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# Use of the PPCS-R scale to analyse the impact of training and experience on self-perceived perioperative nursing competence: A multicentre cross-sectional study

## Abstract

**Introduction:** Competence in perioperative nursing integrates technical and non-technical skills essential for safe and effective clinical practice. Nurses' self-perception of competence plays a vital role in professional development and patient safety. Understanding the factors influencing self-perceived competence is crucial for supporting growth in high-intensity environments like the operating room (OR).

**Aim:** This study assessed self-perceived competence of perioperative nurses using the Perceived Perioperative Competence Scale-Revised (PPCS-R).

**Methods:** A cross-sectional study was conducted among 59 nurses working in two operating blocks in central Italy. The final sample included 29 participants (65.6% female; mean age  $41.9 \pm 10.3$  years). Most held a first-level nursing degree (55.2%), with only a few (10.3%) having completed postgraduate, OR-specific training. Data were collected using the PPCS-R, and statistical analysis included descriptive statistics and the Mann-Whitney U test.

**Results:** Participants reported the highest perceived competence in 'fundamental knowledge and skills' ( $M = 4.13$ ,  $SD = 0.63$ ) and the lowest in 'leadership' ( $M = 3.05$ ,  $SD = 0.94$ ). Confidence was high in equipment location ( $M = 4.76$ ,  $SD = 0.57$ ) but lower in anticipating surgical procedures ( $M = 3.72$ ,  $SD = 1.06$ ). Challenges emerged in conflict management ( $M = 2.70$ ,  $SD = 0.86$ ) and communication ( $M = 3.34$ ,  $SD = 0.85$ ). Nurses with more than six years of experience scored significantly higher ( $p < 0.05$ ) across five of the six domains, but not for the domain of 'empathy' ( $p = 0.34$ ). Education level and professional role were not significantly associated with perceived competence.

**Conclusion:** Clinical experience strongly influences self-perceived perioperative competence. These findings highlight the importance of professional experience and suggest that structured postgraduate education may support the development of competence in specific areas such as leadership and collaboration.

**Keywords:** Perceived Perioperative Competence Scale-Revised, self-perceived competence, operating rooms, patients' safety, nursing education

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## Introduction

The term 'competence' can be described as the proven ability to apply knowledge, skills and personal, social and/or methodological abilities in work or study situations, as well as in professional and personal development<sup>1</sup>. Nursing competence not only requires knowledge and practical skills but also the ability to effectively apply them in real clinical situations. Perioperative competence demands specific skills and behaviours that operating room (OR) nurses must continuously develop and enhance through ongoing education and self-directed learning<sup>2</sup>. Indicators of competence should reflect diverse abilities, as a competent nurse must integrate knowledge, skills and values into workplace situations<sup>3</sup>.

Nurses' self-perception of their competence is crucial for their professional identity, as it can influence the quality of care provided, professional and personal well-being, teamwork and job satisfaction while also reducing the risk of errors<sup>3</sup>. When nurses perceive themselves as competent, they develop greater motivation to take on new professional challenges and are more likely to engage in continuous learning<sup>4</sup>. This is particularly relevant in high-intensity care areas such as emergency, urgent care and the OR, where decisions must be made quickly yet effectively and efficiently.

Perioperative nursing competence can be classified as technical or non-technical<sup>1</sup>. Technical competence is related to practical and situational knowledge, professional etiquette and practice standards<sup>1</sup>. Non-technical competence involves empathy, communication, collaboration and teamwork<sup>5</sup>.

### The Italian perioperative nursing context

Given the absence of formal recognition and structured training pathways for perioperative nursing in Italy, understanding how nurses perceive their own professional competence is crucial<sup>6</sup>. Although a limited number of postgraduate university master's programs exist, they are few, not uniformly available across regions and often not specific to perioperative

nursing. A structured second-level degree focused on perioperative practice is currently lacking.

This study seeks to generate evidence of the current levels of self-perceived competence among perioperative nurses and to explore how factors such as experience, education and role diversity may influence these perceptions. The findings may help inform future strategies for workforce development and targeted educational initiatives in the Italian perioperative context. Given the absence of formal pathways for perioperative nursing in Italy and the need for structured professional development, it is essential to understand how training and experience influence perceived competence.

## Aim

The aim of this study is to assess perioperative nurses' perceived competence using the Perceived Perioperative Competence Scale-Revised (PPCS-R). In addition, the study explores whether perceived competence is associated with nurses' professional experience, postgraduate education and role diversity. We hypothesised that nurses with more experience or postgraduate training would report higher levels of perceived competence.

## Methods

### Study design

This is a cross-sectional survey study. The manuscript adheres to the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines for reporting cross-sectional studies.

### Sample

Participants included all nurses currently employed in the two operating blocks (OB I and OB II) of a local health authority in central Italy during the data collection period. Inclusion criteria were having an active clinical role in the operating theatre and providing informed consent to participate. Nurses holding purely organisational or managerial positions, despite having clinical OR experience, were excluded to ensure focus on actively practising perioperative nurses. This distinction was made to obtain data

exclusively from nurses directly involved in patient care during surgical procedures.

### Data collection tool

The PPCS-R is the only validated tool in the literature designed to assess nurses' self-perceived competence in the perioperative setting<sup>3,7</sup>. The PPCS-R (see supplement) consists of 40 items divided into six domains: fundamental knowledge and skills (9 items), leadership (8 items), collaboration (6 items), proficiency (6 items), empathy (5 items) and professional development (6 items)<sup>7</sup>. Responses are rated on a 5-point Likert scale (never, sometimes, often, very often, always)<sup>7</sup>. The total score ranges from a minimum of 40 to a maximum of 200, with higher scores indicating greater levels of perceived competence<sup>7</sup>.

The PPCS-R has shown good psychometric properties in terms of internal consistency (Cronbach's alpha > 0.80), content validity and construct validity in previous studies<sup>2,7</sup>. Its reliability was further confirmed in this study, which also included the collection of demographic and professional information – age, gender, highest level of nursing education, years of perioperative experience and participation in formal perioperative education programs.

### Data collection

Data were collected between 9 April and 11 June 2024 using a Google form. The link to the PPCS-R survey was distributed via institutional email to all eligible nurses in the two operating blocks. Participation was voluntary and anonymous. All participants completed the questionnaire independently, and no time limit was imposed. To ensure consistency in responses, all participants received the same instructions and accessed the same version of the form. The anonymised data were stored securely by the principal investigator on a password-protected institutional account. There were no missing data for any of the variables collected.

### Statistical analysis

Descriptive analyses, including frequencies (n), percentage (%), mean (M) and standard deviation ( $\pm$ SD), were used to describe the sociodemographic, educational and professional characteristics of participants, as well

as their responses to the PPCS-R scale. Sample homogeneity was assessed to ensure comparability between groups. The reliability of the questionnaire was verified by calculating Cronbach's alpha, with an accepted value above 0.70, indicating good internal consistency.

The normal distribution of continuous data was tested using the Shapiro-Wilk test and visually assessed through histograms, boxplots and Q-Q plots. The relationship between the PPCS-R scale results and participants' educational and professional characteristics was explored using the Mann-Whitney U test. Statistical significance was set at  $p < 0.05$ . All data were analysed using IBM SPSS version 25.0 (IBM Corp., Armonk, New York, USA). Due to the small sample size, multivariate analysis was not conducted. Non-parametric tests were chosen to account for the limited statistical power, and results were interpreted as exploratory.

Ethical considerations

This study did not require formal ethics committee approval since it involved anonymised survey data collected from healthcare professionals and did not include patients or sensitive personal

data. However, authorisation for the research was formally granted (protocol no. 0039141, dated 2 May 2024).

Prior to beginning the survey, participants were presented with an information page outlining the study's purpose, voluntary nature, data anonymity and the option to decline participation. Consent was explicitly obtained by requiring participants to confirm agreement through a mandatory question before accessing the questionnaire. No identifying data were collected, and participants were given the contact information of the research team in case there were questions or concerns. The research was conducted in full compliance with ethical standards for studies involving human participants, in accordance with European legislation and the principles set out in the Declaration of Helsinki.

Results

Of the 59 nurses invited to participate, 29 completed the questionnaire, yielding a response rate of 49.2 per cent. Participants were equally distributed between OB I (n = 15) and OB II (n = 14). The majority were female (65.6%), with a mean age

of 41.9 years (SD = 10.3). Over half of the participants held a first-level academic degree (55.2%), while only a few had completed a postgraduate, OR-specific course (10.3%). Approximately half worked in a single OR role (55.2%) and half had less than or equal to five years of experience (50.2%).

Prior to analysis, a comparison of demographic and professional variables confirmed sample homogeneity between the two operating blocks (see Table 1); therefore, data were pooled for all subsequent analyses.

PPCS-R assessment tool for perceived perioperative competence

The analysis of PPCS-R domain scores revealed that the highest aggregated mean was observed in the domain of 'fundamental knowledge and skills' (M = 4.13, SD = 0.63), indicating strong self-perceived competence in basic technical aspects of perioperative care. In contrast, the lowest domain score was reported in 'leadership' (M = 3.05, SD = 0.94), suggesting this may be a less developed area among the participants. Cronbach's alpha coefficients for all six domains were above 0.80, indicating good internal consistency and scale reliability (see Table 2).

Item-level analysis showed that nurses felt particularly confident in locating equipment (item 9, M = 4.76) and recognising the layout of different OR environments (item 3, M = 4.55). However, lower confidence emerged in items related to anticipating surgical procedures (item 1, M = 3.72), managing conflicts (item 13, M = 2.70) and integrating literature into clinical practice (item 38, M = 2.86). These areas may indicate specific targets for professional development (see supplement).

Correlation of PPCS-R scores and sociodemographic characteristics revealed that professional experience was significantly associated with higher scores in five of the six domains (all  $p < 0.05$ ), with the exception of the 'empathy' domain ( $p = 0.34$ ) where no significant difference was observed. This confirms that nurses with more than six years of experience perceive themselves as more competent in most areas of perioperative care. No significant associations were

Table 1: Sociodemographic characteristics of the participants (N = 29)

|                                    | Characteristics            | Operating block I<br>(n = 15)<br>n (%) | Operating block II<br>(n = 14)<br>n (%) | p-value |
|------------------------------------|----------------------------|----------------------------------------|-----------------------------------------|---------|
| Gender                             | male                       | 5 (17.2)                               | 5 (17.2)                                | 0.600   |
|                                    | female                     | 10 (34.5)                              | 9 (31.1)                                |         |
| Age                                | average (SD)               | 41.9 (10.3)                            |                                         |         |
| Academic background                | diploma or bachelor degree | 9 (60.0)                               | 4 (28.6)                                | 0.092   |
|                                    | postgraduate course(s)*    | 6 (40.0)                               | 10 (71.4)                               |         |
| Postgraduate courses in OR nursing | yes                        | 2 (6.9)                                | 1 (3.5)                                 | 0.527   |
|                                    | no                         | 13 (44.8)                              | 13 (44.8)                               |         |
| Professional experience            | ≤ 5 years                  | 8 (27.6)                               | 8 (27.6)                                | 0.566   |
|                                    | > 6 years                  | 7 (24.1)                               | 6 (20.7)                                |         |
| Work role                          | single                     | 8 (27.6)                               | 8 (27.6)                                | 0.566   |
|                                    | multiple                   | 7 (24.1)                               | 6 (20.7)                                |         |

\*Some participants attended more than one postgraduate course.

**Table 2: Aggregated PPCS–R domain scores and internal consistency**

| Domain                            | Mean score (M ± SD) | Cronbach's alpha |
|-----------------------------------|---------------------|------------------|
| Foundational knowledge and skills | 4.13 ± 0.63         | 0.89             |
| Leadership                        | 3.05 ± 0.94         | 0.85             |
| Collaboration                     | 3.34 ± 0.85         | 0.8              |
| Proficiency                       | 3.97 ± 0.90         | 0.85             |
| Empathy                           | 3.90 ± 1.20         | 0.89             |
| Professional development          | 3.93 ± 0.99         | 0.86             |

found between PPCS–R scores and participants' education level or type of work role (single vs multiple).

Based on the study's exploratory nature and the limited sample size, non-parametric tests were appropriately employed and no multivariate adjustments were conducted. Detailed item-level results by domain and subgroup are available in the supplement.

### Impact of experience and education

The analysis did not reveal statistically significant differences for most items when comparing results for undergraduate qualifications and postgraduate qualifications and results for postgraduate, OR-specific training and no such training. There were also no statistically significant differences found between performing a single role in the OR and performing multiple professional roles. However, statistically significant differences were found between less than or equal to five years and more than six years of professional experience in the five PPCS–R domains other than the 'empathy' domain ( $p = 0.34$ ). This highlights how experience can positively influence the perception of competence in specific areas, beyond formal university education alone.

## Discussion

This study explored the self-perceived competence of perioperative nurses working in two operating blocks in central Italy, using the PPCS–R. The results revealed a generally high perception of competence in domains related to technical knowledge and routine perioperative tasks; however, lower scores were reported in leadership, collaboration

and professional development. These findings align with those of Gillespie et al., who found that perioperative nurses often exhibit strong technical skills but may lack confidence in areas, such as leadership and conflict management, that require non-technical skills<sup>37</sup>.

The analysis highlighted that years of experience in the operating room significantly influenced perceived competence across five of the six PPCS–R domains, with 'empathy' being the only exception. Nurses with more than six years of experience had higher scores in areas such as leadership, proficiency and professional development. This trend underscores the value of accumulated clinical exposure in developing both technical and non-technical competence<sup>3</sup>. These results are consistent with Gillespie et al., who identified professional experience as a key predictor of self-perceived perioperative competence, particularly in high-pressure environments such as the OR<sup>3</sup>.

Interestingly, while no statistically significant differences were found based on education level or type of professional role, the data suggested a positive trend favouring nurses with postgraduate training. Participants with postgraduate academic education had a higher overall mean PPCS–R score than those with only a bachelor's degree (153.85 vs 137.16). Furthermore, those with specialised postgraduate training in operating room nursing showed the highest average scores (159.01). Although not statistically significant due to the sample size, these findings indicate that targeted educational pathways may enhance nurses' self-confidence and perceived competence. This observation is supported by Gillespie et al., who

argued that formal education, particularly when aligned with the clinical setting, strengthens nurses' abilities to manage complex situations and supports professional identity<sup>2</sup>.

Lower scores in the 'leadership' and 'collaboration' domains also draw attention to the importance of non-technical skills, such as communication, decision-making, situational awareness and teamwork. Mitchell and Flin<sup>5</sup> and Colagrossi et al.<sup>4</sup> emphasise that non-technical skills are essential for ensuring patient safety and effective team functioning in the OR. The relatively low scores in items related to conflict management and adaptation to different communication contexts suggest that these areas remain underdeveloped among perioperative nurses in the current study setting. This gap could be addressed through training programs focused on non-technical skills, which have been shown to improve both team performance and safety outcomes in surgical settings. In the Italian context, the implementation of tools such as the World Health Organization surgical safety checklist has already demonstrated positive effects on communication and team coordination in operating rooms<sup>8</sup>.

In light of the broader organisational setting, where structured and recognised postgraduate pathways in perioperative nursing remain limited, these findings carry important implications<sup>9</sup>. The observed impact of experience and the potential role of education in shaping competence underscore the need for healthcare institutions and academic bodies to invest in accessible, specialty-specific postgraduate training. Additionally, workplace-based strategies such as mentorship, interprofessional simulation and leadership workshops could be implemented to address the gap in non-technical skills and support nurses in transitioning from task-oriented roles to more autonomous and leadership-driven positions. While postgraduate education was correlated with higher PPCS–R scores in this study, the differences did not reach statistical significance. Therefore, tailored unit-based education and mentorship may be more immediately impactful.

## Limitations

A key limitation of this study is the small sample size ( $n = 29$ ), which restricted the ability to perform more complex statistical analyses such as multivariate testing. As a result, findings should be interpreted with caution and viewed as exploratory. Additionally, the study was limited to two operating blocks within a single healthcare organisation, which restricts the generalisability of the findings. The cross-sectional design also limits causal interpretations. Moreover, although trends were observed in relation to postgraduate education, the limited number of participants with formal OR-specific training may have influenced the lack of statistical significance. Future research with larger, more diverse samples is needed to confirm these trends and to explore the role of non-technical skills more comprehensively.

## Conclusion

This study contributes to the understanding of self-perceived competence among perioperative nurses and highlights the significant role of clinical experience in shaping professional confidence and capability. While formal education did not yield statistically significant differences, trends in the data suggest that postgraduate and specialty-specific training may still play a valuable role in developing competence, particularly in underdeveloped domains such as leadership and collaboration. Investments in both continuing education and targeted interventions to improve non-technical skills are essential to support the professional growth of perioperative nurses and enhance the safety and quality of care in operating room settings.

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