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TeleFAST: Pooling Remote Physician Capacity Across Emergency Departments to Improve On-Site Flow and System Resilience

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Abstract

Background

Emergency department (ED) crowding is driven by low-acuity visits that consume physician capacity and lengthen wait times. In Portugal, nearly 40% of ED visits are low-acuity (Manchester Triage System II [MTS II] blue or green). ED demand fluctuates, but conventional fast-track models (FTMs) depend on on-site physician availability, limiting absorption of demand peaks. TeleFAST is a centralised telemedicine FTM that pools remote physician capacity across multiple EDs.

Methods

A multicentre observational study was conducted across four EDs (CUF Hospital Network, Portugal; November 2024–January 2026), comprising a retrospective cohort comparison of TeleFAST versus standard of care (SoC) among low-acuity adults meeting fast-track eligibility criteria, and a cross-sectional survey of healthcare professionals (HCPs) delivering TeleFAST. Outcomes included ED length of stay (LOS), resource utilisation, workload variability, and 72-hour and 7-day reattendance. Between-group comparisons used Wilcoxon rank-sum, chi-square, and Fisher's exact tests. Mixed-effects models adjusted for MTS II presenting flowchart assessed operational outcomes, and logistic regression assessed reattendance. A Resilience Index (RI) was developed to assess demand buffering. Survey analyses included construct scoring, Cronbach's alpha, and correlations among technology acceptance, organisational readiness, and usability constructs.

Results

A total of 7046 ED visits were analysed (TeleFAST n = 3677; SoC n = 3369). TeleFAST reduced median LOS by 43 minutes (74 vs 117 minutes; $p < 0.001$; adjusted − 34.8 minutes) and time to first observation by 9 minutes ($p < 0.001$). Diagnostic and therapeutic interventions were lower in TeleFAST (all $p < 0.001$), and 96% were managed remotely. Reattendance at 72 hours and 7 days did not differ ($p > 0.05$). Total low-acuity demand variability (SD = 11.7) exceeded SoC workload variability (SD = 6.7; RI = 0.42), indicating buffering. HCPs reported positive attitudes and intention to use (4.29–4.33), acceptable usability (SUS 71.8/100), and moderate organisational readiness (3.52–3.79).

Conclusions

TeleFAST improved ED efficiency and maintained short-term safety while buffering on-site workload variability. By pooling physicians across EDs, it addresses the structural dependence of conventional FTMs on local staffing. Centralised telemedicine FTMs may represent a scalable, resilient workforce model for low-acuity demand in multi-site emergency care.

Background

Emergency department (ED) overuse is a well-recognised global challenge, associated with increased costs, longer waiting times, and overstretched services [1, 2]. Estimates suggest that 40–60% of ED visits may be considered potentially non-urgent or avoidable [3]. In Portugal, the burden is particularly high: OECD 2023 data report 77 ED visits per 100 population - about 2.5 times the OECD-28 average (31 per 100) [4]. Available data further indicate that standard cases (triaged as “green”) and non-urgent cases (triaged as “blue”) account for approximately 37% and 2% of ED visits, respectively [4–6].

Several factors contribute to this pattern. For example, limited access to primary care, the widespread perception that EDs offer superior diagnostic and therapeutic capabilities, and the convenience of 24/7 availability all drive excessive demand [2, 7]. High rates of avoidable ED visits are also linked to gaps in primary care continuity, socioeconomic vulnerability, and the complex needs of aging populations with multiple chronic conditions [1, 2]. In addition, ED demand is highly variable over time, fluctuating according to seasonal respiratory outbreaks, holiday periods, and population movements, as well as weather conditions [8]. Consequently, these factors complicate the allocation of human and physical resources and may compromise the quality, efficiency, and continuity of emergency care [9, 10]. When low-acuity overuse translates into sustained demand pressure, the result is ED overcrowding, which further strains capacity and patient flow.

To address ED overcrowding and improve patient flow, many hospitals have implemented fast-track models (FTM) dedicated to patients with low-acuity conditions [11]. Eligible patients are typically identified during triage using predefined inclusion criteria based on presenting complaints and triage categories [11]. Previous studies have shown that ED FTMs can reduce waiting times, shorten ED length of stay (LOS), and alleviate overcrowding without compromising quality of care [12, 13]. More recently, telemedicine has emerged as an extension of ED FTMs, enabling remote assessment of low-complexity patients while maintaining integration within standard ED workflows [14, 15]. It has been proposed to improve organisational efficiency by allowing centralised clinical teams to support multiple sites and dynamically redistribute workforce capacity, with synchronous teleconsultations facilitating timely decision-making without on-site physician presence and increasing operational flexibility [14, 15]. Such workforce flexibility directly supports health system resilience, defined as the capacity of healthcare services to absorb, adapt, and respond to fluctuations in demand while maintaining service delivery and quality of care under varying conditions [16].

Despite increasing interest in telemedicine, evidence regarding its implementation within FTMs remains limited. Most published studies focus on telemedicine models operating outside routine ED workflows, such as virtual and tele-urgent care services [17–20], which may not reflect the operational and organisational characteristics of telemedicine integrated directly into emergency care processes. In particular, there is limited multicentre evidence regarding implementation strategies, organisational performance, workforce flexibility, and user acceptance in real-world ED settings. Hence, the TeleFAST study was designed to address this gap by evaluating a centralised telemedicine-based FTM

implemented across four EDs in Portugal. Specifically, this study aimed to (i) describe the implementation and utilisation of the model; (ii) assess organisational performance; and (iii) explore healthcare professionals' (HCPs) experience, including perceived usefulness and usability of the technology, as well as organisational readiness for implementation.

Methods

Study design and setting

This was a multicentre observational study conducted across four EDs within the private CUF Hospital Network in Portugal. The study comprised two complementary components. The first was a retrospective analysis of clinical and service data (between November 2024 and January 2026) to evaluate the implementation and organisational performance of the FTM compared with the standard in-person (SoC) pathway. The second was a cross-sectional survey administered to HCPs involved in the FTM, designed to assess usability, satisfaction, and organisational readiness for implementation.

The study was approved by the Ethics Committee of CUF, Lisbon, Portugal (Reference No. 82/2025/57454188). Reporting followed the STROBE guidelines for observational studies [21]. The completed checklist is provided in the Supplementary Appendix.

Participants and eligibility criteria

For the retrospective component, the study included all adult patients aged 18–65 years attending one of the four participating EDs during the study period who were triaged as blue ("non-urgent") or green ("standard") according to the Manchester Triage System II (MTS II).

Following standard ED triage, patients were screened for TeleFAST eligibility using predefined institutional criteria based on triage category, presenting complaint, attendance during operational hours, and voluntary acceptance of the telemedicine model. Eligible patients could be actively referred to the TeleFAST service by the triage nurse, whereas non-eligible patients continued through the SoC. Patients were excluded from TeleFAST if they were triaged as urgent or emergent (MTS II yellow, orange, or red), were pregnant, presented with the MTS discriminator "dizziness", were reattending for the same complaint, attended outside TeleFAST operating hours, or declined to participate in the telemedicine consultation process. Detailed eligibility criteria are presented in Table 1.

For the survey component, HCPs aged ≥ 18 years who were directly involved in the implementation or delivery of the TeleFAST pathway were eligible to participate, including remote physicians, nurses, and telemedicine assistants (TMAs). Eligible participants were identified through institutional records and invited by email to complete an online questionnaire administered via Google Forms. Participation was voluntary and based on prior informed consent.

Table 1
Patient eligibility criteria.

Eligible	Not Eligible
Presenting with a condition classified under one of the MTS II presentational flowcharts, designated as fast track eligible (see full list in Appendix Table S1)	Reattendance (patient returns to any ED within the CUF network with the same presenting complaint within 4 weeks, or 2 weeks after April 3, 2025, and met fast track eligibility at the initial visit)
Attending during FTM operating hours	Attending outside FTM operating hours
Adults aged 18–65 years	Pregnancy
Triaged as blue (non-urgent) or green (standard) per MTS II	Triaged as yellow (urgent), orange (very urgent), or red (emergency) per MTS II
Voluntarily subscribing to TeleFAST	Not subscribing to TeleFAST
	Presence of "dizziness" (an MTS II discriminator)

ED = Emergency department, MTS II = Manchester Triage System II, TeleFAST = CUF centralised fast track model

TeleFAST

TeleFAST is a telemedicine FTM designed to integrate remote clinical assessment into standard ED workflows for low-acuity patients across multiple hospital sites (Fig. 1). The model combines synchronous video consultations, digital physical examination devices, and on-site operational support, enabling centralised physician coverage and dynamic redistribution of workforce capacity between EDs in real time.

Following standard ED triage, patients meeting predefined eligibility criteria could be identified and actively flagged for the TeleFAST pathway by the triage nurse within the electronic health record (EHR). They entered a shared queue within the ED information system. Assignment to TeleFAST or SoC was determined by first physician availability across both pathways. When a TeleFAST physician became available first, the TMA approached the eligible patient, explained the teleconsultation pathway, and obtained verbal consent. Patients who declined stayed in the shared queue and waited for the next available on-site physician. When an on-site SoC physician became available first, the patient was seen through the standard pathway regardless of TeleFAST eligibility (Fig. 2).

Remote ED physicians conducted real-time consultations supported by TMAs, who prepared patients, operated digital examination devices, and facilitated physical assessments (e.g., otoscopy, oropharyngoscopy, and auscultation) under physician guidance. Remote physicians had full access to the ED clinical information on the EHR, and documentation procedures were identical for remote and on-site physicians, ensuring continuity of care, traceability, and confidentiality.

Additional diagnostic and therapeutic interventions, including laboratory testing, imaging, treatment administration, referral to other specialties, and patient disposition, followed the same protocols used in the SoC pathway. Patients requiring in-person assessment or escalation of care were transferred to the SoC circuit.

Remote physicians were recruited from experienced ED clinicians across the CUF hospital network and received targeted training in teleconsultation workflows and digital examination platforms. TMAs underwent blended and supervised training to ensure standardised workflow execution and device handling. Continuous coordination between remote physicians and TMAs was supported through a real-time communication platform.

Figure 2. Patient allocation workflow and integration of the TeleFAST and SoC circuits.

ED = Emergency department, EHR = Electronic health record, SoC = Standard of care ED, TeleFAST = CUF centralised fast track model

Data collection and Instruments

Clinical and operational data were extracted from routinely collected EHRs and administrative databases, including patient demographics, episode timestamps, triage information, diagnostic and therapeutic procedures, resource utilisation, and short-term reattendance. Diagnoses and presenting conditions were categorised according to the International Classification of Diseases, 11th Revision (ICD-11) [22], and MTS II flowcharts.

Survey data were collected anonymously through an online questionnaire administered to HCPs involved in TeleFAST implementation and operation. The instrument incorporated validated versions of the Technology Acceptance Model (TAM) [23], the System Usability Scale (SUS) [24], and the Organizational Readiness for Implementing Change (ORIC) [25]. The TAM assessed perceived usefulness, attitudes toward TeleFAST, and behavioural intention to use the system. The ORIC evaluated organisational commitment and perceived efficacy regarding implementation, while the SUS measured perceived usability and ease of use. In addition, participants answered three open-ended questions exploring perceived benefits of the TeleFAST pathway, implementation challenges, and suggestions for improvement.

Outcome measures

TeleFAST was evaluated across three main domains: organisational performance, system resilience, and HCPs' experience. Organisational performance outcomes included time from triage to first medical observation, ED LOS, diagnostic and therapeutic resource utilisation, referral to in-person care, and short-term reattendance within 72 hours and 7 days. Analyses were restricted to patients presenting under the same MTS II flowcharts to improve comparability between pathways.

System resilience was operationalised as the capacity of the TeleFAST model to buffer fluctuations in total low-acuity ED demand, assessed by comparing variability of overall demand with that of the SoC workload over time.

HCPs' experience outcomes included technology acceptance, usability, organisational readiness, and qualitative perceptions regarding TeleFAST implementation.

Data analysis

Analyses were conducted using R version 4.5.0 and SPSS version 29.0.2.0. All statistical tests were two-sided, with $p < 0.05$ considered statistically significant. Continuous variables were summarised using means and standard deviation (SD) or medians and interquartile ranges (IQR), as appropriate, while categorical variables were presented as counts and percentages. Between-group comparisons (TeleFAST versus SoC) were performed using Wilcoxon rank-sum tests for continuous variables and chi-square or Fisher's exact tests for categorical variables. Linear mixed-effects models were used to assess associations between care pathway and operational outcomes, adjusting for MTS II presenting flowchart as a fixed effect. Short-term safety outcomes, including 72-hour and 7-day reattendance, were analysed using logistic regression models, with results reported as odds ratios (OR) and 95% confidence intervals (CI).

Monthly admission counts were used to derive a Resilience Index (RI), reflecting the extent to which fluctuations in total low-acuity ED demand were translated into variability in on-site workload, calculated as: $RI = 1 - SD_{SoC} / SD_{Total\ Demand}$, where SD_{SoC} represents the SD of monthly SoC admissions and $SD_{Total\ Demand}$ denotes the SD of total monthly low-acuity ED admissions. This formulation is conceptually related to demand-amplification and mitigation phenomena described in the supply chain resilience literature, where resilient systems absorb and mitigate disruptions rather than allowing them to propagate through the system [26]. An RI of 0 indicates that fluctuations in total low-acuity ED demand are fully reflected in on-site workload, whereas increasing RI values indicate progressively greater decoupling between demand fluctuations and on-site workload variability. Monthly aggregated admission counts were also used to visualise temporal patterns in admissions across pathways.

Survey data underwent structured preprocessing, including data screening, identification and listwise handling of missing values (maximum 4.2% per item; no imputation performed), reverse coding of negatively worded items, and calculation of construct scores as item means. Internal consistency reliability was assessed using Cronbach's alpha (α), and correlations between TAM, ORIC, and SUS constructs were explored using correlation analyses.

Responses to open-ended questions were analysed using an inductive thematic analysis approach. Open-ended data were reviewed and grouped into recurrent themes related to perceived benefits, implementation barriers, and suggested improvements. Frequencies of coded themes were calculated descriptively to support the interpretation of qualitative findings.

Results

Patient and Operational Outcomes

A total of 7046 low-acuity adult ED visits (MTS II blue or green) across four EDs were analysed, including 3677 (52.2%) managed through TeleFAST and 3369 (47.8%) receiving standard of care (SoC). Groups were comparable in demographic and triage acuity category (median age 38 years [IQR 27–48], 64% female, 99% triaged green; all P > 0.05). However, the distribution of triage flowcharts differed significantly between groups ($p < 0.001$; Appendix Table S2), reflecting variation in the type rather than the severity of presenting complaints, although the most frequent flowcharts were common to both groups.

TeleFAST was associated with improved operational efficiency. Median time to first clinical observation was reduced by 9 minutes (35 [IQR 23–58] vs. 44 [24–77] minutes; $p < 0.001$), and median ED LOS decreased by 43 minutes overall (74 [48.8–119] vs. 117 [70–180] minutes; $p < 0.001$) (Fig. 3). In adjusted analyses accounting for the flowchart, ED LOS remained 34.8 minutes shorter in the TeleFAST group ($p < 0.001$), with no consistent differences across flowcharts (all $p > 0.05$; Appendix Tables S3–S4).

TeleFAST visits also required fewer therapeutic interventions (median 0 [0–2] vs. 1 [0–7]) and diagnostic tests (median 0 [0–0] vs. 0 [0–3]; both $p < 0.001$). In analyses adjusted for the MTS II presenting flowchart, these differences persisted, with 2.23 fewer therapeutic consumptions, 1.91 fewer complementary diagnostic and therapeutic procedures, and 0.33 fewer total consumptions in the TeleFAST group (all $p < 0.05$; Appendix Tables S5–S7), indicating that lower resource utilisation was not attributable to differences in flowchart distribution between pathways. Most TeleFAST patients (95.9%; n = 3526 of 3677) were fully managed remotely.

Short-term safety outcomes were comparable between groups. Seventy-two-hour reattendance occurred in 1.3% of both groups (OR 0.96; 95% CI 0.62–1.49), while 7-day reattendance occurred in 2.2% versus 2.0% (OR 1.08; 95% CI 0.77–1.52). Reattendance for the same complaint was also similar at 72 hours (2.2% vs. 2.3%; OR 0.96; 95% CI 0.69–1.34) and 7 days (3.9% vs. 4.2%; OR 0.94; 95% CI 0.74–1.20) (all $p > 0.05$).

Figure 3. Comparison of SoC Versus TeleFAST Monthly Median ED LOS Over Time.

ED = Emergency department, LOS = Length of stay, SoC = Standard of care ED, TeleFAST = CUF centralised fast track model

Total low-acuity ED demand showed substantial monthly variation (SD 11.7), whereas variability in SoC admissions was lower (SD 6.7), corresponding to an RI of 0.42. TeleFAST and SoC admissions showed similar temporal patterns across the study period, although median monthly volumes differed between pathways ($p < 0.05$) (Appendix Table S8).

Experience of Healthcare Professionals

A total of 24 HCPs involved in the TeleFAST pathway completed validated questionnaires assessing implementation experience, technology acceptance, organisational readiness, and usability. Participants had a mean age of 37.7 years (SD = 10.17), 20 (83.3%) were female, and represented multiple professional roles, including 13 TMAs (54.2%), 5 triage nurses (20.8%), 4 remote physicians (16.7%), and 2 nurses (8.3%). Respondents were distributed across the participating sites, with the largest representation from Hospital CUF Sintra (37.5%, n = 9), followed by Hospital CUF Descobertas (25.0%, n = 6), Hospital CUF Porto (20.8%, n = 5), and CUF Digital and Hospital CUF Torres Vedras (8.3% each, n = 2). Most respondents reported substantial ED experience, with 22 (91.7%) having more than one year of ED practice (1–5 years: 45.8%; 6–10 years: 20.8%; >10 years: 25.0%), while 14 (58.3%) had 6–12 months of direct experience with TeleFAST.

Overall, HCPs reported favourable perceptions of TeleFAST, including positive attitudes toward use (mean 4.33), behavioural intention to continue use (mean 4.29), and moderate perceived usefulness (mean 3.80) and usability (mean SUS item score 3.89; overall SUS score 71.8/100), corresponding to an acceptable rating on the Bangor et al. adjective grading scale [27]. Organisational readiness scores were generally modest, with comparatively lower scores for change commitment (mean 3.52) and change efficacy (mean 3.79). Moderate positive correlations were observed between perceived usefulness and both technology acceptance and organisational readiness constructs ($r = 0.42–0.49$; all $p < 0.05$), while attitude and behavioural intention showed a strong association ($r = 0.887$; $p < 0.01$). Usability scores showed no meaningful association with any TAM or ORIC construct, with correlations ranging from −0.24 to 0.40 (all $p > 0.05$), suggesting that perceived usability may operate independently of technology acceptance and organisational readiness in this sample (Table 2).

Open-ended responses identified reduced waiting times as the most frequently perceived benefit of TeleFAST (16 responses, 67%), followed by improved ED flow and reduced overcrowding (8 responses, 33%). Reported challenges mainly related to communication and acceptance among patients and clinical teams (11 responses, 46%) and technological barriers or system failures (9 responses, 38%). Suggested improvements primarily focused on strengthening technological infrastructure and digital tools (11 responses, 46%) and improving workflow organisation and dedicated staffing (5 responses, 21%).

Table 2
Mean scores, internal reliability and correlations among technology acceptance, organisational readiness, and system usability constructs.

Variable	Mean	Perceived Usefulness	Attitude	Intention	Change Commitment	Change Efficacy	SUS
TAM - Perceived Usefulness	3.80	(0.81)	0.430*	0.494*	0.457*	0.422*	-0.059
TAM - Attitude	4.33		(0.86)	0.887**	0.165	0.104	0.341
TAM - Intention	4.29			(0.97)	0.312	0.155	0.401
ORIC - Change Commitment	3.52				(0.77)	0.522**	-0.241
ORIC - Change Efficacy	3.79					(0.76)	0.215
SUS	3.89						(0.63)

TAM = Technology Acceptance Model, ORIC = Organizational Readiness for Implementing Change, SUS = System Usability Scale. Values in parentheses on the diagonal are Cronbach's alpha coefficients. P values *$p < .05$; **$p < .01$.

Discussion

In this multicentre study of 7046 low-acuity ED visits, TeleFAST, a centralised telemedicine FTM pooling remote physician capacity across four EDs, was associated with a 43-minute reduction in median ED LOS (adjusted: −34.8 minutes), a 9-minute reduction in time to first clinical observation, and lower diagnostic and therapeutic resource utilisation. Reattendance rates at 72 hours and 7 days were comparable between groups, and 95.9% of patients were managed fully remotely. Total low-acuity demand variability (SD 11.7) exceeded on-site SoC workload variability (SD 6.7), corresponding to an RI of 0.42 and suggesting that centralised pooling buffered fluctuations in demand. HCPs reported favourable acceptance across professional groups.

These findings address a persistent structural limitation of conventional FTMs. Despite their widespread adoption in ED care, evidence on their workforce implications, operational performance under real-world conditions, and capacity to support system resilience across multi-site networks remains limited. Conventional FTMs are structurally dependent on on-site physician availability, as their throughput is bounded by local staffing, leaving multi-site systems unable to pool non-synchronous demand or buffer capacity shortfalls across sites [3, 11]. TeleFAST was designed to address this constraint by constituting a geographically agnostic remote physician pool that serves multiple EDs dynamically. To our

knowledge, this study is among the first to operationalise ED resilience using a workload variability metric that quantifies the extent to which fluctuations in low-acuity demand are reflected in on-site workload.

The observed reduction in ED LOS is consistent with the model's intended mechanism: the primary objective of TeleFAST was to reduce waiting times for low-acuity patients by removing their care from the on-site physician queue. These findings are also in line with the pooled reduction reported in a previous systematic review and meta-analysis of FTM strategies (− 21.8 minutes; 95% CI − 41.79 to − 1.83) [28].

The characteristics of our cohort were consistent with prior descriptions of low-acuity ED populations. Most patients were triaged as green under the MTS II, corroborating Ausserhofer et al. (2026) [29], who reported a similar predominance of green-coded visits among non-urgent ED presentations. Previous studies have further shown that younger age, female sex, shorter visit duration, and non-specific or minor complaints are commonly associated with potentially non-urgent ED use [30], aligning with the demographic profile observed in our sample. Within this context, the high proportion of patients managed entirely remotely through TeleFAST (95.9%) supports the suitability of telemedicine pathways for low-complexity ED demand and is consistent with prior telehealth evidence reporting remote resolution of both urgent and non-emergent needs in approximately 84–87% of cases [31].

The comparable 72-hour and 7-day reattendance rates between TeleFAST and SoC (all OR 0.94–1.08) provide no evidence of harm attributable to remote management, consistent with findings by Ashenburg et al. (2022) [14], who observed no significant differences in revisit rates between an ED virtual fast-track and conventional care for low-acuity patients. Notably, lower resource utilisation in TeleFAST persisted after adjustment for MTS II presenting flowchart, indicating that, for the same presenting complaint and triage priority, the telemedicine FTM pathway involved fewer diagnostic and therapeutic procedures. Combined, these findings suggest that clinical management was maintained with fewer resources.

The RI of 0.42 provides preliminary quantitative support for the resilience proposition underpinning TeleFAST: that a remote physician pool, by serving multiple sites simultaneously, can absorb non-synchronous demand peaks that a site-bound model cannot. Because the same pool is shared across EDs, demand surges at one site can be partially offset by lower demand at others, translating network volatility into a more stable on-site workload. This buffering effect is structurally unavailable in conventional single-site FTMs, where throughput is directly coupled to local staffing.

HCPs reported generally favourable perceptions of TeleFAST, including positive attitudes toward use and strong intention to continue using the system, alongside moderate perceived usefulness and ease of use. Organisational readiness scores were above the scale midpoint, although lower scores for change commitment and change efficacy suggest some uncertainty regarding implementation. Open-ended responses further reinforced these findings, with reduced waiting times and improved ED flow identified as the main perceived benefits, while communication, staff acceptance, and technological limitations emerged as the principal constraints. This aligns with previous research in Swiss EDs, where FTMs were

associated with high staff satisfaction and perceived improvements in patient flow and personnel resource allocation, despite persistent operational challenges [32]. Additionally, usability scores showed no significant association with TAM or ORIC constructs, suggesting that perceived ease of use may represent a distinct dimension of HCP experience not captured by acceptance or readiness measures alone.

This study has limitations. Patient allocation to TeleFAST was governed by first physician availability within a shared queue, rather than by active referral or patient preference at the point of triage, a mechanism that approximates quasi-random allocation among eligible patients and partially mitigates the risk of selection bias. Nonetheless, the observational, non-randomised design precludes definitive causal inference, and residual confounding cannot be excluded, notably the significant between-group difference in presenting flowchart distribution, which reflects variation in the type rather than the severity of complaints. Furthermore, the study was conducted within a single private healthcare network in Portugal, which may limit generalisability to systems with different organisational structures, funding models, levels of digital maturity, and patterns of ED utilisation.

Economic data, including cost per TeleFAST encounter, TMA labour costs, and device amortisation, were not available for this analysis, and patient-reported outcomes were not assessed. In addition, the model's dependence on reliable connectivity and digital examination devices may constitute a structural barrier in resource-limited settings, potentially restricting its transferability beyond well-resourced healthcare networks. Finally, the RI was developed as an exploratory operational measure specific to this setting. These gaps nonetheless define a clear research agenda. Future work should validate the RI across different healthcare contexts, evaluating its sensitivity to secular trends and its behaviour under varying demand patterns and network configurations, and should incorporate economic evaluations, patient-reported experience measures, and 30-day safety outcomes to establish the model's value from both system and patient perspectives.

Conclusions

The TeleFAST model was associated with improved ED operational performance and increased system resilience while maintaining short-term safety outcomes, with most low-acuity patients managed remotely. The RI provides preliminary evidence that centralised physician pooling may reduce the translation of demand variability into on-site workload fluctuation, and HCPs reported positive attitudes, supporting its feasibility for sustained implementation. These findings suggest that centralised FTMs, organised around geographically agnostic physician pooling, may represent a scalable and resilient workforce model for the management of low-acuity demand in multi-site emergency care systems.

Abbreviations

CI
Confidence Interval

ED
Emergency Department
EHR
Electronic Health Record
FTM
Fast Track Model
HCP
Healthcare Professional
ICD-11
International Classification of Diseases 11th Revision
IQR
Interquartile Range
LOS
Length of Stay
MTS II
Manchester Triage System II
OECD
Organisation for Economic Co-operation and Development
OR
Odds Ratio
ORIC
Organizational Readiness for Implementing Change
SD
Standard Deviation
SoC
Standard of Care
SUS
System Usability Scale
TAM
Technology Acceptance Model
TeleFAST
CUF Centralised Fast Track Model
TMA
Telemedicine Assistant

Declarations

Ethics approval and consent to participate

This study was approved by the Ethics Committee of CUF Hospital Network (Reference No. 82/2025/57454188; approval date: 1 September 2025). The study used anonymised retrospective data from CUF Hospital Network emergency departments; therefore, informed consent from patients was

waived. Healthcare professionals participating in the cross-sectional survey provided prior informed consent. All procedures complied with the principles of the Declaration of Helsinki.

Consent for publication

Not applicable.

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Author Contribution

M.M: Conceptualization, Funding acquisition, Investigation, Project administration, Supervision, Visualization, Writing – review & editing. F.L: Conceptualization, Writing – review & editing. S.R: Conceptualization, Writing – review & editing. D.C: Conceptualization, Writing – review & editing. E.O: Conceptualization, Formal analysis, Investigation, Methodology, Project administration, Supervision, Writing – original draft, Writing – review & editing. A.R.S: Conceptualization, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing. K.B: Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing. A.P.G: Conceptualization, Formal analysis, Investigation, Methodology, Writing – review & editing. F.G: Writing – review & editing. A.R.L: Conceptualization, Project administration, Supervision, Writing – review & editing.

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Data Availability

Access to data may be considered for bona fide research purposes upon reasonable request to the corresponding author, subject to CUF institutional approval and execution of an appropriate data-sharing agreement.

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Figures

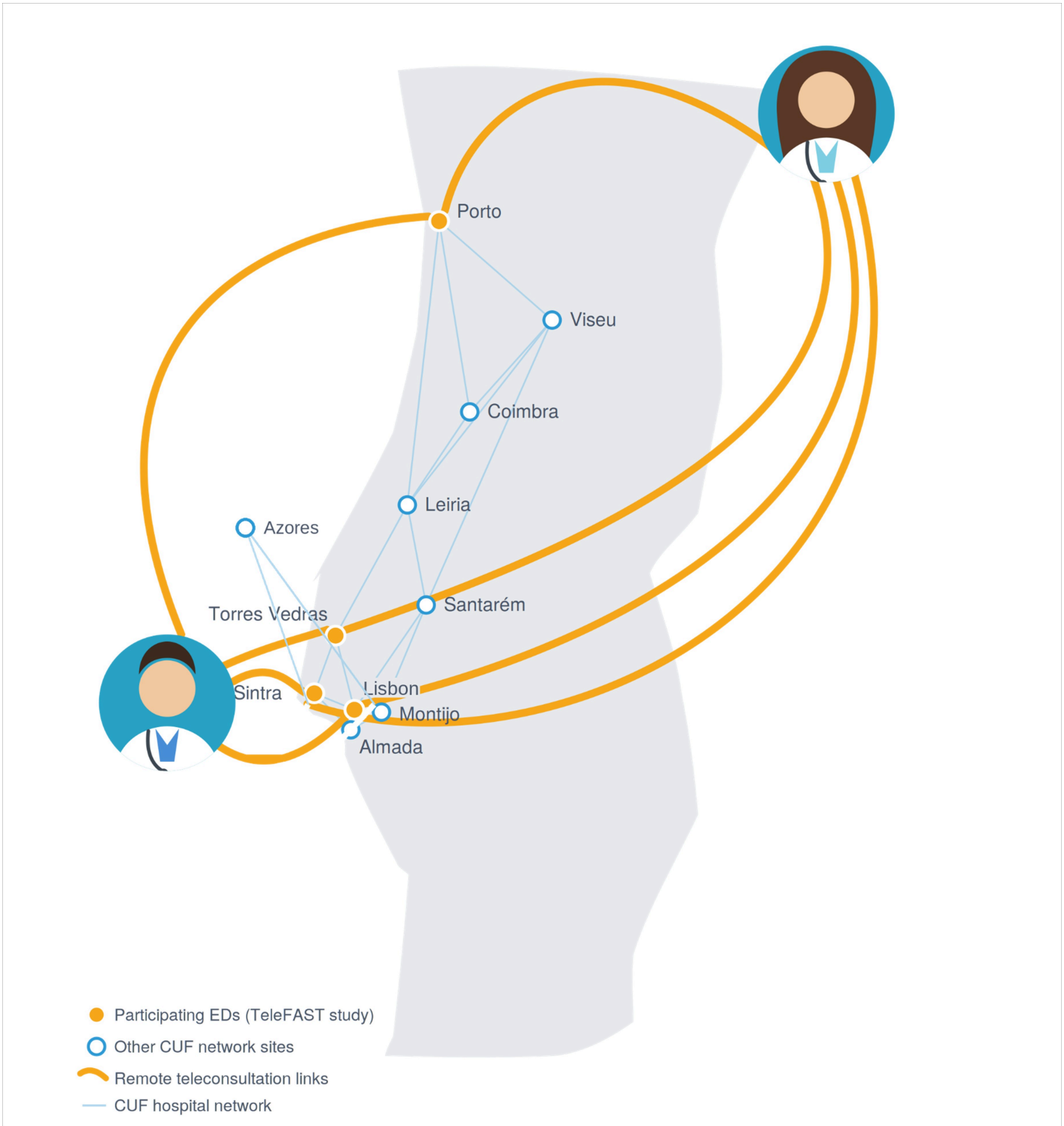


Figure 1

Geographic representation of a centralised telemedicine FTM for low-acuity ED care across multiple hospitals in Portugal.

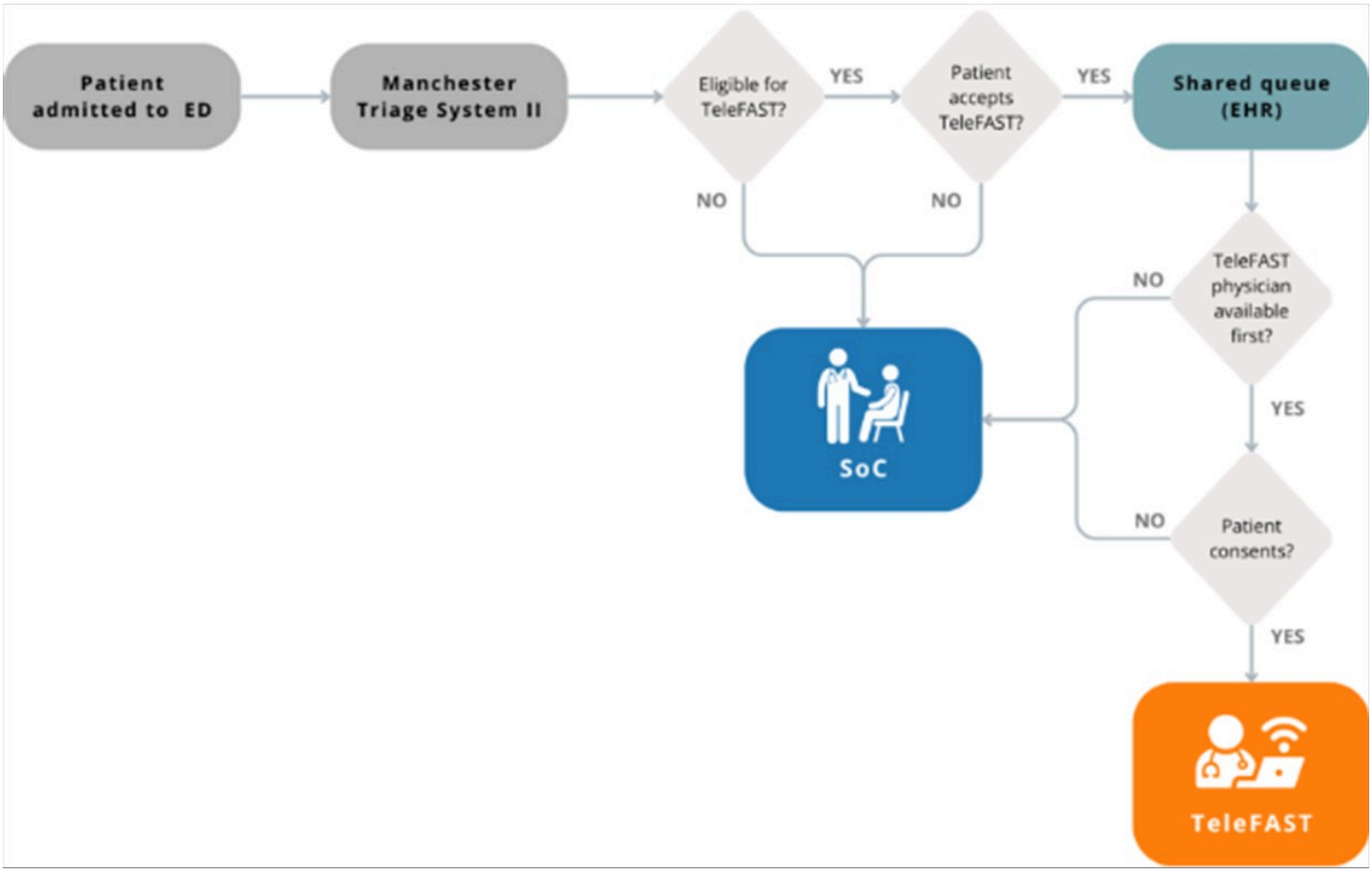


Figure 2

Patient allocation workflow and integration of the TeleFAST and SoC circuits.

ED = Emergency department, EHR = Electronic health record, SoC = Standard of care ED, TeleFAST = CUF centralised fast track model

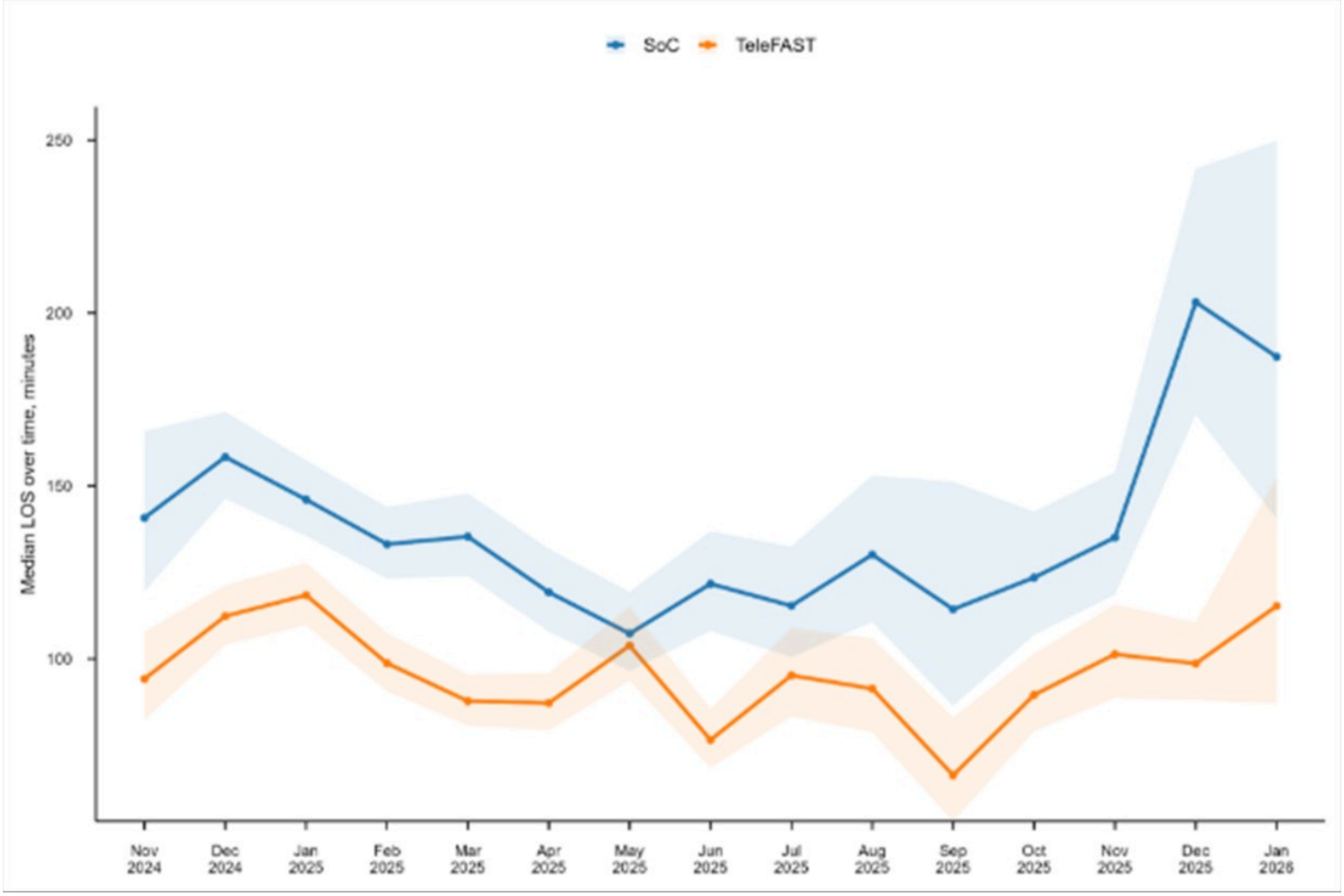


Figure 3

Comparison of SoC Versus TeleFAST Monthly Median ED LOS Over Time.

ED = Emergency department, LOS = Length of stay, SoC = Standard of care ED, TeleFAST = CUF centralised fast track model

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- TeleFASTBMCHealthServicesResearchAppendix.docx