

Emergency Department Overcrowding and Its Potential Impact on Care Processes: A Literature Review

by Yusron Amin And Haswita

Submission date: 07-May-2024 09:13AM (UTC+0530)

Submission ID: 2372954184

File name: ikel_IJAHST_Yusron-Haswita_Emergency_Department_Overcrowding.pdf (175.02K)

Word count: 5969

Character count: 32955

RESEARCH ARTICLE

OPEN ACCESS

Manuscript received February 5, 2023; revised March 20, 2023; accepted April 20, 2023; date of publication April 30, 2023

Digital Object Identifier (DOI): <https://doi.org/10.35882/ijahst.v3i2.221>

Copyright © 2023 by the authors. This work is an open-access article and licensed under a Creative Commons Attribution-ShareAlike 4.0 International License (CC BY-SA 4.0)

How to cite: Yusron Amin and Haswita, "Emergency Department Overcrowding and Its Potential Impact on Care Processes: A Literature Review", International Journal of Advanced Health Science and Technology, vol. 3, no. 2, pp. 92–98, April. 2023.

Emergency Department Overcrowding and Its Potential Impact on Care Processes: A Literature Review

Yusron Amin and Haswita

Diploma of Nursing, School of Nursing Science (STIKES) Rustida, Indonesia

Corresponding author: Yusron Amin (e-mail: yusronamin312@gmail.com).

This study was supported by STIKES Rustida

ABSTRACT Emergency department overcrowding was an obstacle of providing timely and effective care in emergency department. This condition had negatively impact on many aspect of care process. There were different finding related to impact of emergency department overcrowding in care process. The aim of the study was to analyze research articles that discusses emergency department overcrowding and its potential impact on care process. The study was literature review using database journal resources from PubMed, Proquest, and ScienceDirect. Emergency department (ED), Overcrowding, and impact we used as keyword. Inclusion criteria of the study were original article, Published at 10 years later (2012-2022), written in english language, focus on patient, staff, or health care system level. Whereas, the exclusion criteria were overcrowding because of other condition (endemic or infection disease), and not focus on patient, staff, or health care system. 9 selected articles that met inclusion criteria were analysed based on author, years, title, and main idea of the study. The finding of the study were emergency department overcrowding had negatively impact on care process including patients, staff, and healthcare system. Impact on patients including increasing mortality and admission rate, impact on staff including increasing workload and non-adherence for practicing best guidelines, meanwhile impact on healthcare system including inappropriate triage process and increasing Length of Stay (LOS). Need an effort to decrease impact of ED overcrowding especially on patient, staff, and healthcare system. The result of the study could be used as considering to formulate an effort to reduce impact of ED overcrowding by controlling patient, staff, and healthcare system factors

INDEX TERMS overcrowding, emergency department (ED), literature review

I. INTRODUCTION

Emergency department was a front of hospital healthcare that expected to provide timely and effective care [1]. However, implementation of effective care in emergency department was very complex and difficult, it depended on many factors as causes. The one is overcrowding [2]. Emergency department overcrowding was defined as condition when increasing need for emergency services exceeds available resources in emergency department or hospital [3,4].

Emergency department overcrowding was one obstacle factors in caring processes of patients [4]. Ireland, Canada, and Australia had been experiencing significant and sustainable increases in emergency department performance and enhancing number of visiting patients as manifestation of emergency department overcrowding [5]. In United States, there were increasing of visiting patients in emergency department was about 131 million in 2012, from which 14,5 million (11%) had in hospital admission, meanwhile 13% of patients number were carry out into intensive care unit because

of deteriorate condition. In South Korea, there were increasing emergency department visiting patients up to 4,9 million patients in 2012, from which 995,326 patients (20%) in hospital admission because of deteriorate condition [6].

Emergency department overcrowding had effect on decreasing quality of healthcare services, such as delaying medication time [7], increasing mortality rate of admitted patients [8,9]. Other effects were prolonged waiting times for triage and treatment [10], decreasing patient satisfaction [11], and hospital profit loss [12].

There were some different finding related to impact of emergency department overcrowding in care process [13]. Previous studies proved that emergency department overcrowding effect on three aspects including patient, staff, and healthcare system level [14]. Some studies proved that impact on patient including delaying getting health care and increasing inpatient mortality [15], other studies focused on

healthcare system impact including ineffective triage process and increasing Length of Stay (LOS) [16,17].

Based on patient effect, there were contradicted finding related to impact of ED overcrowding on patient [18]. Some studies reported that increasing inpatient mortality was not correlation with emergency department overcrowding [19,20]. Increasing inpatient mortality was happened because of their disease severity (majority on patient with Acute Coronary Syndrome (ACS) [21]. But other study reported that emergency department overcrowding had impact on increasing rate events of cardiovascular patients with both acute coronary syndrome (ACS) and non-ACS related to chest pain admitted to emergency department [22].

Based on health care system, there were also contradicted findings related to impact of ED overcrowding to health care system. Some study proved that ED overcrowding impact to timing and modality of triage process, there was increasing waiting time for first triage process conducted, so it impact on delaying diagnosis and initiation of treatment [23]. But other study proved that triage processes including timing and triage decision were not depended on condition of ED (overcrowding), but depended on ED resources and patient severity condition [24].

The findings of the study was emergency department overcrowding negatively had impact on patient, staff, and healthcare system level. Impact on patient including increasing mortality and admission rate. Impact on staff were increasing workload and non-adherence for practicing best guideline and impact on healthcare system including triage process and Length of Stay (LOS). Based on this phenomenon, the researcher intent to identify several recent articles related to impact of ED overcrowding on care process using articles that publish at least 10 years recent (2012-2022). The study goal was to examine integrative studies related to impact of ED overcrowding on patient, staff, and health care system.

II. MATERIAL AND METHODS

Study design was literature review using PRISMA approach that consisted of four steps including identification, screening, eligibility, and included. Identification was searching articles from journal databases sources. This study using PubMed (MEDLINE), Proquest, and ScienceDirect to identify articles based on title/ abstract that same with the purpose of the study. In this section, we found 122 articles from pubmed (n=12 articles), ScienceDirect (n=90), and Proquest (n=20). After the title/ abstract identified, the articles that duplicated were excluded (n=14).

The second steps was screening. In this study, there were 108 articles available based on quality of article components including title, abstract, introduction, methods, result, discussion, and other information. Using manual screening, there were 48 articles excluded related to low level of study, 60 articles reviewed because of met standart as PRISMA considered. The third step was eligibility. In this section, there were 24 articles reviewed were excluded because of non specific discuss about ED overcrowding, whereas 12 articles accessed based on inclusion criteria. Inclusion criteria of the

study were original article, articles in english language, Publish at 10 years later (2012-2022), discuss specific impact of ED overcrowding on patient, staff, or health care system level. Whereas, exclusion criteria were not original article, overcrowding because of other contributed factors (endemic or infection disease), not focus effect on patient, staff, or health care. The last step was article included. There were 9 articles were selected because met inclusion criteria and eligible to analyse. The process of searching articles be presented in FIGURE 1.

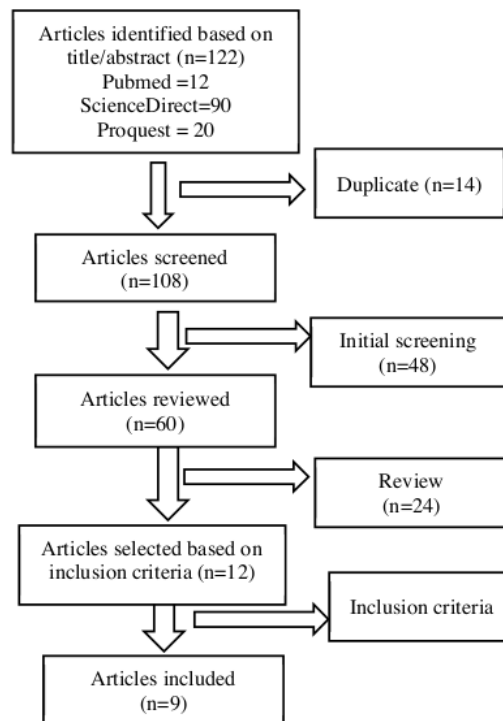


FIGURE 1. Data Selection Process From Journal Database

III. RESULTS

Based on result of the articles that had been analysed, we classified or categories articles into year of publish, place of aticles publish, and main idea of articles. Based on year of publish, majority articles (7 articles) were publish at 5 years later (2018-2022), and 2 articles was published between 2012 to 2017. Based on place of published, majority articles were published in USA (3 articles), followed by Canada (2 articles), Sweden (1 article), Netherland (1 article), South Korea (1 article), and Saudi Arabia (1 article). Based on main idea of the study, majority studies discusses about impact of ED overcrowding on patients (4 articles), healthcare system (3 articles), and staff (2 articles). The summaries of articles had been analysed and presented in TABLE 1.

TABLE 1
Summaries of Article about Emergency Department and Its Impact on Care Process

Author	Title of article	Country	Main idea of the study (Result)
Castner & Suffoletto (2018) [25]	Emergency Department Crowding and Time at the Bedside: A Wearable Technology Feasibility Study	New York (USA)	<ol style="list-style-type: none"> 1) Emergency department overcrowding impact on increasing physician- patient contacting time 2) There were no correlation for (patient gender, triage acuity level, shift at arrival, disposition to home, or discharge diagnosis category) with increasing physician- patient contacting time
Chen et al. (2020) [26]	The effects of emergency department crowding on triage and hospital admission decisions	USA	<ol style="list-style-type: none"> 1) There were significant correlation between ED overcrowding with triage or disposition decision 2) Increasing ED occupancy was found on patient with higher level of triage acuity and hospital admission
Connor et al. (2014) [27]	Evaluating the effect of emergency department crowding on triage destination	Canada	ED overcrowding impacted on changing triage destination (need more long time for triage, many patient not to be triaged), more longer for investigation, and increasing number of unscheduled patient return to ED
Khutbani et al. (2020) [28]	Association between Emergency Department Overcrowding and Mortality at a Teaching Hospital in Saudi Arabia	Saudi Arabia	<ol style="list-style-type: none"> 1) There were correlation between ED overcrowding with mortality rate of ED patients 2) There were increasing number of mortality patient in ED during overcrowding (38%) that dominated patient age (30-44 years), 60 and 74 years old 3) Highest number of patients was dominated by patient triage at level four (62,7%), and level five (33,1%) 4) There were increasing admission rate during ED overcrowding
Jung et al. (2021) [29]	The effect of overcrowding in emergency departments on the admission rate according to the emergency triage level	South Korea	<ol style="list-style-type: none"> 1) Level of ED overcrowding was dominated by high level (34%), low level (33,9%), and normal level (32,1%) 2) There was correlation between ED overcrowding with patient admission rate 3) Increasing admission rate was experienced by patient triage with high level (4,5)
Linden et al. (2016) [30]	Emergency department crowding affects triage processes	Netherlands	<ol style="list-style-type: none"> 1) ED overcrowding impacted on triage process (more prolonged time for triage) and increasing od ED <i>Leng of Stay</i> (LOS) 2) ED overcrowding did not effected to triage destination 3) Triage process was not effective during overcrowding (time for triage more often elapsed, and more patients were not triaged)
Ouyang et al. (2022) [31]	The impact of emergency department crowding on admission decisions and patient outcomes	Canada	<ol style="list-style-type: none"> 1) ED overcrowding had positive correlation with patient admission and physician workload 2) ED overcrowding had negative correlation with number of boarding patients 3) There was positive correlation between patient readmission 7 days after hospitalization with number of boarding patients
Berg et al. (2019) [32]	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	Sweden	<ol style="list-style-type: none"> 1) There was positive correlation between ED overcrowding with 10 days mortality rate 2) Higher mortality was found on patient with aged 80 years or older (51%) and triage with acuity level 3 (63,3%) dan had greater comorbidity 3) Increasing 10 days mortality was found on patient with ED LOS greater than or equal 8 hours 4) Majority ED occupation was found in ratio quartile 2,3, dan 4
Abir et al. (2019) [33]	Evaluating the impact of emergency department crowding on disposition patterns and outcomes of discharged patients	USA	<ol style="list-style-type: none"> 1) ED overcrowding effected to decreasing of patient hospitalization, but enhancing patient discharging 2) There was increasing number of patient return to ED after 2 weeks with deteriorate condition

IV. DISCUSSION

A. IMPACT OF EMERGENCY DEPARTMENT OVERCROWDING ON PATIENT

Based on patient mortality rate, study result showed that there was correlation between emergency department overcrowding with mortality rate of ED patients [28,34,35]. There were increasing number of mortality patient in ED during overcrowding. This result was contradicted with other study that increasing mortality patients do not directly happened because of ED overcrowding, but also effected by increasing Length of Stay (LOS), patients age, and level of triage acuity [22,36,37]. Increasing 10 days mortality was found on patient with ED LOS more than or equal 8 hours, with age more than 80 years old, and triage with level acuity 3 [38]. Increasing mortality patient in emergency department was primarily affected by overcrowding and other contributed factors (patients age and severity condition).

Based on patient admission rate, there was correlation between emergency department overcrowding with patient admission rate [29,39,40,41]. There were increasing patient admission rate during overcrowding that dominated by patient with triage level acuity 4 and 5. This result was contradicted with other study that emergency department overcrowding had impact on increasing patient discharging, not patient admission [32,42,43]. When overcrowding in ED, patient with triage high acuity at level 4 and 5 was discharged without any early treatment in ED, finally the patient would return to ED after 2 weeks with deteriorate condition [32,44]. Increasing incidents of patients admission in emergency department was primarily affected by overcrowding and other contributed factors (patients triage level acuity and finally decision by physician).

B. IMPACT OF EMERGENCY DEPARTMENT OVERCROWDING ON HEALTH CARE SYSTEM

Based on triage process, the study result proved there was significant correlation between ED overcrowding with triage or disposition decision [26,45,46]. There were increasing patient with higher level of triage acuity (at level 4,5) during ED overcrowding [47]. The result was similar with other study that ED overcrowding impact on changing triage destination [27]. There were changing of triage process when ED overcrowding (need more time to initiate triage, many patients not to be triaged). Whereas, other study proved that ED overcrowding did not effect on triage destination, but effect on Length of Stay [30,48,49]. Triage process could not conducted optimally during overcrowding, many patient directly to treated or discharging by the physician [50]. So implementing of triage process when ED overcrowding was not effective without any supported by number and quality of staff ED (physician and nurses).

Based on Length of Stay (LOS). The study found that there was correlation between ED overcrowding with Length of Stay (LOS) [30,51,52]. There were increasing LOS both in emergency department and hospital ward during overcrowding [30,53]. Whereas, other study proved that increasing Leng of Stay (LOS) was happened related to patient disease complexity and other comorbidity [29,54,55]. Patient with severe condition need more long time for

treatment and other diagnostic test, so this condition tend to increasing Length of Stay (LOS) in emergency department [56]. Increasing LOS both in emergency department and hospital ward affected by overcrowding and other factors (patient disease complexity and other comorbidity).

C. IMPACT OF EMERGENCY DEPARTMENT OVERCROWDING ON STAFF

Based on workload, there was correlation between ED overcrowding with ED physician workload [31,57,58]. There were increasing of physician workload while ED overcrowding. Increasing physician workload was also related by increasing of patient admission that dominated by patients with high level acuity (triage at level 4 and 5) [29,59,60]. The result was similar with other study that ED overcrowding made increasing time of contacting between patient- physician that effected to workload, but there were also supported by other contributed factor including patient gender, triage acuity level, shift at arrival, disposition to home, or discharge diagnosis category [25,61,62]. Based on non-adherence for implementing of best practice guidelines, overcrowding in emergency department had negatively impact on implementation of best practice guidelines by physician and nurses [63,64,65]. There were increasing incidents of non-adherence for implementing of practice guidelines by ED staff (physician and nurses) during ED overcrowding. This condition caused by decreasing of focus level and exhaustion related to enhancing workload during ED overcrowding, especially when facing patients with deteriorate condition (stroke, acute coronary syndrome (ACS) [64,66]. Whereas, other studies reported that events of non-adherence for practicing best guidelines by ED staff not caused by ED overcrowding, but based on supporting of ED management, facilities, and their self efficacy [62,65,67]. increasing incidents of non-adherence for best practicing guideliness was affected by ED overcrowding and supported by other factors (internal based on self efficacy of staff and external from hospital management)

V. CONCLUSION AND RECOMMENDATION

Emergency department overcrowding negatively impact on patient, healthcare system, and staff. Impact on patient including increasing mortality rate and patient admission. Impact on healthcare system including ineffective triage process and increasing Length of Stay (LOS) both in ED and hospital ward. Meanwhile, impact on staff including increasing workload and non-adherence for practicing best guidelines. Need an effort to decrease impact of ED overcrowding especially on patient, staff, and healthcare system. The result of the study could be used as considering to formulate an effort to reduce impact of ED overcrowding by controlling patient, staff, and healthcare system factors.

ACKNOWLEDGEMENT

The researchers appreciated all person who had participated to this study, including Head of STIKES Rustida and the entire academic staff who giving support and providing the opportunities to conduct the study. We hope that the result of

the study could be best guidelines of emergency nursing subject, so had positive impact on learning outcome of emergency nursing object in academic.

REFERENCES

- [1] D. Anderson, L. Pimentel, B. Golden, E. Wasil, and J.M. Hirshon, "Drivers of ED efficiency: a statistical and cluster analysis of volume, staffing, and operations," *Am J Emerg Med.*, vol. 38, no. 2, pp. 155-161, 2016.
- [2] Y. Tiwari, S. Goel, and A Singh, "Arrival time pattern and waiting time distribution of patients in the emergency outpatient department of a tertiary level health care institution of North India," *J Emerg Trauma Shock.*, vol. 7, no. 3, pp. 160-165, 2014.
- [3] American College of Emergency Physicians, "Policy Statement Crowding," *Annals of emergency medicine*. Dallas: American College of Emergency, 2019.
- [4] Australasian College for Emergency Medicine, "Australasian College for Emergency Medicine Policy on Standard Terminology," Melbourne: Australian college Press, 2019.
- [5] A.S.Stang, J. Crotts, D.W. Johnson, L. Hartling, and A. Guttman, "Crowding measures associated with the quality of emergency department care: a systematic review," *Academic emergency medicine: official journal of the Society for Academic Emergency Medicine*, vol. 22, no. 6, pp. 643-56, 2015, <https://doi.org/10.1111/acem.12682> PMID: 25996053
- [6] S. Di Somma, L. Paladino, L. Vaughan, I. Lalle, L. Magrini, and M. Magnanti, "Overcrowding in emergency department: an international issue," *Intern Emerg Med*, vol. 24, no. 2, pp. 171-5, 2015, <https://doi.org/10.1007/s11739-014-1154-8> PMID: 25446540
- [7] P. Mc Kenna, S.M Heslin, P. Viccellio, W.K. Mallon, C. Hernandez, E.J. Morley, "Emergency department and hospital crowding: causes, consequences, and cures," *Clin Exp Emerg Med.*, vol. 6, no. 3, pp. 189-195, 2019, doi: 10.15441/ceem.18.022. Epub 2019 Jul 12. PMID: 31295991; PMCID: PMC6774012.
- [8] S.M. Lo, K.T. Ying Choi, E.M.L. Wong, L. Y. Lee, and R.S.D. Yeung, "Effectiveness of Emergency Medicine Wards in reducing length of stay and overcrowding in emergency departments," *International Emergency Nursing*, Vol. 22, no. 2, pp. 116-120, 2014, ISSN 1755-599X, <https://doi.org/10.1016/j.ienj.2013.08.003>.
- [9] O. Geelhoed, and N. de Klerk, "Emergency department overcrowding, mortality and the 4-hour rule in Western Australia," *The Medical Journal of Australia.*, vol. 196, no. 2, pp. 122-126, 2012.
- [10] G. Lindner, and B.K. Woitok, "Emergency department overcrowding: Analysis and strategies to manage an international phenomenon," *Wiener Klinische Wochenschrift*, vol. 133, no. 6, pp. 229-233, 2021.
- [11] F. Mustafa, P. Gilligan, D. Obu, P. O'Kelly, E. O'Hea, C. Lloyd et al., "Delayed discharges and boarders': a 2-year study of the relationship between patients experiencing delayed discharges from an acute hospital and boarding of admitted patients in a crowded ED," *Emerg Med J.*, vol. 33, no. 9, pp. 636-640, 2016.
- [12] R. Sikka, S. Mehta, C. Kaucky, and E.B. Kulstad, "ED crowding is associated with an increased time to pneumonia treatment," *Am J Emerg Med.*, vol 2, no. 7, pp. 809-12, 2010, <https://doi.org/10.1016/j.ajem.2009.06.023> PMID: 20837259
- [13] G. Savioli, I.F. Ceresa, N. Gri, P.G. Bavestrello, Y. Longhitano, C. Zanza, A. Piccioni, C. Esposito, G. Ricevuti, and M.A. Bressan, "Emergency Department Overcrowding: Understanding the Factors to Find Corresponding Solutions," *J. Pers. Med*, vol. 12, no. 4, pp.279, 2022, <https://doi.org/10.3390/jpm12020279>
- [14] K.J.Hong, S.D. Shin, K.J. Song, W.C. Cha, and J.S. Cho, "Association between ED crowding and delay in resuscitation effort. Am," *J. Emerg. Med.*, vol. 31, no. 6, pp. 509-515, 2013.
- [15] C. Morley, M. Unwin, G.M. Peterson, J. Stankovich, and L. Kinsman, "Emergency department crowding: A systematic review of causes, consequences and solutions," *PLoS ONE.*, vol. 13, no. 8, pp. e0203316, 2018, <https://doi.org/10.1371/journal.pone.0203316>
- [16] H. Wang, R.D. Robinson, C.D. Cowden, V.A. Gorman, C.D. Cook, E.K. Gicheru et al., "Use of the SONET score to evaluate urgent care center overcrowding: a prospective pilot study," *BMJ Open*, vol. 5, no. 4, pp. e006860, 2015.
- [17] J.F. Kenny, B.C. Chang, and K.C. Hemmert, "Factors Affecting Emergency Department Crowding," *Emerg. Med. Clin. North Am.*, vol. 38, no. 6, pp. 573-587, 2020.
- [18] H.R. Rasouli, E.A. Aliakbar, and F.M. Abbasi, "Challenges, consequences, and lessons for way-outs to emergencies at hospitals: a systematic review study," *BMC Emerg Med.*, vol. 19, no. 6, pp.62-68, 2019, <https://doi.org/10.1186/s12873-019-0275-9>
- [19] A. Guttman, M.J. Schull, M.J. Vermeulen, and T.A. Stukel, "Association between waiting times and short term mortality and hospital admission after departure from emergency department: Population based cohort study from Ontario, Canada," *BMJ*, vol. 12, no. 4, pp. 342-350, 2014.
- [20] S. Verelst, P. Wouters, J-B. Gillet, and G. Van den Berghe, "Emergency department crowding in relation to in-hospital adverse medical events: a large prospective observational cohort study," *J Emerg Med.*, vol. 49, no. 6, pp. 949-61, 2015, <https://doi.org/10.1016/j.jemem.2015.05.034> PMID: 26279514
- [21] J.M. Pines, C.V. Pollack, C.V. D.B. Diercks, A.M. Chang, F.S. Shofer, J. Hollander, "The Association Between Emergency Department Crowding and Adverse Cardiovascular Outcomes in Patients with Chest Pain," *Acad. Emerg. Med.*, Vol. 16, no. 4, pp. 617-625, 2013.
- [22] S.K. Polevoi, J.V. Quinn, N.R. Kramer, "Factors associated with patients who leave without being seen," *Acad. Emerg. Med.*, vol. 12, no. 6, pp. 232-236, 2018.
- [23] A. Kuriyama, S. Urushidani, and T. Nakayama, "Five-level emergency triage systems: variation in assessment of validity," *Emergency medicine journal: EMJ*, vol. 34, no. 11, pp. 703-10, 2017, <https://doi.org/10.1136/emmed-2016-206295> PMID: 28751363
- [24] S. Jo, T. Jeong, Y.H. Jin, J.B. Lee, J. Yoon, B. Park, "ED crowding is associated with inpatient mortality among critically ill patients admitted via the ED: post hoc analysis from a retrospective study," *Am J Emerg Med*, vol. 33, no. 6, pp. 1725-1756, 2015, <https://doi.org/10.1016/j.ajem.2015.08.004> PMID: 26336833
- [25] J. Castner, and H. Suffoletto, "Emergency Department Crowding and Time at the Bedside: A Wearable Technology Feasibility Study," *Journal of Emergency Nursing*, vol. 44, no. 6, pp.624-631.e2, 2018, ISSN 0099-1767. <https://doi.org/10.1016/j.jen.2018.03.005>.
- [26] W. Chen, B. Linthicum, N.T. Argon, T. Bohrmann, K. Lopiano, A. Mehrotra, D. Travers, and S. Ziya, "The effects of emergency department crowding on triage and hospital admission decisions," *American Journal of Emergency Medicine*, vol. 38, no. 6, pp. 774-779, 2020, /doi.org/10.2019.06.039
- [27] E. O. Connor et al, "Evaluating the effect of emergency department crowding on triage destination," *International Journal of Emergency Medicine*, vol. 16, no. 7, pp. 1-7, 2014.
- [28] F.Y. Khutbani, and M.F. Al-Qahtani, "Association between Emergency Department Overcrowding and Mortality at a Teaching Hospital in Saudi Arabia," *The Open Public Health Journal*, vol. 13, no. 4, pp. 756-762, 2020, DOI: 10.2174/1874944502013010756
- [29] H.M. Jung, M.J. Kim, J.H. Kim, Y.S. Park, H.S. Chung, S.P. Chung et al, "The effect of overcrowding in emergency departments on the admission rate according to the emergency triage level," *PLoS ONE*, vol. 16, no. 2, pp. e0247042, 2021, <https://doi.org/10.1371/journal.pone.0247042>
- [30] M.C. Linden, B. Meester, and N. Van der Linden, "Emergency department crowding affects triage processes," *International Emergency Nursing*, vol. 29, no. 6, pp. 1-7, 2016, DOI:10.1016/j.ienj.2016.02.003
- [31] H. Ouyang, J. Wang, Z. Sun, E. Lang, "The impact of emergency department crowding on admission decisions and patient outcomes," *Am J Emerg Med.*, vol. 51, no.4, pp.163-168, 2022, doi: 10.1016/j.ajem.2021.10.049. Epub 2021 Oct 30. PMID: 34741995
- [32] L.M Berg, A. Ehrenberg, J. Florin, J. Östergren, A. Discacciati, and K.E. Göransson, "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," *Ann Emerg Med.*, vol. 74, no. 3, pp. 345-356, 2019, doi: 10.1016/j.annemergmed.2019.04.012. Epub 2019 Jun 20. PMID: 31229391.
- [33] M. Abir, M, J.E. Goldstick, R. Malsberger et al, "Evaluating the impact of emergency department crowding on disposition patterns and

- outcomes of discharged patients," *Int J Emerg Med.*, vol. 12, no. 4, pp. 376-385, 2019, <https://doi.org/10.1186/s12245-019-0223-1>
- [34] J. McCusker, A. Vadeboncoeur, J-F. Levesque, A. Ciampi, and E., "Increases in emergency department occupancy are associated with adverse 30-day outcomes," *Acad Emerg Med*, vol. 21, no. 8, pp. 1092-1100, 2014, <https://doi.org/10.1111/acem.12480> PMID: 25308131
- [35] T. Boulain, A. Malet, and O Maitre, "Association between long boarding time in the emergency department and hospital mortality: A single-center propensity score-based analysis," *Intern Emerg Med*, vol. 15, no. 3, pp. 479-489, 2020.
- [36] N. Akhtar, S. Kamran, R. Singh *et al.*, "Prolonged stay of stroke patients in the emergency department may lead to an increased risk of complications, poor recovery, and increased mortality," *J Stroke Cerebrovasc Dis*, vol. 25, no. 3, pp. 672-678, 2016.
- [37] I.M. Chiu, Y.R. Lin, Y.J. Syue, C.T. Kung, K.H. Wu, and C.J. Li, "The influence of crowding on clinical practice in the emergency department," *Am J Emerg Med*, vol. 36, no. 1, pp. 56-60, 2018.
- [38] B.C. Sun, R.Y. Hsia, R.E. Weiss, D. Zingmond, L.J. Liang, W. Han *et al.*, "Effect of emergency department crowding on outcomes of admitted patients," *Ann Emerg Med*, vol. 61, no. 6, pp. 605-616, 2012, <https://doi.org/10.1016/j.annemergmed.2012.10.026> PMID: 23218508
- [39] E. Willard, E.F. Carlton, L. Moffat, and B.E. Barth, "A full-capacity protocol allows for increased emergency patient volume and hospital admissions," *J Emerg Nurs*, vol. 43, no. 5, pp. 413-421, 2017, <https://doi.org/10.1016/j.jen.2017.01.007> PMID: 28456336
- [40] A. Guttmann, M.J. Schull, M.J. Vermeulen, and T.A. Stukel, "Association between waiting times and short term mortality and hospital admission after departure from emergency department: population based cohort study from Ontario, Canada," *BMJ*, vol. 48, no. 6, pp. d2983-d2990, 2017, <https://doi.org/10.1136/bmj.d2983> PMID: 21632665
- [41] S. Al-Qahtani, A. Alsultan, S. Haddad *et al.*, "The association of duration of boarding in the emergency room and the outcome of patients admitted to the intensive care unit," *BMC Emerg Med*, vol. 17, no. 1, pp. 34-40, 2017, <https://link.springer.com/content/pdf/10.1186/s12873-017-0143-4.pdf>.
- [42] J. Boyle, M. Jessup, J. Crilly *et al.*, "Predicting emergency department admissions," *Emergency Medicine Journal*, vol. 29, no. 4, pp. 358-365, 2012.
- [43] L. Salehi, P. Phalpher, R. Valani, C. Meaney, Q. Amin, K. Ferrari, and M. Mercuri, "Emergency department boarding: a descriptive analysis and measurement of impact on outcomes," *Canadian Journal of Emergency Medicine*, vol. 20, no. 6, pp. 929-937, 2018.
- [44] S. Jones, C. Moulton, S. Swift *et al.*, "Association between delays to patient admission from the emergency department and all-cause 30-day mortality," *Emergency Medicine Journal*, vol. 39, no. 4, pp. 168-173, 2022.
- [45] L. C. Kienbacher, A. Steinacher, V. Fuhrmann, H. Herkner, A.N. Laggner, and D. Roth, "Factors influencing door-to-triage- and triage-to-patient administration-time," *Australasian Emergency Care*, vol. 25, no. 3, pp. 219-223, 2022, ISSN 2588-994X, <https://doi.org/10.1016/j.auec.2022.01.001>.
- [46] M. Betz, J. Stempien, S. Trevidi, and R. Bryce, "A determination of emergency department pre-triage times in patients not arriving by ambulance compared to widely used guideline recommendations," *Canadian Journal of Emergency Medicine*, vol. 19, no. 4, pp. 265-270, 2017.
- [47] C. Houston, L. Sanchez, C. Fischer *et al.*, "Waiting for triage: unmeasured time in patient flow," *West J Emerg Med*, vol. 16, no. 1, pp. 39-42, 2015, doi:10.5811/westjem.2014.11.22824.
- [48] B. Hansen, D. Bonin, K. Van Aarsen, and J. Dreyer, "Door-to-triage time in a canadian tertiary-care center," *The Journal of emergency medicine*, vol. 60, no. 1, pp. 121-124, 2021.
- [49] Y. Shen, and L.H. Lee, "Improving the wait time to triage at the emergency department," *BMJ Open Quality*, vol. 9, no. 1, pp. e000708, 2020.
- [50] J.B. Becker, M.C.B.T. Lopes, M.F. Pinto, C.R.V. Campanharo, D.A. Barbosa, and R.E.A. Batista, "Triage at the Emergency Department: association between triage levels and patient outcome," *Rev Esc Enferm USP*, vol. 49, no. 5, pp.783-789, 2015.
- [51] G.H. Alemu, K.G. Negari, K.M. Rodamo, and A.T. Hirigo, "Factors associated with the length of stay in emergency departments in Southern-Ethiopia," *BMC Res Notes*, vol. 12, no. 1, pp. 239-245, 2019.
- [52] M. Schull, M. Vermeulen, A. Guttmann *et al.*, "Better performance on length-of-stay benchmarks associated with reduced risk following emergency department discharge: an observational cohort study," *Can J Emerg Med*, vol. 17, no. 3, pp. 253-262, 2015, doi:10.1017/cem.2014.39.
- [53] O. Bashkin, S. Caspi, R. Haligoa *et al.*, "Organizational factors affecting length of stay in the emergency department: initial observational study," *Isr J Health Policy Res*, vol. 38, no. 4, pp. 38-45, 2015, <https://doi.org/10.1186/s13584-015-0035-6>
- [54] B.C. Sun, R.Y. Hsia, R.E. Weiss, D. Zingmond, L.J. Liang, and W. Han *et al.*, "Effect of emergency department crowding on outcomes of admitted patients," *Ann Emerg Med*, vol. 61, no. 6, pp. 605-616, 2013, <https://doi.org/10.1016/j.annemergmed.2012.10.026> PMID: 23218508
- [55] A. Benjamin, White, D. Paul, Biddinger, Y. Chang, B. Grabowski, S. Carignan, and D.F.M. Brown, "Boarding Inpatients in the Emergency Department Increases Discharged Patient Length of Stay," *The Journal of Emergency Medicine*, vol. 44, no. 1, pp. 230-235, 2013, ISSN 0736-4679, <https://doi.org/10.1016/j.jemmed.2012.05.007>.
- [56] I.H. Chiu, Y.R. Lin, Y.J. Syue, Chia-Te Kung, Kuan-Han Wu, and Chao-Jui Li, "The influence of crowding on clinical practice in the emergency department," *The American Journal of Emergency Medicine*, vol. 36, no. 1, pp. 56-65, 2018, ISSN 0735-6757, <https://doi.org/10.1016/j.ajem.2017.07.011>.
- [57] H. Wang, R.D. Robinson, C.D. Cowden, V.A. Gorman, C.D. Cook, E.K. Gicheru EK *et al.*, "Use of the SONET score to evaluate urgent care center overcrowding: a prospective pilot study," *BMJ Open*, vol. 5, no. 4, pp. e006860, 2015.
- [58] W. Peter, Crane, Y. Zhou, Y. Sun, L. Lin, S.M. Schneider, "Entropy: A Conceptual Approach to Measuring Situation-level Workload Within Emergency Care and its Relationship to Emergency Department Crowding," *The Journal of Emergency Medicine*, vol. 46, no. 4, pp. 551-559, ISSN 0736-4679, <https://doi.org/10.1016/j.jemmed.2013.08.113>.
- [59] D.F. Gaieski, A.K. Agarwal, M.E. Mikkelsen, B. Drumheller, S.S. Cham, F. Shofer *et al.*, "The impact of ED crowding on early interventions and mortality in patients with severe sepsis," *Am J Emerg Med*, vol. 35, no. 7, pp. 953-960, 2017.
- [60] J.L. Wiler, E. Bolandifar, R.T. Griffey, R.F. Poirier, and T. Olsen, "An emergency department patient flow model based on queueing theory principles," *Acad Emerg Med*, vol. 20, no. 9, pp. 939-946, 2013.
- [61] M.A. Reznick, E. Murray, M.N. Youngren, N.T. Durham, S.S. Michael, "Door-to-imaging time for acute stroke patients is adversely affected by emergency department crowding," *Stroke*, vol. 48, no. 1, pp. 49-54, 2017.
- [62] M. Weigl, A. Müller, S. Holland *et al.*, "Work conditions, mental workload and patient care quality: a multisource study in the emergency department," *BMJ Quality & Safety*, vol. 25, no. 4, pp. 499-508, 2016.
- [63] C.C. Lee, N.Y. Lee, M.C. Chuang, P.L. Chen, C.M. Chang, and W.C. Ko, "The impact of overcrowding on the bacterial contamination of blood cultures in the ED," *Am J Emerg Med*, vol. 30, no. 6, pp. 839-884, 2012, <https://doi.org/10.1016/j.ajem.2011.05.026> PMID: 22169577
- [64] D.B. Diercks, M.T. Roe, A.Y. Chen, W.F. Peacock, J.D. Kirk, J. Pollack, V. Charles *et al.*, "Prolonged emergency department stays of non-ST-segment-elevation myocardial infarction patients are associated with worse adherence to the American College of Cardiology/American Heart Association guidelines for management and increased adverse events," *Health Policy and Clinical Practice*, vol. 50, no. 5, pp. 489-496, 2017, <https://doi.org/10.1016/j.annemergmed.2007.03.033> PMID: 17583379
- [65] H.E. Depinet, S.B. Iyer, R. Hornung, N.L. Timm, and T.L. Byczkowski, "The effect of emergency department crowding on reassessment of children with critically abnormal vital signs," *Acad Emerg Med*, vol. 21, no. 10, pp. 1116-1120, 2014.
- [66] U. Hwang, L. Richardson, E. Livote, B. Harris, N. Spencer, and S. Morrison, "Emergency department crowding and decreased quality of

- pain care," *Acad Emerg Med*, vol. 15, no. 12, pp. 1248-1255, 2014, <https://doi.org/10.1111/j.1553-2712.2008.00267.x> PMID: 18945239
- [67] K. Pascasio, and N. G. Mtshali, "A descriptive analysis of Emergency Department overcrowding in a selected hospital in Kigali, Rwanda," *African Journal of Emergency Medicine*, vol. 1, no. 4, pp. 178-183, 2013, ISSN 2211-419X, <https://doi.org/10.1016/j.afjem.2013.10.001>.

Emergency Department Overcrowding and Its Potential Impact on Care Processes: A Literature Review

ORIGINALITY REPORT

7%	6%	5%	3%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to University of Lincoln Student Paper	1%
2	Submitted to University of Glamorgan Student Paper	1%
3	Submitted to University of Bedfordshire Student Paper	1%
4	Submitted to South Bank University Student Paper	<1%
5	stikesmu-sidrap.e-journal.id Internet Source	<1%
6	ifnmujournal.com Internet Source	<1%
7	journal.ijprse.com Internet Source	<1%
8	shura.shu.ac.uk Internet Source	<1%
9	www.cambridge.org Internet Source	<1%

10	openarchive.ki.se Internet Source	<1 %
11	warm.dovepress.com Internet Source	<1 %
12	www.emeraldinsight.com Internet Source	<1 %
13	Charles J. Cogan, Utku Kandemir. "Role of Peripheral Nerve Block in Pain Control for the Management of Acute Traumatic Orthopaedic Injuries in the Emergency Department: Diagnosis-based Treatment Guidelines", <i>Injury</i> , 2020 Publication	<1 %
14	coek.info Internet Source	<1 %
15	westminsterresearch.westminster.ac.uk Internet Source	<1 %
16	www.jove.com Internet Source	<1 %
17	www.tandfonline.com Internet Source	<1 %
18	"Paper Session Ethics & Quality of Life", <i>Journal of the American Geriatrics Society</i> , 4/2008 Publication	<1 %

19

Lena M. Berg, Anna Ehrenberg, Jan Florin, Jan Östergren, Andrea Discacciati, Katarina E. Göransson. "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*, 2019

Publication

<1 %

20

e-journal.usd.ac.id

Internet Source

<1 %

Exclude quotes On

Exclude matches Off

Exclude bibliography On