Risk Of Overcrowding Within The Hospital Emergency Care Model

Marie Jesie Carrillo Barrera[1]*

[1] *Department of Nursing, Faculty of Medicine, Universidad de Chile, Santiago, Chile*
Corresponding author: marie.carrillo@uchile.cl
ORCID: https://orcid.org/0000-0002-8675-6778

Abstract

Background: Overcrowding in hospital emergency units (HEU) occurs when demand exceeds the capacity to provide timely care, impacting patient outcomes and the overall management of the hospital and health network. This phenomenon is particularly concerning for patients with time-sensitive conditions.

Methods: The study analyzes freely available data from the Department of Health Statistics and Information (DEIS) within the hospital emergency care model considering three components: access to the emergency room, emergency care process, and patient discharge. Circular processes, such as registration without available appointments and hospitalization without access to a bed, are identified as factors contributing to overcrowding.

Results: The analysis reveals that the demand for emergency care is higher in primary care than in hospital care, with a significant increase in primary care demand from 2015 to 2023. The study also highlights the importance of categorizing emergency demand using the Emergency Severity Index (ESI), which ensures rapid clinical assessment and appropriate referral flows. Additionally, the study identifies the waiting time for hospital beds as a critical factor in overcrowding, with a significant percentage of patients waiting more than 12 hours.

Conclusions: The study identifies critical nodes for overcrowding in the three components of the model. Strengthening primary health care and improving patient flow within emergency units are essential strategies to mitigate overcrowding. The study also emphasizes the need for comprehensive data on care times and hospital bed access to better understand and address overcrowding.

Keywords

Overcrowding, hospital emergency care model, hospital emergency units, demand for emergency care, emergency severity index.

Introduction

Overcrowding is defined as the point at which demand in the hospital emergency unit (HEU) exceeds the capacity to provide timely care. This threshold, though it may be attained for a brief period, exerts a substantial influence on the quality of patient care, elevating the probability of deleterious outcomes, such as delays in diagnosis and treatment initiation. This phenomenon is of particular concern for patients with time-sensitive pathologies (1, 2).

The phenomenon of overcrowding, which pertains to the capacity to provide timely care in UEH, has the capacity to affect and involve the management of the entire hospital complex. It can even have an impact on the Health Network, reflecting a public health problem (3, 4).

Within the Health Network, the UEH care model is regarded as services that are situated within hospital facilities, providing outpatient care, that is, care in transit. It encompasses the clinical processes of demand selection, diagnosis, and medical treatment. These processes culminate in the medical act of discharge, transfer, or hospitalization (4, 5).

These units exhibit variable demand and possess the capacity to deliver health services on a 24-hour basis. The services they provide are commensurate with the level of complexity of the hospital to which they belong, and patients may require referral to other facilities in the network that can respond to their needs (5, 6). As previously mentioned, the UEH are part of a health network, and their coordination affects demand (7, 8) and consequently the risk of overcrowding.

Method
In order to estimate the possibility of overcrowding within the UEH, freely available data reported by the Department of Health Statistics and Information (DEIS) will be analyzed within the hospital emergency care model according to Bret Aspli. Aspli's model considers three important components or milestones, and their impact in an overcrowding situation (5). This model reflects the necessity to consider emergency departments (EDs) as a single flow, and consequently, circular processes favor the risk of overcrowding, since they are returned to the previous process, and the user does not leave the ED. The most prevalent circular processes, as delineated in extant literature, encompass registration with primary care without available appointments and the indication of hospitalization without access to a hospital bed (9). The analytical model is delineated in Figure 1.
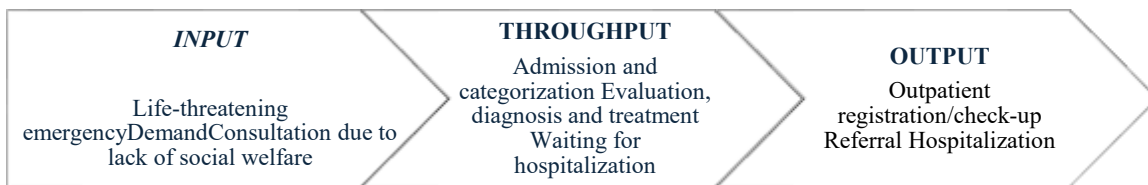

INPUT	THROUGHPUT	OUTPUT
Life-threatening emergencyDemandConsultation due to lack of social welfare	Admission and categorization Evaluation, diagnosis and treatment Waiting for hospitalization	Outpatient registration/check-up Referral Hospitalization

Figure 1: Emergency care model in hospitals
Source: Own elaboration.

Analysis of the UEH healthcare model

I.   First component: Access to the Emergency Room "Input"
To understand this component of the model, it is necessary to identify the EUH as a clinical service within the hospital, which belongs to a health care network that is in accordance with the strategies promoted and committed to by the member states of the Pan American Health Organization (PAHO), where the Integrated Health Services Networks strategy is recognized as the best alternative to overcome fragmentation and the difficulty in meeting health objectives (7,8). The PAHO defines integrated health services networks (IHSN) as "a network of organizations that provides, or arranges to provide, equitable and comprehensive health services to a defined population and is willing to be held accountable for its clinical and economic outcomes and for the health status of the population it serves" (8).

Consequently, access to emergency units must be in the context of the existence of an integrated health network. There are two ways of accessing a hospital emergency unit: spontaneously, that is, without the intervention of any referral mechanism in the network or referred from a facility in the

health network. For both situations it is essential to have knowledge of the functioning of the healthcare network, its levels of complexity, occupation of the healthcare facilities, the presence of contingencies and all those factors that may affect the capacity to respond, requiring integrated territorial coordination (8,9).

Figure 2 shows the percentage of emergency care provided in primary and hospital care out of the total emergency care, broken down annually between 2015 and 2023, showing that the demand for emergency care is greater in primary care than in hospital care. The same graph shows an increase in the demand for PHC, if we compare the years 2015 with 2023 this increase is 9.8%.
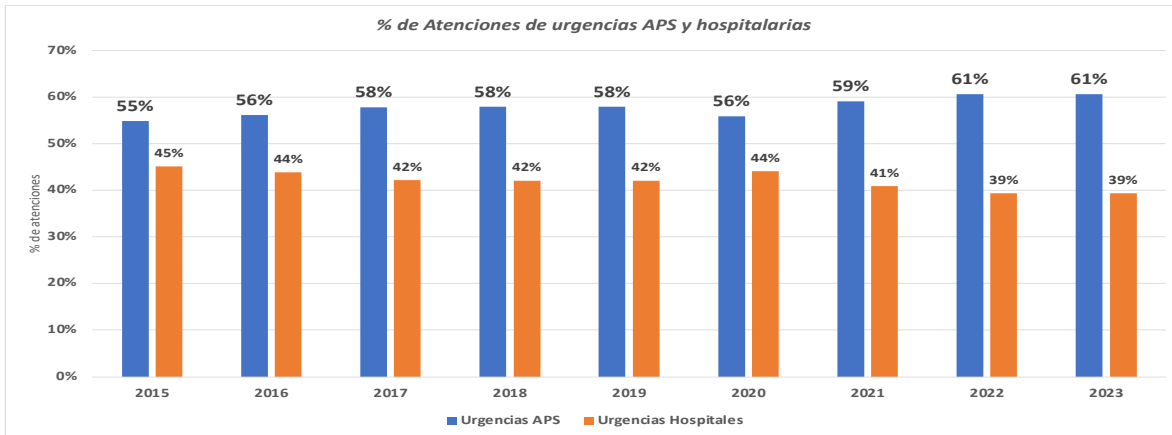

Figure 2: Percentage of primary healthcare and hospital emergencies. In original Spanish language Source: Department of Health Statistics and Information (DEIS), MINSAL

The increase in demand for primary care emergency rooms (PHC ERs) as opposed to hospital emergency rooms can be attributed to the escalating complexity of the services they provide. A PHC ER has emerged as a pivotal component in addressing this demand, underscoring its growing significance.

A health network with a PHC emergency department that possesses greater resolution capacity is inversely proportional to the number of secondary transfers, which are defined as the transport of patients from a facility in the health network to a hospital emergency department (7).

Figure 3 illustrates the number of secondary transfers made from 2017 to 2023. Prior to the pandemic, there was a notable increase in secondary transfers. However, between 2021 and 2023, there was a significant decrease in secondary transfers, reaching 30% of the secondary transfers made in 2019, prior to the pandemic. The reasons for this decrease could be associated with the reorganization of clinical teams in response to the pandemic.
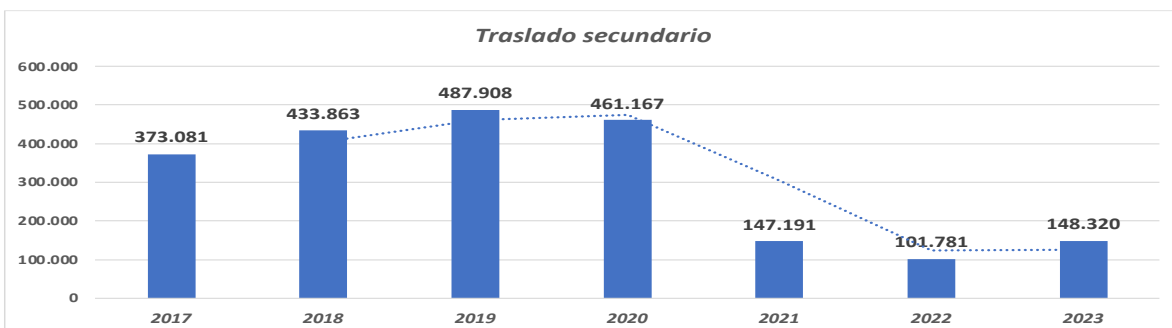
Figure 3: Secondary transfer. In original Spanish language
Source: Department of Health Statistics and Information (DEIS), MINSAL

I.   Second component, Hospital Emergency Care "Throughput"

The second milestone refers to the emergency care process and includes the stages of admission, selection of the demand or categorization, medical evaluation and the last stage, discharge from the emergency room, as shown in Figure 4.

Figure 4: Patient traceability within the hospital emergency unit
Source: Own elaboration.

The traceability of the patient within the emergency unit is fundamental for their continuity of care and for evaluating the time of medical resolution, that is, from the first medical attention to the indication of discharge from the emergency, which should not exceed 6 hours (11). An increase favors the risk of overcrowding in the emergency room and a greater proportion of users who leave the emergency room without completing the process, that is, without a medical resolution (12). An increase in decision-making time and patient abandonment are associated with greater user dissatisfaction and an increased risk of adverse events (13)

Since 2018, the same categorization instrument, called the Emergency Severity Index (ESI), has been used in Chile in the demand selector of public hospital emergency rooms, guaranteeing a rapid clinical assessment of the patients and determining the degree of complexity (14).

Figure 5 shows that over 97% of hospital emergency department demand is categorized, with a higher proportion of users characterized according to degree of complexity, and consequently being able to have referral flows according to category. These flows allow for monitoring of the patient's resolution time from the first medical attention, which the literature recommends be less than 6 hours. From the same graph we can see that patients selected in C1, the most critical level, do not reach 0.4% of the total emergency demand. By 2023, this demand has decreased by 50% compared to the beginning of the pandemic.

The same graph (Figure 5) shows that the greatest demand on hospital emergency services, including the years of the Covid-19 pandemic, was from people characterized at levels C4 and C5, that is to say with a low level of complexity and a low number of resources to respond to care. With a value close to 70%, reaching 73.5% in 2023.
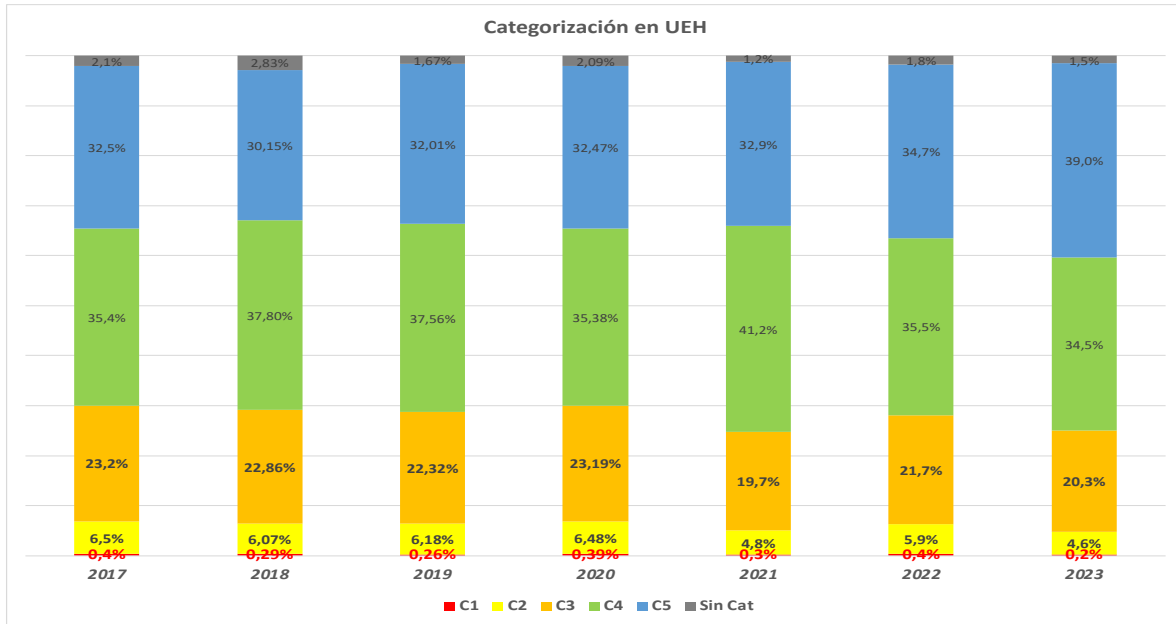
Figure 5: Categorization of demand in hospital emergency. In original Spanish language
Source: Department of Health Statistics and Information (DEIS), REM A08, MINSAL

When analyzing the demand for hospital beds from the UEH, Figure 6 shows a hospitalization rate for the year 2023 of 7.5%, values that have been increasing for the last 7 years. If we look at the same graph for the variation between 2015 and 2019, the hospitalization rate shows an increase of 20.6%, translating into a greater requirement for unplanned hospital beds, and an increase in the complexity of the patients. During the initial period of the Covid-19 pandemic, there was an increase in the hospitalization rate and then a decrease in hospitalizations in 2022, data that can be associated with the immunity achieved against Covid-19. In 2023, there was a rapid increase in the hospitalization rate (7.5%), resembling the values of 2019.
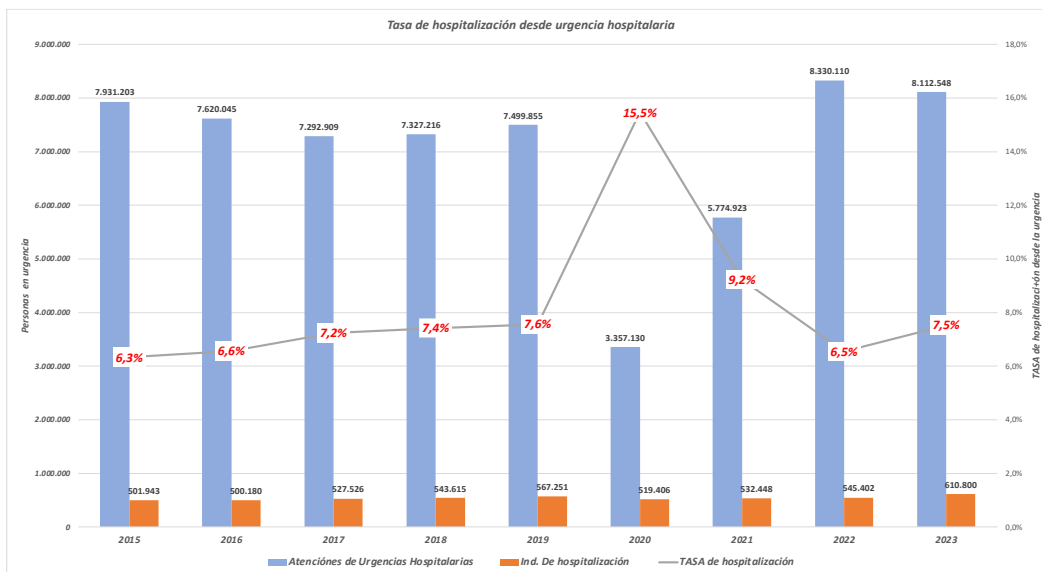

Figure 6: Hospitalization rate from hospital emergency . In original Spanish language
Source: Department of Health Information Statistics (DEIS), Ministry of Health.

II. Third component, Output

The output component of the model involves providing a solution to the patient's medical query, that is to say the demand, and this act involves the following destinations (7):

1. Person discharged from the emergency department to home and/or open care, once they have been stabilized or improved.
2. Inpatient (closed care)
3. Patient referred to another facility
4. Deceased patient

Of the destinations indicated, the decision to hospitalize patients is cited by various publications as an important cause of overcrowding in emergency departments, which occurs due to the difficulty of transferring admitted patients from the emergency department to a hospital bed. The flow of the emergency unit is blocked until beds are available. This situation can lead to diversions of admissions from referred ambulances, in addition to the significant consumption of medical and nursing resources due to the need for continuous care of the patient awaiting hospitalization. (4).

Figure 7 shows that between 2017 and 2023, the percentage of patients who accessed a hospital bed in less than 12 hours was on average over 60% of the total hospitalizations, with a significant percentage of patients waiting more than 12 hours in the emergency department, altering its flow and increasing the risk of overcrowding. (4,15).

An average of 10% of users who end their hospitalization process in the emergency unit, a proportion that by 2023 increases by 20% compared to 2022, being 11.5%, compared to 9.2%.
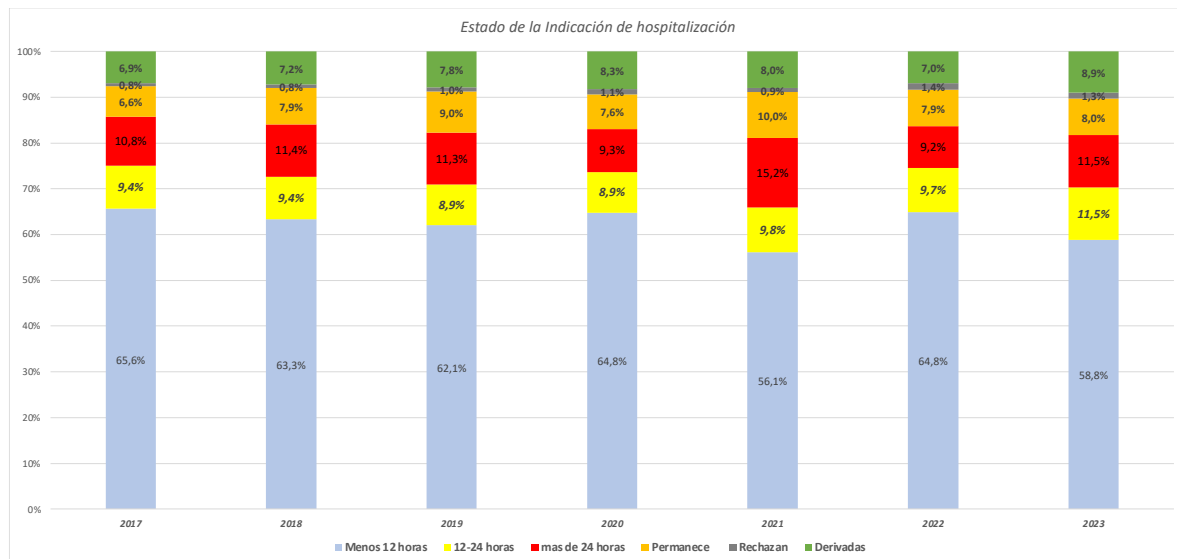

Figure 7: Status of patients with indication for hospitalization in hospital emergency romos. In original Spanish language
Source: Department of Health Statistics and Information (DEIS), REM A08, MINSAL

When analyzing deaths in the UEH, these represent less than 0.1 percent of the total demand. Figure 8 shows that more than 90% of cases occur within emergency care, either while waiting for a bed or while waiting for a medical resolution.
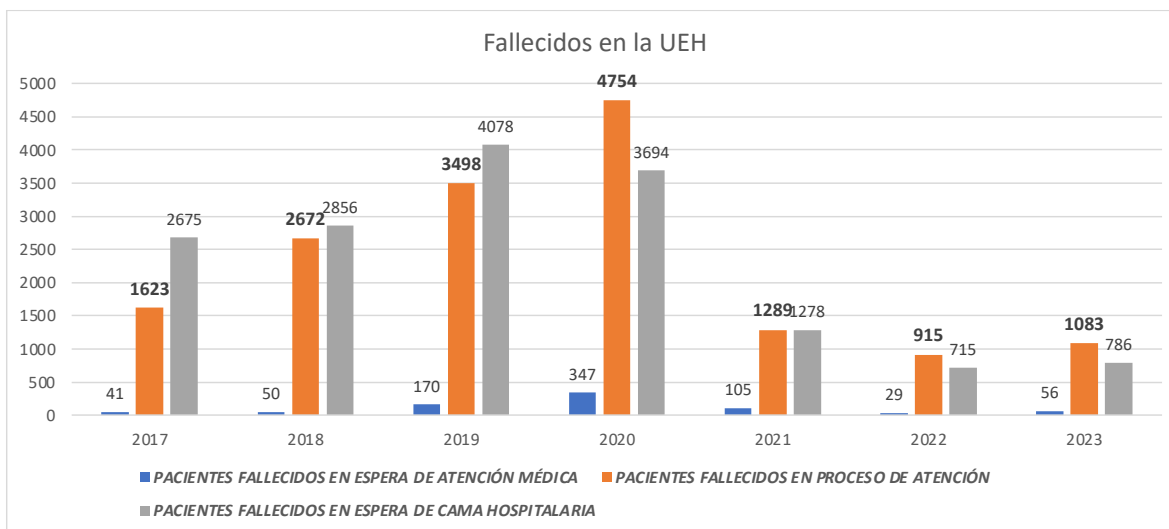
Figure 8: Deaths in the EUH. In original Spanish language
Source: Department of Health Statistics and Information (DEIS), REM A08, MINSAL

Analysis and discussion

When analyzing the risk of overcrowding according to the model, the demand for UEH (emergency care units) is shown to be lower than the demand in primary care units, it being understood that the more complex cases occupy hospital facilities. However, when characterizing the demand that enters the UEH, this corresponds mainly to people tabulated at complexity levels C4 and C5, that is to say, that can be resolved in primary care units, demonstrating an inefficient use of the health network. The literature says that some important measures to prevent overcrowding, considering this component of the model, are:

a. Strengthening Primary Health Care (PHC): One of the first measures mentioned in the literature to prevent overcrowding in hospital emergency rooms refers to strengthening PHC with actions that include increasing access through medical care operations with a decisive capacity (10, 11 and 12). Another action that showed significant results in the reduction of emergency room visits was to increase the population's knowledge of their health network, its services and how to access them (16, 17).

b. Identify people who require frequent attention in the emergency room. The literature indicates that these users correspond mainly to people with a lack of social well-being, and the interventions involve coordination with the network and the community (18, 19). Targeting solutions to a particular population reduces the pressure on the emergency doctor and improves overall results and user satisfaction (20).

Another stage in the model for preventing overcrowding is during the emergency care process and the maintenance of a one-way flow of care. Since 2018, the country's UEH have had a unified demand selector for all public emergency rooms, which indicates differentiated flows of care according to the level of selection. This, added to the data reflected shows a high percentage of categorized demand. This provides a great opportunity to establish differentiated care, allowing more resources and time to be allocated to those groups differentiated by complexity and needs, but unfortunately the monitoring carried out from the macro networks does not include data on the delay times of the emergency care process. Extensive literature indicates the need to monitor the times of the emergency process, mainly the time elapsed from the first medical attention to the diagnosis and the indication of discharge from the UEH. These monitoring models have achieved a decrease in the percentages of

abandonment and greater patient satisfaction, with a redistribution of spaces into fast and slow zones (21,22) where the fast evaluation zones were associated with a reduction in the time for initial evaluation. Medical assessment units for a specific group of patients, for example older adults, have been shown to reduce the number of days patients stay in hospital and are associated with cost savings (23).

Results show that there is a waiting time for hospital beds, and that patients die while waiting for a hospital bed. These interventions depend on the administrative management of the hospital where the HEU is located, as it depends on the available hospital beds and the flow of inpatient units.

Some widely recommended alternatives are to create temporary admission or pre-discharge spaces that refer to flows dependent on the total bed capacity, in which patients hospitalized from the UEH are transported to temporary care spaces. This solution has been associated with a reduction in the length of stay and reductions in access blockage and hospital access blockage (24,25).

Medical assessment units for a specific group of patients, for example older adults, have been shown to reduce the number of days patients stay in hospital and are associated with cost savings (26,27,28).

Conclusions

The analysis facilitated the identification of critical nodes for the occurrence of overcrowding, with these nodes being in the three components, as indicated by the model.

In the first component, the demand for UEH should be focused on complex groups, with the objective of more efficient resources and time distribution. However, despite various strategies, the APS emergency network is unable to respond to people demanding care. One of the reasons for this is the limited opening hours, as many hospitals are open until 11 pm. or midnight.

The nation has made significant strides in the management of demand through the implementation of a structured and validated triage protocol, which is currently utilized by all public hospital emergency rooms. However, a notable limitation is the exclusion of PHC emergency rooms from this network, despite their high demand and the documented evidence of their effectiveness. Data indicates that most cases are resolved at the primary care level, leading to a decline in secondary transfers. This suggests the potential for a more robust primary healthcare system. However, this opportunity appears to be underutilized by the health network. As previously mentioned, most patients presenting to the hospital emergency room (70%) are classified as C4 and C5, suggesting that these cases should be primarily managed within primary care settings.

The Department of Statistics and Health Information (DEIS) maintains a platform that houses data on healthcare. However, the platform currently lacks comprehensive data on the duration of medical care and instances where the treatment process is terminated or abandoned. Care times are imperative in emergency situations and enable the visualization of continuity of care, as well as the identification of potential bottlenecks.

In conjunction with data on hospitalizations from emergency units and access to hospital beds, which is also provided by the DEIS, it is imperative to obtain a value that represents the risk of overcrowding. Furthermore, it is necessary to subdivide the group of hospitalizations with access to a bed in less than 12 hours into two groups: those with access in less than 6 hours and those with access between 6 and 12 hours.

Conflicts of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Data availability
The data supporting the findings of this study are available from the corresponding author, upon reasonable request.

References

1. Savioli G. Hacinamiento en el departamento de emergencias: comprensión de los factores para encontrar las soluciones correspondientes. J Personal Med. 2022;12(2)
2. Sartini M. Hacinamiento en el departamento de emergencias: causas, consecuencias y soluciones: una revisión narrativa. Atención sanitaria. vol 10. Basilea, Suiza; 2022
3. Javidan AP. Informe de la Federación Internacional de Medicina de Emergencia sobre el hacinamiento y el bloqueo de acceso a los departamentos de emergencia: un breve resumen. CJEM. 2021; 23(1):26–28.
4. Pearce S, Marr E, Shannon T, Marchand T, Lang E. Hacinamiento en los departamentos de emergencia: una descripción general de las revisiones que describen las soluciones globales y sus resultados. Pasante Emerg. Med. [Internet]. Available in http://dx.doi.org/10.1007/s11739-023-03477-4I.
5. Asplin BR, Magid DJ, Rhodes KV, Solberg LI, Lurie N, Camargo CA Jr. A conceptual model of emergency department crowding. Ann Emerg Med [Internet]. 2003;42(2):173–80. Available in: http://dx.doi.org/10.1067/mem.2003.302
6. Ordinario N°313, Subsecretaria de Redes Asistenciales, MINSAL , 2018
7. Organización Panamericana de la Salud. Hospitales en redes integradas de servicios de salud. Recomendaciones estratégicas. Washington, D.C. OPS.2018
8. Organización Panamericana de la Salud. Redes integradas de servicios de salud. Conceptos, opciones de política y hoja de ruta para su implementación en las Américas. Washington DC:OPS.2010
9. Resolución exenta Nº 108. Aprueba "Orientación Técnica del Sistema de Priorización Estructurada de la atención de pacientes en UEH 2018", Subsecretaría de Redes Asistenciales, MINSAL Chile.2018
10. Shojaei E, Wong A, Rexachs D, Epelde F, Luque E. Investigación de los impactos de la telemedicina en los servicios de urgencias mediante la disminución de pacientes no urgentes en España. Available in IEEE.8:164238–45
11. Meta sanitaria de Nueva Zelanda: bajo iniciativa "Target", "shorter stays in emergency departments": meta: 95% de cumplimiento de estadías en urgencia menor a 6 horas. 2020
12. Jiménez-Fábrega X, Jacob J. Servicios de urgencias y de emergencia prepandemia y pospandemia: en qué se parecen y qué los diferencia. Emergencias. 2023; 35:142-5
13. Crawford J. El impacto de los centros sin cita previa y las cooperativas de médicos de cabecera en las presentaciones en los departamentos de emergencia: una revisión sistemática de la literatura. Enfermeras internacionales emergentes. 2017; 34:36–42
14. Gilboy N, Tanabe T, Rosenau TD. Emergency Severity Index (ESI): A Triage Tool for Emergency Department Care, Version 4. Imple- mentation Handbook 2012 Edition. AHRQ Publication No. 12-0014. Rockville, MD; 2011
15. Yarmohammadian MH. Hacinamiento en los departamentos de emergencia: unarevisión de estrategias para disminuir los desafíos futuros. J Res Med Ciencias. 2017. 22:23

16. Rasouli HR, Aliakbar Esfahani A, Abbasi Farajzadeh M. Desafíos, consecuencias y lecciones para las salidas a las emergencias en los hospitales: un estudio de revisión sistemática. BMC Emerg Med. 2019;19(1):62

17. Gonçalves-Bradley D. Profesionales de atención primaria que brindan atención no urgente en los departamentos de emergencia de hospitales. Sistema de base de datos. Cochrane Rev. 2(2):Cd002097. 2018

18. Hesselink G, Sir Ö, Schoon Y. Efectividad de las intervenciones para aliviar la aglomeración de adultos mayores en los departamentos de emergencia: una revisión sistemática. BMC Emerg Med. 2019;19(1):69

19. Leduc S. La seguridad y eficacia de las intervenciones de tratamiento de salud afines y paramédicos in situ dirigidas a la reducción de las visitas al departamento de emergencias por parte de pacientes con cuidados a largo plazo: revisión sistemática. Atención de emergencia prehospográfica 2021;25(4):556–565

20. Grant KL. Intervenciones de rendimiento para reducir la aglomeración en los departamentos de emergencia: una revisión sistemática. Cjem. 2020; 22(6):864–874

21. Ortíz-Barrios MA, Alfaro-Saiz JJ. Enfoques metodológicos para apoyar la mejora de procesos en los departamentos de emergencia: una revisión sistemática. Int J Environ Res Salud Pública. 2020; 17(8):2664

22. Weiss, SJ, Ernst, AA, Derlet, R., King, R., Bair, A. y Nick, TG. Relación entre la Escala Nacional de Sobrepoblación de SU y el número de pacientes que salen sin ser atendidos en un SU académico. La revista americana de medicina de emergencia. 2005; 23 (3), 288-294.

23. Rowe BH, McRae A, Rosychuk RJ.Tendencias temporales en los volúmenes de los departamentos de emergencia y métricas de hacinamiento en una provincia del oeste de Canadá: un estudio de datos administrativos basado en la población. BMC Health Serv Res. 2020; 20(1):356

24. Rasouli HR. Resultados del hacinamiento en los departamentos de emergencia; una revisión sistemática. Arch Acad Emerg Med. 2019;7(1):e52

25. Voaklander B. Intervenciones para mejorar las consultas en el departamento de emergencias: una revisión sistemática. Acad Emerg Med. 2022; 29(12):1475–1495

26. Beckerleg W, Wooller K, Hasimjia D. Intervenciones para reducir el tiempo de consulta en el departamento de emergencias: una revisión sistemática de la literatura. Gem. 2020; 22(1):56–64

27. WU, Lijuan. La asociación entre la duración de la estancia en el departamento de urgencias y la mortalidad hospitalaria en pacientes mayores que utilizan el aprendizaje automático: un estudio de cohorte observacional. Revista de Medicina Clínica . vol. 12. 2023.

28. Savioli G, Bressan MA, Piccini B, Novelli G, Cutti V, Oddone S. Triaje de población geriátrica: el riesgo de sobre y subclasificación en la vida real en un servicio de urgencias superpoblado: sistemas de clasificación de 4 y 5 niveles comparados: el estudio CREONTE. TriagE nacional de organización de aglomeración y RE. Revista de Medicina Personalizada. 2024;14(2).