
	Train other professionals in the area of pain management	87.50%	4.62 \pm 0.71	0.75
	Give emotional support to patients in the chronic pain unit	87.50%	4.75 \pm 0.68	0
	Risk management	Conduct procedures according to the recommended standards, to guarantee the cleaning and sterilization of equipment	100.00%	4.87 \pm 0.34
Stay up to date with national guidelines on the risk of infection		93.75%	4.81 \pm 0.54	0
Engage in the adaptation of national standards for anaesthesia procedures		87.50%	4.5 \pm 0.89	1
Documentation	Record patient information completely	100.00%	4.75 \pm 0.44	0.75
	Facilitate comprehensive care for the patient by recording information in patient records	100.00%	4.87 \pm 0.35	0
Communicator		91.67%		
	Establish effective communication and synergies with the patient	93.75%	4.56 \pm 0.72	1
	Establish effective communication and synergies with the family of the patient ^b	93.75%	4.68 \pm 0.70	0
	Provide emotional support to patients	93.75%	4.75 \pm 0.57	0
	Provide emotional support to patients' families ^b	93.75%	4.75 \pm 0.57	0
	Demonstrate skills to ensure patient understanding, respect, empathy and trust by maintaining confidentiality and discretion	93.75%	4.75 \pm 0.57	0
	Demonstrate skills for resolving interpersonal conflicts	81.25%	4.5 \pm 0.81	1
Collaborator		99.11%		
	Collaborate with other members of the team to identify solutions to health problems	100.00%	4.81 \pm 0.40	0
	Implement new technologies that improve patient safety	100.00%	4.81 \pm 0.40	0
	Establish professional relationships with health professionals from other fields	100.00%	4.87 \pm 0.34	0
	Promote cooperation among the different members of the anaesthesia team	100.00%	4.87 \pm 0.34	0
	Respect the roles and competencies of other team members	100.00%	4.93 \pm 0.25	0
	Engage in constructive discourse and promote the strengths of the members of the health care team	93.75%	4.75 \pm 0.57	0
	Offer solutions to problems that appear inside the health care team	100.00%	4.75 \pm 0.44	0.75
Manager		85.71%		
	Make decisions in advance to organize health care staff and prepare equipment and materials	93.75%	4.62 \pm 0.61	1
	Use resources to design and participate in evidence-based strategies that integrate patient needs	87.50%	4.43 \pm 0.72	1
	Establish plans for eco-friendly waste management	75.00%	3.87 \pm 1.08	2
	Evaluate and optimize the impact of the use of products and technologies in patient care	81.25%	4.06 \pm 0.99	1
	Conduct quality-of-care assessments	87.50%	4.62 \pm 0.71	0.75
	Participate in committees for the quality of patient care	81.25%	4.5 \pm 0.81	1
	Participate in patient safety committees as a manager/leader ^b	93.75%	4.62 \pm 0.61	1

(Continues)

TABLE 3 (Continued)

Domain	Competency	Participants reporting "agree" or "strongly agree" (%)	Mean \pm SD (1–5)	IR
Health advocate		90.63%		
	Assess patients' health state	93.75%	4.68 \pm 0.60	0.75
	Participate in health promotion in patients	100.00%	4.75 \pm 0.44	0.75
	Participate in patient health education at any time in the perioperative period	93.75%	4.68 \pm 0.60	0.75
	Participate in family health education at any time in the perioperative period	81.25%	4.43 \pm 1.09	0.75
	Participate in patient empowerment in the perioperative period	81.25%	4.43 \pm 0.96	1
	Ensure the patient's right to privacy and confidentiality	100.00%	4.93 \pm 0.25	0
	Participate in safety commissions	81.25%	4.43 \pm 0.81	1
	Use information & communication technologies and digital health tools in the perioperative period ^b	93.75%	4.62 \pm 0.61	1
Scholar		96.88%		
	Participate in continuous professional development	100.00%	4.75 \pm 0.44	0.75
	Be evaluated during his/her professional career	87.50%	4.5 \pm 0.73	1
	Incorporate evidence-based techniques, such as those described in updated national guidelines and standards	100.00%	4.62 \pm 0.5	1
	Participate in funded research and other studies	93.75%	4.75 \pm 0.57	0
	Incorporate research into his/her daily practice	93.75%	4.5 \pm 0.81	1
	Protect the rights of patients who participate in research	100.00%	4.81 \pm 0.40	0
	Know the standards of education and practice in the profession	100.00%	4.75 \pm 0.44	0.75
	Contribute to the education of professionals and students by sharing one's experience	100.00%	4.75 \pm 0.44	0.75
	Help other health care professional by sharing one's experience in anaesthesia	100.00%	4.75 \pm 0.44	0.75
	Demonstrate knowledge about national-level professional regulations ^b	93.75%	4.56 \pm 0.62	1
Professional		95.31%		
	Provide patient-centred, evidence-based care	93.75%	4.75 \pm 0.57	0
	Recognize one's responsibility in professional practice by maintaining a high level of quality in knowledge, judgement and technological skills	100.00%	4.93 \pm 0.25	0
	Accept and carry out responsibilities delegated by others	100.00%	4.81 \pm 0.40	0
	Delegate regularly to other members of the health care team	81.25%	4.06 \pm 0.85	1
	Identify opportunities for the continuous professional development activities	100.00%	4.87 \pm 0.34	0
	Participate in professional associations	93.75%	4.43 \pm 0.62	1
	Use criteria of quality, satisfaction and study of costs to make changes in the practice and care of the patient	100%	4.56 \pm 0.62	1
	Ensuring the rights of patients according to their individual, cultural, ethnic and religious characteristics, giving the most appropriate care and respecting these singularities	93.75%	4.75 \pm 0.57	0

Note: Competencies in **bold** did not meet the threshold of 80% of participants having reported "agree" or "strongly agree" and were therefore discarded from the final set of competencies. SD: standard deviation. IR: interquartile range.

^aCompetencies proposed by the participants in round 1 and added for consideration in round 2.

^bCompetencies that only met one or two consensus criteria in round 1 and were therefore reconsidered in round 2.

Spain do not have the same level of competencies as in other countries. Despite this shortcoming, our research reveals that participants recognized the seven-domain competency framework defined by the International Federation of Nurse Anaesthetists (2016), with all seven domains having achieved "agree" or "strongly agree" among more than 80% of respondents.

The expert domain is the most variable across countries, because of differing legal frameworks. The participation of nurse

anaesthetists in the administration of different types of anaesthesia varies depending on the training received and on national legislation. In Spain, nurse prescribing is in its infancy. Nurse anaesthetists can indicate, administer and authorize drugs that do not require a medical prescription. However, anaesthetic drugs do not fall into this category. In some states of the United States, there are legal regulations that permit nurse anaesthetists to administer anaesthetic drugs. In others, the presence of a physician,

though not necessarily an anaesthesiologist, is required (Hoyem et al., 2019). In China, nurse anaesthetists are permitted to administer anaesthetic drugs under the supervision of an anaesthesiologist (Hu et al., 2017). In France, the training of the nurse anaesthetists is recognized as a state diploma, and French law states that only nurse anaesthetists and anaesthesiologists may administer anaesthesia drugs (Légifrance, 2017).

Also under the expert domain, the nurse anaesthetists in our study recognized non-invasive airway management as an autonomous activity (cannula, face mask) and invasive airway management as one they performed in collaboration with physicians (laryngeal mask, orotracheal intubation). The competencies related to monitoring, safety and recording information coincide with competencies signalled by the International Federation of Nurse Anaesthetists and other authors (Halakou et al., 2017; Herion et al., 2019; Syndicat National des Infirmier(e)s-Anesthésistes, 2019). In terms of the pre-anaesthesia visit, the nurse anaesthetists conducted preanaesthetic assessment autonomously or collaboratively, including patient history assessment, pharmacological treatments, preoperative tests and airway assessment (the latter of which varied depending on the patient's anaesthetic risk and the complexity of the surgery). This finding differs from the situation in France, in which nurse anaesthetists have an undeniable presence in surgery but not in the pre-anaesthesia visit (SYNA, 2019).

Information about the anaesthesia process appears in the expert domain and also in the communicator domain because communication with the patient and his/her family is a cross-cutting competency. For our participants, informing the patient is a nurse anaesthetist competency, but obtaining informed consent is not, because, according to Spanish legislation, informed consent can only be obtained by a physician. This practice is shared with other in other Western countries, except for the United States, where the health professional who provides the information to the patient also obtains his/her informed consent (American Association of Nurse Anesthesiology, 2019).

The participants were in high agreement with the competencies related to management, answering affirmatively to participation in quality and safety committees, the use of new technologies, the use of evidence-based practice and the role of manager inside teams. This finding contrasts with those of other studies in which nurse anaesthetists are less autonomous in management but more autonomous in the expert domain (Herion et al., 2019).

The results for the domain of health advocate are similar. Nursing education in Spain is firmly rooted in health education, and this emphasis is transferred to clinical practice. Nurse anaesthetists have integrated the values of promotion, education and empowerment of the patient and his/her family. Nurse anaesthetists participation in the pre-anaesthesia visit and in pain units gives this competency greater weight in Spain than in places such as France and Switzerland (Herion et al., 2019; SYNA, 2019).

In terms of the scholar domain, the consensus percentage was high, especially in the competencies related to continuing education and participation in the training of other health professionals. Participation

in and support for research has room for improvement, as is also the case in other countries (Halakou et al., 2017; Herion et al., 2019).

The degree of consensus for the domains collaborator and professional are slightly higher than that of other studies. In perioperative care in Spain, teams are increasingly multidisciplinary. For example, nurse anaesthetists participate actively in enhanced recovery after surgery. Teamwork and collaboration among health professionals are noteworthy in the clinical practice of nurse anaesthetists in our study.

5.1 | Limitations

The study was carried out in Catalonia, which shares responsibility for health care with the central government of Spain. The management of hospitals and teams may be different from those of other regions of Spain. The fact that Spain does not have legislation covering nursing anaesthesia may cause professional and personal conflicts in health teams, which need to be considered in the development of a competencies model. We are currently conducting a qualitative analysis to tackle this issue. Legislation and regulation about nurse anaesthesia vary by country, meaning that caution must be used in extrapolating our results to other contexts.

6 | CONCLUSION

We have shown that the competencies of nurse anaesthetists in Spain largely coincide with those defined by the International Federation of Nurse Anaesthetists. In Spain, nurse anaesthetists are an essential pillar throughout the perioperative period. Their holistic approach to the person offers not only nursing expertise but also cross-cutting elements such as communication skills and the integration of the family into the health-illness continuum. At the same time, the inclusion of nurse anaesthetists in pre-anaesthesia visits and pain units allows them to carry out health education for patients and their families, thus contributing to the quality of care received and taking part in the community. The role of nurse anaesthetists in our study in the pre-anaesthesia visit and their competencies related to preparing and accompanying the patient and providing information about the anaesthesia process could serve as a model for other health care systems in which these roles of the nurse anaesthetist are not fully developed.

The scope of the nurse anaesthetists' practice in Spain depends on the workplace and not on national regulations. This may be why advanced practice competencies are not developed equally throughout the sample. For example, consensus was not reached on the administration of general anaesthesia, invasive airway management, discharge from recovery units and the autonomous management of opioid rotation for patients in chronic pain units. It is surprising that in a country in which nurse anaesthetists have no recognized role in the post-operative process that they are carrying out pre-anaesthetic visits with the consent of health institutions. Nurse anaesthetists' theoretical and practical training should allow

them to advance in these competencies, while continuing to ensure high quality patient care. To accomplish this goal, nurse anaesthetist university education should follow the standards published by the International Federation of Nurse Anaesthetists. Health care teams in general and anaesthesia teams in particular should be prepared to incorporate the nurse anaesthetist, who has a differentiated role that is complementary to that of the anaesthesiologist.

The study has revealed the contribution of nurse anaesthetists to the perioperative process as a key member of the anaesthesia team. Defining nurse anaesthesia as a speciality and regulating its practice would make it possible to expand the training available, especially for the competencies that were less widespread. This expansion in the competency framework would enable patients to receive higher quality care from anaesthesia teams, care that adheres to the highest standards of safety and quality. Policy makers, managers and the nurse anaesthetists themselves are positioned to take the next steps in the regulation process.

The regulatory situation of nurse anaesthetists in Spain may be similar to that of other countries in which nurse anaesthesia is still in development. In this sense, our methodological approach and our results may be of help to other health systems that are in the process of defining the competencies of the nurse anaesthetists.

AUTHOR CONTRIBUTIONS

All authors have agreed on the final version and meet at least one of the following criteria (recommended by the ICMJE*):

1. substantial contributions to conception and design, acquisition of data or analysis and interpretation of data;
2. drafting the article or revising it critically for important intellectual content.

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Author elects to not share data: Research data are not shared.

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