ORGINAL ARTICLE

Estimation of the nurse-to-patient optimal ratio in the emergency department based on workload: OPTIRATIO Study

Aurora Fontova-Almató[1,2], Adrián Nieto-Ortiz[2], Xavier Basurto-Oña[1,3], Núria Carreras-López[1,4], Laia Salleras-Duran[1,4], Olalla González-Boris[1]

Objective. To establish the optimal nurse-patient ratio based on the area of care, the level of triage and the level of dependence of the patients.

Method. Observational study to assess the nursing load of an emergency department between October 2024 and January 2025 using the Assessment of Nursing Workloads and Time (VACTE)© scale. The covariates of complexity (high/low), triage level, dependence (Barthel), sex and age were recorded. The ratio was established using a multivariate model and information on the actual influx and the number of existing nurses.

Results. A total of 409 patients were analysed. Time per patient was statistically higher as age increased and according to the level of dependence. It was also superior in the area of high complexity and resuscitation, as well as in patients classified as triage level 1. 46% of the variability in the time spent with patients was explained by the level of triage and age, the number of nurses needed according to the data was 14,77. 12,09 nurses in the high complexity area and 2,2 in the low complexity area for a real workload of 223,4 patients/24h.

Conclusions. The workload was directly proportional to age, the complexity of the triage level and the degree of dependency. Based on the data, it is possible to propose an optimal nurse-patient ratio.

Keywords: Nursing staff. Personnel management. Hospital emergency service. Triage.

Estimación de la ratio óptima enfermera-paciente en urgencias a partir de la carga de trabajo: estudio OPTIRATIO

Objetivo. Establecer la ratio optima enfermera-paciente a partir del área de atención, el nivel de triaje y el nivel de dependencia de los pacientes.

Método. Estudio observacional de evaluación de la carga enfermera de un servicio de urgencias realizado entre octubre 2024 y enero 2025 mediante la escala de Valoración de las Cargas de Trabajo y Tiempos de Enfermería (VACTE©). Se registraron las covariables de complejidad (alta/baja), nivel de triaje, dependencia (Barthel), sexo y edad. La ratio se estableció mediante un modelo multivariante y la información de la afluencia real y el número de enfermeras existente.

Resultados. Se analizaron 409 pacientes. El tiempo por paciente fue estadísticamente superior a medida que aumentaba la edad y según el nivel de dependencia. También fue superior en el área de alta complejidad y reanimación, así como en los pacientes catalogados como nivel 1 de triaje. El 46% de la variabilidad del tiempo dedicado a los pacientes se explicó a partir del nivel de triaje y la edad, el número de enfermeras necesarias según los datos fue de 14,77. 12,09 enfermeras en el área de alta complejidad y 2,2 en el de baja complejidad para una carga de trabajo real de 223,4 pacientes/24 horas.

Conclusiones. La carga de trabajo fue directamente proporcional a la edad, a la complejidad del nivel de triaje y al grado de dependencia. A partir de los datos es posible proponer una ratio enfermera-paciente óptima.

Palabras clave: Personal de Enfermería. Administración de Personal. Servicio de Urgencia en Hospital. Triaje.

Author Affiliations:
[1]Servicio de Urgencias, Hospital de Figueres, Fundació Salut Empordà, Girona, Spain.
[2]Institut de Recerca Glòria Compte, Fundació Salut Empordà, Girona, Spain.
[3]Formación Sanitaria Especializada, Fundació Salut Empordà, Girona, Spain.
[4]Departamento de Enfermería, Facultad de Enfermería, Universidad de Girona, Spain.

Author Contributions:
All authors have confirmed his authorship in the document of author responsibilities, publication agreement and assignment of rights to EMERGENCIAS.

Corresponding Author:
Aurora Fontova Almató
Servicio de Urgencias
Hospital de Figueres
Ronda Rector Arolas, s/n
17600 Figueres, Girona, Spain

Email:
afontova@salutemporda.cat

Información del artículo:
Received: 20-9-2025
Accepted: 9-11-2025
Online: 9-1-2026

Editor in Charge:
Juan González del Castillo

Introduction

Several international studies have shown that an increase in the number of patients assigned to a nurse is associated with higher mortality.[1-4] In addition, better nurse staffing improves patient outcomes, reduces the length of stay, decreases hospital-acquired infections, leads to fewer readmissions, increases patient satisfaction, and reduces nurse turnover.[1]

In 2018, the International Council of Nurses issued a position statement outlining key principles regarding nurse–patient ratios.[5] This document acknowledged that safe nurse staffing is crucial to maintaining both patient quality of care and safety. Similarly, the American College of Emergency Physicians published a statement supporting the adequacy of the number of qualified and experienced nurses in emergency departments (EDs) to maintain quality standards.[6]

EDs have characteristics that differ from other hospital care settings, such as continuous care delivery, demand driven by patients, dependence on other services, and their role as the main point of entry into the

hospital.[7] Although appropriate nurse–patient ratios have been studied in inpatient wards,[1] there is limited literature addressing this issue in EDs. In this regard, the Spanish Society of Emergency and Emergency Nursing (SEEUE) published a report in 2009 establishing recommended nurse–patient ratios according to the type of area in which the patient is located.[8] In addition, a study conducted in Brazil demonstrated that measuring workload by care areas is an efficient method for calculating and determining the number of nurses required in the ED.[9] Nevertheless, although ensuring minimum nurse–patient ratios is important, flexibility is required to respond to a complex and constantly changing environment such as the ED.[10,11]

To determine these ratios, it is necessary to understand the care workload of emergency nurses. Former studies have used a validated scale originally designed for intensive care units that appears to encompass all aspects of nursing care and has been shown to objectively measure the time required by ED patients and to estimate nursing workload.[12,13] Other parameters, such as dependency level, patient severity, or triage level, have been shown to influence workload according to former studies.[9,10,14]

Therefore, if patient characteristics are known, it would be possible to hypothesize an optimal nurse–patient ratio. Accordingly, the objective of this study is to establish the optimal nurse–patient ratio based on patients' personal and care-related characteristics.

Methods

Study design

We conducted observational, cross-sectional, analytical study of nursing workload in an ED. Data were collected from patients aged ≥ 18 years treated from October 2024 through January 2025 in the ED of Hospital de Figueres (Girona). Obstetric patients, pediatric patients, and patients treated by primary care staff during the operating hours of the continuous care point were excluded. Sample size was calculated based on a bibliographic reference reporting the mean score for estimated time per patient over 24 hours in an emergency unit.[13] A minimum detectable difference of 45 minutes was assumed, requiring a sample of 385 patients to obtain a 95% confidence interval with a beta risk of 20%.

Variables, instruments, and data collection

The variables studied included age (years), sex, date and time of admission, triage level according to the MAT-SET system,[15] Barthel score (dichotomized as independent for scores of 100 and dependent for scores < 100),[16] care pathway (high and low complexity), and date and time of discharge.

Measurement and calculation of nursing time were performed using the Nursing Workload and Time Assessment Scale (VACTE©). The VACTE© scale consists of 13 sections that reflect the tasks and care activities conducted by the nursing staff. The score for each subsection corresponds to the average time in minutes that the nurse dedicates to providing such care over a 24-hour period.[12]

The ED is organized into 2 care pathways—high and low complexity—according to triage level and the patient's presenting condition. The high-complexity pathway manages patients from all specialties with MAT-SET triage levels 1, 2, and 3[15] and includes 2 resuscitation bays for level 1 patients or those who develop life-threatening conditions during their stay. The low-complexity pathway manages patients with triage levels 4 and 5, including pediatric patients (pediatric patients with triage levels 1, 2, and 3 are treated in an external pediatric ED). This pathway operates within the same hospital only on weekdays from 8:00 a.m. to 8:00 p.m.; at other times it functions as a continuous care point (CCP) and care is provided by primary care staff.

Data were recorded per patient and per care unit. On each data collection day, observations were conducted in a different ED unit to increase sample representativeness, except in the resuscitation bay, where all triage level 1 patients treated during the study period who provided consent were recruited.

Each day of data collection, an additional nurse obtained informed consent, completed sociodemographic data, and assisted the patient's nurse in maintaining a continuous activity log. The nurse responsible for the patient continued the record until the patient left the ED or 24 hours had elapsed. Data collection was carried out using paper forms, without the possibility of real-time tracking of valid cases. Completed records were stored in an office, and data coding and transcription were performed by the research team. Recruitment continued until the estimated sample size was exceeded. All consecutive patients aged ≥ 18 years were included, except those who did not meet participation criteria or did not provide consent. The research team trained clinical staff to ensure protocol adherence and minimize data loss.

To estimate total VACTE© scores for patients, as well as planned and operational nurse–patient ratios, real visit data from the study period were obtained from the hospital's electronic system (date and time of admission, date and time of discharge, sex, age, triage level, care area, resuscitation, and disposition), along with the number of nurses available over 24 hours throughout the study period.

Data analysis

The VACTE© scale establishes a maximum workload time (895 minutes) and a maximum time that a nurse can reach over 24 hours, corresponding to an 82.1% workload (735.1 minutes). Based on these times and the mean time dedicated to each patient (VACTE©/patient), the operational nurse–patient ratio

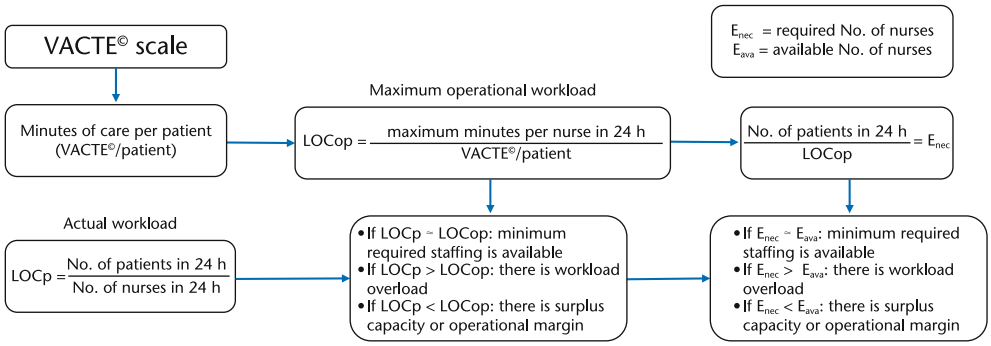

Figure 1. Summary diagram of the calculation of LOCp and LOCop and of real nursing workload.
LOCp: planned nurse–patient ratio; LOCop: operational ratio assuming 100% workload.

can be established.[12] However, to adapt the results to the ED setting, the reference used was the sum of the times nurses dedicated to patients over a 24-hour period.[13]

The calculation of the optimal number of nursing staff was performed according to the original scale using the planned nurse–patient ratio (levels of care planned, LOCp) and the operational nurse–patient ratio (levels of care operative, LOCop), based on the number of patients attended and the number of nurses available. LOCp is defined as the ratio between the total number of patients attended and the number of nurses available during the observation period (24 hours), that is, the number of patients attended per nurse. LOCop, in contrast, is defined as the maximum number of patients a nurse could attend while maintaining a maximum workload (Figure 1).

For the study framework, the sample was described using absolute and relative frequency analyses for qualitative variables and measures of central tendency and dispersion for quantitative variables.

To determine nursing workload, the mean time devoted to each patient (VACTE©/patient) was calculated. Subsequently, the actual patient-to-nurse ratio (LOCp) and the operational ratio assuming 100% workload (LOCop) were calculated based on the VACTE©/patient. Finally, the LOCp/LOCop × 100 ratio determined the percentage of actual workload. This ratio is proportional to VACTE©/nurse, which is the mean time each nurse dedicates to patients over 24 hours.

Workload was compared according to ED unit, triage level, and patient characteristics (age and sex), as well as the presence of dependency (Barthel index), using a mean comparison test according to variable normality. Subsequently, a Gamma regression model with a logarithmic link was fitted using the sample data. This approach allowed estimation of VACTE©/patient for the total patient influx based on the recorded sample, by fitting a multivariable model using triage level and age as covariates. An expanded model including sex and Barthel index as additional covariates was also proposed. Assumptions of the Gamma model with log link were verified through analysis of Pearson and deviance residuals. Residuals were randomly distributed around zero with no evidence of heteroscedasticity, and the Q–Q plot showed a reasonable fit to the theoretical distribution, with slight asymmetry expected for this type of model. Oversampling of triage level 1 was taken into consideration when applying the model.

Assuming actual workload as the reference, the optimal nurse–patient ratio was established for each ED unit relative to the maximum possible VACTE©. The most influential variable was identified based on the significance level of each model covariate, and calculations of required nursing staff by triage level were performed.

Ethical and legal aspects

The study was approved by the Research Ethics Committee for Medicinal Products (REC) of CEIM Girona, reference No. 2024.007. It complies with current legislation on personal data protection and the guarantee of digital rights (LOPDGDD), with Regulation (EU) 2016/679 of the European Parliament, and with the most recent ethical principles of the Declaration of Helsinki. All participants or their legal representatives provided written informed consent.

Results

Data were collected from 409 patients, 48.9% of whom were women, with a mean age of 55.73 years (SD, 19.88). A total of 66.26% (n = 271) were treated in the low-complexity pathway. Of the 138 patients treated in the high-complexity pathway, 31 (22.4%) were managed in the resuscitation bay (Table 1).

The mean 24-h time per patient was 63 minutes (IQR, 107) and correlated with older age (r = 0.32; $P < .01$).

Table 1 illustrates time per patient in minutes according to care pathway (high vs low complexity), care in the resuscitation bay, triage level, and dependency level according to the Barthel index. In the high-complexity area, time was greater (median, 195 minutes; IQR, 270) vs the low-complexity area (median 30 minutes; IQR, 55; Mann–Whitney U test; $P < .01$). Patients

Table 1. VACTE© time per patient (minutes) according to care pathway (high vs low complexity), resuscitation bay care, triage level, and dependency level (Barthel Index)

	Total N = 409 n (%)	Median VACTE©/ patient (IQR)	*P* value
Care pathway			
High complexity	138 (33.74)	195 (270)	< **.01**
Low complexity	271 (66.26)	30 (55)	
Resuscitation bay			
Yes	31 (7.58)	440 (196)	< **.01**
No	378 (92.42)	55 (75.75)	
Triage level			
Level 1	21 (5.13)	406 (146)	< **.01**
Level 2	20 (4.89)	260 (341)	
Level 3	129 (31.54)	101 (146)	
Level 4	220 (53.79)	33.5 (50)	
Level 5	19 (4.65)	25 (20)	
Barthel category			
Independent (100 points)	328 (81.39)	57 (78)	< **.01**
Dependent (< 100 points)	75 (18.61)	115.6 (378.5)	

Median times are expressed in minutes.
IQR: interquartile range.
Bold values indicate statistical significance ($P < .05$).

treated in the resuscitation bay had higher scores (median, 440 minutes; IQR, 196) vs those who were not (median, 55 minutes; IQR, 75.75; Mann–Whitney U test; $P < .01$). Time per patient differed significantly according to assigned triage level, with patients categorized as level 1 showing the highest values (median, 406 minutes; IQR, 146; Kruskal–Wallis test; $P < .01$). Differences were also observed between patients who were independent in activities of daily living (median,57; IQR, 78) and those who had some degree of dependency (median, 115.6; IQR, 378.5; Mann–Whitney U test; $P < .01$).

A regression model was fitted using the logarithm of VACTE©/patient as the response variable and triage level and age as predictors. Up to 46% of the variability in VACTE©/patient was explained by these variables, according to McFadden's pseudo-R^2. Model results are shown in Table 2. Other available predictors (sex and Barthel index) were considered; however, the expanded model provided only a modest improvement (< 3%) vs the base model.

Table 2. Regression model assessing variability in VACTE© time per patient

	Estimate	Standard error	t value	*P* value
(Intercept)	5.53	0.274	20.123	< **.001**
Triage level 2	–0.596	0.307	–1.938	.053
Triage level 3	–1.180	0.235	–5.011	< **.001**
Triage level 4	–2.129	0.233	–9.150	< **.001**
Triage level 5	–2.632	0.308	–8.540	< **.001**
Age (per year)	0.012	0.002	4.682	< **.001**

Bold values indicate statistical significance ($P < .05$).

Optimal nurse–patient ratio

Based on the regression model, nursing management parameters were estimated. LOCp and LOCop were established by care area to avoid bias in the distribution of nursing teams.

Table 3 presents the results for LOCp, estimated total VACTE©, VACTE©/nurse, and percentage workload. The total number of patients seen during the data collection period was 26,813, with a mean daily volume of 223.4 patients (95% CI, 218.16–228.72). On average, each nurse attended 6.8 patients in the high-complexity area and 26.11 in the low-complexity area, with a mean per-patient time of 139.26 and 59.37 minutes over 24 hours, respectively. This resulted in a nurse time commitment of 947.69 minutes per 24 hours in the high-complexity area and 1,550.23 minutes in the low-complexity area. When calculating the workload percentage using the current average number of nurses, workload was 105.9% in the high-complexity area and 173.2% in the low-complexity area. These findings allowed calculation of the number of nurses required: 12.09 nurses in the high-complexity area and 2.2 in the low-complexity area, resulting in a total of 14.77 nurses per day for an actual workload of 223.4 patients per 24 hours.

Based on the sample and daily patient influx during the data collection period, nursing requirements were estimated for each triage level. For level 1 patients, 0.22 nurses would be required; 2.66 for level 2; 11.65 for level 3; 1.90 for level 4; and 0.19 for level 5 patients (Table 4).

Table 3. Results for planned nurse–patient ratio (LOCp), estimated total VACTE©, VACTE© per nurse, percentage workload, and required daily No. of nurses

	Total patients	Daily patients (95% CI)	LOCp (95% CI)	VACTE©/ patient/24 h (95% CI), minutes*	VACTE©/nurse/24 h (95% CI), minutes*	% workload (95% CI) [current mean daily nurses]	Required daily nurses (95% CI) (assuming 82.1% workload)*
Total patients treated	9.749	81.2 (77.4-85.0)	7.82 (7.5-8.2)	116.0 (102.6-131.1)	1.046.5 (926.0-1.182.6)	116.9 (103.5-132.1) [10.38]	14.8 (13.0-16.8)**
High complexity	7.660	63.8 (61.9-65.7)	6.8 (6.6-7.0)	139.3 (120.8-160.5)	947.7 (822.4-1.092.1)	105.9 (91.9-122.0) [9.38]	12.1 (10.5-14.0)**
Low complexity	2.089	26.1 (25.0-27.2)	26.1 (25.0-27.2)	59.4 (53.4-66.0)	1.550.2 (1.394.5-1.723.5)	173.2 (155.8-192.6) [1]	2.2 (1.9-2.4)**

*Values estimated for total patient inflow using the regression model calculated from the study sample.
**95% confidence intervals obtained by parametric simulation of the model (5,000 replications) and day-level bootstrap.
LOCp: planned nurse–patient ratio; VACTE©/patient: mean time dedicated to each patient; VACTE©/nurse: mean time a nurse dedicates to patients over 24 hours.

Table 4. Estimated nursing requirements by triage level based on VACTE© time per patient and mean daily patient inflow

Triage level	VACTE©/ patient (minutes)	Mean daily inflow (n patients)	Mean daily inflow (n patients receiving nursing care)	Daily nurses required (100% workload)	Daily nurses required (82.1% workload)
1	557.9	0.3	0.3	0.18	0.22
2	306.8	7.4	7.4	2.19	2.66
3	175.1	68.6	57.59*	9.57	11.65
4	53.5	121.2	24.5*	1.56	1.90
5	35.6	15.6	4.1*	0.16	0.19
Total	**116.0**	**223.4**	**81.24***	**12.14**	**14.77**

*The estimated number of daily nurses required was calculated based on the number of patients actually receiving nursing care.

Discussion

The present study aims to determine the actual workload of nurses in an ED to adjust nurse–patient ratios to patient inflow. The time dedicated to patients was slightly higher than that reported in the study by Pérez-Aradros Calvo and Soto Olarte,[13] although scores were analyzed by care areas, as in former studies.[9,13] In our case, differences were observed in patient scores according to care complexity: patients in the high-complexity area had higher scores, whereas those in the low-complexity area had lower scores.[13] In addition, it was confirmed that older patients and those with a higher level of dependency had greater nursing workloads, consistent with former studies.[13,14]

Differences observed in the time nurses dedicated to patients according to triage level, with level 1 patients requiring the greatest amount of nursing time. In this regard, Graff *et al.*[17] observed that patients categorized as more severe required more nursing time than those with lower severity levels.

VACTE©/nurse values were very high, indicating a disproportionate workload according to the original scale criteria,[12] although this finding is consistent with former studies using the same scale, which reported moderate-to-high workloads with excessive scores,[13] indicating a trend toward elevated nursing workloads. An overload of nursing care was observed, and the recommended nurse–patient ratio was lower than the ratio actually observed. Operational workload was calculated assuming an 82.1% workload, as described in the original scale,[12] a percentage comparable to that reported in another study in which nurses' productive time was estimated to represent 85% of actual working time.[9] The number of nurses required by care area and triage level was calculated based on this percentage, indicating that nearly 15 nurses would be needed to meet current demand. Overall, these findings highlight the need to adjust nurse staffing levels to meet patients' real needs, taking into consideration that excessive workload may negatively affect both patients and nurses.

High workload levels may represent a risk that should be recognized, as former studies have shown that having more patients assigned to a nurse increases total length of stay,[18,19] time to diagnosis,[20] decreases time to treatment administration,[19,21,22] increases the number of patients leaving the ED without being seen,[19,21,23] and raises the likelihood of cardiac arrest in the ED[19] and 30-day mortality.[24] Furthermore, improved nurse staffing has been shown to increase patient satisfaction[23,25] and reduce nurses' risk of burnout syndrome.[12,26,27]

In the regression model, which explained nearly half of the variability in workload, triage level and age were the most influential factors. Based on these findings, we defined the number of nurses required for each triage level according to mean patient inflow. Similarly, Graff *et al.*[17] calculated the number of nurses required based on the Manchester Triage System, although their estimates were derived from the annual number of patients that a nurse could attend. In the present study, nurse staffing was calculated using a sample assessed with a scale that measures both direct and indirect time dedicated to patients, and estimates were made based on actual patient inflow during the study period. Furthermore, other international studies have shown that dynamic patient inflow and patient characteristics play a key role in determining nursing workload and staffing needs. Nurse staffing levels are factors that help determine the appropriate number of nurses,[28] as is the measurement of direct and indirect nursing activities, highlighting that all of this could improve ED efficiency[29] and reduce nurse stress.[28] The present study may help organize the ED and nursing distribution according to expected patient inflow and the proportion of triage levels. At the international level, NICE guidelines[30] provide general recommendations for establishing safe nurse staffing ratios (although they do not include emergency departments). These guidelines propose that ratios be calculated over 24-hour periods based on occupancy and workload, which is consistent with the approach used in the present study.

Regarding limitations, the observational and single-center design may limit the generalizability of the findings to all EDs. In addition, the specific characteristics of care for level 4 and 5 patients may not be comparable to those of other centers. Nevertheless, the use of the MAT-SET triage system is comparable across public hospitals in Spain, as are patient characteristics.

The data collection period was selected to minimize the effect of tourism seasonality, as the study area experiences high patient inflow during the summer months, and efforts were made to reduce potential bias through analysis of real-world data. The results confirmed that patient inflow does not seem to directly affect time per patient. However, future research could explore seasonal variations and address other centers experiencing similar tourist-related pressure.

The VACTE© scale does not account for the number of nursing assistants, and therefore it is not possible to estimate their influence on total nursing workload, nor the impact of professional experience or interpersonal variability among staff.

In conclusion, nursing workload in the ED is influenced by several variables: age, triage level, level of de-

pendency, care pathway, and admission to the resuscitation area. Workload was directly proportional to age, triage complexity, and degree of dependency.

Nursing workloads were very high, and workload was considered disproportionate according to the measurement scale used. Based on the analyzed data, an optimal nurse–patient ratio is proposed for the ED under study, adjusted to the actual workload according to care pathway and triage level, consisting of 14.77 nurses per day for a real workload of 223.4 patients.

As a future line of research, a multicenter study could allow the establishment of a standardized nurse–patient ratio according to MAT-SET triage level.

Conflict of Interest Disclosures: None reported.

Funding: The authors declare the non-existence of funding related to this article.

Ethical Responsibilities: All authors have confirmed the maintenance of confidentiality and respect for patients' rights in the author's responsibilities document, publication agreement and assignment of rights to EMERGENCIAS. The study was approved by the Research Ethics Committee for Medicinal Products (REC) of CEIM Girona, reference No. 2024.007.

Article not commissioned by the Editorial Board and with external peer review.

Acknowledgements: To all nursing staff and nursing care assistants of the emergency department. To the communication department for assistance with informational posters for users and dissemination on social media. To the Institut de Recerca Glòria Compte, Oriol Turró-Garriga, Pere Plaja-Roman, and Zineb Ghazi-Moataz.

References

1 McHugh MD, Aiken LH, Sloane DM, Windsor C, Douglas C, Yates P. Effects of nurse-to-patient ratio legislation on nurse staffing and patient mortality, readmissions, and length of stay: a prospective study in a panel of hospitals. Lancet. 2021;397:1905-13.
2 Musy SN, Endrich O, Leichtle AB, Griffiths P, Nakas CT, Simon M. The association between nurse staffing and inpatient mortality: A shift-level retrospective longitudinal study. Int J Nurs Stud. 2021;120:103950.
3 Aiken L H, Sloane D M, 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;383:1824-30.
4 Dall'Ora C, Saville C, Rubbo B, Turner L, Jones J, Griffiths P. Nurse staffing levels and patient outcomes: A systematic review of longitudinal studies. Int J Nurs Stud. 2022;134:104311.
5 International Council of Nurses. Position statement: Evidence-based safe nurse staffing. (Accessed 30 November 2023). Available at: https://www.icn.ch/es/node/735
6 Emergency Department Nurse Staffing. Ann Emerg Med. 2017;70:115.
7 Faci Gracia B, Espeso Izquierdo A, Pérez Navarro R, Seijas Malavé C, Júdez Pérez J, Blasco Serrano P, et al. Urgencias intrahospitalarias, gestión y eficiencia. [internet] Portales Médicos. 2022; XVII:768.
8 Emergencias SE de E de U y. Recomendación profesional SEEUE sobre ratios de enfermería en la atención de urgencias hospitalarias. 2010. (Accessed 30 November 2023). Available at: http://www.enfermeriadeurgencias.com/images/archivos/recomendacionratios.pdf
9 Rossetti AC, Gaidzinski RR, Fugulin FM. Nursing workload in the emergency department: a methodological proposal. Rev Lat Am Enfermagem. 2013;21:225-32.
10 Wise S, Fry M, Duffield C, Roche M, Buchanan J. Ratios and nurse staffing: the vexed case of emergency departments. Australas Emerg Nurs J. 2015;18:49-55.
11 Janhunen K, Kankkunen P, Kvist T. Nurse staffing and care process factors in paediatric emergency department-An administrative data study. J Clin Nurs. 2020;29:4554-60.
12 Braña Marcos B, del Campo Ugidos RM, Fernández Méndez E, de la Villa Santoveña M. Propuesta de una nueva escala de valoración de cargas de trabajo y tiempos de enfermería (VACTE©). Enferm Intensiva. 2007;18:115-25.
13 Pérez-Aradros Calvo AM, Soto Olarte R. Utilización de la escala VACTE adaptada para la medición de las cargas de cuidados enfermeros en urgencias. ReMUE.c@t. 2021;8:31-7.
14 Iordache S, Elseviers M, De Cock R, Van Rompaey B. Development and validation of an assessment tool for nursing workload in emergency departments. J Clin Nurs. 2020;29:794-809.
15 Gómez-Jiménez J. Sistema Estructurado de Triaje – SET: Manual de implementación. Andorra: Esbarzer S.L. Treelogic S.L; 2015.
16 Cid-Ruzafa J, Damián-Moreno J. Valoración de la discapacidad física: el indice de Barthel. Rev Esp Salud Publica. 1997;71:127-37.
17 Graff I, Goldschmid B, Glien P, Klockner S, Erdfelder F, Schiefer JL, et al. Nurse Staffing Calculation in the Emergency Department – Performance - Oriented calculation based on the Manchester Triage System at the University Hospital Bonn. PLoS ONE. 2016;11:e0154344.
18 Henneman PL, Shin SY, Brun Y, Balasubramanian H, Blank F, Osterweil LJ. Using Computer Simulation to Study Nurse-to-Patient Ratios in an Emergency Department. J Nurs Adm. 2015;45:551-6.
19 Drennan J, Murphy A, McCarthy VJC, Ball J, Duffield C, Crouch R, et al. The association between nurse staffing and quality of care in emergency departments: A systematic review. Int J Nurs Stud. 2024;153:104706.
20 Shindul-Rothschild J, Read CY, Stamp KD, Flanagan J. Nurse Staffing and hospital characteristics predictive of time to diagnostic evaluation for patients in the emergency department. J Emerg Nurs. 2017;43:138-44.
21 Weichenthal L, Hendey GW. The effect of mandatory nurse ratios on patient care in an emergency department. J Emerg Med. 2011;40:76-81.
22 Lee SR, Hong H, Choi M, Yoon JY. Nursing staff factors influencing pain management in the emergency department: Both quantity and quality matter. Int Emerg Nurs. 2021;58:101034.
23 Recio-Saucedo A, Pope C, Dall'Ora C, Griffiths P, Jones J, Crouch R, et al. Safe staffing for nursing in emergency departments: evidence review. Emerg Med J. 2015;32:888-94.
24 Skela-Savic B, Albreht T, Sermeus W, Lobe B, Bahun M, Dello S. Patient Outcomes and Hospital Nurses' Workload: A Cross-Sectional Observational Study in Slovenian Hospitals Using the RN4CAST Survey. Zdr Varst. 2023;62:59-66.
25 Nelson D, Hearld LR, Wein D. The Impact of Emergency Department RN Staffing on ED Patient Experience. J Emerg Nurs. 2018;44:394-401.
26 Lyneham J, Cloughessy L, Martin V. Workloads in Australian emergency departments a descriptive study. Int Emerg Nurs. 2008;16:200-6.
27 Brassington S, Thomas-Hawkins C, Johansen ML, de Cordova PB, Cimiotti JP, Zha P. Impact of Registered Nurse Staffing, Workload, and the Practice Environment on Burnout in Emergency Nurses. J Emerg Nurs. 2025;51:684-91.
28 Paul S, Krishnamoorthy P, Dinesh MS, Kailash S, Bussa N, Mariyanna S. Methodologies for workforce optimization in Hospital's Emergency Department. Annu Int Conf IEEE Eng Med Biol Soc. 2018;2018:4050-3.
29 Wundavalli L, Kumar P, Dutta S. Workload Indicators of Staffing Need as a tool to determine nurse staffing for a high volume academic Emergency Department: An observational study. Int Emerg Nurs. 2019;46:100780.
30 National Institute for Health and Care Excellence (NICE). Safe staffing for nursing in adult inpatient wards in acute hospitals (SG1). 2014. (Accessed 5 November 2025). Available at: https://www.nice.org.uk/guidance/sg1