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Factors Associated With Prolonged Ambulance Turnaround Time in a Large Quebec Health Network: A Two-Year Retrospective Study

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ABSTRACT

Background

Ambulance turnaround time (TAT), defined as the interval from ambulance arrival at the emergency department (ED) to vehicle readiness for a new call, is a key performance indicator for emergency medical services (EMS). Prolonged TAT reduces ambulance availability, compromises system efficiency, and may adversely affect patient outcomes. In Quebec, performance targets require that 80% of TATs be under 35 minutes and 98% under 45 minutes.

Objective

This study aimed to identify factors associated with ambulance TAT exceeding 45 minutes across hospitals within the Mauricie-Centre-du-Quebec Integrated Health and Social Services Centre (CIUSSS MCQ) over two consecutive fiscal years.

Methods

A retrospective observational study was conducted using anonymized EMS operational data from the PACQSPU database. All ambulance calls recorded between April 2023 to March 2024 and April 2024 to March 2025 were analyzed. Calls with TAT >45 minutes were examined according to month, time of day, call priority, receiving hospital, and day of the week.

Results

Of 118 953 ambulance calls, approximately 23 to 25% exceeded the 45-minute TAT threshold in both years. Delays occurred predominantly during daytime shifts and weekdays. Priority levels P1 and P3 accounted for most delayed calls, while P0 calls showed the highest proportion of prolonged TAT. Urban hospitals, particularly the regional referral center, exhibited higher delay rates.

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Prolonged TAT was associated with a substantial financial burden with an estimated direct cost of more than 1,75 million dollars over two years.

Conclusion

Ambulance offload delays remain persistent and structurally driven. Targeted interventions focusing on hospital capacity, stretcher availability, and coordination of ambulance arrivals and reorientation are urgently needed to improve system performance and reduce recurrent costs.

INTRODUCTION

Emergency medical services (EMS) are a critical component of the healthcare system. They provide both medical care and transportation to patients with time-sensitive health conditions, from point of contact until their admission to the emergency department (ED). EMS are required to meet the response time standards established by the Quebec Ministry of Health and Social Services for each phase of an emergency call [1].

In Quebec, EMS calls are coordinated through a structured prehospital intervention chain. The process begins with call reception, during which emergency calls are received and assessed. It is followed by dispatch coordination, where calls are prioritized and ambulance teams are assigned and coordinated based on patient acuity, hospital capabilities and geographic proximity. Paramedic teams subsequently respond to the scene, provide prehospital assessment and management, and transport patients. The intervention chain concludes with the transfer of care from paramedic teams to ED staff upon hospital arrival (Gouvernement du Quebec, 2022) [2].

This study examined ambulance turnaround time (TAT), defined as the time interval during which patient care is transferred from the prehospital team to the ED team [1]. It begins with the ambulance arrival to the ED and ends when the vehicle is ready to respond to a new call. TAT includes four key phases: (1) waiting time (from arrival until triage), (2) triage, (3) patient handover and release and (4) vehicle reconditioning [3]. Among these phases, waiting time (1) and patient handover (3) are the primary contributors to prolonged TAT and represent areas where improvements can be made. Upon ambulance arrival at the ED, paramedic teams generally provide advance notification regarding the urgency and clinical condition of the patient. Ambulance then wait outside the hospital until they can transfer the patient through the ambulance access area to the designated ambulance triage section. A triage nurse will evaluate their condition and determines the most appropriate destination within the ED. Depending on severity and nature of the patient's condition, he may be directed to the resuscitation room, an observation or monitored care area, or the waiting room if their condition is considered stable and does not require stretcher placement. In 2023, the Quebec government established that 80% of ambulance turnaround times should be under 35 minutes, and 98% under 45 minutes [3]. However, various factors can prolong the handover process leading to a decrease in ambulance availability for emergency responses, thereby affecting both system efficiency and community safety [4]. Moreover, patients transported by ambulance often require urgent care and any delay in treatment can negatively impact their health outcomes [5].

TAT delays are multifactorial, involving administrative, clinical and operational factors [6]. Several articles have identified contributors such as ED overcrowding, the number of ambulance offloading, seasonal variation, time of day and patient characteristics [4, 7, 8]. Comparisons of TAT delays often include different types of hospitals. Urban hospitals typically have larger emergency departments, greater stretcher capacity and staffing levels, broader access to specialists, and more extensive diagnostic resources. In contrast, rural hospitals generally operate with smaller emergency departments, which often necessitates the transfer of unstable patients to urban centres. This study aims to identify the main factors contributing to prolong the TAT within different hospitals of Mauricie-Centre-du-Quebec Integrated Health and Social Services Centre (CIUSSS MCQ) over 2 consecutive fiscal years. In this region, Trois-Rivières hospital (CHAUR) serves as the main urban centre and secondary regional trauma centre, offering a full range of medical specialties and acting as the primary referral hospital for patient transfers.

METHOD

We conducted a retrospective observational study examining EMS calls within the CIUSSS MCQ over a two-years period with the aim of identifying factors contributing to TAT longer than 45 minutes.

The data was organized according to two fiscal years, the first running from April 2023 to March 2024 and the second from April 2024 to March 2025. During these periods, 57 909 ambulance calls were recorded in the first year and 61 044 in the second. From those, only the calls with a TAT greater than 45 minutes were selected for analysis, resulting in 13 531 calls during the first year and 14 279 during the second year.

All information were collected from the «Progiciel d'Amélioration Continue de la Qualité des Services Préhospitaliers d'Urgence» (PACQSPU), which is used by the EMS in the CIUSSS MCQ to document and manage EMS operations. The dataset included operational metrics but contained no personal or identifying information. After extraction, the calls exceeding the 45 minutes threshold were grouped

by month to facilitate comparisons. For each month, several variables were examined, including the total number of calls, the day of the week, the time of day, the priority assigned to the call and the hospital receiving the patient. All processing, verifications and analyses were performed using Microsoft Excel.

Given that the dataset is routinely used for internal quality-improvement and the process was anonymized and devoid of any personal identifiers, this study did not require formal ethical approval. The analysis relied only on standard spreadsheet procedures, ensuring complete methodological transparency.

RESULTS

Based on the results presented below, it should be noted that for every 60-minute delay, an additional cost of $175 is incurred as the minimum direct cost of the delay. This represents an estimated total cost of 834 104.41$ for the 2023–2024 fiscal year and 915 936.20$ for the 2024–2025 fiscal year.

Results by month

Of the total 57 909 calls, 77% had a TAT less than 45 minutes and 23% exceeded 45 minutes.

When comparing monthly data, the first year showed between 24% and 31% of calls with a TAT greater than 45 minutes. The best months were October and March (24% each), while the worst were April, May and September (30%, 31% and 29%). In the second year, the proportion of calls with TAT greater than 45 minutes ranged from 21% to 35%. The best months were April and May (21% and 22%), whereas the worst were September, February and March (30%, 35% and 31%) **(Figure 1)**.

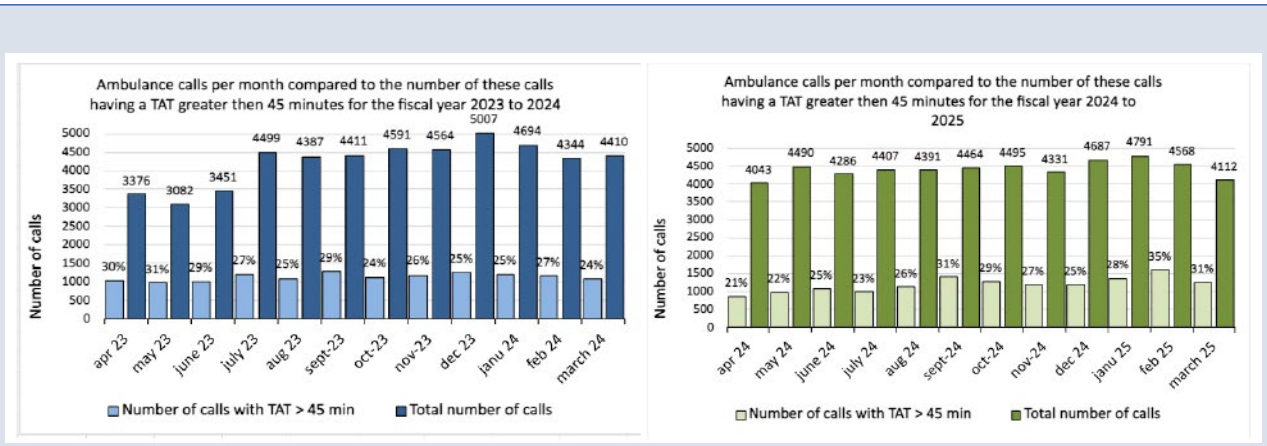

FIGURE 1 - Ambulance calls per month compared to the number of these calls having a TAT greater then 45 minutes for both fiscal years.

Results by time of the day

In the first year, among the 13 531 calls with a TAT greater than 45 minutes, 6780 (50%) occurred during the day shift, 5088 (38%) during the evening shift and 1661 (12%) during the night shift. Monthly distributions followed the same pattern, with 48-54% of these calls occurring during the day shift, 33-42% during the evening shift and 10-13% during the night shift **(Figure 2)**.

In the second year, the distribution was nearly identical. When examined monthly, the day shift accounted for 46-53% of calls exceeding 45 minutes, the evening shift for 34-41% and the night shift for 12-15% **(Figure 2)**.

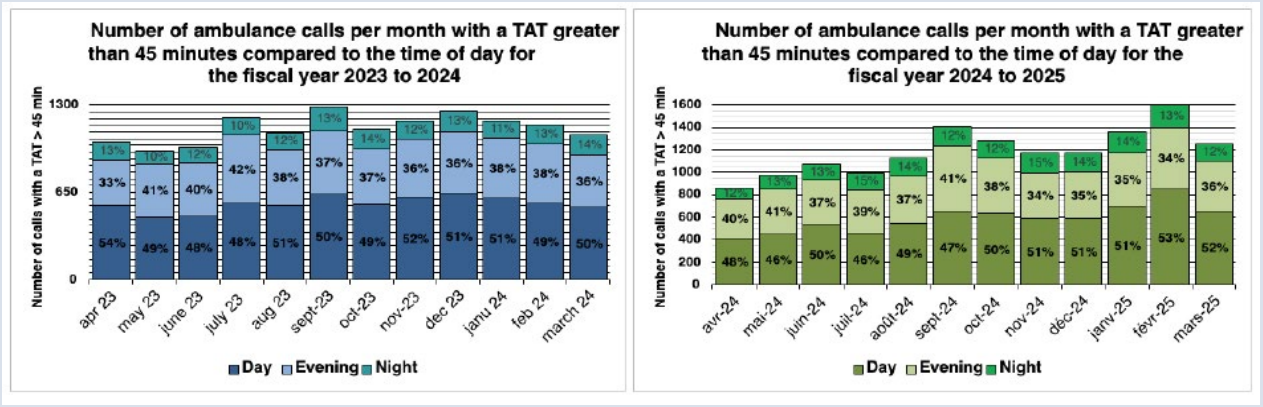

FIGURE 2 - Number of ambulance calls per month with a TAT greater than 45 minutes compared to the =me of day for both fiscal years.

Results by call priorities

In both years, the total number of EMS calls for each priority level was compared with the number of calls exceeding a TAT of 45 minutes. In Quebec, priorities are classified according to the urgency of patient's medical condition on a scale from P1 to P8 **(Figure 3)**.

In the first year, priority 1 (P1) and 3 (P3) were the most frequent with 5 848 and 4 679 calls respectively. Both categories showed a substantial proportion of calls with a TAT greater than 45 minutes: 26% for P1 and 23% for P3. Priority 0 (P0) was less common (564 calls), yet it presented the highest proportion of delays with 32% of calls exceeding the 45 minutes threshold **(Figure 4)**.

The second year showed similar trends. P1 accounted for 6 089 calls, of which 26% exceeded the required TAT. P3 represented 5 020 calls with 22% surpassing the 45 minutes limit. P0 was again the least frequent category (549 calls) but continued to show the highest proportion of inadequate response times with 31% of calls exceeding the cutoff **(Figure 4)**.

Across both years, the remaining priority levels were used less frequently and consistently showed approximately 18% of their calls with a TAT greater than 45 minutes.

Priority	Medical Condition	Assignment
Priority 0	High risk of cardiorespiratory arrest	Urgent
Priority 1	Immediate risk of mortality	Urgent
Priority 3	Potential risk of clinical deterioration	Urgent
Priority 4	Risk of clinical deterioration – hours	Non-urgent
Priority 7	Stable clinical situation with no identified risk	Non-urgent

FIGURE 3 - Ambulance dispatch priorities based on the urgency of the patient's medical condition in Quebec.

Skorupski, K. and Shooner, C. (2023). Déploiement de la paramédecine de régulation [PowerPoint slide 11]. Centre intégré universitaire de santé et de services sociaux de la Mauricie-Centre-du-Québec.

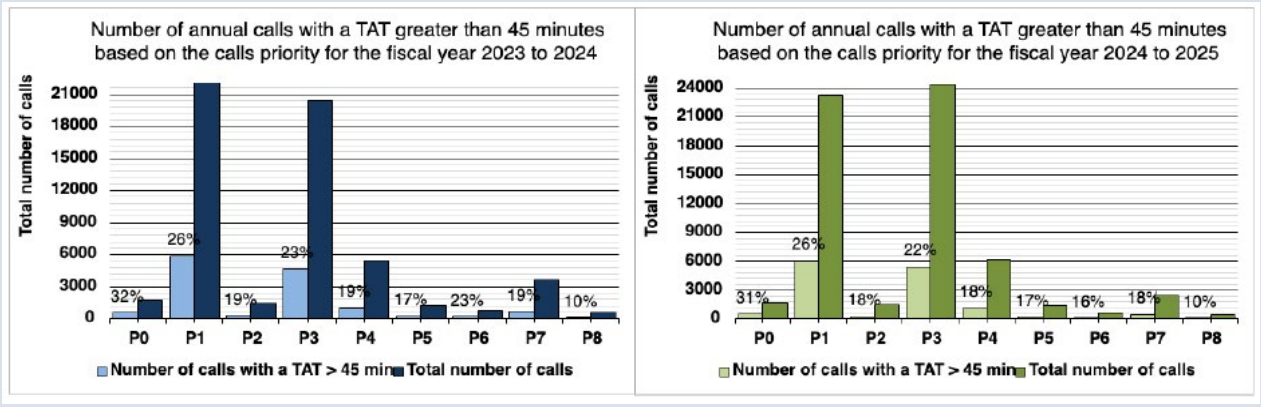

FIGURE 4 - Number of annual calls with a TAT greater than 45 minutes based on the calls priority for both fiscal years.

Results by hospital

Across both fiscal years, Trois-Rivières Hospital (CHAUR) was the primary recipient of ambulances, recording 19 744 ambulances in 2023-2024 and 19 930 in 2024-2025. CHAUR also exhibited the greatest proportion of prolonged TAT with 43% of ambulance TAT exceeding the 45 minutes threshold in the first year and 46% in the following year. Shawinigan Hospital (HCM) ranked second in ambulance volume, receiving 9 215 in 2023-2024 and 9 053 in 2024-2025. HCM maintained a 29% of ambulance arrivals with a TAT greater than 45 minutes. In contrast, the remaining hospitals within the CIUSSS MCQ had approximately 10% of ambulance calls exceeding the 45-minute TAT threshold **(Figure 5)**.

Results by the day of the week

In the first year, a total of 13 531 ambulance calls recorded a TAT greater than 45 minutes. Of these, 9 952 occurred on weekdays, accounting for 74% of all delayed calls, while 3 577 took place on weekends (26%). On a monthly basis, weekdays consistently represented most delays, ranging from approximately 65% to 80%, whereas weekends accounted for 21% to 35% **(Figure 6)**.

A similar pattern emerged in the second year. A total of 14 279 calls exceeded the 45 minutes TAT threshold, with 10 407 occurring on weekdays (73%) and 3 871 on weekends (27%). Monthly distributions mirrored those of the previous year, with weekday delays between 68% and 79%, compared with 21% to 32% on weekends **(Figure 6)**.

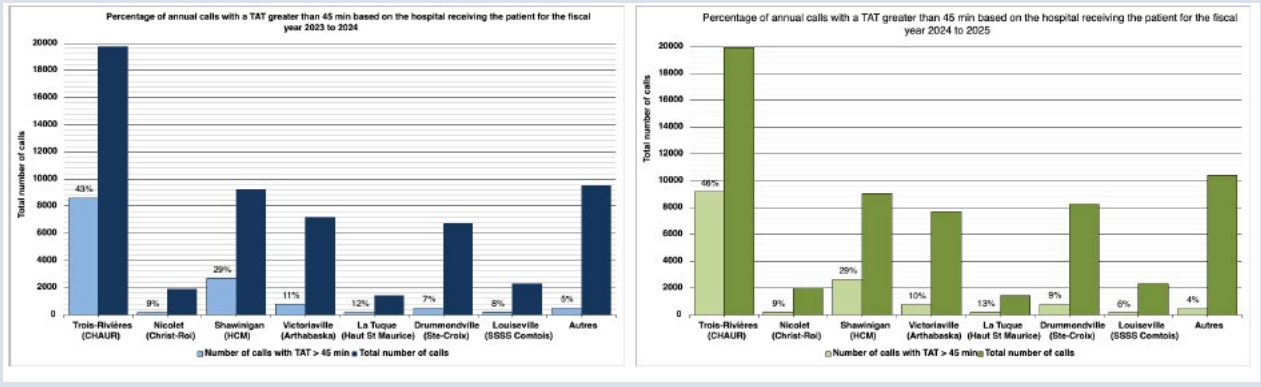

FIGURE 5 - Percentage of annual calls with a TAT greater than 45 minutes based on the hospital receiving the pa=ent for both fiscal years.

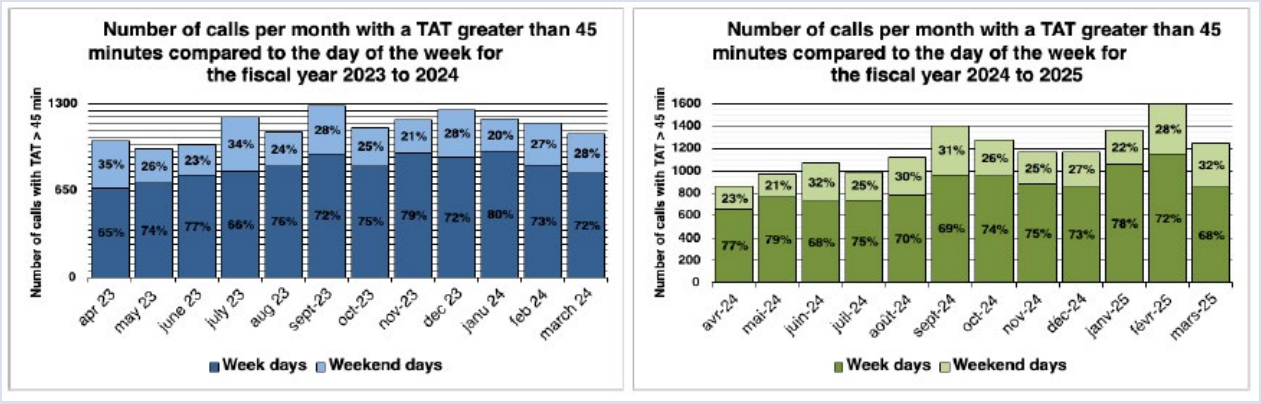

FIGURE 6 - Number of calls per month with a TAT greater than 45 minutes compared to the day of the week for both fiscal years.

DISCUSSION

The two years following the COVID-19 pandemic were selected for this study in order to minimize the confounding effects associated with the pandemic period, such as atypical patient volumes, altered care pathways, and exceptional organizational measures. Focusing on this post-pandemic timeframe allows for a more stable and representative assessment of TAT delays, thereby providing a clearer and more accurate overview of delays occurring in emergency departments within the CIUSSS MCQ.

This observational retrospective study demonstrated a substantial and persistent level of delayed TAT across hospitals within the CIUSSS MCQ. Over two consecutive fiscal year, we found that approximately one quarter of all ambulance calls each year had a TAT greater than 45 minutes. Although the total number of ambulance calls increased during the second year, the proportion of delayed calls remained largely unchanged, suggesting these delays are more likely related to persistent structural and organizational challenges rather than temporary fluctuations in ambulance demand. One factor that may contribute to these delays is the central role of triage nurses within the ED. Triage nurses are responsible for rapidly assessing patient severity and prioritizing care according to clinical urgency, regardless of whether patients arrive by ambulance or by other means. They also are responsible for determining whether patients require stretcher placement and for directing them to the most appropriate area of the ED, such as the waiting room, monitored care section, resuscitation room, or other specialized treatment areas [9]. Paramedics usually contact the ED before arrival to provide advance notification regarding patient condition and urgency. However, when ED are already operating near or beyond capacity, even patients transported by ambulance may experience delays before formal evaluation by the triage nurse and handover can occur. This may contribute to prolonged TAT and reduced ambulance availability for subsequent emergency responses.

Monthly analysis revealed marked variability in delays, with substantial fluctuations from month to month, ranging from 21% to 35%. This heterogeneity may reflect seasonal variations in ambulance service utilization, increased hospital pressure during winter periods, or fluctuations in resource availability. In Quebec, the factors contributing most significantly to accidents and injuries are strongly influenced by seasonal conditions, particularly during the winter months. February and March are typically associated with increased emergency department pressure due to harsh weather conditions, icy roads, respiratory illnesses, and a higher incidence of falls and motor vehicle collisions. September is often characterized by elevated healthcare system utilization related to the return to work and school, increased traffic density, and higher overall patient volumes, which may help explain the increased number of ambulance calls and prolonged turnaround times observed during these periods. In these results, the absence of consistent «best» and «worst» months when comparing the two years suggests that these patterns are likely influenced by multiple interacting factors and depend more on the broader organizational context than on seasonality alone [5].

The analysis stratified by receiving hospital revealed marked disparities across the CIUSSS MCQ. The CHAUR received the highest volume of ambulance arrivals in both years and exhibited the highest number of cases with a TAT exceeding 45 minutes. Shawinigan Hospital ranked second in terms of ambulance volume and delayed TAT, although its figures were substantially lower in both categories. In contrast, all other facilities

demonstrated markedly better performance, with approximately 10% of exceeding TATs. These findings suggest a strong association between patient volume, organizational capacities, and ambulance offload delays [6, 7]. Within the CIUSSS MCQ, the CHAUR functions as the primary regional referral centre and provides a broad range of specialized medical and surgical services. As a result, the hospital receives a large proportion of complex and high-acuity cases, including severe trauma, myocardial infarction requiring cardiac catheterization, severe head trauma and other specialized emergencies transferred from surrounding facilities. The increased clinical complexity of these patients may contribute to prolonged TAT through longer patient handovers, greater resource utilization and increased demand on emergency department personnel and stretcher availability. In addition, the concentration of specialized services at the CHAUR may create disproportionate pressure on the ED compared with smaller regional hospitals. Considering that ambulance dispatch is primarily determined by patient closeness to the hospital and the capability of hospitals to provide the required level of care, the main urban centers could potentially benefit from improved patient reorientation or dynamic ambulance diversion strategies toward less congested ED when clinically appropriate. Such measures may help reduce overcrowding, TAT delays and optimize EMS operational availability across the region.

Across both fiscal years, prolonged TAT occurred predominantly during weekdays and daytime shifts. More than three quarters of delayed calls were recorded on weekdays, while the day shift consistently accounted for most cases with extended TAT, followed by the evening shift. In contrast, the night shift was the least affected period. These findings likely reflect the greater concentration of hospital and ambulance activity during daytime hours and weekdays, period typically associated with increased emergency department utilization, scheduled clinical activities, delayed inpatient discharges, patient transfer delays and reduced stretcher availability [7]. Ambulance delays are closely associated with patient flow management within the ED, which itself largely depends on hospital bed availability and overall healthcare system capacity. Emergency departments are primarily intended to stabilize patients and provide initial treatment before discharge or hospital admission when necessary. However, when inpatient beds are unavailable, admitted patients remain in the ED for prolonged periods while awaiting transfer to hospital wards. This contributes significantly to stretcher occupancy and ED overcrowding. Consequently, stretcher availability within the ED is influenced not only by ambulance arrivals, but also by broader organizational factors such as hospital occupancy rates, inpatient discharge efficiency and overall resource management. From a wider system perspective, many patients occupying stretchers are often those requiring hospitalization, whereas lower-acuity patients waiting in the ED may potentially be managed through alternative care pathways such as outpatient clinics or family medicine services. Several interventions could therefore help reduce ED overcrowding and prolonged TAT during dayshift and weekdays. These include improving public education regarding appropriate ED utilization, expanding access to primary care and outpatient services, increasing the availability of family physicians, and enhancing triage systems to redirect non-urgent patients toward more appropriate healthcare resources. Together, these measures may help optimize patient flow, improve stretcher availability, and reduce persistent structural pressures affecting emergency departments, EMS systems and TAT delays [6].

Priority levels P1 and P3 were the most frequently used in both years and were associated with a substantial proportion of delays, with approximately 24% of calls at these priority levels exceeding the TAT threshold. Although less frequently used, P0 calls consistently exhibited the highest proportion of prolonged TAT. This finding is particularly concerning and may reflect specific challenges related to case complexity, hospital resource availability, and the allocation of human resources potentially prioritizing patient care over the timely release of ambulance crews [5, 8]. However, this observation may also be partially explained by the extra time needed to help the emergency department staff with chest compressions for example or cleaning and preparing the ambulance. In contrast, the remaining, less frequently used priority levels, demonstrated more stable and favorable performance overall. In 2023, the CIUSSS MCQ implemented the «paramédecine de regulation» program, an initiative that will contribute to improving patient orientation, priorization processes, and overall EMS efficiency. This program introduces a secondary triage system for lower-priority calls, specifically for P4 and P7. Following the initial 911 dispatch evaluation, eligible patients will be transferred to a specialized nurse directly linked to the primary care access system. The nurse then conducts a telephone assessment to determine the most appropriate care pathway and evaluate whether ambulance transport is truly required or whether alternative healthcare resources may be more suitable. Furthermore, when ambulance crews respond to higher-priority calls, such as P0 to P3, after assessing the patient condition on scene, paramedics can request additional evaluation by the nurse of the program if they believe the initial priority level are not accurate. In certain situations, this process may allow patient reorientation toward alternative healthcare services without ED transport when clinically appropriate [10]. This integrated triage and reassessment model may help optimize ambulance utilization, reduce unnecessary ED transports, improve patient orientation, and decrease pressure on overcrowded ED. By limiting avoidable

ambulance transports and improving resource allocation, such interventions may contribute to reducing TAT and enhancing EMS readiness for higher-acuity emergencies.

Prolonged ambulance offload delays were associated with a significant financial burden. Based on established minimal direct cost estimates, each additional 60-minute delay resulted in an incremental cost of approximately 175$. When summed across both study years, this corresponded to an estimated excess expenditure of 1 750,040.61$. This is probably an underestimate as the indirect costs of delaying an ambulance, like medicolegal complaints, fuel consumption in the winter for running the vehicles, deterioration of the patients conditions while waiting, cannot be calculated. These findings highlight that persistent TAT delays not only compromise operational efficiency but also generate substantial and recurrent costs for the publicly funded prehospital care system. Reducing offload delays could therefore represent an important opportunity for cost containment and reinvestment in system improvements, while simultaneously enhancing system performance and resource availability.

The principal strength of this study lies in the analysis of a large dataset encompassing all ambulance calls received over two consecutive years across all CIUSSS MCQ facilities. This comprehensive coverage provides a broad overview of ambulance offload times and allows for meaningful comparisons. Nevertheless, several limitations must be acknowledged. The retrospective observational design restricts the ability to establish causal associations between the factors examined and the observed TAT. Furthermore, the analysis relied exclusively on prehospital data from the SPU system, without access to hospital-level data [11]. As a result, several potentially important clinical and organizational variables could not be assessed. In particular, emergency department crowding at the time of ambulance arrival, a factor recognized as a key contributor to prolonged TAT, was not evaluated [7]. This limitation constrains a detailed understanding of the mechanisms underlying the inability to meet the 45 minutes TAT target for certain calls. Finally, although this study included all facilities within CIUSSS MCQ, it did not incorporate data from other regions of Quebec or Canada in general. Consequently, the finding may not be fully generalizable to settings with different organizational structures, patient volumes or resource availability [12, 13].

CONCLUSION

In conclusion, this study demonstrated that prolonged ambulance turnaround time (TAT) remains a significant and persistent challenge in both emergency and prehospital care systems, extending beyond local context and affecting healthcare networks internationally. Over two consecutive fiscal years, approximately one quarter of ambulance calls exceeded the provincial 45 minutes TAT target, these delays occurred more frequently during weekdays, daytime shifts, and among higher-acuity calls, with greatest impact observed at the CHAUR, the region's principal referral and specialized care center. ED overcrowding, limited stretcher and inpatient bed availability and resource allocation challenges all likely contribute to ambulance offload delays and reduced EMS operational availability. Immobilized ambulance while awaiting patient handover prolonged TAT and can compromise emergency response capacity, delay access to definitive care, and generate substantial recurrent costs for the healthcare system.

Several targeted interventions may help mitigate these delays and improve overall system performance. Strategies aimed at optimizing patient flow within ED, improving stretcher and inpatient bed management, facilitation earlier hospital discharges, and enhancing coordination between EMS and hospital teams may all contribute significantly to reduce TAT delays [16, 17]. The implementation of dedicated ambulance offload nurses, rapid-assessment or transition zones, and real-time monitoring of ED occupancy and stretcher availability may further improve patient handover efficiency and ambulance availability. In addition, regional coordination strategies such as dynamic ambulance diversion toward less congested facilities and improved patient reorientation systems, with the emergency reorientation by triage nurses and the «paramédecine de regulation» program, may help distribute patient volume more efficiently across the healthcare network when clinically appropriate [10, 14, 15]. By redirecting lower-acuity patients to more appropriate care pathways, these approaches may help decrease ED overcrowding, improve stretcher availability, and reduce prolonged TAT. Beyond operational interventions, improving access to primary care services, such as outpatient clinics and family medicine resources, and public education regarding appropriate ED use may also help alleviate persistent pressure on emergency healthcare systems.

Taken together, these findings highlight the importance of adopting an integrated systems-based approach involving EMS services, hospitals, healthcare administrators, and provincial policymakers. Reducing ambulance turnaround delays may not only improve EMS operational efficiency and resource utilization, but also enhance patient safety, access to timely care, and the overall resilience of the healthcare system.

Keywords

Ambulance turnaround time, Emergency medical services, Emergency department offload delay, Hospital capacity, Quebec health network

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Author contributions

All authors contributed equally and validated the final version of record.

Declarations

Conflicts Of Interests

The Authors declare that there is no conflict of interest.

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Registration

No registration applicable.

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Ethical approval

Ethical approval for this study was not required.

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