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Boarding beyond the emergency department: inpatient physicians' perspectives from a hospital-wide survey

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Abstract

Emergency Department (ED) overcrowding and boarding are increasingly recognized as hospital-wide phenomena related to patient flow and inpatient bed capacity, rather than isolated ED operational issues. However, little is known about how inpatient physicians perceive ED admissions and their relationship with boarding. The authors aim to explore inpatient physicians' perspectives on the appropriateness of ED admissions and their perception of boarding as a system-level issue. We conducted a single-center cross-sectional survey of heads of inpatient medical wards in a large tertiary academic hospital, IRCCS Azienda Ospedaliero-Universitaria – Policlinico di Sant'Orsola, Bologna, Italy. The questionnaire investigated ward characteristics, perceived alignment between ED admissions and ward skill mix, organizational consequences of mismatches in admissions, and perceptions of ED boarding. Administrative data on ED admissions and Diagnosis-Related Groups (DRGs) were incorporated to contextualize responses. Descriptive statistics were used to summarize survey results. Sixteen ward heads participated (response rate 100%). Alignment between ED admissions and the ward clinical profile was perceived as moderate. Inappropriate admissions were

perceived as being mainly associated with organizational consequences, particularly longer hospital length of stay and resource waste, rather than major clinical outcomes. All respondents recognized ED boarding as a hospital-wide issue and reported frequently receiving boarded patients. Inpatient physicians perceive ED boarding as a system-level phenomenon linked to hospital capacity and patient flow. Improving alignment between patient needs, departmental expertise, and hospital resources may therefore represent a key organizational strategy for addressing hospital overcrowding and ED boarding.

Introduction

Emergency Department (ED) overcrowding represents one of the most persistent challenges faced by modern hospitals and healthcare systems.[1–3] Although it has traditionally been described as a problem occurring within the ED, an increasing body of literature suggests that overcrowding should be interpreted as the visible manifestation of broader dysfunctions affecting hospital capacity and patient flow.[4–6] When hospital capacity is saturated, hospital congestion (often referred to as hospital overcrowding) propagates upstream, exacerbating overcrowding in the ED.[7]

Among the mechanisms linking hospital capacity to ED overcrowding, boarding plays a central role.[8,9] Boarding occurs when patients who require hospital admission remain in the ED after the decision to admit them because no inpatient bed is available, resulting in access block to inpatient care.[8,10] In this situation, the ED temporarily assumes the function of an inpatient ward while continuing to receive new patients requiring urgent evaluation. This limits the ED's ability to provide timely care to incoming patients while caring for admitted patients in a non-inpatient setting. As a result, the clinical implications of ED overcrowding and boarding include delayed treatment for time-sensitive conditions,[11–13] reduced patient safety and satisfaction,[14] higher healthcare costs,[15] and avoidable morbidity and mortality.[16,17] The accumulation of boarded patients also places substantial strain on ED staff and resources.[18,19]

The determinants of ED overcrowding are commonly described through the input–throughput–output framework, which conceptualizes overcrowding as resulting from interactions between demand for emergency care (input), internal ED processes (throughput), and the hospital's capacity to admit patients (output).[20] While early strategies focused on regulating demand or optimizing ED workflows, accumulating evidence has progressively shifted attention toward the output domain.[21,22] High hospital bed occupancy, delayed discharge processes, and inefficient coordination of inpatient services have consistently been associated with prolonged boarding.[23,24] From this

perspective, the ED becomes the location where system-wide bottlenecks become clinically visible.[25–28]

If boarding reflects downstream constraints rather than ED inefficiency, overcrowding should be addressed through hospital-wide strategies aimed at improving patient flow across the entire system.[29–31] Nevertheless, most studies and operational interventions continue to focus primarily on ED throughput, whereas relatively little attention has been directed toward the perspective of inpatient services that ultimately receive admitted patients.[32]

In highly specialized hospitals, the case mix of patients presenting to the ED may not always align with the subspecialty orientation of inpatient wards. Such misalignment can lead to organizational challenges during the admission process and may contribute to delays in bed allocation. Understanding how inpatient physicians perceive ED admissions and the phenomenon of boarding may therefore provide valuable insights into hospital-level barriers affecting patient flow.

Materials and Methods

Study design

This study was a single-center cross-sectional survey aimed at exploring ward characteristics, perceived appropriateness of ED admissions, alignment with the ward's clinical mission, perceived consequences of mismatches between case mix and ward skill mix, and boarding as a system-wide issue.

Setting and inclusion criteria

The study was conducted at a large tertiary academic hospital in Italy, IRCCS Azienda Ospedaliero-Universitaria – Policlinico di Sant'Orsola, Bologna. Participants were the heads of inpatient medical wards that regularly admit patients from the ED. Non-medical wards (such as surgical wards), as well as wards with fewer than 80 direct admissions per year from the ED were excluded from the study. This threshold was defined using 2023 hospital administrative data to exclude wards with only sporadic ED admissions and focus the analysis on services routinely involved in ED-driven admission pathways. Furthermore, to specifically capture direct ED-ward interactions in relation to access block, admissions managed through intermediate units (such as short-stay or observation units) were excluded. This was cross-checked with the head of the ED to confirm that it reflected real-world practice. All heads of eligible wards were invited to participate in the survey. A total of 16 were contacted and agreed to participate.

Survey design

The survey was specifically developed for this study to explore the relationship between the ED and inpatient services. The survey consisted of 29 items organized into five thematic sections: i) ward characteristics; ii) scientific activity and academic involvement; iii) clinical activity and available resources; iv) perceived appropriateness of ED admissions; v) perceptions regarding ED boarding. Most items were structured as Likert-scale questions. Key items assessing perceived appropriateness and organizational impact were measured using 5-point Likert scales (1=never, 2=in most cases no, 3=in approximately half of cases, 4=in most cases yes, 5=always). Selected items, particularly those exploring the perceived impact of boarding on clinical outcomes, were assessed using 3-point Likert scales to reduce response complexity for more subjective items. Diagnosis-specific items were also assessed using a 3-point scale ("yes", "partially", "no") to simplify response options when evaluating multiple diagnostic categories. In addition, selected items exploring expected outcomes and underlying organizational factors were structured as binary (yes/no) questions to allow a more straightforward identification of perceived associations. The full questionnaire, including the exact wording and response options for all items, is provided as Supplementary materials, Appendix 1.

To better define the appropriateness of ED admissions and map the clinical expertise of the involved wards, quantitative data were incorporated into the survey.

Hospital administrative data on ED admissions in 2023 were extracted from the hospital information system. Diagnoses at admission were coded according to the International Classification of Diseases, Ninth Revision (ICD-9) and grouped into broader clinical categories to avoid excessive fragmentation and facilitate interpretation. This was necessary because of redundancy in the ICD-9 classification system and variability in coding granularity across clinicians. Based on this aggregation process, the ten most frequent diagnoses leading to hospital admission in 2023 for each ward were identified. These were presented to the surveyed physicians, who were asked to evaluate whether they were appropriate for admission to their respective wards. In addition, to better describe the clinical profile of each ward, administrative data on hospital discharges were analyzed according to Diagnosis-Related Groups (DRGs). For each ward, the ten most frequent DRG discharge categories were identified and presented within the survey. These data allowed comparison between ED admission case mix and each ward's typical clinical activity.

The survey was developed based on the existing literature and was reviewed by two clinicians with expertise in emergency medicine and hospital patient flow to ensure content relevance, clarity, and alignment with the study objectives. Pilot testing was conducted with two heads of inpatient wards, who were asked to complete the questionnaire and provide feedback on clarity and interpretability. Minor revisions to wording and item comprehensibility were made accordingly.

The questionnaire was not formally validated, as it was developed as an exploratory instrument.

Survey administration

The survey was distributed electronically to the heads of all eligible wards via institutional email. Participants were invited to complete the questionnaire individually based on their professional experience and leadership role. Completed questionnaires were returned to the investigators via institutional communication channels. Data collection was conducted between July and October 2025.

Statistical analysis

All participants completed the questionnaire, and no missing responses were observed.

All survey responses were compiled into a single spreadsheet dataset and subsequently analyzed in aggregate form. Descriptive statistics were used to summarize survey responses. Categorical variables (e.g., binary yes/no responses) were reported as absolute frequencies and percentages. Ordinal variables derived from Likert-scale items were summarized using medians and interquartile ranges (IQR). Statistical analyses were performed using R statistical software (R Foundation for Statistical Computing, Vienna, Austria).[33] No inferential statistical analysis was performed, given the exploratory nature of the study and the limited sample size.

Ethical considerations

This study was conducted as part of a broader research project on hospital patient flow and ED admissions that had received approval from the local Ethics Committee. Within this framework, the data used in the study were collected and analyzed in anonymized and aggregate form. Participation in the survey was voluntary, and completion of the questionnaire was considered to imply informed consent.

Results

Characteristics of surveyed wards

A total of 16 inpatient medical wards met the eligibility criteria. All invited physicians completed the survey (response rate 100%). The wards included the six internal medicine units in the hospital and ten additional medical wards: cardiology, gastroenterology, pneumology, two nephrology units, oncology, infectious diseases, two geriatrics units, and acute medicine.

Among the participating units, ten were university-affiliated (four internal medicine units and six other medical wards).

Clinical activity and available resources

Questions explored clinical expertise, diagnostic and therapeutic self-sufficiency, the ease of access to external resources, and the availability of dedicated outpatient pathways.

Overall, responses indicated high perceived expertise and good availability of internal diagnostic resources, whereas heterogeneity was observed in access to external resources (Table 1).

The perceived expertise of the clinical team in managing selected high-complexity patients was high, with a median score of 4 (IQR 4–5). Similarly, the availability of diagnostic resources during hospitalization had a median score of 4 (IQR 3–4). In contrast, perceived ease of access to external resources showed a lower median score of 3 (IQR 3–4).

The availability of dedicated outpatient pathways and their role in facilitating early discharge both had median scores of 4, indicating a generally positive evaluation.

Perceived appropriateness of ED admissions

Respondents also evaluated alignment between ED admissions and ward profile, as well as the need for competencies or resources not readily available (Table 2).

Overall, the perceived alignment between ED admissions and the clinical and scientific profile of the ward was moderate, with a median score of 3 (IQR 3–4). Responses were heterogeneous: 7/16 respondents (43.8%) reported alignment in approximately half of cases, while 3/16 (18.8%) expressed a negative assessment.

However, when physicians evaluated the ten ICD-9 macro-categories of ED admission diagnoses, diagnosis-specific assessments appeared more favorable than the overall perceived alignment, with 103/160 (63.8%) of ward-level evaluations rated as appropriate (Table 3; Supplementary Table 1).

The perceived need for specialist competencies beyond those available within the ward staff had a median score of 3 (IQR 3–3.25), suggesting that such situations occur relatively frequently.

Similarly, the ward's ability to independently provide the diagnostic and therapeutic resources required for ED patients had a median score of 3 (IQR 2.75–3.25), indicating only partial self-sufficiency. By contrast, the need to rely on diagnostic resources that are difficult to access showed a median score of 2 (IQR 2–3), with 10/16 respondents (62.5%) reporting that this occurs rarely.

Finally, secondary transfers due to inappropriate admission were reported as uncommon, with a median score of 2 (IQR 2–2), and 15/16 respondents (93.8%) indicated that this situation occurs infrequently.

Consequences of mismatched admissions and expected benefits of improved appropriateness

Perceived consequences of ED admissions considered inappropriate for the receiving ward differed between organizational and major clinical outcomes (Table 2).

The perception of longer hospital length of stay associated with inappropriate admissions was high, with a median score of 4 (IQR 4–4). Overall, 13/16 respondents (81.3%) indicated that this outcome occurs in most cases. Similarly, inappropriate admissions were widely recognized as a source of resource waste, with a median score of 4 (IQR 3.5–4). Secondary transfers to other wards had a median score of 3 (IQR 2–4), suggesting that transfers represent a possible but not systematic consequence of inappropriate admissions.

In contrast, major clinical outcomes were perceived as less strongly associated with inappropriate admissions. The perception of increased in-hospital complications showed a median score of 2 (IQR 2–3), with 10/16 respondents (62.5%) indicating that such events occur rarely. A similar pattern was observed for infectious complications, which showed a median score of 3 (IQR 2–3.5).

The perceived association between inappropriate admissions and increased mortality was low overall, with a median score of 2 (IQR 2–3).

Regarding the potential benefits of improved admission appropriateness, participants showed a high level of agreement (Table 4). Optimization of hospital resources and improvement in the quality of work for the clinical team were identified as expected consequences by all respondents.

A large majority (13/16 respondents, 81.3%) indicated that improved admission appropriateness would lead to reduced length of stay, improved quality of care, higher discharge rates, and greater bed availability for the ED, thereby contributing to reduced ED boarding.

Respondents also identified several organizational mechanisms that could facilitate these benefits (Table 4). Staff skill mix was considered relevant by 15/16 respondents (93.8%), while 13/16 (81.3%) emphasized the importance of internal diagnostic resources. Alignment with the ward's scientific activity was also indicated by 13/16 (81.3%), and 12/16 (75%) highlighted the importance of dedicated post-discharge pathways.

Perceptions regarding ED boarding and hospital overcrowding

All respondents were familiar with the term boarding and recognized the presence of patients remaining in the ED after the decision to admit due to a lack of available inpatient beds. Similarly, all ward heads agreed that boarding is a hospital-wide issue rather than a problem confined to the ED.

The reported frequency of receiving patients who had spent hours or days boarding in the ED was high, with a median score of 4 (IQR 3–4) and 9/16 respondents (56.3%) reporting this as a frequent situation. In contrast, the perceived impact of boarding on clinical outcomes during hospitalization was more cautious. The median score was 2 (IQR 2–2.25) on a 3-point Likert scale, indicating that

most respondents perceived only a partial effect. Overall, 9/16 respondents (56.3%) selected the intermediate response, while 4/16 (25%) reported a clear worsening of clinical outcomes.

Discussion

ED overcrowding and boarding are increasingly recognized as hospital-wide phenomena linked to patient flow and inpatient capacity. This aligns with previous studies showing that ED overcrowding is largely driven by output factors, such as access block and downstream constraints in hospital capacity. Understanding how inpatient physicians perceive ED admissions may therefore provide insight into the organizational determinants of these phenomena.

Three main findings emerge from this study and should be interpreted considering the perceptual nature of the data, as respondents' views may not fully reflect objectively measured clinical outcomes.

First, surveyed wards reported high levels of perceived clinical expertise in managing specific high-complexity conditions. This was accompanied by generally good availability of internal resources, while access to external resources appeared more heterogeneous. This pattern suggests that wards are generally confident in managing patients whose clinical needs align with their skill mix, even when they may rely on other hospital services to complete the diagnostic and therapeutic process.

Second, the overall alignment between ED admissions and the clinical profile of inpatient wards was perceived as only moderate. While respondents reported only partial correspondence between ED case mix and the clinical and scientific focus of their wards when asked in general terms, perceived appropriateness was generally higher when evaluated using ICD-9 macro-categories. This discrepancy likely reflects a combination of clinical and organizational factors. ED patients frequently present with multimorbidity, frailty, and complex needs that do not fit neatly within subspecialty-oriented services, particularly in highly specialized academic hospitals. As such, this mismatch likely reflects the inherent complexity of patient allocation in this context, rather than suboptimal decision-making at the ED level. These findings should be interpreted considering the highly specialized academic setting of the study, which may have influenced respondents' perceptions and may differ in more generalist hospital settings.

At the same time, reliance on ICD-9 coding may lead to an overestimation of admission appropriateness, as it provides a simplified representation of clinical conditions and does not adequately capture patient complexity. Consequently, patients with substantially different profiles and required resources may be grouped into a single diagnostic category, potentially masking relevant mismatches between patient needs and ward expertise.

Admission coding may also reflect pragmatic choices aimed at facilitating patient placement, rather than fully representing the complexity of the clinical presentation. This further highlights the limitations of relying solely on administrative data to assess admission appropriateness.

Despite this mismatch, secondary transfers due to inappropriate admission were reported as uncommon, suggesting that inpatient wards often retain patients without systematically redirecting them to alternative units.

Respondents associated inappropriate admissions primarily with organizational consequences, such as longer hospital length of stay and resource waste, rather than with major clinical outcomes. At first glance, this pattern may suggest that, from the respondents' perspective, mismatched admissions are not perceived to significantly compromise patient outcomes. However, this pattern likely reflects the system's ability to compensate rather than its intrinsic efficiency. Inpatient teams may mitigate the impact of suboptimal patient-ward alignment through high levels of expertise, increased workload, and multidisciplinary involvement. Furthermore, patients are typically admitted after an initial phase of assessment, stabilization, and risk stratification in the ED. This upstream process may enable both the allocation of unstable patients to higher-intensity settings and the identification of more specific subspecialty needs, allowing some patients to be directly routed to more appropriate wards.

As a result, even when patients are not perfectly aligned with a ward's subspecialty profile, they may still be adequately treated within a general medical setting. This adaptive capacity ensures safe care delivery, but comes at the cost of increased organizational strain, higher workload, and suboptimal use of clinical expertise. In this context, inappropriate admissions may lead to prolonged hospital length of stay and reduced bed turnover, thereby indirectly contributing to boarding. These findings suggest that admission appropriateness may be perceived as an underrecognized system-level determinant of ED overcrowding.

Participants consistently indicated that improving alignment could enhance resource utilization, shorten length of stay, increase discharge capacity, and improve bed availability in the ED. Staff skill mix, internal diagnostic resources, alignment with departmental activity, and post-discharge pathways were identified as key facilitating factors.

Third, the findings related to boarding are particularly relevant. All respondents reported familiarity with this phenomenon and unanimously considered boarding and overcrowding to be hospital-wide issues. They also frequently reported receiving patients who had spent prolonged periods boarding in the ED, indicating that this is routinely encountered in inpatient practice.

However, respondents generally perceived its impact on clinical outcomes during hospitalization as less evident from their perspective, with most indicating only a partial effect. This perception

appears to be at odds with the existing literature reporting worse clinical outcomes associated with boarding. Importantly, these findings reflect clinicians' perceptions and should not be interpreted as evidence of limited clinical impact. This discrepancy likely reflects differences between perceived and objectively measured outcomes, as clinical endpoints were not directly assessed in this study. In addition, inpatient clinicians may be less exposed to the early consequences of boarding, which often occur during the ED stay and may therefore be less apparent to receiving teams, potentially leading to an underestimation of boarding-related harm. Furthermore, when effective treatment is initiated early during the ED boarding phase, patients may appear clinically stable upon arrival to the ward.

Taken together, these findings suggest that inpatient physicians primarily perceive boarding as a system-level phenomenon requiring system-level solutions.

Limitations

This study has several limitations. First, the findings are based on the perceptions of inpatient ward heads and therefore reflect subjective assessments rather than objectively measured clinical outcomes. Although administrative data were incorporated to support diagnosis-specific analyses, clinical endpoints were not directly assessed. In addition, objective longitudinal data on ED boarding times and ward length of stay trends were not included in the present analysis and should be addressed in future studies. Furthermore, responses may reflect managerial perspectives and may not fully capture those of all clinicians involved in patient care, as ward heads may have a more organizational perspective than frontline physicians. Responses may also have been influenced by cognitive and contextual factors, including recall processes and institutional perspectives.

Second, the sample size (16) was limited, reducing the robustness of the estimates and the generalizability of the findings.

Third, this was a single-center study conducted in a tertiary academic hospital with a high level of subspecialization. This organizational context may have shaped both patient allocation processes and clinicians' perceptions and may limit reproducibility, as local organizational characteristics and patient flow processes may differ in less specialized or more generalist hospital settings. Although the focus on medical wards with substantial interaction with the ED was an intentional methodological choice aligned with the study objective, the exclusion of surgical and predominantly elective specialties may further limit the generalizability of the findings to other hospital settings.

Finally, the questionnaire was specifically developed for this study and, although it was reviewed for content relevance, it was not validated and no formal assessment of reliability was performed.

This may affect the robustness of the findings, which should therefore be interpreted as context-specific, perception-based, and exploratory.

Conclusions

This survey suggests that inpatient physicians perceive ED boarding and overcrowding as hospital-wide organizational challenges closely related to the management of hospital capacity and patient flow. While ED admissions were not always perceived as fully aligned with the clinical and scientific profile of inpatient wards, respondents perceived that patients generally receive appropriate clinical care, albeit at the cost of greater organizational strain and prolonged hospital throughput. This dynamic may ultimately contribute to reduced bed turnover and worsening access block, thereby reinforcing ED boarding.

Addressing this mismatch through better alignment between patient needs, departmental expertise, and hospital resources may represent a key system-level lever to improve patient flow and reduce boarding and ED overcrowding.

References

1. Kenny JF, Chang BC, Hemmert KC. Factors affecting emergency department crowding. Emerg Med Clin North Am 2020;38:573-87.
2. Pearce S, Marchand T, Shannon T, et al. Emergency department crowding: an overview of reviews describing measures, causes, and harms. Intern Emerg Med 2023;18:1137-58.
3. Moskop JC, Sklar DP, Geiderman JM, et al. Emergency department crowding, part 1--concept, causes, and moral consequences. Ann Emerg Med 2009;53:605-11.
4. Driesen BEJM, van Riet BHG, Verkerk L, et al. Long length of stay at the emergency department is mostly caused by organisational factors outside the influence of the emergency department: a root cause analysis. PLoS One 2018;13:e0202751.
5. Richardson DB, Mountain D. Myths versus facts in emergency department overcrowding and hospital access block. Med J Aust 2009;190:369-74.
6. Richardson DB, Brockman K, Abigail A, et al. Effects of a hospital-wide intervention on emergency department crowding and quality: a prospective study. Emerg Med Australas 2017;29:415-20.
7. McKenna P, Heslin SM, Viccellio P, et al. Emergency department and hospital crowding: causes, consequences, and cures. Clin Exp Emerg Med 2019;6:189-95.

8. Clark J, Islam MS. Hospital access block: a scoping review. J Emerg Nurs 2022;48:430-54.
9. da Silva Ramos FJ, Freitas FGR, Machado FR. Boarding in the emergency department: challenges and mitigation strategies. Curr Opin Crit Care 2024;30:239-45.
10. American College of Emergency Physicians. Definition of boarded patient: policy statement. Ann Emerg Med 2011;57:548.
11. Kulstad EB, Kelley KM. Overcrowding is associated with delays in percutaneous coronary intervention for acute myocardial infarction. Int J Emerg Med 2009;2:149-54.
12. Gaieski DF, Agarwal AK, Mikkelsen ME, et al. The impact of ED crowding on early interventions and mortality in patients with severe sepsis. Am J Emerg Med 2017;35:953-60.
13. Bernstein SL, Aronsky D, Duseja R, et al. The effect of emergency department crowding on clinically oriented outcomes. Acad Emerg Med 2009;16:1-10.
14. Chang BP, Carter E, Suh EH, et al. Patient treatment in ED hallways and patient perception of clinician-patient communication. Am J Emerg Med 2016;34:1163-4.
15. Baloescu C, Kinsman J, Ravi S, et al. The cost of waiting: association of ED boarding with hospitalization costs. Am J Emerg Med 2021;40:169-72.
16. Iozzo P, Spina N, Cannizzaro G, et al. Association between boarding of frail individuals in the emergency department and mortality: a systematic review. J Clin Med 2024;13:1269.
17. Singer AJ, Thode HC, Viccellio P, et al. The association between length of emergency department boarding and mortality. Acad Emerg Med 2011;18:1324-9.
18. Savioli G, Ceresa IF, Gri N, et al. Emergency department overcrowding: understanding the factors to find corresponding solutions. J Pers Med 2022;12:279.
19. Robertson S, Ryan T, Talpur A. Staff and patient experiences of crowding, corridor care and boarding: a rapid review. Emerg Nurse 2025;33:15-21.
20. Asplin BR, Magid DJ, Rhodes KV, et al. A conceptual model of emergency department crowding. Ann Emerg Med 2003;42:173-80.
21. Pearce S, Marr E, Shannon T, et al. Overcrowding in emergency departments: an overview of reviews describing global solutions and their outcomes. Intern Emerg Med 2024;19:483-91.
22. Jones PG, Jackson G. Emergency department crowding is not being caused by increased inappropriate presentations. N Z Med J 2023;136:94-8.
23. Cooke MW, Wilson S, Halsall J, et al. Total time in English accident and emergency departments is related to bed occupancy. Emerg Med J 2004;21:575-6.
24. Hoot NR, Aronsky D. Systematic review of emergency department crowding: causes, effects, and solutions. Ann Emerg Med 2008;52:126-36.

25. Morley C, Unwin M, Peterson GM, et al. Emergency department crowding: a systematic review of causes, consequences and solutions. PLoS One 2018;13:e0203316.
26. Samadbeik M, Staib A, Boyle J, et al. Patient flow in emergency departments: a comprehensive umbrella review of solutions and challenges across the health system. BMC Health Serv Res 2024;24:274.
27. Forero R, McCarthy S, Hillman K. Access block and emergency department overcrowding. Crit Care 2011;15:216.
28. Lang-Hodge AM, Monaghan MN, Lim R, et al. Modulating patient output: rethinking the role of EM in the healthcare system. Intern Emerg Med 2025;20:215-20.
29. Chan SSW, Cheung NK, Graham CA, et al. Strategies and solutions to alleviate access block and overcrowding in emergency departments. Hong Kong Med J 2015;21:345-52.
30. Chang AM, Cohen DJ, Lin A, et al. Hospital strategies for reducing emergency department crowding: a mixed-methods study. Ann Emerg Med 2018;71:497-505.e4.
31. Hammer C, DePrez B, White J, et al. Enhancing hospital-wide patient flow to reduce emergency department crowding and boarding. J Emerg Nurs 2022;48:603-9.
32. Rasouli HR, Aliakbar Esfahani A, Abbasi Farajzadeh M. Challenges, consequences, and lessons for way-outs to emergencies at hospitals: a systematic review study. BMC Emerg Med 2019;19:62.
33. Posit team. RStudio: integrated development environment for R. Boston, MA: Posit Software; 2024.

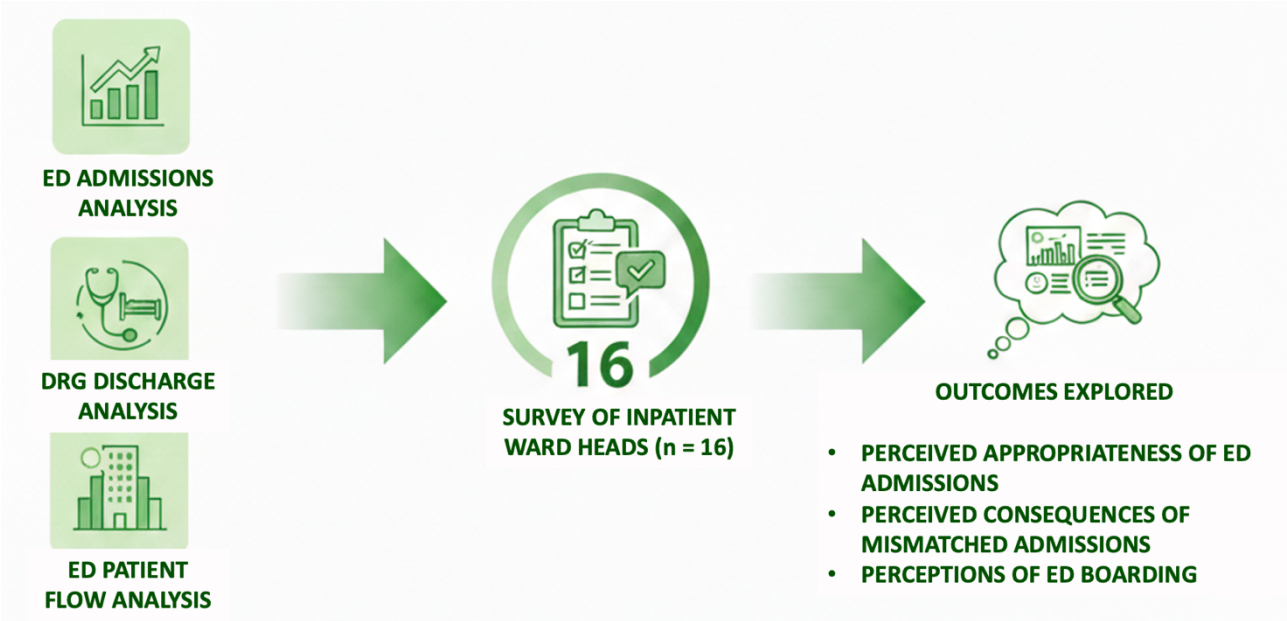

Figure 1. Study framework. Administrative hospital data on ED admissions, DRGs, and ED patient flow were integrated with a hospital-wide survey of inpatient ward heads to explore perceptions of admission appropriateness, organizational consequences of mismatched admissions, and ED boarding.

Table 1. Clinical activity, expertise, and availability of diagnostic and outpatient resources in participating wards. Data are presented as median values with interquartile ranges (IQR).

Survey item	**Median**	**IQR**
Expertise of the clinical team in managing selected high-complexity patients	4	4-5
Availability of internal diagnostic resources during hospitalization	4	3-4
Ease of access to external diagnostic resources or specialist consultations	3	3-4
Availability of dedicated outpatient pathways for selected patients	4	4-5

Outpatient clinics and day-hospital pathways facilitating early discharge	4	4-4.25

Table 2. Inpatient physicians' perceptions regarding the appropriateness of ED admissions and the perceived consequences of inappropriate admissions. Data are presented as median values with interquartile ranges (IQR).

Survey item	**Median**	**IQR**
Perceived appropriateness of ED admissions		
Alignment between ED admissions and the ward's clinical profile	3	3-4
Need for specialist competencies not available within the ward	3	3-3.25
Ward ability to self-sufficiently provide diagnostic and therapeutic resources	3	2.75-3.25
Need to rely on difficult-to-access diagnostic resources	2	2-3
Secondary transfers due to inappropriate admission	2	2-2
Perceived consequences of inappropriate ED admissions		
Longer hospital length of stay	4	4-4
Increased in-hospital complications	2	2-3
Increased infectious complications	3	2-3.5
Increased mortality	2	2-3
Resource waste	4	3.5-4
Secondary transfers to other wards	3	2-4

Table 3. Overall perceived alignment and diagnosis-specific appropriateness of ED admissions. Overall alignment between ED admissions and ward clinical profile is reported using a 5-point Likert scale (1 = never, 5 = always). Diagnosis-specific appropriateness refers to the evaluation of the ten most frequent ICD-9 macro-categories leading to admission for each ward and is expressed as the number and percentage of assessments rated as appropriate, partially appropriate, or not appropriate. Percentages are calculated on 160 diagnosis-specific evaluations (16 wards × 10 diagnoses). Detailed ward-level results are provided in Supplementary Table 1.

Perceived alignment between ED admissions and ward profile	**Results**
Overall alignment (5-point Likert)	Median 3, IQR 3-4
ICD-9-specific appropriateness: appropriate	102/160 (63.8%)
ICD-9-specific appropriateness: partially	44/160 (27.5%)
ICD-9-specific appropriateness: not appropriate	14/160 (8.7%)

Table 4. Perceived benefits of improved ED admission appropriateness and organizational factors contributing to these benefits. Data are presented as n/N (%), where n represents the number of respondents and N the total number of participants (N = 16).

Survey item	Agreement n/N (%)
Perceived benefits of improved admission appropriateness	
Reduced hospital length of stay	13/16 (81.3%)
Improved quality of patient care	13/16 (81.3%)
Optimization of hospital resources	16/16 (100%)
Higher discharge rates	13/16 (81.3%)

Increased bed availability for the ED and potential boarding reduction	13/16 (81.3%)
Improved quality of work for the ward clinical team	16/16 (100%)
Perceived reasons for the benefits of improved admission appropriateness	
Availability of internal diagnostic resources	13/16 (81.3%)
Post-discharge outpatient pathways managed by the ward	12/16 (75%)
Staff skill mix	15/16 (93.8%)
Alignment with the ward's scientific activity	13/16 (81.3%)

Oline supplementary materials

Appendix 1. English version of the survey questionnaire.
Appendix 2. Supplementary Table 1. Ward-level comparison between overall perceived alignment and diagnosis-specific appropriateness.

Contributions: Mario Corciulo and Claudio Borghi contributed to the conception and design of the study. Mario Corciulo and Davide Pianori designed the survey. Fabrizio Giostra revised the survey and the dataset. Mario Corciulo analyzed and interpreted the data, performed the statistical analysis, and drafted the manuscript. Eleonora Tubertini and Davide Agnoletti critically revised the manuscript for important intellectual content. All authors approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

Conflict of interest: the authors declare that they have no competing interests.

Ethics approval and consent to participate: this study was conducted as part of a broader research project on hospital patient flow and emergency department admissions that was approved by the Comitato Etico Area Vasta Emilia Centro della Regione Emilia-Romagna (CE-AVEC)

(protocol number 690/2024/Oss/AOUBo). Participation in the survey was voluntary, and completion of the questionnaire was considered to imply informed consent. All data were collected and analyzed in anonymized and aggregate form. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Consent for publication: not applicable

Availability of data and materials: the datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

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