# CRITICAL CARE NURSES' SELF-ASSESSED PATIENT OBSERVATION SKILLS– A CROSS-SECTIONAL SURVEY STUDY

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## ABSTRACT

### Background

Observing a patient's clinical condition is an important responsibility of critical care nurses and an essential component of their competence. Critical care nurses' patient observation skills contribute to patient safety and quality of care. These observation skills have not been assessed or measured previously.

### Aim

The aim of this study was to measure the self-assessed level of critical care nurses' patient observation skills and to explore the factors associated with these skills.

### Study design

Multi-centre cross-sectional survey in Finland

**Methods**

The sample consisted of critical care nurses working at Finnish university hospitals. The data were collected between September 2017 and January 2018 using an instrument developed for the study—Patient Observation Skills in Critical Care Nursing (visual analogue scale 0–100). Descriptive and inferential statistics were used for analysing the data.

**Results**

A total of 372 critical care nurses (49%) responded. Finnish critical care nurses assessed their patient observation skills overall as excellent. The bio-physiologic foundation was assessed as good, whereas skills in using observation methods and skills in recognising the changing clinical condition were assessed as excellent. Education for special tasks in intensive care units, information searching in scientific journals, working experience in critical care nursing and critical care nurses' perception of critical care as a preferred field of nursing were factors promoting patient observation skills.

**Conclusions and relevance to clinical practice**

The study provided a novel instrument for measuring critical care nurses' patient observation skills. The instrument may be used as an assessment tool in clinical practice and education. Developing orientation and on-the-job training in intensive care units is essential in assuring critical care nurses' adequate patient observation skills. Patient observation skills could be developed during the nursing education by providing students with opportunities for clinical training and applying patient cases in virtual learning environments.

critical care nursing, patient observation, clinical skills, instrument development, survey

## INTRODUCTION

Critical care nurses (CCN) apply an extensive set of skills when observing a patient's clinical condition. They base their observations on their understanding of human needs and bio-physiologic functions, and they employ their observation skills both in clinical assessment and technical monitoring to recognise the changes in the clinical condition. Patient observation is an intrinsic element of nursing care, as CCNs constantly observe their patient's condition along with their other duties (XX, 2017).

Patient observation skills are part of CCNs' competence (Ääri *et al.*, 2008; EfCCNa, 2013; CCN3, 2015) and an essential factor in ensuring safety (Lavoie *et al.*, 2014; Kvande *et al.*, 2016; Jones and

Johnstone, 2017; Milhomme *et al.,* 2018) and well-being (Randen *et al.,* 2013) of a critically ill patient. Skilled patient observation even contributes to lowering intensive care mortality (Kelly *et al.,* 2014). Furthermore, CCNs' patient observation skills are important from the perspective of desired patient outcomes, as CCNs follow up the effects of therapeutic interventions (XX, 2017) and offer their observations in multidisciplinary decision-making (Kvande *et al.,* 2017).

Studies assessing CCNs' patient observation skills are relatively scarce. CCNs' activities in hemodynamic observation have been investigated, and novice and expert CCNs' observations have been compared (Currey and Botti, 2006; Hoffman *et al.,* 2009). Neonatal intensive care nurse trainees' patient observation skills related to the care of children with congenital heart disease were assessed in an educational intervention (Solberg *et al.,* 2012). There are some critical care nursing competence studies having dimensions relating to patient observation skills. The Nurse Competence Scale (NCS) (Meretoja *et al.,* 2004a) contains the dimension "diagnostic functions", ranging from good (Meretoja *et al.,* 2004b; Salonen *et al.,* 2007) to excellent (O´Leary, 2012). The Intensive and Critical Care Nursing Competence Scale (ICCN-CS-1) (Lakanmaa *et al.,* 2013a) includes items concerning skills in recognising and reacting to abnormal vital signs; and an instrument based on Australian College of Critical Care Nurses (ACCCN) competency standards (Fisher *at al.,* 2005) contains items concerning patient observation skills as well. However, patient observation skills did not constitute an independent dimension in those two instruments. In conclusion, previous studies had either a broader focus on skills or they focused on a certain aspect of observation.

Developing and measuring competencies are highly relevant issues in critical care nursing globally (Lakanmaa *et al.,* 2012; Williams *et al.,* 2015). Measuring competence as a broad concept is a complex task with many challenges (Franklin and Melville, 2015; Flinkman *et al.,* 2016); thus there is a need for focusing on concrete and contextual clinical skills (Windsor *et al.,* 2012). Measuring patient observation skills provides a concrete insight into CCNs' competence (Lakanmaa *et al.,* 2012), and information can be used in developing education and training.

## AIMS AND OBJECTIVES

The aim of this study was to measure the self-assessed level of CCNs' patient observation skills and to explore the factors associated with these skills. The following research questions were answered:

1. What is the self-assessed level of CCNs' patient observation skills?
2. What are the factors associated with the self-assessed level of CCNs' patient observation skills?

## METHODS

### Design

This was a multi-centre cross-sectional survey in Finland. All five Finnish university hospitals with seven mixed adult ICUs participated in the study, all taking care of the adult patients with various medical and surgical conditions. All voluntary registered nurses working in the ICUs (N=767) were eligible to participate in the study.

### Instrument

The Patient Observation Skills in Critical Care Nursing (POS-CCN) instrument was developed for the study due to the lack of instruments in the field. The instrument's theoretical structure and content were formulated based on a qualitative descriptive study (XX, 2017) and the prior literature (Currey and Botti, 2006; Hoffman *et al.,* 2009; Doig *et al.,* 2009; Haugdahl and Storli, 2012; Solberg *et al.,* 2012; EfCCNa, 2013; Karra *et al.,* 2014; Li *et al.,* 2014; CC3N, 2015; Kydonaki *et al.,* 2016). POS-CCN is a self-assessment test measuring CCNs' patient observation skills in three different dimensions: 1. Bio-physiologic foundation of observation, 2. Skills in using observation methods (2.1: technical methods, 2.2: non-technical methods), and 3. Skills in recognising the changing clinical condition. Furthermore, each dimension is divided into seven physiologic areas observed by CCNs: 1. Cardiovascular, 2. Respiratory, 3. Neurological, 4. Renal, 5. Gastrointestinal, 6. Metabolic and 7. Coagulation. CCNs' patient observation also covers psychological condition and patient comfort. However, POS-CCN was limited to physiological observation to keep it concise. Moreover, physiologic observation can be regarded as a foundational level of observation in the care of critically ill patients.

Self-assessment is a feasible and appropriate method providing CCNs with an opportunity for critical self-reflection (Cowan *et al.,* 2008). The items (n=63) were formulated as sentences demonstrating CCNs skills in different dimensions and physiologic areas (e.g., *I'm able to observe changes in a patient's cardiovascular system*). Assessment of skills takes place with a visual analogue scale (VAS) from 0 to 100, 0 designating *does not represent my skills at all* and 100 designating *does represent my skills very well*. The ratings can be divided into poor (0–20), fair (>20–40), average (>40–60), good (>60–80) and excellent (>80–100). VAS was chosen due to its potential sensitivity in recognising differences between respondents (DeVellis, 2012) and its suitability for measuring skills (Meretoja *et al,* 2004a).

POS-CCN's content validity was evaluated by eleven critical care nursing experts. They evaluated and rated the relevance of the items. The content validity index (CVI) for individual items (I-CVI) was calculated based on the ratings and for the whole instrument (S-CVI) by calculating the mean of the I-CVIs. I-CVIs ranged from 0.55 to 1.0, and items below the recommended minimum of 0.78 were excluded (n=7). The S-CVI for the instrument with remaining items was 0.96, which is considered to be excellent content validity (Polit and Beck, 2017).

The pre-test, in the form of paper and pencil, was executed to test the instrument's clarity and applicability, the item's distribution, and internal consistency. Convenience sampling (Polit and Beck, 2017) was used, and the instrument was delivered to CCNs (N=100) at two intensive care units. The response rate was 46% (n=46). The items' distributions for the sum variables were adequate, and Cronbach's alphas for sum variables referred to good internal consistency (0.86 to 0.92). POS-CCN contains 56 items: Bio-physiologic foundation of observation (14 items), Skills in using observation methods (28 items), and Skills in recognising the changing clinical condition (14 items).

**Data collection**

POS-CCN was delivered as a paper and pencil questionnaire containing background questions (September 2017–January 2018) by contact persons to all CCNs (N=767) working in Finnish intensive care units. Brief information sessions in ICUs were organised by the researcher, and written information was delivered to CCNs prior to the data collection. The CCNs were instructed to answer independently according to their individual perception. A paper and pencil format was chosen instead of electronic survey as CCNs may have limited access to computers during their working day making it less feasible option for them.

**Data analysis**

SPSS for Windows version 24 (IBM, Chicago, Illinois) was used to analyse the data. The descriptive statistics were used for sample characteristics. Cronbach's alpha statistics and item analysis were used to evaluate sum variables' internal consistency. Exploratory factor analysis with the maximum likelihood extraction method and oblique Promax rotation was used to evaluate construct validity. Exploratory factor analysis was chosen instead of confirmatory factor analysis because POS-CCN is in the early stage of development. Inferential statistics were chosen according to the conditions: independent samples t-test and Mann-Whitney U-test were used for comparing the two groups—one-way analysis of variance (ANOVA) with Tukey's method in post-hoc comparisons and the Kruskall-Wallis test for multiple group comparisons. Correlations between continuous variables were calculated with Pearson's and Spearman's correlations. Variables significantly associated with

patient observation skills in univariate analysis were included in a general linear model to identify the factors independently associated with patient observation skills.

The data from the participants who answered only background questions (n=4) were excluded from the data set. The sum variables were calculated from the cases that had at least 85% of items answered. The level of statistical significance was set at 0.05.

## ETHICAL AND RESEARCH APPROVALS

The study was conducted in accordance with the Declaration of Helsinki (World Medical Association, 2013). The study protocol was accepted by the ethics committee of the local university (the approval number 37/2016). The research permissions were granted by the hospitals. CCNs were informed about the confidentiality and voluntary participation in the cover letter of the questionnaire. CCNs returned the questionnaires in a closed envelope to a closed box, and they were not controlled when returning the questionnaire. No identifiable personal data were collected. Completing and returning the questionnaire was considered as a sign of informed consent.

## RESULTS

### Sample description

Altogether 372 CCNs returned the questionnaire, giving a response rate of 49%. Most of the CCNs were women (n=316, 87%) with a bachelor-level nursing degree (n=252, 66%; diploma level nurses, n=70, 19%). Their mean age was 39.8 years (SD 10.3) and mean working experience was 15.02 years (SD 9.76) in nursing and 11.77 years (SD 9.24) in critical care nursing. Four-fifths of the CCNs (n=296, 81%) had working experience in other fields of nursing—most commonly in surgical (n=129, 35%) and medical nursing (n=109, 30%). Furthermore, 40% of the CCNs (n=146) had worked in another ICU during their career.

Regarding educational background, 69% of CCNs (n=254) had completed a critical care nursing course and 71% (n=261) had completed a clinical placement in an ICU during their nursing education. Less than one-fifth of the CCNs (n=54, 15%) had completed continuing education in critical nursing (course with certificate); and furthermore, 61% (n=222) had education in patient observation and 48% (n=147) in clinical examination. 69% of CCNs (n=252) were educated in special tasks in an ICU, e.g. working as a member of a medical emergency team and performing renal replacement therapies. And 76% of them (n=276) had some special responsibilities in an ICU, e.g. mentoring students and working as a shift coordinator.

A clear majority of CCNs (n=347, 95%) search for information independently, most commonly from information databases (n=285, 78%), the hospital intranet (n=225, 62%) and professional journals (n=222, 61%). The mean score for critical care as a preferred field of nursing was 87.85 (SD 12.48, Min 23, Max 100), and the mean score for confidence in their own critical care nursing competence was 74.84 (SD 16.50, Min 3, Max 100).

**Self-assessed patient observation skills of critical care nurses**

Overall, 62% of CCNs assessed their skills in patient observation as excellent, 33% as good, 5% as average and 0.3% as fair (Table 1). Nobody assessed their patient observation skills as poor. Regarding the mean of the sum variables, the bio-physiologic foundation was assessed as good, while skills in using observation methods and skills in recognising the changing clinical condition were both assessed as excellent. (Table 1).

On the item level, the lowest scoring items in each sum variable were "understanding the normal function of the coagulation system" (mean 70.73, SD 19.84) in the bio-physiologic foundation, "observing EEG" (mean 47.91, SD 26.36) in skills in using observation methods, and "observing clinical interventions' effects on the coagulation system" (mean 73.24, SD 20.22) in skills in recognising the changing clinical condition.

**Factors associated with patient observation skills**

The factors associated with patient observation skills were: working experience, confidence in one's own critical care nursing competence, critical care as a preferred field of nursing, education for special tasks, and information searching in national scientific journals.

CCNs who had two to five years' working experience in critical care nursing (n=67) assessed their patient observation skills significantly better (Mean 78.26, SD 10.53, p=0.001) than CNNs who had a maximum of two years' experience (n=57, Mean 70.84, SD 13.40). A statistically significant difference (p =< 0.001) was also detected between CCNs with a maximum of five years' experience (n=124, Mean 74.85, SD 12.45) in critical care nursing and CCNs with more than five years' experience (n=238, Mean 85.59, SD 9.08). The length of working experience in nursing (r=0.43, p=< 0.001) and the length of working experience in critical care nursing (r=0.43, p=< 0.001) had a positive correlation with patient observation skills. The length of working experience in critical care nursing was identified as an independent factor associated with patient observation skills and all three sum variables. Furthermore, working experience in paramedic nursing was associated with bio-

physiologic foundation, and working experience in perioperative nursing was associated with skills in using observation methods (Table 2).

Confidence in one's own critical care nursing competence had a strong correlation (r=0.63, p=0.000) and critical care as a preferred field of nursing had a modest positive correlation (r=0.30, p=0.000) with patient observation skills. Critical care as a preferred field of nursing was independently associated with patient observation skills and all sum variables (Table 2).

Education for special tasks in the intensive care unit was independently associated with patient observation skills and all sum variables. Information searching in national scientific journals was independently associated with patient observation skills, as well as the sum variables' bio-physiologic foundation and skills in using observation methods (Table 2).

## DISCUSSION

This study aimed at measuring the level of self-assessed patient observation skills of CCNs using an instrument specifically developed for this purpose. Finnish CCNs self-assessed their patient observation skills as excellent. The skills were highest in using observation methods, especially non-technical observation methods. The bio-physiologic foundation of observation was assessed the lowest.

Some previous studies suggest that CCNs' use of observation methods is inadequate (Currey and Botti, 2006; Karra *et al.*, 2014). CNNs' self-assessment in the current study to some extent provides a contrary view regarding this dimension of observation skills. The CCNs were relatively experienced, and they may have embraced a very comprehensive approach to patient observation. On the other hand, the difference may be explained by the incongruence between self-assessment in the current study and non-participant observation in the previous study (Currey and Botti, 2006).

The bio-physiologic foundation of observation skills was assessed lower than other dimensions. Even though the scores are lower, they are still at the good level. However, this raises the question about the depth of patient observation, as the focus was specifically on physiologic observation. Therefore, it can be assumed that skills are based on a comprehensive bio-physiologic understanding. CCNs' patient observation—and moreover evaluating the reliability of observation and analysing observed information (XX, 2017) — may not be very thorough, if their bio-physiologic foundation is suboptimal. More objective assessment methods are needed to investigate the depth of the observation and CCNs' understanding of bio-physiologic functions.

Working experience in critical care nursing was strongly associated with patient observation skills. Even though the nurses with less than two years of critical care nursing experience assessed their patient observation skills as good, their skills were significantly lower compared to more experienced colleagues. According to Benner (1984), two to three years of working experience is required for a CCN to develop as competent. An excellent level of self-assessed patient observation skills was reached by the CCNs with more than five years' experience in critical care nursing. Referring to Benner's theory, they can be regarded as proficient in observing a patient's clinical condition. The acquisition of patient observation skills takes a relatively long time, and speeding up the learning process would be beneficial.

Graduating nursing students and new nurses entering an ICU need practice to develop their patient observation skills. Presumably clinical placement and orientation in an ICU are in a key role, but not all nursing students have the opportunity to practice in a real ICU environment. Almost one-third of the CCNs had not had a clinical placement in an ICU. Therefore, attention must be paid to way skills are developed prior to entering an ICU. This is especially an issue in Finland because there is no specializing post-graduate program in critical care nursing. This demands high quality and effective orientation programs in ICUs. In addition to clinical practice, patient observation skills could potentially be developed through experiential learning in virtual learning environments (Cant and Cooper, 2014) and gamification (Koivisto *et al.,* 2016).

Education for special tasks in the ICU was identified as a factor promoting patient observation skills, whereas education in patient observation and clinical examination was not. This reflects the very special nature of the skills and education CCNs need in their work. This raises concern over the quality of the education in patient observation and clinical examination in terms of critical care nursing. The education provided in the nursing programs may be too general to develop observation skills in critical care settings. Therefore, substantial requirements are imposed for orientation and on-the-job training and the demand for specialized education is justified. Evidently the role of education is crucial, but CCNs' own activities in keeping up their skills is important as well. This was proved as CCNs' independent information searching in national scientific journals was associated with better self-assessed patient observation skills.

**Methodological considerations**

The POS-CCN instrument was specifically developed for the study, and it showed excellent content validity. Regarding internal consistency, all sum variables had relatively high alpha values, ranging from 0.91 to 0.97. Item-to-total correlations ranged from 0.36 to 0.86, and inter-item correlation

ranged from 0.10 to 0.95. High Cronbach's alphas may be due to the relatively large number of items (56), whereas high inter-item correlations refer to the similarity between items. The number of the items can be reduced to 49 for the next version of POS-CCN by removing the items with the greatest similarity.

Exploratory factor analysis (EFA) turned out not to be very helpful in examining POS-CCN's construct validity. EFA provided alternative factorial structures for POS-CCN; however, they were not theoretically meaningful. This may be explained by the strong correlations between the items, which is rather typical when measuring skills and competencies (Meretoja *et al.,* 2004; Fisher *et al.,* 2005).

POS-CCN's sensitivity to detect differences between respondents' assessments turned out to be adequate. However, in future studies, more objective assessment methods should be combined with POS-CCN to gain a more reliable perspective on CCNs' observation skills.

## STRENGTHS AND LIMITATIONS

The major strength of the study is its novelty: this was the first study measuring CCNs' patient observation skills. Secondly, the data were collected nation-wide, covering all the university hospitals in the country, and there were responses from each of the seven ICUs. CCNs from different age groups and with different amounts of working experience were represented in the sample. The sample was relatively similar to a previous national survey among CCNs (Lakanmaa *et al.,* 2013a) in terms of age and working experience and therefore represented the population relatively well. The sample was large enough for conducting diverse statistical tests.

The first limitation of the study is the novel instrument that was used for the first time in the study. POS-CCN was structured on the basis of a descriptive study and the prior literature. However, the structure was not supported in EFA. Secondly, the response rate (49%) was moderate. More than half of the CCNs did not respond, and therefore the representativeness of the sample among Finnish CCNs is limited, resulting in limitations to the generalizability of the findings (Polit and Beck, 2017). The third limitation involves self-assessment as a method. Even though self-assessment is a recommended method for evaluating skills (Cowan *et al.,* 2008) and it can promote nurses' critical thinking (Kajander-Unkuri *et al.,* 2014), it does not come without limitations. There is some evidence of incongruence between self-assessment and more objective methods of assessment (Lakanmaa *et al.,* 2013b; Kajander-Unkuri *et al.,* 2016).

## IMPLICATIONS FOR PRACTICE, EDUCATION AND RESEARCH

In clinical practice, POS-CCN can be used as a tool for assuring CCNs' patient observation skills. POS-CCN provides a method for skills self- and peer-assessment. Furthermore, assessments can be used as a framework for development discussions and evaluating the progress of orientation. POS-CCNs dimensions "skills in using observation methods" and "skills in recognising the changing clinical condition" can be used as an observational tool for peer-assessment of CCNs' skills. On-the-job training should be developed and systematically provided to all nurses entering ICUs because education for special tasks promotes patient observation skills.

In nursing education, POS-CCN can be used as a self-assessment method in critical care nursing courses and during clinical placement in ICUs. Nursing students' patient observation skills may be promoted by applying patient cases in virtual learning environments, simulations and games. These solutions can offer students opportunities to train their patient observation skills through experiential learning. Assuring a sound bio-physiological foundation including a comprehensive physiologic and pathophysiologic understanding during the nursing education can be recommended.

POS-CCN should be tested in varied critical care settings such as specialized ICUs and in different countries. In addition to physiologic observation, other dimensions of observation like psychologic condition and patient comfort deserve notice as well. Patient observation skills should be assessed using objective methods like non-participant observation, and objective assessment and self-assessments should be compared. The knowledge base of patient observation should be studied as well. There is a need for developing and evaluating educational interventions such as games and orientation programs for learning patient observation skills.

## CONCLUSION

Finnish CCNs' self-assessed skills in observing a patient's clinical condition are excellent. ICU-specific education, independent activity in information searching, clinical experience in critical care nursing and CCN's perception of critical care as a preferred field of nursing promote patient observation skills. The CCNs were most confident in their skills in using observation methods, whereas bio-physiologic foundation was the lowest skill domain. The study provided a novel self-assessment instrument, POS-CCN, for measuring CCNs' patient observation skills.

What is known about the subject:

- Observing a critically ill patient's clinical condition is one of the most important duties and responsibilities of critical care nurses.
- Critical care nurses employ a wide set of skills in patient observation.
- Patient observation skills are an essential part of critical care nurses' competence, and they have a great importance in terms of patient safety and quality of care.

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Table 1. CCNs' self-assessed patient observation skills

| **CCNs' self-assessed patient observation skills (VAS 0–100, n = 361–363)** | | | | Excellent > 80–100 | | Good > 60–80 | | Average > 40–60 | | Fair > 20–40 | | Poor 0–20 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean (SD) | IQR | n | % | n | % | n | % | n | % | n | % |
| Total | Patient observation skills (56 items) | 81.91 (11.53) | 74.72 – 90.54 | 224 | 61.9 | 120 | 33.1 | 17 | 4.7 | 1 | 0.3 | 0 | 0 |
| 1. | Bio-physiologic foundation (14 items) | 78.59 (13.47) | 69.71 – 89.36 | 184 | 50.7 | 148 | 40.8 | 27 | 7.4 | 4 | 1.1 | 0 | 0 |
| 2. | Skills in using observation methods (28 items) | 83.35 (10.89) | 77.07 – 91.75 | 249 | 68.8 | 101 | 27.8 | 13 | 3.6 | 0 | 0 | 0 | 0 |
| *2.1.* | *Skills in using technical observation methods (14 items)* | *80.32 (11.90)* | *72.71 – 89.86* | *204* | *56.2* | *135* | *37.2* | *22* | *6.1* | *2* | *0.6* | *0* | *0* |
| *2.2.* | *Skills in using non-technical observation methods (14 items)* | *86.35 (10.62)* | *80.32 – 94.14* | *272* | *75.3* | *80* | *22.2* | *9* | *2.5* | *0* | *0* | *0* | *0* |
| 3. | Skills in recognising the changing clinical condition (14 items) | 82.36 (12.17) | 75.29 – 91.68 | 230 | 63.5 | 112 | 30.9 | 18 | 5.0 | 2 | 0.6 | 0 | 0 |

IQR = Interquartile range

Table 2. Independent factors associated with patient observation skills

| **Patient observation skills, total** ($R^2$ = 0.36, Adjusted $R^2$ = 0.34) Factor | | n | Adjusted mean (95% CI) | Adjusted Mean Difference (95% CI) or Adjusted β [95% CI] | Adjusted p |
|---|---|---|---|---|---|
| Education for special tasks | | | | | |
| | Yes | 239 | 87.04 (84.28 to 89.80) | 3.39 (1.03 to 5.74) | 0.005 |
| | No | 105 | 83.65 (80.40 to 86.90) | | |
| Information search from national scientific journals | | | | | |
| | Yes | 64 | 86.94 (83.68 to 90.20) | 3.19 (0.18 to 6.20) | 0.038 |
| | No | 280 | 83.75 (80.70 to 86.80) | | |
| The length of working experience in critical care nursing (years) | | 344 | | 0.41 [0.29 to 0.53] | <0.001 |
| Critical care as a preferred field of nursing (0–100) | | 344 | | 0.19 [0.11 to 0.27] | <0.001 |
| **Bio-physiologic foundation** ($R^2$ = 0.33, Adjusted $R^2$ = 0.31) Factor | | n | Adjusted mean (95% CI) | Adjusted Mean Difference (95% CI) or Adjusted β [95% CI] | Adjusted p |
| Education for special tasks | | | | | |
| | Yes | 241 | 84.55 (81.26 to 87.84) | 3.06 (0.24 to 5.87) | 0.034 |
| | No | 105 | 81.49 (77.61 to 85.38) | | |
| Working experience in paramedic nursing | | | | | |
| | Yes | 39 | 85.22 (80.89 to 89.56) | 4.41 (0.20 to 8.62) | 0.040 |
| | No | 307 | 80.81 (77.35 to 84.28) | | |
| Information searching in national scientific journals | | | | | |
| | Yes | 65 | 85.46 (81.57 to 89.35) | 4.88 (1.34 to 8.43) | 0.007 |
| | No | 281 | 80.58 (76.96 to 84.19) | | |
| The length of working experience in critical care nursing (years) | | 346 | | 0.45 [0.30 to 0.59] | <0.001 |
| Critical care as a preferred field of nursing (0–100) | | 346 | | 0.26 [0.13 to 0.32] | 0.000 |

**Skills in using observation methods** ($R^2$ = 0.34, Adjusted $R^2$ = 0.32)

| Factor | | n | Adjusted mean (95% CI) | Adjusted Mean Difference (95% CI) or adjusted β [95% CI] | Adjusted p |
|---|---|---|---|---|---|
| Education for special tasks | | | | | |
| | Yes | 239 | 89.25 (86.24 to 92.27) | 3.07 (0.80 to 5.34) | 0.008 |
| | No | 105 | 86.18 (82.63 to 89.74) | | |
| Working experience in perioperative nursing | | | | | |
| | Yes | 31 | 89.57 (85.33 to 93.81) | 3.70 (0.23 to 7.18) | 0.037 |
| | No | 314 | 85.87 (83.18 to 88.56) | | |
| The length of working experience in critical care nursing (years) | | 345 | | 0.37 [0.26 to 0.49] | <0.001 |
| Critical care as a preferred field of nursing (0–100) | | 345 | | 0.18 [0.09 to 0.26] | <0.001 |

**Skills in recognising a changing clinical condition** ($R^2$ = 0.36, Adjusted $R^2$ = 0.33)

| Factor | | n | Adjusted mean (95% CI) | Adjusted Mean Difference (95% CI) or Adjusted β [95% CI] | Adjusted p |
|---|---|---|---|---|---|
| Education for special tasks | | | | | |
| | Yes | 239 | 88.16 (84.79 to 91.53) | 4.01 (1.49 to 6.53) | 0.002 |
| | No | 105 | 84.15 (80.17 to 88.13) | | |
| Information search from national scientific journals | | | | | |
| | Yes | 64 | 87.95 (83.95 to 91.95) | 1.63 (0.38 to 6.81) | 0.028 |
| | No | 280 | 84.36 (80.73 to 87.99) | | |
| The length of working experience in critical care nursing (years) | | 344 | | 0.43 [0.30 to 0.56] | <0.001 |
| Critical care as a preferred field of nursing (0–100) | | 344 | | 0.18 [0.10 to 0.27] | <0.001 |

General linear model, adjusted for other factors included in the model, β=Regression Coefficient