

Nursing staff ratio and skill mix in Swedish emergency departments: A national cross-sectional benchmark study

Maria A. Amritzer RN, CNS (Emerg Care), PhD student^{1,2}  |
 Åsa Muntlin RN, CNS (Emerg Care), PhD, Associate Professor^{3,4,5}  |
 Lena M. Berg RN, PhD, Associate Senior Lecturer of Caring Sciences⁶  |
 Katarina E. Göransson RN, PhD, Associate Professor^{2,7} 

¹Emergency and Reparative Medicine Theme, Karolinska University Hospital Huddinge OO H, Stockholm, Sweden

²Department of Medicine, Karolinska Institutet, Stockholm, Sweden

³Department of Emergency Care and Internal Medicine, Uppsala University Hospital, Uppsala, Sweden

⁴Department of Medical Sciences/Clinical Epidemiology, Uppsala University, Uppsala University Hospital, Uppsala, Sweden

⁵Department of Public Health and Caring Sciences/Health Services Research, Uppsala University, Uppsala, Sweden

⁶School of Education, Health and Social Studies, Dalarna University, Falun, Sweden

⁷Emergency and Reparative Medicine Theme, Karolinska University Hospital, Stockholm, Sweden

Correspondence

Maria A. Amritzer, Karolinska University Hospital Huddinge OO H, Emergency and Reparative Medicine Theme, Hälsovägen 13, S-141 57 Huddinge, Stockholm, Sweden. Email: maria.amritzer@ki.se

Funding information

Uppsala University Hospital, Department of Emergency Care and Internal Medicine; Karolinska University Hospital, Emergency Medicine Function

Abstract

Aim: The aim of this study is to describe ratio and skill mix for nursing staff in Swedish emergency departments over a specific 24-h period.

Background: The link between number of patients per nursing staff and missed nursing care is well described within the in-hospital setting, showing association with negative outcomes such as increased mortality. Potential association within the emergency department setting is still unexplored.

Method: This is a national descriptive cross-sectional benchmark study.

Results: The majority ($n = 54$; 89%) of Swedish emergency departments participated. The patients-per-registered nurse ratio varied between the shifts, from 0.3 patients to 8.8 patients (mean 3.2). The variation of patients per licenced practical nurse varied, from 1.5 to 23.5 patients (mean 5.0). The average skill mix was constant at around 60% registered nurses and 40% licenced practical nurses.

Conclusion: The varying ratios for patient per registered nurse and licenced practical nurse in Swedish emergency departments are noteworthy. Furthermore, the patient flow and nursing staff numbers did not match one another, resulting in higher nursing staff ratios during the evening shift.

Implications for Nursing Management: Findings can be used to improve rosters in relation to crowding, to manage the challenging recruitment and retention situation for nursing staff and to improve patient safety.

KEYWORDS

emergency departments, nursing staff hospital, patient safety, registered nurse, workload

Maria A. Amritzer and Åsa Muntlin shared first authorship.

This is an open access article under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.

© 2021 The Authors. *Journal of Nursing Management* published by John Wiley & Sons Ltd.

1 | INTRODUCTION

The association between patients-per-registered nurse (RN) ratio (the amount of patients each RN tends to) and patient outcome at in-hospital wards is well documented (Lankshear et al., 2005). For example, one well-cited multicentre study including in-hospital wards at 300 hospitals in nine European countries identified that an increase in the workload of nurses by one patient (above a 6:1 ratio) increased the likelihood of inpatient hospital mortality by 7% (Aiken et al., 2014). The likelihood of death decreases by 7% with a 10% increase in bachelor degrees among the nurses (Aiken et al., 2014). Moreover, a study by Needleman et al. (2011) found a significant association between increased mortality in patients and locations where the number of RNs was below the estimated target level (Needleman et al., 2011).

Missed nursing care is believed to be a mediator of the association between patients-per-RN ratio and mortality at in-hospital wards, as the amount of missed nursing care is associated to the number of patients under one RN's care (Ball et al., 2014). Missed nursing care, also known as care left undone, is defined as any aspect of required patient care that is omitted (in part or in whole) or delayed (Kalisch et al., 2009). One study identified that a 10% increase in missed nursing care was associated with a 16% increase in the likelihood of 30-day inpatient mortality (Ball et al., 2018). Frequently found reasons for missed nursing care are lack of staffing, material resources and miscommunication (Kalisch & Xie, 2014). Another study, Ball et al. (2014) showed that when RNs reported lack of time, for example, when caring for six or more patients simultaneously, the level of missed nursing care increased.

The amount of missed nursing care does not decrease if surrounding functions, such as increase in support staff, because this care seems to be closely connected to the level of RNs (Ball et al., 2014, 2016; Griffiths et al., 2018). Support staff can have different competences and roles, such as being unregistered nurses/licenced practical nurses (LPNs), and deliver nursing care, although RNs are responsible for the provided nursing care. A literature review around skill mix (proportion of RNs to unregistered nurses, i.e., LPNs) at in-hospital wards favours a higher proportion of RNs to LPNs, as research indicates that RNs are the key group in achieving patient safety (Griffiths et al., 2014). A simultaneous low RN and support staff level is correlated with risk for patients (Needleman et al., 2020).

International studies and literature reviews state that crowding is a patient safety risk in the emergency department (ED) (af Ugglas et al., 2020; Berg et al., 2019; Morley et al., 2018; Rasouli et al., 2019). Crowding occurs when the identified need for emergency services exceeds available resources for patient care (American College of Emergency Physicians, 2019). The association between crowding and mortality has yet not been fully understood. Based on the knowledge that the amount of missed nursing care is associated with the number of patients under one RN's care (Ball et al., 2014), there is a reason to believe that missed nursing care might be a mediator between crowding and mortality. Research on patients-per-RN

ratios and skill mix, as well as their associations with patient safety outcomes, are to a large extent unexplored in the ED setting (Recio-Saucedo et al., 2015). One recently published study investigated staffing levels, among other things, at five prespecified time points during a 24-h period found an average of 2.6 patients per RN and 4.6 per LPN (Wretborn et al., 2020). Nelson et al. (2018) identified that higher levels of RN staffing in the ED were associated with better patient care experience ratings. ED length of stay also seems to be affected by the RN ratio, because time to diagnostic evaluation increased significantly when RNs cared for a higher number of patients (Shindul-Rothschild et al., 2017). Staffing decisions are complex, and there is no evidence to suggest that a ratio based solely on the number of patients is sufficient. Patient acuity, nursing experience and skill mix should also guide the staffing decisions (Wolf et al., 2017).

Therefore, it is important to continue to investigate patients-per-RN ratio in the EDs. We designed this study as a first step around understanding the association between ED crowding and mortality and based on the knowledge from in-hospital wards. Because information from EDs to a large extent is lacking in the scientific community, this study is aiming to describe ratio and skill mix for nursing staff in Swedish EDs over a specific 24-h period.

2 | METHODS

2.1 | Study design

This is a descriptive cross-sectional design utilizing a study protocol.

2.2 | Sample and setting

All Swedish hospital-based EDs ($N = 61$) were eligible for participation. These EDs are open every day, 24 h, and primarily see patients with somatic conditions. Some of the EDs included may also see paediatric patients and patients with mental health conditions. Exclusion criteria were single speciality emergency care clinics, children-only EDs and EDs not within a hospital.

Sweden, with a population of 10 million, is divided into municipalities and regional councils. The Swedish health care system is primarily tax funded, making health care accessible to all Swedish citizens (Swedish Institute, 2021). In the present study, we refer to the hospital categories used in the annual ranking of Swedish hospitals: university hospitals, mid-size hospitals (ED open 24/7 including maternity and obstetric care) and small hospitals (ED open 24/7 without maternity and obstetric care) (Dagens Medicin, 2020). Bedside staff at Swedish EDs consist primarily of physicians, RNs and LPNs. The RNs have a bachelor's degree in Nursing and are responsible for nursing care. RNs and physicians with specialist training in emergency nursing/emergency medicine are still rare, because these are fairly new specialties in Sweden. LPNs have a high school diploma and are assistants to physicians and RNs.

2.3 | Data collection

All EDs eligible for participation were contacted by telephone or email to inform them about the study, ask for verbal consent and identify a contact person (to fill out the study protocol). The initial contact was made with the head nurse or manager of the ED. They identified contact persons to fill out the protocol (often the nurse in charge of the shift). Prior to the data collection, the study protocol and written informed consent (to be signed and returned) was sent via email to the contacts at the study sites.

For data collection, a study-specific protocol (see Data S1) was designed by members of the Scientific Advisory Board at the Swedish Emergency Nurses Association (SENA), based on previous research on RN-to-patient ratios and a Swedish study around ED crowding (Wretborn et al., 2020). Prior to data collection, a pilot test was conducted, resulting in minor changes in the study protocol. The protocol comprised of two parts. Part A is composed of rows for 24 consecutive hours (from 07:00 on 16 September to 06:59 on the 17 September 2019), where the number of patients, RNs and LPNs, respectively, present at the ED at one time point for each hour was documented. Each time point was chosen by the person dedicated to fill out the protocol and could be any time during each 1-h interval. All RNs and LPNs on duty at the ED during the chosen time point were included, including those working in triage, resuscitation rooms and as charge nurses. Nursing staff with strictly administrative roles without patient contact or engagement in daily operations, staff under introduction and students were excluded. Part B covered data on ED characteristics such as type of hospital, annual number of patients, ordinary number of nursing staff per shift (day, evening and night shifts and staffing across shifts, e.g., special shifts from 16:00 to 02:00) and the organization's perception as to whether the patient level was representative on the day of the study.

2.4 | Data analysis

For data analysis, the hospitals were grouped into the three previously mentioned categories (Dagens Medicin, 2020). Hospitals with multiple sites were registered as separate hospitals. IBM SPSS Statistics 25 software was used to collate and analyse the data. Data were analysed through descriptive statistics analysis, and to enable comparison to previous research, mean and standard deviation (SD) were used to describe the central tendency. Also, minimum–maximum was presented, to further visualize the spread of data and facilitate clinical understanding. Means over time periods (24 h and different shifts) were calculated by adding total number of patients and dividing them by the total number of RNs or LPNs working during the same time period. Two hospitals did not have LPNs during night shift, and one did not have LPNs during evening shift, and those hospitals were therefore excluded in the patient per LPN calculations.

2.5 | Ethical considerations

Ethical approval was obtained from the regional Ethical Review Board in Stockholm (2019-02704), and the management staff of the EDs gave their written consent for the data to be collected. To ensure confidentiality, findings were presented on a group level.

3 | RESULTS

3.1 | Demographic data

A total of 89% ($n = 54$) of the hospital-based EDs in Sweden took part in this study. The hospitals were representative for the Swedish

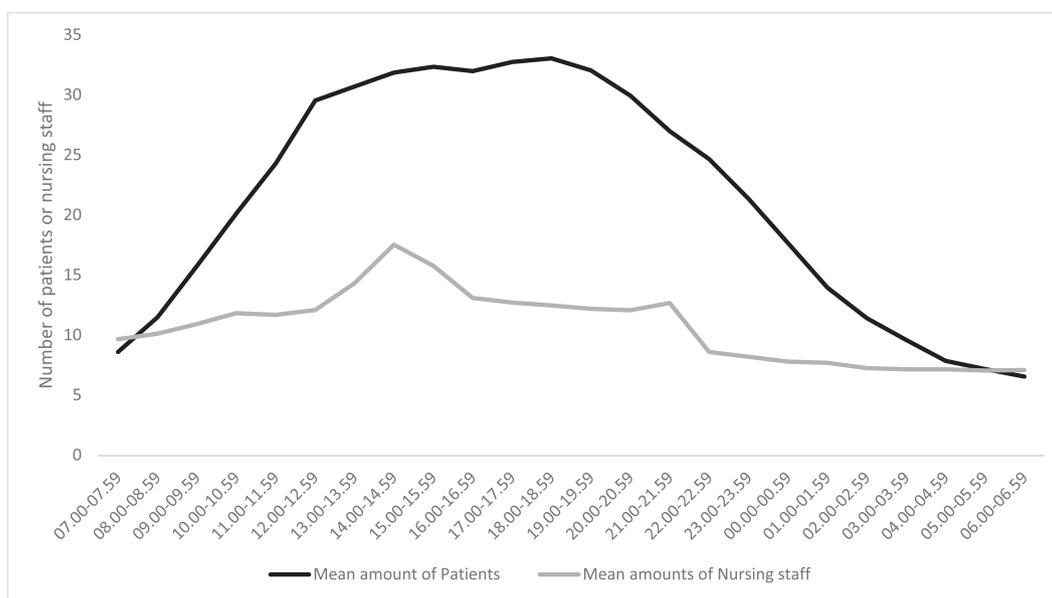


FIGURE 1 Mean number of patients and nursing staff (registered nurses and licenced practical nurses) in 54 Swedish emergency departments over a specific 24-h period

ED context with regard to hospital category as nine of 10 university hospitals, 30 of 34 mid-sized hospitals and 15 of 17 smaller hospitals took part. The EDs were geographically spread across the country, and the majority (94%, $n = 51$) were staffed by both RNs and LPNs while the remaining EDs limited nursing staff to RNs at some shifts. A total of 42 (76%) of the hospitals reported that they schedule RNs in special shifts to address patient flow patterns while special shifts for LPNs were applied by 26 (49%) hospitals. The majority of the hospitals reported the estimated level of patients in their ED as normal (28/54) or above normal (10/54), while about one third (16/54) estimated fewer patients than normal during the day of data collection. By hospital category, the university hospitals deviated from the others by reporting a higher proportion of normal level.

The patient flow during the 24-h study period is visualized in Figure 1. As seen, the highest number of patients present at the EDs occurs around lunch time until late evening where a decrease commences from around 20:00. Nursing staff also increase during the day but during the evening hours deviate from the patient pattern.

3.2 | Patients-per-nursing staff ratios in Swedish EDs

The pattern of ratios per nursing staff category was similar, and both patients-per-RN ratio and patients-per-LPN ratio peaked at three times during the 24-h period (Figure 2). On average, RNs cared for three patients per RN while LPNs cared for five (Table 1).

3.2.1 | Patients-per-RN ratios

Per shift, the highest patients-per-RN ratio was found during the evening shift regardless of category of hospital (Table 1). The ratios varied considerably within the shifts, even within each hospital category. For the evening shift, the largest range was found among the mid-sized hospitals where the ratio ranged from two patients per RN to nearly nine per RN.

Per hospital category, the smaller hospitals had the lowest ratios across the evening and night shifts as well as over the entire 24-h period. Smaller and mid-sized hospitals followed a common pattern with the lowest ratios during the night shift followed by the day shift while the university hospitals demonstrated an opposite pattern.

Patients-per-RN ratio varied across the 24-h period also on an hour-to-hour basis and not just on a shift level (Figure 3). The curve illustrates a lower patients-per-RN ratio during the early morning hours, with increasing ratio from around 10:00 and continuously high ratio until after midnight. As the shift changed from day to evening, around 13:00–15:00, the patients-per-RN ratio decreased as most hospitals have a double workforce in place for a number of hours.

3.2.2 | Patients-per-LPN ratios

Fifty-one of the included EDs (94%) scheduled for LPNs during the entire 24-h period. The patients-per-LPN ratios per shift were highest during the evening shift for each hospital type (Table 1). Like the RN ratio, it varied within the shifts, and largest variation was found during the evening shift where it ranged from two to

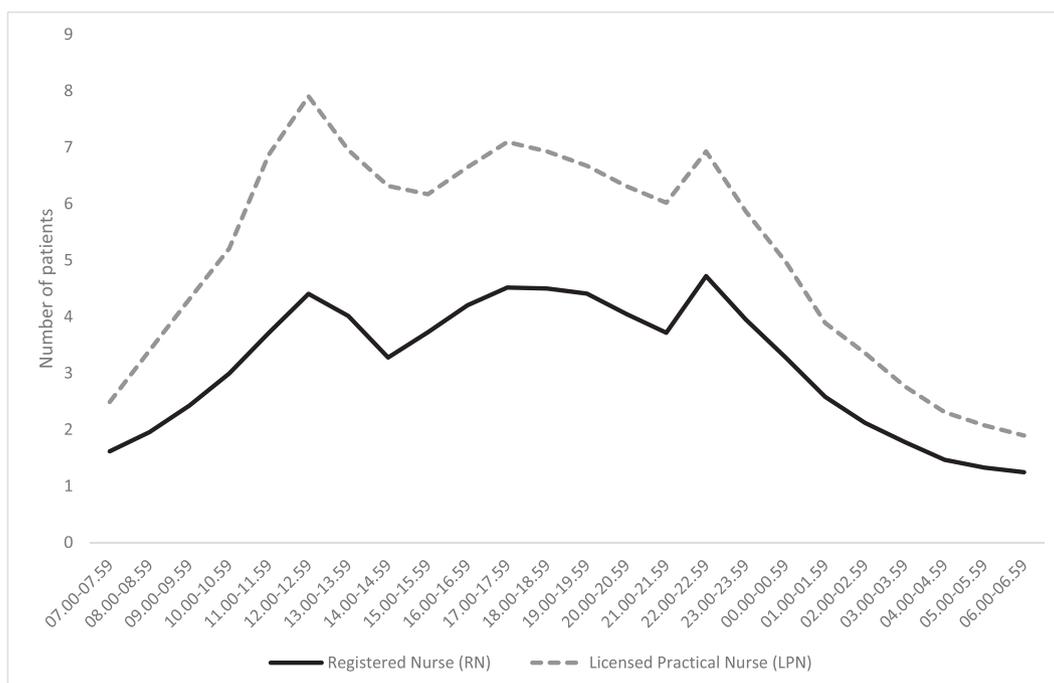


FIGURE 2 Patients-per-nursing staff ratio in Swedish emergency departments ($n = 54$) over a specific 24-h period

TABLE 1 Patients-per-nursing staff ratios in Swedish emergency departments, presented as an average ratio during a 24-h period and by shift

Average patients-per-RN/hospital category	All hospitals (n = 54)	University hospitals (n = 9)	Mid-size hospitals (n = 30)	Smaller hospitals (n = 15)
During 24 h				
Mean (SD, min-max)	3.2 (1.1, 1.0-6.1)	3.6 (1.3, 2.2-6.1)	3.3 (1.1, 1.9-5.9)	2.8 (1.1, 1.0-4.9)
During day shift ^a				
Mean (SD, min-max)	3.0 (1.0, 1.1-6.0)	3.1 (1.5, 1.8-6.0)	3.0 (0.8, 1.8-4.4)	3.1 (1.2, 1.1-6.0)
During evening shift ^a				
Mean (SD, min-max)	4.1 (1.5, 1.1-8.8)	4.3 (1.4, 3.0-7.6)	4.3 (1.7, 2.0-8.8)	3.4 (1.1, 1.1-5.3)
During night shift ^a				
Mean (SD, min-max)	2.6 (1.5, 0.3-6.5)	3.5 (1.4, 1.7-6.2)	2.8 (1.5, 0.4-6.5)	1.6 (0.9, 0.3-3.0)
Average patients-per-LPN/hospital category				
	All hospitals (n = 51)	University hospitals (n = 9)	Mid-size hospitals (n = 29)	Smaller hospitals (n = 13)
During 24 h				
Mean (SD, min-max)	5.0 (2.2, 1.5-11.9)	6.9 (2.4, 4.6-10.9)	4.8 (2.1, 2.3-11.9)	4.3 (1.8, 1.5-8.0)
During day shift ^a				
Mean (SD, min-max)	5.2 (3.5, 1.7-23.4)	7.5 (6.2, 3.2-23.4)	4.6 (2.4, 1.7-11.3)	5.1 (2.7, 1.7-10.6)
During evening shift ^a				
Mean (SD, min-max)	6.4 (3.3, 1.5-23.4)	8.8 (5.8, 4.7-23.36)	5.9 (2.2, 2.4-11.9)	5.5 (2.6, 1.5-11.8)
During night shift ^a				
Mean (SD, min-max)	3.9 (2.6, 0.7-13.1)	6.3 (1.7, 4.5-10.2)	3.9 (2.6, 0.9-13.1)	2.1 (1.3, 0.7-4.8)

Abbreviations: LPN, licenced practical nurse; RN, registered nurse; SD, standard deviation.

^aDay shift = 07:00-14:59, evening shift = 15:00-21:59 and night shift = 22:00-06:59.

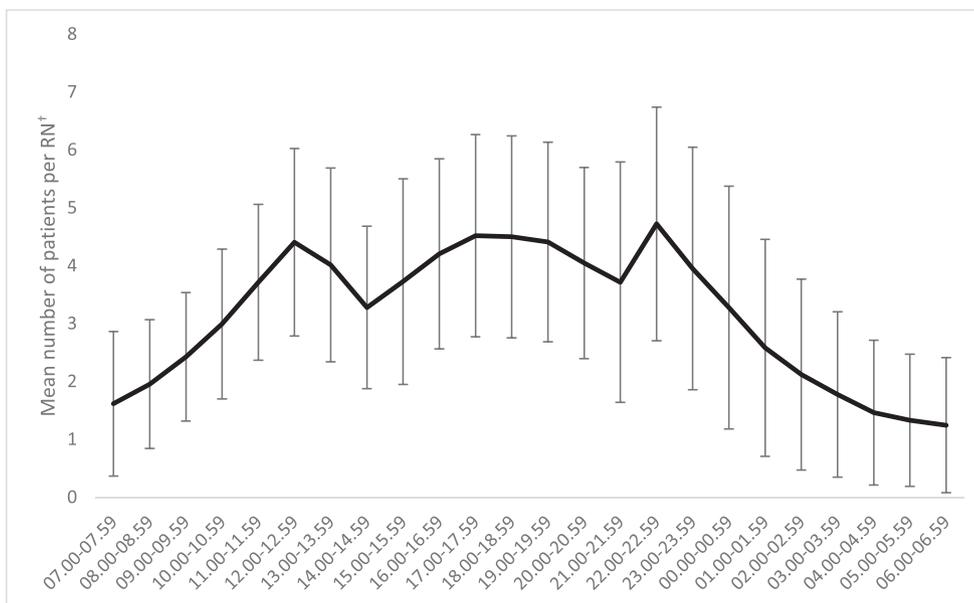


FIGURE 3 Patients-per-RN[†] ratio (including standard deviation) in Swedish emergency departments (n = 54) over a specific 24-h period. [†]Registered nurse

23 patients per LPN. Per hour, the ratios varied considerably, ranging from, for example, zero to 13 during early afternoon (14:00-14:59) (Figure 4). Highest patients-per-LPN ratio was found at the university hospitals. All hospital categories followed the pattern of lowest ratios during the night shift followed by day shift and the highest during the evening shift.

3.3 | Skill mix in Swedish EDs

The skill mix, that is, the proportion of RNs and LPNs reported, was close to constantly 60% RNs and 40% LPNs across the entire 24-h period. As illustrated in Figure 5, mid-sized hospitals had the lowest proportion of RNs.

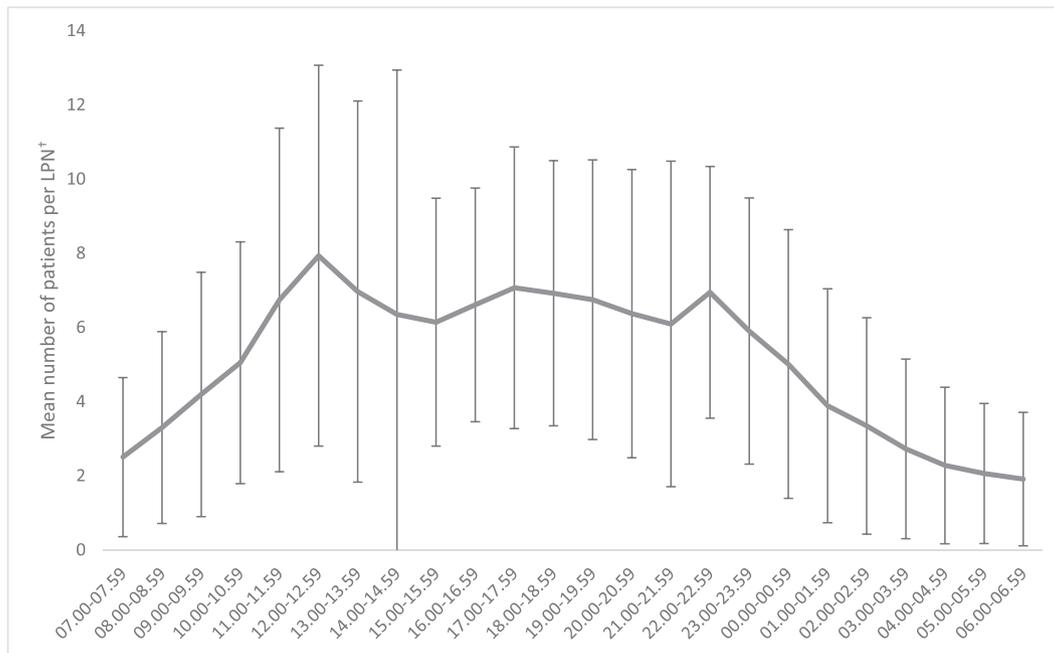
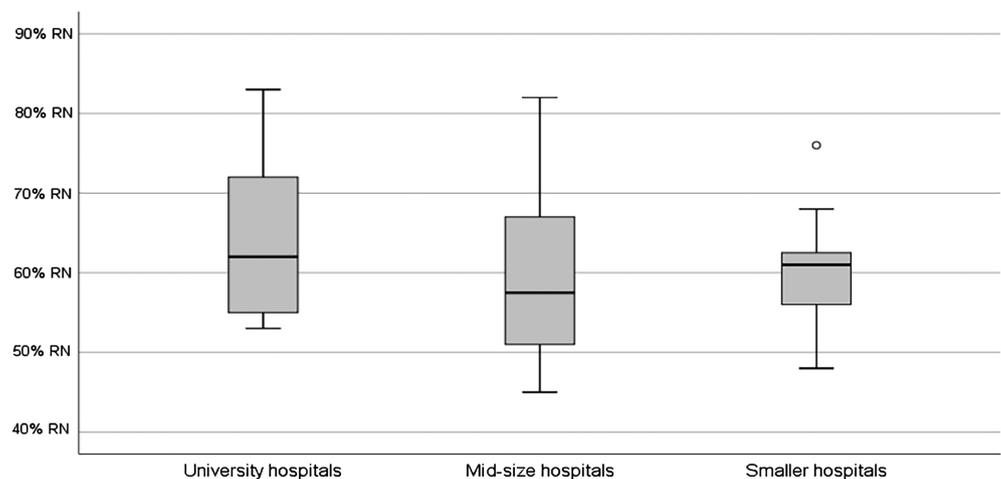


FIGURE 4 Patients-per-LPN[†] ratio (including standard deviation) in Swedish emergency departments ($n = 51$) over a specific 24-h period.
[†]Licensed practical nurse

FIGURE 5 Nursing staff skill mix per hospital type in Swedish emergency departments ($n = 54$) reported as proportion of registered nurses



4 | DISCUSSION

This study, one of few studies investigating patients-per-nursing staff ratios in the ED setting, showed that ratios varied largely across the types of hospitals and time of the day, with increased ratios during the evening shift regardless of the type of hospital. Main findings showed that ratios per nursing staff category peaked at three times during the 24-h period. However, the number of nursing staff did not match the flow of patients visiting the ED. The patients-per-RN ratios varied between the shifts, with a mean of 3.2. The ratio for patients per LPN varied even larger and had a mean of 5.0 patients. Also, these findings need to be further discussed in light of the presented skill mix at Swedish EDs, where the average nursing staff mix was 60% RNs and 40% LPNs regardless of time of day.

There is a lack of studies describing ED staffing and its impact on patient outcome (Recio-Saucedo et al., 2015), and comparisons with other studies and countries are therefore difficult to make. However, our findings can support evidence for the need to highlight patients-per-RN ratio to ensure a high nursing care quality, even within the ED field. We do know that there is an association between increased RN workload and in-hospital mortality (Aiken et al., 2014) and it is possible that a similar association occurs in the ED setting. More studies are needed to investigate the impact of nursing staff ratios on the direct patient care as it is known that in situations where RNs tend to have a high number of patients, the level of missed nursing care increases (Ball et al., 2014). Failure to rescue also increases, as does mortality among patients on in-hospital wards (Aiken et al., 2002; Lankshear et al., 2005). A recent study

supports the hypothesized link between a high number of RNs and better patient outcomes (Musy et al., 2021). To address the importance of RNs in the ED and the impact such care has on in-hospital mortality is still an unexplored area. Therefore, it would be interesting to investigate the level of missed nursing care in the ED context and the relationship between missed nursing care and the patients-per-RN ratio. To further understand missed nursing care within this context, patients-per-RN ratio and the amount of time spent at patient care should be studied.

Even though more than half of the included EDs reported that they had special shifts for RNs and LPNs to address the patient flow, our findings illuminated that the patients-per-nursing staff ratio did not match the patient flow. However, the lower ratio at night in EDs might be a direct reflection of the need for emergency preparedness, which needs to be considered 24/7. It would be worthwhile to study patient flow patterns in more detail, because these findings can support the development of systems for better scheduling of nurses in the ED. The number of patients is not the only decisive variable when organizing an appropriate roster—the workload and variations therein should also be considered (Wundavalli et al., 2019). Our study illuminated that a few of the included EDs did not schedule LPNs for evening and night shifts, which may have negative impact on present RNs' workload as they have to perform all nursing work tasks. We do not know the arguments for the variation in baseline rostering at the included EDs. Given that appropriate baseline staffing is necessary and higher baseline rosters have been shown to be more cost-effective, this needs to be further elaborated and evaluated within the ED context (Emergency Nurses Association, 2018; Griffiths et al., 2021; Needleman et al., 2011).

In order to fully address questions concerning an appropriate staffing of EDs, support staff and health care professionals within the team around the patient needs to be addressed better. Cunningham et al. (2019) showed that most studies use an intraprofessional perspective when studying nursing staff mix, where others used a more interprofessional perspective on this topic. The review highlights that skill mix should not be exclusive to the nursing profession (Cunningham et al., 2019). The present study included both RNs and LPNs as these two categories make up the majority of the staff in Swedish EDs. Within the Swedish context, there are some similarities between these two categories but more important to highlight some major differences, particularly regarding education and responsibilities. These differences and similarities need to be considered more in the further work around skill mix at EDs. The complexities around skill mix are addressed in a conceptual model for skill mix presented by Cunningham et al. (2019). The model demonstrates three dimensions of the concept (i.e., atomization, transversality of practice [intraprofessional] and transversality of practice [interprofessional]). The model addresses attributes of skill mix and various relationships between these attributes, which may support implications for practice. Twigg et al. (2019) also highlighted that there is an ambiguity in the definition of skill mix, which makes it difficult to evaluate the impact of changes in skill mix. Internationally, little is known about skill mix in EDs because there is a lack of research (Recio-Saucedo

et al., 2015). In order to get a comprehensive picture of appropriate skill mix in EDs, all areas of health care professionals (i.e. RNs, LPNs and physicians) ought to be researched. Skill mix in Swedish EDs is determined independently at each individual hospital, and its impact on patient outcomes has not been explored. The skill mix in this study, 60% RNs, is in line with previous skill mix studies from Swedish in-hospital wards (58%) (Aiken et al., 2013). However, the Organisation for Economic Co-operation and Development (OECD, 2019) report *Health at a Glance for 2019* shows that Sweden has few RNs compared with other OECD countries and especially compared with the Nordic countries. Given the large differences and variations in patient ratios in the present study, more research on this topic and how skill mix affects the provision of nursing care in EDs is warranted. A clear definition of skill mix and a deeper understanding of the term are necessary to enable managers to embrace the use of skill mix and implement it into clinical practice (Cunningham et al., 2019).

4.1 | Strengths and limitations

The present benchmark study has both strengths and limitations, and findings might be general to northern parts of Europe with similar health care systems. A strength of this study is that a large majority of the Swedish EDs took part (89%). This gives a good overview of the national situation. It was considered important to prioritize the response rate and provide a user-friendly study protocol, rather than undertaking an in-depth survey during this first step. A few of the potential participants declined participation as they had limited resources or were too busy with reorganization. However, the present study highlights that a more explorative study design regarding patients-per-nursing staff ratios and impact on provision of care is also needed. The choice of Monday as the day for data collection, usually seen as the busiest day in many EDs, could be questioned as not showing ratios representative to the entire week. But, given a usually busy day with a high number of patients, the number of nursing staff could be expected to be adjusted to this. This might be supported by the findings showing that majority of the EDs assessed the number of patients for the period as normal. Another limitation is that the exact time points between the hours could vary between the EDs. The present study shows the patients-per-nursing staff ratio for every hour, in contrast to Wretborn et al. (2020), who used only five prespecified time points during a 24-h period. No data loss was seen which strengthens the decided way of collecting data for each time point. The self-reporting way of collecting data was considered feasible, as EDs have different rostering systems and different working roles for the nursing staff. With more similar health record systems and rostering systems, routinely collected data could have been an option for this study. A good contact with the individual contact persons facilitated the data collection process.

A limiting factor regarding the ratios could be that only strictly administrative roles without any patient contact have been excluded. This means that the patients-per-nursing staff ratios may include

nursing staff that have additional tasks apart from working bedside such as operational management, responding to telephone calls, educational tasks or overseeing patient flow in the ED. Therefore, the actual number of nursing staff working bedside might be lower in some hospitals. However, reviewing each individual member of staff was not possible in the present study. In terms of being able to compare this study with international patients-per-RN ratios, this study is limited by the fact that it only included the number of patients, without linking it to triage levels, patient dependency, number of trauma patients or patients in need of resuscitation or critical care. Finally, as skill mix is more than just comparing different groups of staff, it would have been interesting to elaborate their experiences, education levels and functions. This was not possible given limited resources but important to address to add value to the evidence around skill mix and impact on the provision of safe and high-quality patient care in EDs.

5 | CONCLUSIONS

The wide variation of the patients-per-nursing staff ratios in Swedish EDs is noteworthy. Also, the nursing staff ratios did not align with the patient flow, resulting in higher nursing staff ratios during the evening shift. Further benchmarking to highlight appropriate patients-per-nursing staff ratios and skill mix in the ED setting is warranted to ensure the quality of nursing care and patient safety.

6 | IMPLICATIONS FOR NURSING MANAGEMENT

Findings can be used by nursing managers to consider the baseline staffing rates and support improvement of rosters in relation to ED crowding and time of day, to manage the challenging recruitment and retention situation for RNs and further to improve patient safety.

ACKNOWLEDGEMENTS

The authors are grateful for the valuable support provided by their points of contact for each emergency department included in the study. The study is funded by Karolinska University Hospital, Emergency Medicine Function and by Uppsala University Hospital, Department of Emergency Care and Internal Medicine.

ETHICS STATEMENT

Ethical approval was obtained from the regional Ethical Review Board in Stockholm (2019-02704).

CONFLICT OF INTEREST

There are no conflicts of interest.

DATA AVAILABILITY STATEMENT

Data are available on request due to privacy/ethical restrictions.

ORCID

Maria A. Amritzer  <https://orcid.org/0000-0003-4935-6086>

Åsa Muntlin  <https://orcid.org/0000-0002-7221-2876>

Lena M. Berg  <https://orcid.org/0000-0003-1815-799X>

Katarina E. Göransson  <https://orcid.org/0000-0002-4062-4470>

REFERENCES

- af Ugglas, B. D. T., Ljungman, P. L. S., & Holzmann, M. J. (2020). Emergency department crowding associated with increased 30-day mortality: A cohort study in Stockholm Region, Sweden, 2012 to 2016. *JACEP Open*, 2020, 1–8.
- Aiken, L. H., Clarke, S. P., Sloane, D. M., Sochalski, J., & Silber, J. H. (2002). Hospital nurse staffing and patient mortality, nurse burnout, and job dissatisfaction. *Jama*, 288(16), 1987–1993. <https://doi.org/10.1001/jama.288.16.1987>
- Aiken, L. H., Sloane, D. M., Bruyneel, L., Van den Heede, K., Griffiths, P., Busse, R., Diomidous, M., Kinnunen, J., Kozka, M., Lesaffre, E., McHugh, M. D., Moreno-Casbas, M. T., Rafferty, A. M., Schwendimann, R., Scott, P. A., Tishelman, C., van Achterberg, T., Sermeus, W., & RN4CAST consortium. (2014). Nurse staffing and education and hospital mortality in nine European countries: A retrospective observational study. *Lancet*, 383(9931), 1824–1830.
- Aiken, L. H., Sloane, D. M., Bruyneel, L., Van den Heede, K., Sermeus, W., & RN4CAST consortium. (2013). Nurses' reports of working conditions and hospital quality of care in 12 countries in Europe. *International Journal of Nursing Studies*, 50(2), 143–153.
- American College of Emergency Physicians. (2019). Crowding. Policy statement. In *Advancing emergency care*. ACEP.
- Ball, J. E., Bruyneel, L., Aiken, L. H., Sermeus, W., Sloane, D. M., Rafferty, A. M., Lindqvist, R., Tishelman, C., Griffiths, P., & RN4CAST consortium. (2018). Post-operative mortality, missed care and nurse staffing in nine countries: A cross-sectional study. *International Journal of Nursing Studies*, 78, 10–15. <https://doi.org/10.1016/j.ijnurstu.2017.08.004>
- Ball, J. E., Griffiths, P., Rafferty, A. M., Lindqvist, R., Murrells, T., & Tishelman, C. (2016). A cross-sectional study of 'care left undone' on nursing shifts in hospitals. *Journal of Advanced Nursing*, 72(9), 2086–2097. <https://doi.org/10.1111/jan.12976>
- Ball, J. E., Murrells, T., Rafferty, A. M., Morrow, E., & Griffiths, P. (2014). 'Care left undone' during nursing shifts: Associations with workload and perceived quality of care. *BMJ Quality & Safety*, 23(2), 116–125. <https://doi.org/10.1136/bmjqs-2012-001767>
- Berg, L. M., Ehrenberg, A., Florin, J., Ostergren, J., Discacciati, A., & Göransson, K. E. (2019). Associations between crowding and ten-day mortality among patients allocated lower triage acuity levels without need of acute hospital care on departure from the emergency department. *Annals of Emergency Medicine*, 74, 345–356. <https://doi.org/10.1016/j.annemergmed.2019.04.012>
- Cunningham, J., O'Toole, T., White, M., & Wells, J. S. G. (2019). Conceptualizing skill mix in nursing and health care: An analysis. *Journal of Nursing Management*, 27(2), 256–263. <https://doi.org/10.1111/jonm.12673>
- Dagens Medicin. (2020). Bästa sjukhuset - Topplistan.
- Emergency Nurses Association. (2018). Staffing and productivity in the emergency department.
- Griffiths, P., Ball, J., Drennan, J., James, L., Jones, J., Recio, A., & Simon, M. (2014). The association between patient safety outcomes and nurse/healthcare assistant skill mix and staffing levels & factors that may influence staffing requirements. (N.I.f.C.a.H.E. (NICE) ed.).
- Griffiths, P., Recio-Saucedo, A., Dall'Ora, C., Briggs, J., Maruotti, A., Meredith, P., Smith, G. B., Ball, J., & Missed Care Study Group. (2018). The association between nurse staffing and omissions in nursing care: A systematic review. *Journal of Advanced Nursing*, 74(7), 1474–1487. <https://doi.org/10.1111/jan.13564>

- Griffiths, P., Saville, C., Ball, J. E., Jones, J., Monks, T., & Safer Nursing Care Tool study team. (2021). Beyond ratios—Flexible and resilient nurse staffing options to deliver cost-effective hospital care and address staff shortages: A simulation and economic modelling study. *International Journal of Nursing Studies*, 117, 103901. <https://doi.org/10.1016/j.ijnurstu.2021.103901>
- Kalisch, B. J., Landstrom, G. L., & Hinshaw, A. S. (2009). Missed nursing care: A concept analysis. *Journal of Advanced Nursing*, 65(7), 1509–1517. <https://doi.org/10.1111/j.1365-2648.2009.05027.x>
- Kalisch, B. J., & Xie, B. (2014). Errors of omission: Missed nursing care. *Western Journal of Nursing Research*, 36(7), 875–890. <https://doi.org/10.1177/0193945914531859>
- Lankshear, A. J., Sheldon, T. A., & Maynard, A. (2005). Nurse staffing and healthcare outcomes—A systematic review of the international research evidence. *Advances in Nursing Science*, 28(2), 163–174. <https://doi.org/10.1097/00012272-200504000-00008>
- Morley, C., Unwin, M., Peterson, G. M., Stankovich, J., & Kinsman, L. (2018). Emergency department crowding: A systematic review of causes, consequences and solutions. *PLoS ONE*, 13(8), e0203316. <https://doi.org/10.1371/journal.pone.0203316>
- Musy, S. N., Endrich, O., Leichtle, A. B., Griffiths, P., Nakas, C. T., & Simon, M. (2021). The association between nurse staffing and inpatient mortality: A shift-level retrospective longitudinal study. *International Journal of Nursing Studies*, 120, 103950. <https://doi.org/10.1016/j.ijnurstu.2021.103950>
- Needleman, J., Buerhaus, P., Pankratz, V. S., Leibson, C. L., Stevens, S. R., & Harris, M. (2011). Nurse staffing and inpatient hospital mortality. *New England Journal of Medicine*, 364(11), 1037–1045. <https://doi.org/10.1056/NEJMsa1001025>
- Needleman, J., Liu, J., Shang, J., Larson, E. L., & Stone, P. W. (2020). Association of registered nurse and nursing support staffing with inpatient hospital mortality. *BMJ Quality & Safety*, 29, 10–18.
- Nelson, D., Hearld, L. R., & Wein, D. (2018). The impact of emergency department RN staffing on ED patient experience. *Journal of Emergency Nursing*, 44(4), 394–401. <https://doi.org/10.1016/j.jen.2018.01.001>
- OECD. (2019). Health at a Glance 2019—OECD Indicators. <https://www.oecd.org/health/health-at-a-glance-19991312.htm>
- Rasouli, H. R., Esfahani, A. A., Nobakht, M., Eskandari, M., Mahmoodi, S., Goodarzi, H., & Farajzadeh, M. A. (2019). Outcomes of crowding in emergency departments; a systematic review. *Archives of Academic Emergency Medicine*, 7(1), e52. <https://doi.org/10.22037/aaem.v7i1.332>
- Recio-Saucedo, A., Pope, C., Dall’Ora, C., Griffiths, P., Jones, J., Crouch, R., & Drennan, J. (2015). Safe staffing for nursing in emergency departments: Evidence review. *Emergency Medicine Journal*, 32(11), 888–894. <https://doi.org/10.1136/emmermed-2015-204936>
- Shindul-Rothschild, J., Read, C. Y., Stamp, K. D., & Flanagan, J. (2017). Nurse staffing and hospital characteristics predictive of time to diagnostic evaluation for patients in the emergency department. *Journal of Emergency Nursing*, 43(2), 138–144. <https://doi.org/10.1016/j.jen.2016.07.003>
- Swedish Institute. (2021). Healthcare in Sweden.
- Twigg, D. E., Kutzer, Y., Jacob, E., & Seaman, K. (2019). A quantitative systematic review of the association between nurse skill mix and nursing-sensitive patient outcomes in the acute care setting. *Journal of Advanced Nursing*, 75(12), 3404–3423. <https://doi.org/10.1111/jan.14194>
- Wolf, L. A., Perhats, C., Delao, A. M., Clark, P. R., & Moon, M. D. (2017). On the threshold of safety: A qualitative exploration of nurses’ perceptions of factors involved in safe staffing levels in emergency departments. *Journal of Emergency Nursing*, 43(2), 150–157. <https://doi.org/10.1016/j.jen.2016.09.003>
- Wretborn, J., Henricson, J., Ekelund, U., & Wilhelms, D. B. (2020). Prevalence of crowding, boarding and staffing levels in Swedish emergency departments—a National Cross Sectional Study. *BMC Emergency Medicine*, 20(1), 50. <https://doi.org/10.1186/s12873-020-00342-x>
- Wundavalli, L., Kumar, P., & Dutta, S. (2019). Workload indicators of staffing need as a tool to determine nurse staffing for a high volume academic Emergency Department: An observational study. *International Emergency Nursing*, 46, 100780.

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

How to cite this article: Amritzer MA, Muntlin Å, Berg LM, Göransson KE. Nursing staff ratio and skill mix in Swedish emergency departments: A national cross-sectional benchmark study. *J Nurs Manag*. 2021;29:2594–2602. <https://doi.org/10.1111/jonm.13424>