

# **Important factors for planning nurse staffing in the emergency department: A consensus study**

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## **HIGHLIGHTS**

- Nurse staffing in EDs requires the consideration of multiple factors to optimise staffing
- The complexity of EDs and contextual differences influences the way staffing should be done
- Staffing of ED's should be further investigated with specific focus on acuity and workload.

## **ABSTRACT**

**Introduction:** Planning adequate nurse staffing in the emergency department (ED) is challenging. Although there are models to determine nurse staffing in EDs, these models do not consider all the factors. Inadequate nurse staffing causes overcrowding, poor quality of patient care, increased hospital costs, poor patient outcomes and high levels of burnout amongst nurses. In this paper, we report stakeholders' perceptions of important factors to be considered when planning ED nursing ratios.

**Methods:** We applied a consensus research design. The data was generated from modified nominal group techniques followed by an e-Delphi with two rounds. The factors were generated during two nominal groups by 19 stakeholders which included management and healthcare professionals working in EDs. The generated factors were then put on a survey format for use in an e-Delphi. Using purposive and snowball sampling the survey was distributed to 74 national and international experts for consensus.

**Results:** Ultimately, 43 experts agreed (a validity index of  $\geq 80\%$ ) on four categories namely: hospital, staff, patient and additional categories which included 17 related factors.

**Conclusion:** Ideal nurse staffing ratios are influenced by the complexity of the environment and interactions between multiple factors. The categories and factors identified emphasised the need for extensive further research to ensure a financially

viable model that will be accepted by both staff and patient, and thus promote optimal outcomes.

**Key words:** emergency department, nurse patient ratio, nurse staffing, staff planning

## **INTRODUCTION**

Nursing staff, who represent the largest sector of the healthcare workforce, have a significant ability to influence the work environment, patient experience and overall quality of healthcare [1]. Ideal nurse staffing ratios play an important role in ensuring the optimal operation of healthcare systems. The American Nurses Association [2] maintains that appropriate staffing is needed to meet patient demands in a practical setting and refers to 'nurse-patient ratios', in which 'the number of nurses per number of patients or patient days determines staffing levels' [2].

Currently, nurse-patient ratios are determined with the aim of providing cost-effective, safe and quality patient care [3]. Two common types of models or combinations thereof are used to determine nurse staffing namely budget-based, and patient acuity [4]. Nurse staffing models do not always consider patient movement, minimum and maximum staffing levels, nursing activities required for quality of care and are often not specifically designed for the emergency department (ED) [4].

Emergency departments are unique and unpredictable environments and require a dynamic approach to staffing. Some EDs use staffing models based on historical patient data, while others apply trial and error methods [5]. Different staffing models are used in EDs for example the BEST model and NICE guidelines. The BEST model considers the number of patients presenting to the ED in combination with the patients' dependency on nursing care but not on their acuity [6]. The NICE staffing guideline for EDs systematically predicts the number of ED nursing care hours [7] and determines the hours of nursing time required, the needed staff skill mix and expected activities. Nurse staffing models sometimes consider seasonality, the staff availability, and their competencies as well as adequate resources, ancillary staff, structural and administrative capabilities of the hospital [8].

In any hospital or medical department, appropriate nurse staffing at any given time is associated with improved performance, especially reduced mortality rates, fewer complications, improved outcomes, shorter length of stay, decreased hospital costs and, most importantly, patient satisfaction [9, 10]. Appropriate nurse staffing is also associated with enhanced teamwork, autonomy, job satisfaction and a positive work environment [11]. Too few nursing staff are associated with overcrowding of patients, poor quality of care, increased hospital costs, increased litigation, and poor patient outcomes [7, 12]. For managers, having too few staff also causes mounted pressure and anxiety to deliver quality care, which is associated with mild to high levels of burnout [13]. Burnout is directly linked to nurses' intention to leave the profession.[14]. Managers should strive to achieve a balance between understaffing and overstaffing, despite constantly changing patient numbers, to assure high quality patient care and the satisfaction of nursing staff [15]. In EDs, patient numbers are constantly in flux, complicating the prediction of ideal staffing levels [5]. Evidently, there seems to be little consensus on the factors that should be considered when developing staffing ratios in EDs. There has been a marked increase in ED visits over recent years [16]. More patients are seeking care at EDs because they are sceptical about the ability of primary healthcare systems to manage their seemingly urgent problems [17]. Many patients with non-urgent problems may also choose to visit the ED if it is closer and more convenient for them [18]. The purpose of the article is to report the identified factors that are important when planning ED nursing ratios.

## **METHODS**

### **Study design**

We applied a consensus research design, using modified nominal group technique (NGT) and e-Delphi. The NGT is extensively used in conjunction with e-Delphi, especially in situations where there is a lack of concrete evidence on a specific topic [19]. The research was conducted in two steps: 1) Local generation of factors and 2) National and international consensus. All data was collected in English.

### **Ethical considerations**

The Faculty of Health Sciences Research Ethics Committee of the University of Pretoria (119/2018) approved the study. All participants were informed about the purpose of the study and data was collected following informed consent.

### **Step 1: Local generation of factors**

The participants included stakeholders involved with nurse staffing in two EDs from a private hospital group in the Gauteng province of South Africa. Potential participants were included from top and middle management, human resources, professional nurses working in EDs and patients visiting the ED. We purposefully selected participants based upon their knowledge and experience [20].

#### ***Data collection and analysis***

We conducted a consensus study between June - November 2018. The NGT generates high-quality ideas since each participant has an equal opportunity to voice their ideas and produces more unique ideas than Delphi groups [21, 22]. The process was completed in 4 stages [23]. The facilitator introduced and explained the study and NGT procedure. Participants had 10 minutes to quietly consider and write down their ideas on the factors that influence nurse staffing ratios in the ED. The participants then shared their ideas in a round robin, and the ideas were recorded on a flip chart. The process was repeated until no new factors emerged from the group, and all factors were then discussed for clarification. No ranking of the ideas were done. The data was themed by the participants (N=19) into categories and factors. The data from both NGTs was integrated and utilised for the e-Delphi survey for Step 2.

### **Step 2: National and international consensus on factors**

We included national and international experts involved in nurse staffing of EDs from a clinical or research background. We used purposive and snowball sampling to identify experts that complied with the inclusion criteria as suggested by Junger et al (24) 5 years or more experience, and 2) who were experienced in the ED environment, 3) human and financial resource structures and/or who had published regarding nurse staffing in the ED in the past three years (N=74). Two e-Delphi rounds were conducted with the same experts during the period of 10th September to 15th November 2018.

#### ***Data collection and analysis***

Data collected using an e-Delphi to improve data collection efficiency [25]. E-Delphi is convenient, and saves time and costs, especially when participants are widely dispersed [26]. In the first round we emailed the identified experts (N=74), informing them of the research and inviting them to participate. Once the experts volunteered to

participate, they received a demographic information sheet accompanied by a survey that included the locally generated categories and factors identified during the modified NGTs. The experts were asked to independently rate the relevance of the categories and factors using a four-point Likert Scale ranging between 'strongly disagree' and 'strongly agree'. Each item had a space where experts could comment. Once completed, the experts returned the survey by e-mail. Feedback remained anonymous and was analysed by all authors. All the identified experts (N=74) were contacted for the second round of the e-Delphi which followed the same process. We used the Validity Index (I-CVI) to assess the extent of expert agreement on the relevance of items. The I-CVI has the advantage of providing an item-level score [27, 28]. Prior to data analysis we agreed that a Validity Index (I-CVI) of  $\geq 80\%$  per item by the experts indicated consensus [27]. Table 1.

### **Rigour**

Meaningful coherence was achieved as the methods and procedures fitted the purpose of the study. The authors provided a thick description and concrete detail of the research process, providing transparency regarding the methods and challenges [29]. Data triangulation, as well as regular peer debriefing sessions amongst authors enhanced the credibility of the study [30]. The I-CVI was used to enhance the validity and reliability of the findings as an I-CVI of  $\geq 80\%$  in a panel of 10 or more respondents indicates a strong agreement between participants [27].

## **RESULTS**

### **Step 1: Local generation of factors**

The first NGT comprised of 11 participants, including a unit manager, a nursing standard manager, eight registered nurses and one medical doctor. The second NGT included eight participants, comprising two nursing managers, a unit manager, four registered nurses and a medical doctor. The NGTs comprised a total of 19 participants, with an average of 12 ( $\pm 9$ ) years' experience. Following integration of data, stakeholders identified four distinct categories and related factors to be considered during nurse staffing in the ED, namely: hospital, staff, patient and additional categories.

**Table 1: Demographic profile of experts who completed an e-Delphi evaluating which factors are important when considering nursing staff ratios in emergency departments (ED).**

Variable	Count (%) (N=43)
Professional qualification	
Registered nurse (national)	30 (70)
Registered nurse (international)	7 (16)
Medical doctor (national)	6 (14)
Medical doctor (international)	0
Level of employment	
Unit manager	6 (13.9)
Nursing service manager	5 (11.6)
Clinical training specialist	2 (4.7)
Clinical nurse	24 (55.8)
Medical doctor	6 (14)
Post-graduate qualification in emergency care	
Yes	18 (41.9)
No	25 (58.1)
Years of experience in ED	
A minimum of 5 years	13 (30.2)
6 to 10 years	20 (46.5)
11 to 15 years	4 (9.3)
16 to 19 years	3 (7)
20 years or more	3 (7)

## **Step 2: National and international consensus on factors**

The e-Delphi included 43 participants: international (n=5) [Australia, New Zealand, United States of America, United Kingdom and Canada], greater Africa (n=2) [Kenya and Botswana] and South Africa (n=37). Additional qualifications reported by the participants included nursing management (n=1), critical care nursing (n=1), nursing education and training (n=1), master's degree in clinical nursing (n=1) and nursing quality management (n=1).

During the first round of the e-Delphi, experts agreed on 17 of the 19 locally generated factors (I-CVI  $\geq$  80%) identified by stakeholders as being important when calculating nurse staffing for the ED. The experts did not add any new factors to the survey. Since the response rate for the first round was 19% (n=14), we decided to do a second

round. This resulted in an increased response rate of 57% (n=43). All 19 factors were included in the second round.

The second round utilised a two-point Likert scale: “Disagree” and “Agree”. Surveys were sent out electronically to 74 participants, including those from the first round. During the second round, experts did not reach the predetermined level of agreement on two factors, namely, ‘Patient expectation levels’ (72%) and ‘Use of electronic documentation’ (70%) (Table 2). We did not conduct a third round as there was minor differences between the level of agreement in the first and second rounds (Table 2).

**Table 2: Stakeholders and experts’ perceptions of important factors to consider for nurse staffing in an emergency department (ED). The relevance (I-CVI) indicates agreement between locally generated factors (NGTs) and expert opinion (e-Delphi, Round 1 and Round 2).**

Categories	Factors	Likert scale Relevance (I-CVI)	
		Round 1 (n=19)	Round 2 (n=43)
Hospital factors	Geographical setting and accessibility	86	88
	Level of the ED	93	100
	Specialist services	100	88
	Ancillary services	86	91
	Physical layout	93	91
	Events taking place around the hospital	93	95
Staff factors	Skill mix	100	100
	Staff qualification	100	100
	Staff competency	100	100
	Set nurse patient ratio	93	88
	Staff resilience and burnout	79	91
Patient factors	Patient acuity	93	95
	Patient volumes	100	100
	Care required	100	100
	Length of stay	93	100
	Patient expectation level	64	72
Additional factors	Unpredictability in the ED	100	100
	Number of doctors	100	95
	Relationships with EMS	86	86
	Use of electronic documentation	71	70

## DISCUSSION

Nurses represent the largest group of workers in the ED and are responsible for the majority of the patient care. In this study, stakeholders identified important factors to consider when planning nurse staffing in the ED. The ED is characterised by continuously fluctuating patient numbers and is a demanding environment to plan for. Inadequate nurse staffing levels have been linked to excess mortality and poor patient

experiences [31]. Stakeholders and experts agreed that various factors including hospital factors, staff factors, patient factors and some additional factors should be considered when planning nurse staffing numbers in the ED. (View Table 2).

Referring to hospital factors the participants reached consensus that the geographical location of the ED, as well as accessibility, will influence the number of patients visiting the ED and therefore it's staffing. Patient influx and acuity influenced by the level of the ED were also regarded as important [32, 33]. Higher level EDs usually require more nursing staff with an appropriate skillset to provide acute care to critically ill patients [32] and should have the ability to interact with other departments and specialities [34]. The availability and type of specialist services should be considered when planning nurse staffing for the ED as many patients [35] and emergency medical services [36] choose an ED based on the available specialist services. Similarly, EDs with ancillary services such as pathology and other diagnostic modalities offer more effective treatment [37], increasing the number of patients [38]. The increased number of patients visiting the ED directly influence nurse staffing and requires a great deal of flexibility. The hospital should deviate from staffing models developed for wards and critical units. In addition, management should reconsider the standard shifts for nurses in EDs to accommodate the influx of patients based on peak admission times.

The physical layout of the ED also has an impact on efficiency [39, 40], a sentiment shared by stakeholders and experts in our study. In contrast, Recio-Saucedo et al. (2015) found no direct link between the physical layout of the ED and the number of nursing staff required [7]. The physical layout of the ED influences co-ordination with the rest of the hospital. If the ED and other hospital departments are not co-ordinated, then patients may not be transferred timeously and the ED may become overcrowded [41, 42]. As the ED becomes overcrowded, new patients may not receive adequate care [41]. The flow of patients through the unit as well as waiting times and ED crowding must be examined to seek the best use of the physical layout with the average nurse-patient ratios for each ED.

All EDs should consider local events when planning staffing. Extraordinary situations, such as mass gatherings could cause a marked increase in ED visits, and need to be considered [43]. Similarly, extraordinary disaster situations could occur at any given



time [44]. During disasters, nurses are in greater demand than any other healthcare professional [45] due to surges in patient numbers [46]. The unpredictable nature of disasters or pandemics should be planned and prepared for in advance to mitigate nursing staff shortages [47]. In order to plan for unpredictable events management could initiate an on-call system with at least two levels.

Emergency departments are also more likely to become overcrowded should there be a mismatch between staffing, patient volume and acuity [5]. Safe staffing does not only refer to the correct number of nurses on duty, but encompasses experience and a skill mix, such as professional training, education level and experience [8]. Nursing staff with a rich skill mix, combined with higher qualifications, have a positive influence on patient outcomes and satisfaction [49]. Morphet et al [50] recommends that ED staffing includes more registered nurses with postgraduate qualifications especially in emergency nursing [50]. Registered nurses with specialisations know how to apply their knowledge during clinical care, have better communication skills and are better at critical thinking, positively impacting patient outcomes [50, 51]. Nurse staffing and scheduling in the ED should also consider competency levels to promote delivery of safe, quality care, increasing patient and staff satisfaction [52]. Nurses have reported that working with incompetent colleagues leads to high levels of moral distress [53]. The patients and nurses in EDs should be consulted on the staffing ratios that contribute to patient and staff satisfaction on a continuous basis to ensure responsive staffing ratios.

In the ED, competence is vitally important due to the varying acuity and unpredictable number of patients [8, 48]. Existing nurse-patient ratio models are based on general nursing units and do not consider the unique nature of the ED [8]. Driscoll et al. [54] maintains that modelled nurse-patient ratios are not mandatory but are merely recommendations to guide decision making [54]. In the ED, patients need to be triaged, and this classification should be considered when calculating staffing [61]. Patients with higher urgency levels require more resources, including more nurses [62]. Acuity has a large impact on patient safety [8], and nurse staffing should be calculated according to both patient acuity and volume. Nursing activities, workload, and time motion studies regarding triage levels of patients will need further investigation on its impact on staffing of EDs. In addition patient volumes may vary

according to certain times of the day, on certain days of the week and during a particular season [42]. These variables are likely to depend on local factors, and effective planning of nurse staffing should use statistics of daily patient volumes [65]. Forecasting patient volumes for the ED enables the ED to improve nurse staffing. In the ED, it is thus vitally important to record daily, weekly, monthly, and seasonal trends in patient numbers.

The unpredictability of the ED is an important factor when planning nurse staffing. Nurse staffing should be fluid enough to accommodate variability in acuity, unknown conditions, and volumes of patients [8]. Aside from adequate nurse staffing, shorter waiting times in the ED are also directly linked to the number of doctors on duty [7]. In most countries, doctors are responsible for treating patients and deciding whether to discharge or refer patients for further management [70]. Doctors in the ED therefore contribute to patient flow and overcrowding [71]. More doctors facilitate the even the flow of patients through the ED. There should be a balance between the number of doctors and the number of nurses on duty.

Emergency medical services (EMS) are key stakeholders in the emergency environment [72]. Globally, the number of patients treated by the EMS and transported to EDs are increasing [73]. Good relationships between EMS and EDs ensure timeous information of the patient(s) condition and estimated time of arrival when transporting patients. Receiving information in good time could improve the readiness of EDs by ensuring adequate nurse staffing for optimal patient care. An additional nurse, who is responsible for receiving patients from EMS during busy times in the ED [42], would allow EMS crews to continue their service.

In our study, experts did not agree (CVI < 80%) on two locally identified factors, namely patient expectation levels (72%) and the use of electronic documentation (70%). Continuously meeting patients' expectations is nearly impossible, but patients' experiences and outcome could be improved, and their stress lessened by increasing nurse staffing numbers in the ED [74]. When introducing electronic documentation, EDs may require more nursing staff to maintain efficiency and patient safety during roll-out [75]. Once all nursing staff are comfortable with, and skilled in using electronic

documentation, we could expect a decrease in potential workload, enhanced performance [76] and return to baseline staffing levels.

## **LIMITATIONS**

Our study was limited by not having human resource managers in either the NGDs or e-Delphi parts of the study. We could not include any patient opinions in our study.

## **CONCLUSION**

In the ED, the complex operations and the interaction of multiple factors influence nurse staffing ratios. We assessed stakeholders and experts' opinions on what they believed to be important factors that should be considered when planning nurse staffing ratios for the ED. Current nurse staffing models employed by hospitals do not always consider the volatile and unpredictable ED environment.

Stakeholders and experts agreed on 17 factors that should be considered when planning nurse staffing in the ED. Four broad categories were identified: hospital, staff, patients and additional factors. These factors should be further investigated from a practice, as well as a financial perspective. Due to its unique nature, the ED environment renders staff planning a difficult task and implementing these results will not be a straightforward process. To ensure optimal nurse and patient outcomes, nurse staffing in the ED should be contextual, fluid and adaptable and continuously evaluated.

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## **AUTHOR DISCLOSURE**

Conflict of interest: none to report.

## REFERENCES

- [1] Bowles, J., Adams, J., Batcheller, J., Zimmermann, D. and Pappas, S. (2018). The Role of the Nurse Leader in Advancing the Quadruple Aim. *Nurse Leader*, 16(4), 244-248.
- [2] American Nurses Association (2012). *Principles for Nurse Staffing. Principles for Practice*. [online] Silver Springs, US: Nurses Books.org. Available at: <https://www.nursingworld.org/~4af4f2/globalassets/docs/ana/ethics/principles-of-nurse--staffing--2nd-edition.pdf> [Accessed 31 August 2020].
- [3] Butler, M., Schultz, T., Halligan, P., Sheridan, A., Kinsman, L., Rotter, T., Beaumier, J., Kelly, R. and Drennan, J. (2019). Hospital nurse-staffing models and patient- and staff-related outcomes. *Cochrane Database of Systematic Reviews*, 2019(4), 1-93.
- [4] Mensik, J. (2014). What every nurse should know about staffing. *American Nurse Today*, [online] 9(2), pp.1-5. Available at: <https://www.americannursetoday.com/what-every-nurse-should-know-about-staffing/> [Accessed 20 August 2020].
- [5] Henneman, P., Shin, S., Brun, Y., Balasubramanian, H., Blank, F. and Osterweil, L. (2015). Using computer simulation to study nurse-to-patient ratios in an emergency department. *JONA: The Journal of Nursing Administration*, 45(11), 551-556.
- [6] Royal College of Nursing (2014). *Using the Baseline Emergency Staffing Tool (BEST)*. Faculty of Emergency Nursing, 1-5.
- [7] Recio-Saucedo, A., Pope, C., Dall'Ora, C., Griffiths, P., Jones, J., Crouch, R. and Drennan, J. (2015). Safe staffing for nursing in emergency departments: evidence review. *Emergency Medicine Journal*, 32(11), 888-894.
- [8] Wolf, L., Perhats, C., Delao, A., Clark, P. and Moon, M. (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.
- [9] Betts, D. and Balan-Cohen, A. (2017). *Value of patient experience: Hospitals with higher patient experience scores have higher clinical quality*. [online] Washington, US: Deloitte. Available at: <http://www.deloitte.com/us/value-of-patient-experience> [Accessed 24 May 2017].
- [10] Hairr, D., Salisbury, H., Johannsson, M. and Redfern-Vance, N. (2014). Nurse Staffing and the Relationship to Job Satisfaction and Retention. *Nursing Economics*, 32(3), 142-147.

- [11] Ball, J., Griffiths, P. and Hope, J. (2017). Evidence on the effect of nurse staffing levels on patient outcomes. *Nursing Times*, 113(1), 48-49.
- [12] Madavan Nambiar, K., Nedungalaparambil, N. and Aslesh, O. (2017). Studying the variability in patient inflow and staffing trends on Sundays versus other days in the academic emergency department. *Journal of Emergencies, Trauma, and Shock*, 10(3), 121-127.
- [13] Hall, L., Johnson, J., Watt, I., Tsipa, A. and O'Connor, D. (2016). Healthcare staff wellbeing, burnout, and patient safety: a systematic review. *PLOS ONE*, 11(7), e0159015.
- [14] Ausserhofer, D., Zander, B., Busse, R., Schubert, M., De Geest, S., Rafferty, A., Ball, J., Scott, A., Kinnunen, J., Heinen, M., Strømseng Sjetne, I., Moreno-Casbas, T., Kózka, M., Lindqvist, R., Diomidous, M., Bruyneel, L., Sermeus, W., Aiken, L. and Schwendimann, R. (2013). Prevalence, patterns and predictors of nursing care left undone in European hospitals: results from the multicountry cross-sectional RN4CAST study. *BMJ Quality & Safety*, 23(2), 126-135.
- [15] Loehr, A. and Doyle, S. (2013). *Finding the Emergency Department Staffing "Sweet Spot" through use of Benchmarking*. Atlanta: American Nurses Association 7th Annual Nursing Quality Conference.
- [16] MacKichan, F., Brangan, E., Wye, L., Checkland, K., Lasserson, D., Huntley, A., Morris, R., Tammes, P., Salisbury, C. and Purdy, S. (2017). Why do patients seek primary medical care in emergency departments? An ethnographic exploration of access to general practice. *BMJ Open*, 7(4), e013816.
- [17] Huang, Y., Meyer, P. and Jin, L. (2018). Neighborhood socioeconomic characteristics, healthcare spatial access, and emergency department visits for ambulatory care sensitive conditions for elderly. *Preventive Medicine Reports*, 12, 101-105
- [18] Van den Berg, M., Van Loenen, T. and Westert, G. (2015). Accessible and continuous primary care may help reduce rates of emergency department use. An international survey in 34 countries. *Family Practice*, 33(1), 42-50.
- [19] Nair, R., Aggarwal, R. and Khanna, D. (2011). Methods of Formal Consensus in Classification/Diagnostic Criteria and Guideline Development. *Seminars in Arthritis and Rheumatism*, 41(2), 95-105.
- [20] Palinkas, L.A., Horwitz, S.M., Green, C.A., Wisdom, J.P., Duan, N. and Hoagwood, K. (2015). Purposeful sampling for qualitative data collection and analysis in mixed method

implementation research. *Administration and policy in mental health and mental health services research*, 42(5), 533-544

[21] Varga-Atkins, T., Bunyan, N., Fewtrell, R., & Mclsaac, J. (2011). *The nominal group technique: a practical guide for facilitators*. Written for the ELESIG Small Grants Scheme. Liverpool: University of Liverpool.

[22] Ven, A., & Delbecq, A. (1974). The effectiveness of nominal, Delphi, and interacting group decision making processes. *Academy of Management Journal*, 17, 605–621.

[23] Botma, Y., Greeff, M., Mulaudzi, M. and Wright, S. (2015). *Research in health sciences. 1st ed.* Cape Town: Pearson Holdings Southern Africa, 251-253.

[24] Jünger, S., Payne, S. A., Brine, J., Radbruch, L. & Brearley, S. G. (2017). Guidance on Conducting and Reporting Delphi Studies (CREDES) in palliative care: Recommendations based on a methodological systematic review. *Palliative Medicine*, 31, 684-706.

[25] Donohoe, H., Stollefson, M. and Tennant, B. (2012). Advantages and Limitations of the e-Delphi Technique. *American Journal of Health Education*, 43(1), 38-46.

[26] Singh, R., Rohr, F. and Splett, P. (2011). Bridging evidence and consensus methodology for inherited metabolic disorders: creating nutrition guidelines. *Journal of Evaluation in Clinical Practice*, 19(4), 584-590.

[27] Peirce, D., Brown, J., Corkish, V., Lane, M., & Wilson, S. (2016). Instrument validation process: a case study using the Paediatric Pain Knowledge and Attitudes Questionnaire. *Journal of Clinical Nursing*, 25(11-12), 1566-1575.

[28] Chover-Sierra, E., Martínez-Sabater, A., & Lapeña-Moñux, Y. R. (2017). An instrument to measure nurses' knowledge in palliative care: Validation of the Spanish version of Palliative Care Quiz for Nurses. *Plos one*, 12(5), e0177000.

[29] Tracy, S.J. (2010). Qualitative quality: Eight “big-tent” criteria for excellent qualitative research. *Qualitative inquiry*, 16(10), 837-851.

[30] Forero, R., Nahidi, S., De Costa, J., Mohsin, M., Fitzgerald, G., Gibson, N., McCarthy, S. and Aboagye-Sarfo, P. (2018). Application of four-dimension criteria to assess rigour of qualitative research in emergency medicine. *BMC health services research*, 18(1), 120.

[31] Marcoux, J.L. (2020). How Do Nurse-to-Patient Ratios in the Emergency Department Impact Patient Experience? Available from:

<https://digitalcommons.acu.edu/cgi/viewcontent.cgi?article=1209&context=etd> [Accessed on 18 August 2020].

[32] Dijkink, S., Nederpelt, C.J., Krijnen, P., Velmahos, G.C. and Schipper, I.B. (2017). Trauma systems around the world: a systematic overview. *Journal of trauma and acute care surgery*, 83(5), 917-925.

[33] Hardcastle, T., Reeds, M. and Muckart, D. (2012). Utilisation of a Level 1 Trauma Centre in KwaZulu-Natal: Appropriateness of Referral Determines Trauma Patient Access. *World Journal of Surgery*, 37(7), 1544-1549.

[34] Arrich, J., Raff, T., Hohenstein, C. and Behringer, W. (2017). Adequate staffing in the emergency department. *Hospital Healthcare Europe*. [online] Available at: <http://www.hospitalhealthcare.com/emergency-and-critical-care/adequate-staffing-emergency-department> [Accessed 14 Aug. 2019].

[35] Coster, J., Turner, J., Bradbury, D. and Cantrell, A. (2017). Why Do People Choose Emergency and Urgent Care Services? A Rapid Review Utilizing a Systematic Literature Search and Narrative Synthesis. *Academic Emergency Medicine*, 24(9), 1137-1149.

[36] Freshwater, E., Dickinson, P., Crouch, R., Deakin, C. and Eynon, C. (2013). Extending access to specialist services: the impact of an onsite helipad and analysis of the first 100 flights. *Emergency Medicine Journal*, 31(2), 121-125.

[37] St. John, A. and Price, C. (2018). Benefits of point-of-care testing in the Emergency Department. [online] Available at: <https://acutecaretesting.org/articles/Benefits-of-point-of-care-testing-in-the-Emergency-Department> [Accessed 5 Aug. 2019].

[38] Rising, K., Padrez, K., O'Brien, M., Hollander, J., Carr, B. and Shea, J. (2015). Return Visits to the Emergency Department: The Patient Perspective. *Annals of Emergency Medicine*, 65(4), 377-386.

[39] Claret, P., Bobbia, X., Olive, S., Demattei, C., Yan, J., Cohendy, R., Landais, P. and de la Coussaye, J. (2016). The impact of emergency department segmentation and nursing staffing increase on inpatient mortality and management times. *BMC Health Services Research*, 16(1), 279-286.

[40] Pati, D., Harvey, T. and Pati, S. (2014). Physical Design Correlates of Efficiency and Safety in Emergency Departments. *Critical Care Nursing Quarterly*, 37(3), 299-316.

- [41] Shen, X. and Wang, X. (2015). Improving the health-care delivery process at hospital emergency services by a better use of inpatient bed information. *Electronic Commerce Research and Applications*, 14(1), 14-22.
- [42] Affleck, A., Parks, P., Drummond, A., Rowe, B. and Ovens, H. (2013). Emergency department overcrowding and access block. *CJEM*, 15(06), 359-370.
- [44] Noel, G., Roch, A., Michelet, P., Boiron, L., Gentile, S. and Viudes, G. (2018). Impact of the EURO-2016 football cup on emergency department visits related to alcohol and injury. *European Journal of Public Health*, 28(3), 434-436.
- [45] Whetzel, E., Walker-Cillo, G., Chan, G. and Trivett, J. (2013). Emergency Nurse Perceptions of Individual and Facility Emergency Preparedness. *Journal of Emergency Nursing*, 39(1), 46-52.
- [45] Baack, S. and Alfred, D. (2013). Nurses' Preparedness and Perceived Competence in Managing Disasters. *Journal of Nursing Scholarship*, 45(3), 281-287.
- [46] Veenema, T. (2018). *Disaster Nursing and Emergency Preparedness*. 4th ed. New York: Springer Publishing Company.
- [47] World Health Organization. (2018). *Essential steps for developing or updating a national pandemic influenza preparedness plan* (No. WHO/WHE/IHM/GIP/2018.1). World Health Organization.
- [48] Wise, S., Fry, M., Duffield, C., Roche, M. and Buchanan, J. (2015). Ratios and nurse staffing: the vexed case of emergency departments. *Australasian Emergency Nursing Journal*, 18(1), 49-55.
- [49] Dall'Ora, C., Pope, C., Crouch, R., Sujun, M. and Griffiths, P. (2017). *Skill mix and new roles in Emergency and Urgent care: what is the evidence?* Health Work: Evidence Briefs, 4: University of Southampton.
- [50] Morphet, J., Kent, B., Plummer, V. and Considine, J. (2016). Profiling nursing resources in Australian emergency departments. *Australasian Emergency Nursing Journal*, 19(1), 1-10.
- [51] Kuntz, L. and Sülz, S. (2013). Treatment speed and high load in the Emergency Department—does staff quality matter? *Health Care Management Science*, 16(4), 366-376.
- [52] Negarandeh, R., Pedram Razi, S. and Khosravinezhad, M. (2013). Effect of Clinically Competent Nurses Services on Safety and Patients' Satisfaction in an Emergency Department. *Hayat*, 19(1).



- [53] Fernandez-Parsons, R., Rodriguez, L. and Goyal, D. (2013). Moral Distress in Emergency Nurses. *Journal of Emergency Nursing*, 39(6), 547-552.
- [54] Driscoll, A., Grant, M., Carroll, D., Dalton, S., Deaton, C., Jones, I., Lehwaldt, D., McKee, G., Munyombwe, T. and Astin, F. (2017). The effect of nurse-to-patient ratios on nurse-sensitive patient outcomes in acute specialist units: a systematic review and meta-analysis. *European Journal of Cardiovascular Nursing*, 17(1), 6-22.
- [55] American Association of Critical-Care Nurses. (2016). AACN standards for establishing and sustaining healthy work environments: A journey to excellence (2nd ed.). Aliso Viejo, CA. Retrieved from <https://www.aacn.org/nursing-excellence/standards/aacn-standards-for-establishing-and-sustaining-healthy-work-environments>.
- [56] Kim, L.Y., Rose, D.E., Ganz, D.A., Giannitrapani, K.F., Yano, E.M., Rubenstein, L.V. and Stockdale, S.E. (2020). Elements of the healthy work environment associated with lower primary care nurse burnout. *Nursing outlook*, 68(1), 14-25.
- [57] Darch, J., Baillie, L. and Gillison, F. (2017). Nurses as role models in health promotion: a concept analysis. *British Journal of Nursing*, 26(17), 982-988.
- [58] Yu, F., Raphael, D., Mackay, L., Smith, M. and King, A. (2019). Personal and work-related factors associated with nurse resilience: a systematic review. *International journal of nursing studies*, 93, 129-140.
- [59] Shin, S., Oh, S. J., Kim, J., Lee, I., & Bae, S. H. (2020). Impact of nurse staffing on intent to leave, job satisfaction, and occupational injuries in Korean hospitals: A cross-sectional study. *Nursing & Health Sciences*.
- [60] Cimiotti, J. P., Aiken, L.H., Sloane, D.M., & Wu, E. S. (2012). Nurse staffing, burnout, and health care-associated infection. *American Journal of Infection Control*, 40(6), 486–490.
- [61] Gräff, I., Goldschmidt, B., Glien, P., Klockner, S., Erdfelder, F., Schiefer, J.L. and Grigutsch, D. (2016). Nurse staffing calculation in the emergency department-performance-oriented calculation based on the Manchester Triage System at the University Hospital Bonn. *PloS one*, 11(5), e0154344.
- [62] Fong, R.Y., Glen, W.S.S., Jamil, A.K.M., San Tam, W.W. and Kowitlawakul, Y. (2018). Comparison of the emergency severity index versus the patient acuity category scale in an emergency setting. *International Emergency Nursing*, 41, 13-18.

- [63] Hahn, B., Zuckerman, B., Durakovic, M. and Demissie, S. (2018). The relationship between emergency department volume and patient complexity. *The American Journal of Emergency Medicine*, 36(3), 366-369.
- [64] El-Rifai, O., Garaix, T., Augusto, V. and Xie, X. (2014). A stochastic optimization model for shift scheduling in emergency departments. *Health Care Management Science*, 18(3), 289-302.
- [65] Marcilio, I., Hajat, S. and Gouveia, N. (2013). Forecasting Daily Emergency Department Visits Using Calendar Variables and Ambient Temperature Readings. *Academic Emergency Medicine*, 20(8), 769-777.
- [66] Choudhury, A. (2019). Hourly Forecasting of Emergency Department Arrivals – Time Series Analysis. *SSRN Electronic Journal*. [online] Available at: [https://www.researchgate.net/publication/330276381\\_Hourly\\_Forecasting\\_of\\_Emergency\\_Department\\_Arrivals\\_Time\\_Series\\_Analysis](https://www.researchgate.net/publication/330276381_Hourly_Forecasting_of_Emergency_Department_Arrivals_Time_Series_Analysis) [Accessed 7 Aug. 2019].
- [67] Carmen, R., Van Nieuwenhuysse, I. and Van Houdt, B. (2018). Inpatient boarding in emergency departments: Impact on patient delays and system capacity. *European Journal of Operational Research*, 271(3), 953-967.
- [68] Sun, B., Hsia, R., Weiss, R., Zingmond, D., Liang, L., Han, W., McCreath, H. and Asch, S. (2013). Effect of Emergency Department Crowding on Outcomes of Admitted Patients. *Annals of Emergency Medicine*, 61(6), 605-611.
- [69] Darwinkelx, M. (2019). Crowding at the Emergency Department of the Scheper Hospital Emmen: a system-wide imbalance analysis with staffing optimization and capacity planning to stay in the flow. *M.Sc. Thesis*. [online] University of Twente. Available at: <https://pdfs.semanticscholar.org/9bf7/16d1f769575873f4723835427cb368fb3423.pdf> [Accessed 27 Aug. 2019].
- [70] Krall, S., Cornelius, A. and Addison, J. (2014). Hospital Factors Impact Variation in Emergency Department Length of Stay More Than Physician Factors. *Western Journal of Emergency Medicine*, 15(2), 158-164.
- [71] Anderson, D., Pimentel, L., Golden, B., Wasil, E. and Hirshon, J. (2016). Drivers of ED efficiency: a statistical and cluster analysis of volume, staffing, and operations. *The American Journal of Emergency Medicine*, 34(2), 155-161.
- [72] Landman, A.B., Spatz, E.S., Cherlin, E.J., Krumholz, H.M., Bradley, E.H. and Curry, L.A., 2013. Hospital collaboration with emergency medical services in the care of patients with acute

myocardial infarction: perspectives from key hospital staff. *Annals of emergency medicine*, 61(2), 185-195.

[73] Berg, L. M., Ehrenberg, A., Florin, J., Östergren, J., & Göransson, K. E. (2019). Significant changes in emergency department length of stay and case mix over eight years at a large Swedish University Hospital. *International emergency nursing*, 43, 50-55.

[74] Bongale, S. and Young, I. (2013). Why people complain after attending emergency departments. *Emergency Nurse*, 21(6), 26-30.

[75] Dexheimer, J.W. and Kennebeck, S. (2013). Modifications and integration of the electronic tracking board in a pediatric emergency department. *Pediatric emergency care*, 29(7), 852-857.

[76] Mkalira Msiska, K., Kunitawa, A. and Kumwenda, B. (2017). Factors affecting the utilisation of electronic medical records system in Malawian central hospitals. *Malawi Medical Journal*, 29(3), 247.