



<http://www.diva-portal.org>

This is the published version of a paper published in *International Emergency Nursing*.

Citation for the original published paper (version of record):

Jansson, J., Eklund, A J., Larsson, M., Nilsson, J. (2020)
Prehospital care nurses' self reported competence: A cross-sectional study
International Emergency Nursing, 52: 1-7
<https://doi.org/10.1016/j.ienj.2020.100896>

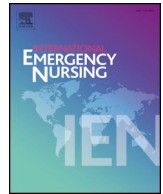
Access to the published version may require subscription.

N.B. When citing this work, cite the original published paper.

This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

Permanent link to this version:

<http://urn.kb.se/resolve?urn=urn:nbn:se:kau:diva-80743>



Prehospital care nurses' self reported competence: A cross-sectional study

Jörgen Jansson^{a,*}, Anna Josse Eklund^a, Maria Larsson^a, Jan Nilsson^{a,b}

^a Department of Health Sciences, Faculty of Health, Science, and Technology, Karlstad University, SE-651 88 Karlstad, Sweden

^b Department of Health Promotion Sciences, Sophiahemmet University, SE-114 86 Stockholm, Sweden

ARTICLE INFO

Keywords:

Ambulance service
ANC scale
Nurses
Professional competence
Research utilization

ABSTRACT

Background: The Swedish ambulance service has undergone major changes in recent decades due to advancements being made in medical and technical resources, professional competence, and patient care. Registered and specialist nurses share the same role, accountabilities, and responsibilities in the ambulance service, and their professional competence has not yet been evaluated.

Objectives: The aim of the study was to investigate and compare self-reported professional competence among nurses working in the ambulance service and to explore associations between potentially predictive background factors and self-reported professional competence.

Method: A cross-sectional study with a digital questionnaire was used for collecting data from 34 registered nurses and 71 specialist nurses. The Ambulance Nurse Competence Scale and the Research Utilization Questionnaire were used for data collection.

Results: Significant differences were found among the nursing categories in terms of age, gender, education, and work experience. Prehospital emergency nurses reported the highest professional competence. Nurses with a master's degree did not report significantly higher professional competence than nurses with a bachelor's degree.

Conclusions: The findings indicated that there are differences in the professional competence of registered nurses and specialist nurses. Length of work experience in the ambulance service is an important factor associated with higher professional competence.

1. Introduction

In recent decades, the Swedish ambulance service has undergone major changes and developments regarding care that can be provided at the scene, during transportation, and to patients with time-critical conditions[1]. These developments also require the adaptation of competence in the ambulance service. For almost two decades, the Swedish ambulance service has employed prehospital emergency nurses (PENs) who have passed a one-year postgraduate programme to become specialist nurses in prehospital care. Among other things, the PEN training programme includes aspects of clinical reasoning, critical thinking, decision making, and evidence-based practice, as well as the completion of a master's thesis. The Swedish National Association of Ambulance Nurses and the Swedish Society of Nursing [2] advocate that PENs' competence is the most relevant for the ambulance service, however, nurses with other specialisations (SNs) and registered nurses without a specialisation (RNs) are also employed in ambulance service positions. Studies have shown that higher competence among nurses is associated with improved quality of care[3,4]. However, there is a shortage of studies describing and comparing professional competence

among the different categories of nurses working in the Swedish ambulance service. It is of importance to know more about nurses' professional competence as further advancements in the ambulance service include adjusting appropriate competence to advanced roles and functions.

2. Background

Registered Nurses (RNs) have completed a general nursing program and are authorized by national regulatory authorities to engage in the general scope of nursing practice[5]. The content, duration, and level of nursing education can vary between countries. In Sweden, RNs must complete a three-year nursing programme resulting in a bachelor's degree.

The role and scope of practice of specialist nurses (SNs) is not easily defined[6] due to differing educational programmes throughout the world[7]. The International Council of Nurses (ICN) defines the "nurse specialist" as nurses prepared beyond the level of general RNs who are authorized to practice as specialists with advanced expertise in a specific branch of the nursing field[5]. SNs and advanced nursing roles

* Corresponding author.

E-mail address: jorgjans@kau.se (J. Jansson).

<https://doi.org/10.1016/j.ienj.2020.100896>

Received 12 February 2020; Received in revised form 22 June 2020; Accepted 1 July 2020

1755-599X/ © 2020 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

Table 1
Background data of registered nurses and specialist nurses in prehospital care.

Characteristics	Total n = 105	RNs n = 34	SNs n = 27	PENs n = 44	p
Age, mean (SD)	43,4 (9.29)	38,9 (9.29)	48,2 (7.78)	43.8 (8.70)	0.00
Gender n (%)					
Women	40 (38.1)	17 (51.5)	12 (44.4)	11 (25)	0.05
Men	64 (61.0)	16 (48.5)	15 (55.6)	33 (75)	
Academical degree n (%)					
Bachelor and under	49 (46.7)	33 (100)	9 (40.9)	7 (16.3)	0.00
Master (one year) and above	49 (46.7)	0 (50)	13 (59.1)	36 (83.7)	
Experience, mean (SD)					
Years as Registered Nurse	12.86 (7.40)	8.65 (6.69)	18.33 (6.69)	12.75 (5.89)	0.00
Years in ambulance service	8.15 (6.75)	4.30 (5.15)	11.44 (8.56)	9.10 (5.11)	0.00
Research Utilization mean (SD)					
Attitudes towards research	3.67 (0.63)	3.49 (0.69)	3.64 (0.62)	3.82 (0.57)	0.79
Availability and support to implement research findings	3.23 (0.54)	3.14 (0.45)	3.34 (0.53)	3.25 (0.61)	0.38
Research use in daily practice	3.19 (0.77)	3.10 (0.62)	3.14 (0.88)	3.29 (0.81)	0.54
Estimation of ambulance assignments, last year in %, mean (SD)					
Emergency assignments	23 (14.38)	24 (16.19)	28 (17.14)	20 (9.91)	0.09
Non-emergency assignments	51 (13.93)	50 (14.28)	47 (13.04)	54 (14.00)	0.20
Not ambulance assignments	26 (13.03)	26 (12.88)	25 (13.06)	26 (13.41)	0.96

RNs = Registered Nurses, SNs = Specialist Nurses (excluding PENs), and PENs = Prehospital Emergency Nurses.

Research Utilization Questionnaire response alternatives: strongly disagree (1), disagree (2), no opinion (3), agree (4) and strongly agree (5). P-values were measured using Pearson's Chi-Square and one-way ANOVA.

include aspects of clinical work, teaching, administration, research, and consultations [8]. In the Swedish context, SNs are normally required to complete at least a one-year specialist post-graduate nursing programme. The Swedish ambulance services employ PENs as well as RNs and various SNs, but distinct and pronounced differences in the scope of practice or nursing roles is lacking.

Nurses' professional competence as a concept has evolved over time. Benner [9] defined nursing skills as an ability to perform nursing actions with desired results under varying clinical circumstances. Benner also highlighted the importance of clinical experience for professional competence development. Several studies have later defined professional competence to include cognitive, affective, and psychomotor skills such as critical thinking and problem solving through the use of theoretical knowledge, values, and attitudes [10–14]. A holistic perspective on nursing competence is now more or less accepted [15,16]. In addition, today's professional competence in nursing also involves demands to provide evidence-based care [17,18], meaning that nurses use their professional knowledge and clinical experience together with the best available scientific evidence, to personalize the care provided to different patients [19]. Evidence-based care is also described as an approach for problem solving and an inherent motivation to use research evidence for clinical decision-making. Stetler & Caramanica [20] denote that the purpose of the evidence process can also be to understand, validate, enhance, or change practice. The evidence process therefore assumes that nurses continuously utilise research; that they search, review, evaluate, and apply research results in practice.

The increased level of professional competence implies that advancements have been made in Swedish ambulance care. Although Swedish universities have been educating PENs for almost 20 years and the amount of SNs, including PENs, employed by the ambulance services is greater than ever before, their professional competence has not been evaluated. Therefore, the aim of this study was to investigate and compare the self-reported professional competence of the various categories of nurses working in the ambulance service, and to explore associations between potential predictive background factors and self-reported professional competence.

3. Methods

3.1. Design and setting

A cross-sectional study was conducted between January and March 2019, and included three ambulance organisations located in central Sweden. The study included 33 ambulance stations with a total of 62 ground ambulances and nine single responders. In total, the organisations managed around 170 000 ambulance assignments a year.

3.2. Participants

All nurses (n = 500) working in the selected prehospital organisations were invited to participate. Emergency medical technicians were excluded. A total of 105 nurses participated by responding to a digital questionnaire, resulting in a response rate of 21%.

3.3. Data collection

Managers in the respective organisations assisted by supplying work specific e-mail addresses for the nurses. A letter with information about the study was sent to the nurses before they received the digital questionnaire. Before accessing the questionnaire, two mandatory questions had to be answered to ensure that the nurses had read the information and that they consented to participate. The digital questionnaire was distributed using the program Survey and Report. Three reminders were sent out during the study period.

3.4. Background characteristics

The respondents were asked for background data: age, gender, education, academic degree, work experience as a registered nurse, and work experience in the ambulance service. The respondents were also asked to estimate the previous year's distribution of ambulance calls (Table 1).

3.5. The ambulance nurse competence (ANC) scale

The Ambulance Nurse Competence (ANC) Scale, developed by Nilsson et al., [21], was used to measure competence. The scale consists of 43 items and is derived from the competence requirements for

Swedish prehospital emergency specialist nurses (Swedish Society of Nursing and Swedish Society of Ambulance Nurses, 2012). The ANC scale covers eight competence areas (CA): Nursing Care (8 items), Value-based Nursing Care (5 items), Medical Technical Care (5 items), Care Environments Emergency (4 items), Care Environments Serious Events (8 items), Leadership Management (3 items), Leadership and Supervision (4 items), and Research and Development (6 items). Self-reported competence for each item is graded on a 7-point Likert scale with response alternatives ranging from “to a very low degree” (1) to “to a very high degree” (7). Mean scores were calculated for all eight competence areas and transformed into a 1–100 scale, with a higher score indicating a higher self-reported competence. The ANC Scale has been systematically tested, with Cronbach’s alpha ranging from 0.71 to 0.88, with the exception of one competence area (Leadership) that was rated 0.54. An explorative factor analysis showed that the factor solution explained 59.2% of the total variance [21]. In the current study, internal consistency measured with Cronbach’s alpha was above 0.70 for all competence areas except Leadership Management (0.64) and Leadership and Supervision (0.65).

3.6. Research utilization questionnaire

To measure nurses’ willingness to provide evidence-based care, the Research Utilization Questionnaire (RUQ), developed by Champion & Leach [22], was used. The questionnaire consists of 29 items [23] covering three index areas: Attitudes toward research (12 items), Availability and support to implement research findings (8 items), and Research use in daily practice (9 items). The RUQ was developed for nurses and has been used in several studies [23,24]. A 5-point Likert scale (strongly disagree, partly disagree, no opinion, partly agree, and strongly agree) are the given response alternatives. The RUQ includes seven items with negative statements (items 1, 12, 13, 15, 16, 24, 29) that were reversed prior to data analysis. The indexes were calculated by adding the respondents’ scores and dividing the sum by the number of items included in the respective index area. Higher scores indicate a more positive attitude towards research and better availability and use of research. Cronbach’s alpha values measured by Wallin et al. [23] and Boström et al. [25] for the index areas were as follows: “Attitudes towards research” 0.88 and 0.89, “Availability and support to implement research findings” 0.75 and 0.51, and “Research use in daily practice” 0.84 and 0.88. In the current study, Cronbach’s alpha values were measured for the three index areas respectively: 0.86, 0.60, and 0.89. In this study, the RUQ indexes were used as background factors and as potential predictive factors in the regression analysis.

3.7. Data analysis

Statistical analyses were performed by using SPSS for Windows, version 25 (SPSS Inc., Chicago, IL, USA). The level of statistical significance (p) was set at 0.05. Parametrical statistics were used as the sum scores in the included instruments (competence areas and index), were measured, and no presentation at item level was displayed. Analysis was performed using chi-square, independent t -test, and one-way ANOVA. The post-hoc Tukey test was used to measure significant differences between more than two groups. Multiple linear regressions were conducted using a general linear model to assess possible associations between the level of Ambulance Nurse Competence, divided between the eight competence areas (dependent variables), and univariate significant predictive background factors.

The dichotomization of nurses’ ambulance service experience (≤ 3 years - > 3 years) and academic degree (\leq Bachelor - \geq Master) were based on practice in the Swedish ambulance service, development of clinical experience, and the Swedish education system for RNs (bachelor’s degree) and SNs (master’s degree). In the ambulance services, an individual assessment is usually made of nurses’ ability to work independently. Independently working nurses are normally judged able

to work together with inexperienced nurses (both as a nurse and as an emergency driver) after three to four years in the profession. Benner [9] placed the competent nurse in the middle, between the novice and the expert nurse. The competent nurse has about 2–3 years of clinical experience and is efficient, self-confident, and demonstrates the ability to solve problems analytically.

3.8. Ethical considerations

Ethical considerations according to the Helsinki Declaration were followed i.e. risks/ benefits, voluntariness, informed consent, and that no unauthorized person had access to the data [26]. The local ethical committee at Karlstad University reviewed and approved the study scheme (C2018/370).

4. Results

4.1. Characteristics of the nurses, research utilization, and ambulance assignments

The mean age of the 105 nurses who responded to the questionnaire was 43 years and 61.5% of them were men. All RNs had a bachelor’s degree, 59.1% of SNs and 83.7% of PENs had a one-year master’s degree. The SNs had the longest work experience as nurses, followed by PENs and then RNs. A similar pattern was found in terms of work experience in prehospital care. About a quarter (23.6%) of the ambulance assignments were estimated by the nurses to be emergency calls (Table 1).

Nurses holding a one-year master’s degree reported a significantly more positive attitude towards research than those holding a lower academic degree (not in Tables). Nurses’ self-reported research utilization ranged from 3.10 to 3.82 on a 5-point Likert scale. The mean scores for the total population, in the respective indexes, were 3.63, 3.24, and 3.18, but there were no significant differences found between nurse categories (Table 1).

4.2. Self-reported competence and background factors

Results from the ANC scale show that the respondents’ highest scores were found in Medical Technical Care and the lowest in Research and Development. In all competence areas, PENs scored higher than SNs and RNs (non-significant). Significant associations (post-hoc Tukey test, not included in Table) were found in Nursing Care between RNs and PENs ($p = 0.024$), in Medical Technical Care between RNs and PENs ($p = 0.032$), in Care Environments Serious Events between RNs and PENs ($p = 0.001$) and RNs and SNs ($p = 0.042$), and in Leadership and Supervision between RNs and PENs ($p = 0.038$). Significant associations were found in all competence areas except for Value-based Nursing Care and a minimum of three years of work experience in the ambulance service (Table 2).

4.3. Associations between the ANC scale competence areas and predictive factors

Associations between nurses ANC competence areas and background factors were explored using multiple linear regression analysis (Table 3). The findings showed that being a woman was positively associated with higher competence in the areas Nursing care and Value-based Nursing. Longer ambulance service experience was positively associated with higher competence in Medical Technical Care, Care Environments Emergency, Care Environments Serious Events, and Leadership Management. Availability and support to implement research findings was positively associated with higher competence in Care Environments Emergency, and research use in daily practice was positively associated with higher competence in Research and Development.

Table 2

Self-reported competence measured with ANC scale competence areas and categorized in gender, nurse categories, experience and academic degree.

	Nursing care	Value-based nursing care	Medical technical care	Care environment-emergency	Care environment-serious events	Leadership management	Leadership and supervision	Research and development
Gender, mean (SD)								
Women	81.91 (8.9)	73.21 (8.3)	88.28 (9.1)	84.34 (9.0)	76.54 (10.8)	74.76 (12.4)	77.95 (10.5)	64.17 (15.7)
Men	81.05 (9.2)	72.64 (11.5)	91.76 (8.1)	86.00 (8.9)	82.43 (10.8)	75.66 (10.9)	79.88 (11.2)	70.66 (17.8)
Ind. <i>t</i> -test	0.646	0.773	0.048	0.364	0.011	0.699	0.385	0.063
Nurse categories, mean (SD)								
RNs	78.72 (7.3)	70.18 (8.6)	87.53 (8.3)	82.67 (9.1)	74.67 (10.4)	72.44 (11.2)	75.87 (9.7)	61.69 (14.8)
SNs	80.49 (11.6)	72.31 (11.1)	90.44 (9.5)	85.71 (8.2)	81.50 (11.5)	76.01 (10.0)	78.17 (10.1)	70.63 (15.4)
PENs	84.15 (7.8)	75.17 (10.5)	92.52 (7.7)	87.16 (8.9)	83.84 (9.8)	77.27 (12.2)	81.98 (11.6)	70.93 (19.2)
ANOVA test	0.028	0.110	0.042	0.087	0.001	0.176	0.044	0.042
Experience ambulance service, mean (SD)								
≤ 3 years	78.84 (8.2)	70.27 (8.2)	86.58 (8.4)	82.36 (9.4)	72.41 (10.4)	70.27 (11.8)	75.44 (9.7)	62.87 (15.6)
> 3 years	82.62 (9.2)	74.03 (10.9)	92.18 (8.1)	86.70 (8.4)	83.88 (9.4)	77.80 (10.5)	80.65 (11.1)	70.15 (17.7)
Ind. <i>t</i> -test	0.048	0.086	0.002	0.020	0.000	0.001	0.024	0.039
Academical degree, mean (SD)								
Bachelor	79.72 (9.6)	71.06 (9.6)	89.52 (9.4)	83.85 (4.9)	79.30 (11.7)	74.80 (10.7)	78.57 (10.7)	67.01 (15.5)
≥ Master	83.11 (8.0)	74.04 (10.3)	90.76 (7.9)	85.94 (8.5)	81.13 (10.7)	75.70 (12.1)	79.96 (11.6)	68.20 (19.9)
Ind. <i>t</i> -test	0.066	0.153	0.490	0.259	0.438	0.704	0.541	0.744

RNs = Registered Nurses, SNs = Specialist Nurses (excluding PENs), and PENs = Prehospital Emergency Nurses.

A 7-point Likert scale, with response alternatives ranging from: “to a very low degree” (1) to “to a very high degree” (7) was used. In each competence area respondents scores were calculated, ranging from 1 to 100. A higher score indicates higher self-reported competence.

Statistical significant differences are indicated with bold figures.

5. Discussion

The Swedish ambulance service employs RNs and SNs (in the current study categorized as RNs, SNs, and PENs) who share the same role, accountabilities, and responsibilities. The aim of the study was to investigate and compare self-reported professional competence among nurses working in the ambulance service.

The findings indicate differences in self-reported professional competence between RNs, SNs and PENs. Nurses with more than three years of experience in the ambulance service scored significantly higher competence in seven out of eight competence areas. In the two competence areas Medical Technical Care and Care Environments Serious Events, men scored significantly higher than women. The analysis of associations between potentially predictive factors and the competence areas in the ANC scale disclosed positively significant associations in seven out of eight competence areas. The potential predictive factors were gender (Nursing Care and Value-based Nursing Care), ambulance service experience (Medical Technical Care, Care Environments Emergency, Care Environments Serious Events, and Leadership Management), Availability to implement research findings (Care Environments Emergency), and Research use in daily practice (Research and Development).

According to the findings, PENs reported the highest self-reported professional competence. However, the regression analysis showed that being a PEN was not associated with higher professional competence. PENs represented the nurse category with the highest level of education (84% had a one-year master's degree). A higher level of education has been found to improve cognitive skills[27,28], but the current findings showed no significant differences in professional competence between nurses with a bachelor's degree and nurses with a one-year master's degree. Evidence-based nursing involves a responsibility to integrate research in clinical care, which is a challenge described in other studies [29,30]. In the findings, research utilization was positively associated with higher competence in only two of the eight competence areas, indicating a limited impact from research utilization. Forsman et al. [31] found that low research utilization among nurses was associated with multiple factors at individual and organisational level i.e. role ambiguity, sufficient staffing, low work challenge, being male, and low student activity. Meijers et al. [32] described important factors associated to nurse's research utilization: nurse role, access to resources, organizational climate, support, time for research activities, and

provision for education. These factors were not specifically considered in this study, but several factors can be traced in the RUQ items. Further studies with focus on professional competence, research utilization, and associated factors are needed in the ambulance service.

The findings showed differences in gender, where men scored higher than women in the competence areas Medical Technical Care and Care Environments Serious Event. Nursing Care and Value-based Nursing Care together comprise more than one third of the items in the ANC scale and the linear regression revealed that being a woman was positively associated with higher competence in these areas. Studies on nursing students revealed similar patterns, where men reported higher scores in development and leadership areas while women reported higher scores in value-based nursing care[33]. Stereotypical self-perceptions could be a barrier for competence development and should be considered in nursing education as well as in the ambulance service. Alm Pfrunder et al. [34] and Castren et al. [35] found differences between men and women regarding pain management in prehospital settings in Sweden and Finland. The results were inconsistent, where men in the first study tended to administer pain medication more than women while men in the second study were more hesitant to administer pain medication. Prehospital studies investigating gender differences related to competence is otherwise lacking.

According to Benner [9], contextual work experience is a necessity for developing clinical competence. The findings indicated the importance of work experience and that competence also develops in ways other than formal education. The preconditions for developing professional competence in the ambulance service differs in some respects compared to hospital healthcare e.g. due to undefined scenes, major incidents, limited resources, space, and decision basis. In order to develop professional competencies, nurses need to be exposed to and reflect upon challenging situations specific to ambulance contexts[36]. Work experience may thereby be of greater importance for nurses in the ambulance service than for nurses in hospital care. Nurses with more than three years of experience reported significantly higher competence in seven of the eight competence areas than nurses with less experience. This finding could be interpreted as ambulance organizations providing a nourishing environment for professional competence development in the first years of professional life. As the delimitation of ambulance service experience (≤3 years and > 3 years) showed differences in self-reported professional competence, the findings also seem to support ambulance organisations' assessments of when nurses can work

Table 3

Multiple linear regression analysis of the associations between potential predictive background factors and competence areas in the ANC scale.

Competence Area 1: Nursing care ($R^2 = 0.214$, $n = 84$)					Competence Area 5: Care environment – serious events ($R^2 = 0.287$, $n = 83$)				
	B	Std error	p	95% CI		B	Std error	p	95% CI
Age (year)	0.146	0.125	0.243	−0.10 to 0.39	Age (year)	0.147	0.137	0.288	−0.13 to 0.42
Gender					Gender				
Man	−4.640	2.071	0.028	−8.77 to −0.51	Man	1.725	2.331	0.462	−2.92 to 6.37
Woman (reference)					Woman (reference)				
Ambulance service experience (years)	0.161	0.178	0.368	−0.19 to 0.52	Ambulance service experience (years)	0.462	0.199	0.023	0.07 to 0.86
Professional title/level of education					Professional title/level of education				
PEN	4.575	2.330	0.053	−0.07 to 9.22	PEN	3.752	2.657	0.162	−1.54 to 9.05
SN	−0.978	2.877	0.735	−6.71 to 4.75	SN	2.318	3.281	0.482	−4.22 to 8.86
RN (reference)					RN (reference)				
RUQ index					RUQ index				
Attitudes toward research	0.705	1.990	0.724	−3.26 to 4.67	Attitudes toward research	0.455	2.228	0.839	−3.98 to 4.90
Availability and support...	3.367	2.093	0.112	−0.80 to 7.54	Availability and support...	−0.579	2.323	0.804	−5.21 to 4.05
Research use in daily practice	−0.193	1.869	0.918	−3.92 to 3.53	Research use in daily practice	2.054	2.172	0.347	−2.27 to 6.38
Competence Area 2: Value-based nursing care ($R^2 = 0.275$, $n = 83$)					Competence Area 6: Leadership management ($R^2 = 0.235$, $n = 86$)				
	B	Std error	p	95% CI		B	Std error	p	95% CI
Age (year)	0.232	0.135	0.090	−0.04 to 0.50	Age (year)	−0.027	0.154	0.862	−0.33 to 0.28
Gender					Gender				
Man	−4.521	2.233	0.047	−8.97 to −0.07	Man	−3.040	2.585	0.243	−8.19 to 2.11
Woman (reference)					Woman (reference)				
Ambulance service experience (years)	0.120	0.192	0.533	−0.26 to 0.50	Ambulance service experience (years)	0.525	0.223	0.021	0.08 to 0.97
Professional title/level of education					Professional title/level of education				
PEN	3.258	2.529	0.202	−1.78 to 8.30	PEN	0.992	2.962	0.739	−4.91 to 6.89
SN	−1.423	3.105	0.648	−7.61 to 4.77	SN	−0.631	3.635	0.863	−7.87 to 6.61
RN (reference)					RN (reference)				
RUQ index					RUQ index				
Attitudes toward research	0.213	2.164	0.922	−4.10 to 4.52	Attitudes toward research	0.153	2.498	0.951	−4.82 to 5.13
Availability and support...	3.210	2.225	0.153	−1.23 to 7.64	Availability and support...	3.685	2.603	0.161	−1.50 to 8.87
Research use in daily practice	2.428	2.032	0.236	−1.62 to 6.48	Research use in daily practice	3.511	2.349	0.139	−1.17 to 8.19
Competence Area 3: Medical technical care ($R^2 = 0.236$, $n = 83$)					Competence Area 7: Leadership and supervision ($R^2 = 0.251$, $n = 86$)				
	B	Std error	p	95% CI		B	Std error	p	95% CI
Age (year)	0.010	0.109	0.927	−0.21 to 0.23	Age (year)	0.088	0.150	0.560	−0.21 to 0.39
Gender					Gender				
Man	1.003	1.847	0.589	−2.68 to 4.68	Man	−2.457	2.528	0.334	−7.49 to 2.58
Woman (reference)					Woman (reference)				
Ambulance service experience (years)	0.372	0.157	0.020	0.06 to 0.69	Ambulance service experience (years)	0.231	0.218	0.292	−0.20 to 0.67
Professional title/level of education					Professional title/level of education				
PEN	2.757	2.073	0.188	−1.37 to 6.89	PEN	2.151	2.862	0.455	−3.55 to 7.85
SN	0.841	2.549	0.742	−4.24 to 5.92	SN	−2.740	3.500	0.436	−9.71 to 4.23
RN (reference)					RN (reference)				
RUQ index					RUQ index				
Attitudes toward research	0.649	1.789	0.718	−2.92 to 4.22	Attitudes toward research	3.916	2.418	0.109	−0.90 to 8.73
Availability and support...	1.953	1.854	0.295	−1.74 to 5.65	Availability and support...	0.789	2.537	0.757	−4.26 to 5.84
Research use in daily practice	0.613	1.683	0.717	−2.74 to 3.97	Research use in daily practice	3.360	2.276	0.144	−1.17 to 7.89
Competence Area 4: Care environment – emergency ($R^2 = 0.214$, $n = 85$)					Competence Area 8: Research and development ($R^2 = 0.414$, $n = 85$)				
	B	Std error	p	95% CI		B	Std error	p	95% CI
Age (year)	0.111	0.119	0.352	−0.13 to 0.35	Age (year)	−0.013	0.213	0.952	−0.44 to 0.41
Gender					Gender				
Man	−1.569	2.021	0.440	−5.60 to 2.46	Man	1.101	3.563	0.758	−6.00 to 8.20
Woman (reference)					Woman (reference)				
Ambulance service experience (years)	0.357	0.173	0.042	0.13 to 0.70	Ambulance service experience (years)	0.351	0.309	0.260	−0.27 to 0.97
Professional title/level of education					Professional title/level of education				
PEN	2.124	2.269	0.352	−2.40 to 6.64	PEN	4.432	4.046	0.277	−3.63 to 12.49
SN	1.071	2.801	0.703	−4.51 to 6.65	SN	2.667	4.928	0.590	−7.15 to 12.48
RN (reference)					RN (reference)				
RUQ index					RUQ index				
Attitudes toward research	0.434	1.932	0.823	−3.41 to 4.28	Attitudes toward research	−0.102	3.476	0.977	−7.02 to 6.82
Availability and support...	4.069	2.033	0.049	0.02 to 8.12	Availability and support...	6.997	3.579	0.054	−0.13 to 14.13
Research use in daily practice	−0.826	1.818	0.651	−4.45 to 2.79	Research use in daily practice	9.838	3.231	0.003	3.40 to 16.27

RN = Registered Nurse, SN = Specialist Nurse (excluding PENs), and PEN = Prehospital Emergency Nurse

Statistical significant differences are indicated with bold figures.

independently.

Bohman et al. [37] studied differences in scope of practice between RNs and SNs. Based on qualitative interviews they found that even if there were no differences in role, accountability, and responsibilities, the level of nursing competence differed. They suggested using the novice-expert generalist-specialist continuum [38] as a future guide to

differentiate between RNs' and SNs' competence in emergency care. Like emergency care, ambulance care includes the assessment and treatment of all types of patients, based on the same protocols or guidelines, which makes it complicated to define and comprehend what specialist competence within this field comprises. In this study, the respondents were asked to estimate the ambulance assignments, and

approximately one quarter of the assignments were estimated as not being ambulance assignments at all, which possibly adds further layers of complexity to developing specialist competence. Other health care units or clinics often specialize in the treatment of a certain condition. With a broad ambulance assignment, even including assignments not defined as ambulance assignments by the nurses, the novice-expert generalist-specialist continuum could be used to further understand the implications of being a specialist nurse in the ambulance service.

5.1. Strengths and limitations

Professional competence among clinical nurses has not previously been evaluated in the Swedish ambulance service and an investigation and comparison of nurse categories, using validated instruments, is therefore of great importance.

The instruments used have been tested with satisfactory psychometrical properties[21,23,25]. The current study showed reliability and internal consistency was rated satisfactory to excellent, except for the competence areas Leadership Management and Leadership and Supervision on the ANC scale, which could be due to the limited number of items in these areas.

The study's low response rate (21%) and the small sample sizes represent the most important limitations on reliability. Others have also experienced low response rates[39] and continuous surveys for organisational feed-back, increased demand on the ambulance service, empirical studies from PEN students, and a comprehensive questionnaire may partially explain the low response rate in the current study. A number of nurses (n = 60) started but did not complete the questionnaire and were regarded as non-responders. All the nurses were approached through their respective ambulance stations' personnel e-mail lists, and due to parental or sick leave, part time employment, or other assignments, etcetera, all the nurses may not have had the chance to answer the questionnaire.

Based on data from two of three ambulance organisations, the target population characteristics were: mean age 40 years, men 55% and woman 45%, RNs 42%, SNs (not PEN) 9%, and PENs 57%. One organisation reported that 57% of their nursing staff had a bachelor's and 43% had a master's degree. Consequently, these data demonstrate that the target population was younger, included more women, PENs, and RNs and that fewer had a master's degree than in the study population, which may influence the generalizability of findings. However, the sample included three nurse categories, working in 33 ambulance stations, and their self-reported professional competence represents their own assessments.

Respondents in self-report studies need a certain degree of endurance, knowledge, and the ability to self-reflect and, as discussed by Forsman et al. [40] and Lauder et al. [41], self-assessments can be characterized by both over and under estimations. However, self-report methods of assessments are supported in literature[41]. Self-reported professional competence can be influenced by factors other than those considered in this study.

6. Conclusion

Length of work experience in the ambulance service was the most significant factor associated with higher professional competence. There were also significant differences in self-reported competence between the nurse categories studied. Further advancements of the ambulance service include adjusting appropriate competence to advanced roles and functions, to facilitate research utilization and ensure evidence-based care. Further studies based on larger populations, and taking a specific interest in how higher education influences research utilization and competence development, are needed.

Funding

This study was funded by Region Värmland County Council, Karlstad, Sweden as part of a doctoral project, with JJ as doctoral student, and AJE, ML, and JN as supervisors.

CRedit authorship contribution statement

Jörgen Jansson: Investigation, Writing - original draft, Writing - review & editing. **Anna Josse Eklund:** Supervision. **Maria Larsson:** Supervision. **Jan Nilsson:** Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

We are grateful to the managers of the prehospital organisations who facilitated the data collection and to all the nurses who participated in the study.

References

- [1] Skogvold S, Wiking L, Lindström V. Development of the prehospital emergency care, the registered nurse's role in the ambulance service – A Swedish perspective. *Emergency Medicine* 2015;6(1):1–6.
- [2] The Swedish National Association of Ambulance Nurses and The Swedish Society of Nursing. (2012). Kompetensbeskrivning – Legitimerad sjuksköterska med specialistsjuksköterskeexamen med inriktning mot ambulanssjukvård.
- [3] Blegen MA, Goode CJ, Park SH, Vaughn T, Spetz J. Baccalaureate education in nursing and patient outcomes. *J Nurs Adm* 2013;43(2):89–94.
- [4] Aiken LH, Sloane DM, Bruyneel L, Van den Heede K, Griffiths P, Busse R, et al. Nurse staffing and education and hospital mortality in nine European countries: A retrospective observational study. *Lancet* 2014;383(9931):1824–30.
- [5] ICN. ICN Framework of Competencies for the Nurse Specialist. International Council of Nurses: ICN Regulation Series; 2009.
- [6] Dury C, Hall C, Danand J-L, Mondoux J, Aguiar Barbieri-Figueiredo MC, Costa MAM, et al. Specialist nurse in Europe: education, regulation and role. *Int Nurs Rev* 2014;61:454–62.
- [7] Roussou E, Lacovou C, Georgiou L. Development of a structured on-site nursing program for training nurse specialists in rheumatology. *Rheumatol Int* 2012;32(6):1685–90.
- [8] Afara F. ICN framework of competencies for the nurse specialist. Geneva: International Council of Nurses; 2009.
- [9] Benner P. From novice to expert: Excellence and power in clinical nursing practice. Reading, MA: Addison-Wesley; 1984.
- [10] Girot EA. Assessment of competence in clinical practice – a review of the literature. *Nurse Educ Today* 1993;13:83–90.
- [11] Eraut M. Concepts of competence. *J Interprof Care* 1998;12(2):127–39.
- [12] Redfern S, Norman I, Calman L, Watson R, Murrells T. Assessing competence to practice in nursing: a review of the literature. *Research Papers in Education* 2002;17(1):51–77.
- [13] Watson R, Stimpson A, Topping A, Porock D. Clinical competence assessment in nursing: a systematic review of the literature. *J Adv Nurs* 2002;39(5):421–31.
- [14] Cowan DT, Norman I, Coopamah VP. Competence in nursing practice: A controversial concept – A focused review of literature. *Nurse Educ Today* 2005;25(5):355–62.
- [15] Cowan DT, Wilson-Barnett J, Norman IJ. A European survey of general nurses self assessment of competence. *Nurse Educ Today* 2007;25(355–362):7.
- [16] Black J, Allen D, Redfern L. Competencies in the context of entry-level registered nurse practice: a collaborative project in Canada. *Int Nurs Rev* 2008;55:171–8.
- [17] Cronewett L, Sherwood G, Barnsteiner J, Disch J, Johnson J, Mitchell P, et al. Quality and safety education for advanced nursing practice. *Nurs Outlook* 2007;57(6):338–48.
- [18] Cronewett L, Sherwood G, Pohl J, Barnsteiner J, Moore S, Sullivan DT, et al. Quality and safety education for nurses. *Nurs Outlook* 2009;55(3):122–31.
- [19] Fineout-Overholt E, Melnyk B, Schultz A. Transforming health care from the inside out: advancing evidence-based practice in the 21st century. *J Prof Nurs* 2005;21:335–44.
- [20] Stetler CB, Caramanica L. Evaluation of an evidence-based practice initiative: outcomes, strengths and limitations of a retrospective, conceptually-based approach. *Worldviews on Evidence-Based Nursing*, fourth quarter 2007:187–99.
- [21] Nilsson, J., Johansson, S., Nordström, G. & Wilde-Larsson, B. (2019). Development and Validation of the Ambulance Nurse Competence Scale. *Journal of Emergency*

Nursing 1-10 (Article in press).

- [22] Champion VL, Leach A. Variables related to research utilization in nursing: an empirical investigation. *J Adv Nurs* 1989;14:705–10.
- [23] Wallin L, Boström A-M, Wikblad K, Ewald U. Sustainability in changing clinical practice promotes evidence-based nursing care. *J Adv Nurs* 2003;41:509–18.
- [24] Boström AM, Nilsson Kajermo K, Nordström G, Wallin L. Registered nurses' use of research findings in the care of older people. *J Clin Nurs* 2008;18:1430–41.
- [25] Boström A-M, Wallin L, Nordström G. Research use in the care of older people: a survey among healthcare staff. *Int J Older People Nurs* 2006;1:131–40.
- [26] World Medical Association. World Medical Association Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects. *JAMA* 2013;310(20):2191–4.
- [27] Audet L-A, Bourgault P, Rochefort CM. Associations between nurse education and experience and the risk of mortality and adverse events in acute care hospitals: A systematic review of observational studies. *Int J Nurs Stud* 2018;80:128–46.
- [28] Jones T, Shaban RZ, Creedy DK. Practice standards for emergency nursing: an international review. *Australasian Emergency Nursing Journal* 2015;18:190–203.
- [29] Grant H, Stuhlmacher A, Bonte-Eley S. Overcoming barriers to research utilization and evidence-based practice among staff nurses. *Journal for Nurses in Staff Development* 2012;28(4):163–5.
- [30] Yoder LH, Kirkley D, McFall DC, Kirksey K, Stalbaum A, Sellers D. Staff nurses' use of research to facilitate evidence-based practice. *Am J Nurs* 2014;114(9):26–38.
- [31] Forsman H, Rudman A, Gustavsson P, Ehrenberg A, Wallin L. Nurses' research utilization two years after graduation—a national survey of associated individual, organizational, and educational factors. *Implementation Science* 2012;7(46):1–12.
- [32] Meijers JMM, Janssen MAP, Cummings GG, Wallin L, Estabrooks CA, Yg Halfens R. Assessing the relationships between contextual factors and research utilization in nursing: Systematic literature review. *J Adv Nurs* 2006;55(5):622–35.
- [33] Carlsson M. Self-reported competence in female and male nursing students in the light of theories of hegemonic masculinity and femininity. *J Adv Nurs* 2019;00:1–8.
- [34] Alm Pfrunder A, Falk A-C, Lindstrom V. Ambulance personnel's management of pain for patients with hip fractures; based on ambulance personnel's gender and years of experience. *International Journal of Orthopaedic and Trauma Nursing* 2017;27:23–7.
- [35] Castren M, Lindstrom V, Hagman Branzell J, Niemi-Murola L. Prehospital personnel's attitudes to pain management. *Scandinavian Journal of Pain* 2015;8:17–22.
- [36] Wihlborg J, Edgren G, Johansson A, Sivberg B. Reflective and collaborative skills enhances Ambulance nurses' competence – A study based on qualitative analysis of professional experiences. *International Emergency Nursing* 2017;32:20–7.
- [37] Boman E, Levy-Malmberg R, Fagerstrom L. Differences and similarities in scope of practice between registered nurses and nurse specialists in emergency care: an interview study. *Scand J Caring Sci* 2019:1–9.
- [38] Barton TD, Thome R, Hoptroff M. The nurse practitioner: redefining occupational boundaries? *Int J Nurs Stud* 1999;36:57–63.
- [39] Lozar Manfreda K, Bosnjak M, Berzelak J, Haas I, Vehovar V. Web surveys versus other survey modes. A meta-analysis comparing response rates. *International Journal of Market Research* 2008;50(1):79–104.
- [40] Forsman H, Jansson I, Leksell J, Lepp M, Sundin Andersson C, Engström M, et al. Clusters of competence: Relationship between self-reported professional competence and achievement on a national examination among graduating nursing students. *J Adv Nurs* 2019;00:1–10.
- [41] Lauder W, Watson W, Topping K, Holland K, Johnson M, Porter M, et al. An evaluation of fitness for practice curricula: self-efficacy, support and self-reported competence in preregistration student nurses and Midwives. *J Clin Nurs* 2008;17(4):1858–67.