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Research Article

Keywords: emergency medical services, prehospital care, epidemiology, China, ambulance, injury, diurnal variation, response time, patient transport, non-emergency medical transport, health resource utilisation, ICD-10

Posted Date: July 11th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-9992127/v1>

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Additional Declarations: No competing interests reported.

Epidemiological Characteristics of Emergency Medical Service Calls in a Large Chinese City: A Retrospective Analysis of 191,730 Prehospital Dispatches in 2024

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Abstract

Background. Emergency medical service (EMS) call records are a continuously generated, population-level data source that can inform prehospital resource planning, yet detailed epidemiological descriptions from individual Chinese cities remain limited. We characterised the temporal pattern, presenting complaints, field diagnoses, and the relationship between patient age and disease category for one full year of EMS activity in a large Chinese city.

Methods. We retrospectively analysed all 191,730 EMS dispatches recorded by the municipal 120 emergency call centre between 1 January and 31 December 2024. Call timing was derived from the encoded dispatch identifier and validated against recorded call times. Presenting complaints (dispatcher triage) and field diagnoses (attending-physician impression) were grouped into clinically meaningful categories aligned with ICD-10 chapters. Distributions were summarised descriptively; associations between age group and both presenting complaint and diagnosis were tested with the Pearson χ^2 test, with Cramér's V as the effect size. Prehospital time intervals and hospital-transport rates were derived from a chain of operational timestamps.

Results. The median patient age was 62 years (interquartile range 39–76); 46.4% were aged ≥ 65 years and the male-to-female ratio was 1.22. Call volume showed a pronounced diurnal pattern, rising sharply in the morning to a peak at 10:00 (7.9% of calls) and reaching a nadir at 04:00 (1.6%); monthly variation was modest, with the highest volume in December (9.2%). Injury was the leading diagnostic group (S00–T14; 24.9%), followed by symptoms and ill-defined conditions (R00–R99; 20.5%) and cerebrovascular disease (I60–I69; 8.5%). Both presenting complaint and diagnosis varied strongly with age (age $\times$ diagnosis $\chi^2 = 46,247$, $df = 104$, Cramér's $V = 0.174$; age $\times$ complaint $\chi^2 = 45,859$, $df = 128$, $V = 0.173$; both $p < 0.001$): injury and alcohol intoxication clustered in young and middle-aged adults, whereas cerebrovascular disease, cardiac arrest, and respiratory illness increased steeply with age. Alcohol-related calls ($n = 9,524$) had a median age of 34 years, a male-to-female ratio of 4.15, and 63.9% occurred between 20:00 and 01:00. Scene/transport mortality rose monotonically with age from 0.46% (0–14 years) to 4.54% (≥ 85 years). The median response interval (call to scene) was 10.3 minutes (interquartile range 7.2–14.7), with 76.2% of responses within 15 minutes; 82.8% of dispatches resulted in hospital transport, but only 30.1% of cardiac-arrest cases were transported. Prehospital interventions mapped closely onto diagnosis—for example, resuscitation and defibrillation in cardiac arrest, oxygen in respiratory disease, and wound care in injury. Non-emergency transport (inter-hospital transfer, discharge, and long-distance transport) accounted for 27.9% of dispatches but an estimated 38.2% of ambulance-hours; it was of very low acuity (mortality 0.09%) and concentrated in daytime, approaching half of all calls at the mid-morning emergency peak.

Conclusions. EMS requires higher-efficiency call triage and ambulance deployment tailored to the characteristics of each emergency request in China. EMS demand in this city was concentrated in older adults and dominated by injury and time-sensitive medical emergencies, with clear age- and time-dependent structure. These patterns support morning-weighted staffing, targeted injury- and alcohol-prevention strategies, age-tailored prehospital protocols, and—given that low-acuity non-emergency transport consumed a disproportionate share of ambulance-time at peak hours—the diversion of eligible non-emergency transport to a dedicated medical-transport service.

Keywords: emergency medical services; prehospital care; epidemiology; China; ambulance; injury; diurnal variation; response time; patient transport; non-emergency medical transport; health resource utilisation; ICD-10

1. Introduction

Emergency medical services (EMS) form the first medical link in the chain of survival for acute illness and injury. In China, prehospital emergency care is delivered through a centralised 120 telephone dispatch system that coordinates ambulances across each municipality^{1,2}. Because every call generates a structured record of the time, the patient, the presenting problem, and the care delivered, accumulated EMS data constitute a large,

continuously updated window onto the acute health needs of a population, and an evidence base for staffing, vehicle deployment, and public-health intervention.

International and Chinese studies have repeatedly shown that EMS demand is patterned rather than random. Call volume follows strong diurnal and weekly cycles⁸, the case-mix is dominated by injury and a small number of time-critical medical conditions^{3,6}, and demand is increasingly concentrated in older adults as populations age^{5,10}. In rapidly urbanising Chinese cities, these pressures are compounded by high traffic-injury burden⁶, a large and growing stroke population¹², and a substantial incidence of out-of-hospital cardiac arrest⁷.

Most large Chinese EMS analyses to date have focused on multi-year trends, single disease groups, or the impact of the COVID-19 pandemic^{4,5}. Comprehensive, single-year descriptions that simultaneously examine the timing of calls, the reasons for calling, the field diagnoses, and—critically—how these vary with patient age remain comparatively scarce for individual cities. Understanding the joint structure of *when* people call, *why* they call, and *who* is calling is directly relevant to operational decisions such as shift design and the pre-positioning of specialised resources.

We therefore conducted a retrospective epidemiological analysis of one complete calendar year of EMS dispatches from a large Chinese city. Our objectives were to describe (i) the hourly and monthly distribution of calls, (ii) the distribution of presenting complaints, (iii) the variation of presenting complaints across age groups, (iv) the distribution of field diagnoses, and (v) the statistical association between patient age and disease category.

2. Methods

2.1 Study design and setting

This was a retrospective, cross-sectional analysis of routinely collected EMS dispatch records. The data originated from the centralised 120 emergency medical dispatch centre of Wuhan, a large metropolitan area in China. All emergency calls resulting in an ambulance dispatch and a completed prehospital care record between 1 January 2024 and 31 December 2024 were eligible for inclusion. The study was reported in line with the STROBE recommendations for observational research.

2.2 Data source and variables

Each record contained a unique encoded dispatch identifier, patient sex and age, the dispatcher's online preliminary triage (the presenting complaint), the attending physician's primary field diagnosis, on-scene vital signs, prehospital interventions, recorded past medical history, an acuity grade, and a death-on-scene/transport indicator. Ages recorded in years were grouped into nine bands (0–14, 15–24, 25–34, 35–44, 45–54, 55–64, 65–74, 75–84, and ≥85 years).

Derivation of call time. The time of each call was determined from the 14-digit timestamp embedded in the

dispatch identifier, which encodes the calendar date and clock time to the second and was available for all records. Where an independently recorded call time was also present ($n = 87,114$), the two agreed closely (median absolute difference 1 second; 99.8% within 2 minutes), supporting use of the identifier-derived timestamp for the complete dataset. Hour-of-day, day-of-week, and month were extracted from this timestamp.

Categorisation of presenting complaint and diagnosis. Free-text dispatcher triage entries were mapped to 17 clinically meaningful complaint categories (e.g., trauma/injury, altered consciousness/neurological, cardiac/chest symptoms, stroke/cerebrovascular, alcohol intoxication). Primary field diagnoses were mapped to diagnostic groups aligned with the chapters of the International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10). Diagnoses recorded as symptoms or as conditions awaiting investigation were assigned to the ICD-10 chapter for symptoms, signs, and abnormal clinical findings (R00–R99). Entries that could not be assigned to a specific category were grouped as “Other/unspecified.”

Time intervals and transport status. In addition to the call time, the record contained a sequential chain of operational timestamps: the time of online triage by the call-taker, the time the receiving station was notified, the time the ambulance departed, the time it arrived on scene, the time it left the scene with the patient, and the time it arrived at hospital. Using the online-triage time as the common anchor (available for all records), we derived six intervals: the activation interval (call to ambulance departure), the travel-to-scene interval (departure to scene arrival), the *response interval* (call to scene arrival), the on-scene interval (scene arrival to departure), the transport interval (scene departure to hospital arrival), and the total prehospital interval (call to hospital arrival). Implausible values (negative intervals or values beyond pre-specified physiological bounds) were treated as missing. A dispatch was classified as resulting in hospital transport when both a scene-departure and a hospital-arrival time were recorded; the remaining dispatches were classified as non-transport (including patients treated and released, those who declined transport, and those pronounced dead on scene). Ten discrete prehospital interventions (cardiopulmonary resuscitation [CPR], defibrillation, endotracheal intubation, mechanical ventilation, airway suction, oxygen therapy, intravenous [IV] access, bedside blood-glucose testing, wound dressing, and fracture immobilisation) were recorded as performed or not performed.

Dispatch type and resource use. Each call carried an operational dispatch-type label assigned by the call centre. We grouped these into *emergency responses* (emergency treatment, on-scene treatment, acute incidents, remote-area and standby calls) and *non-emergency transport* (inter-hospital transfer, discharge transport home, long-distance transport, planned admission, and simple transport). As a proxy for resource consumption, we estimated the ambulance time committed to each call as its total prehospital interval (call to hospital arrival) and summed these to obtain annual vehicle-hours by group. Specific low-acuity transport reasons named in routine practice (follow-up or re-examination, dressing change, urinary catheter or gastric-tube management, dialysis, chemotherapy, and rehabilitation) were additionally identified by keyword search of the free-text triage, complaint, and diagnosis fields; because these fields are not consistently completed, the resulting counts are

lower bounds.

2.3 Statistical analysis

Continuous variables are summarised as the median with interquartile range (IQR) and the mean with standard deviation (SD); categorical variables are summarised as counts and percentages. The hourly, weekly, and monthly distributions of calls were described as the percentage of total annual volume. Associations between age group and presenting complaint, between age group and diagnosis, and between sex and diagnosis were assessed using the Pearson χ^2 test of independence; the strength of each association was quantified with Cramér's *V*. For age-stratified case-mix, the distribution of complaints and diagnoses within each age band was expressed as a column percentage. All tests were two-sided and a *p* value < 0.05 was considered statistically significant. Analyses were performed in Python 3 (pandas, SciPy, and statsmodels).

2.4 Ethics

This study used de-identified, routinely collected operational data and was conducted in accordance with the Declaration of Helsinki. The protocol was approved by Medical Ethics Committee of Wuhan University Zhongnan Hospital, approval number [Approval No.:2026026K]. Because the analysis was retrospective and used anonymised records, the requirement for individual informed consent was waived by the committee.

3. Results

3.1 Patient and call characteristics

A total of **191,730** EMS dispatches were recorded during 2024. The median patient age was 62 years (IQR 39–76; mean 57.8, SD 22.8). Nearly half of all patients were aged 65 years or older (46.4%) and just over one quarter were aged 75 years or older (27.5%), whereas children under 15 years accounted for only 2.9% of calls. Male patients outnumbered female patients (105,473 vs 86,257; ratio 1.22). Most calls were graded as emergent (66.1%) or critical (9.8%), and 4.5% involved cardiac or respiratory arrest. The median call-to-scene interval was 11.2 minutes (IQR 8.0–16.1). Death before or during transport was recorded in 4,230 patients (2.21%). Patient and call characteristics are summarised in **Table 1**.

Table 1. Characteristics of EMS dispatches, Wuhan, 2024 (N = 191,730).

Characteristic	Value
Total dispatches, n	191,730
Age, years — median (IQR)	62 (39–76)
Age, years — mean (SD)	57.8 (22.8)

Characteristic	Value
Aged ≥ 65 years, n (%)	88,916 (46.4)
Aged ≥ 75 years, n (%)	52,635 (27.5)
Aged < 15 years, n (%)	5,636 (2.9)
Male sex, n (%)	105,473 (55.0)
Female sex, n (%)	86,257 (45.0)
Male-to-female ratio	1.22
Acuity — emergent, n (%)	126,737 (66.1)
Acuity — critical, n (%)	18,727 (9.8)
Acuity — cardiac/respiratory arrest, n (%)	8,636 (4.5)
Acuity — life-threatening, n (%)	1,781 (0.9)
Acuity — non-emergent, n (%)	35,819 (18.7)
Call-to-scene interval, min — median (IQR)	11.2 (8.0–16.1)
Death on scene/transport, n (%)	4,230 (2.21)

IQR, interquartile range; SD, standard deviation. Percentages for age and sex are of all dispatches. Acuity grade was missing for a small number of records.

3.2 Temporal distribution of calls

Call volume varied markedly across the day (**Figure 1**). Demand was lowest overnight, reaching a nadir at 04:00 (1.6% of calls), then rose steeply through the early morning to a peak at 10:00 (7.9%). A smaller secondary increase occurred in the early afternoon, after which volume declined gradually into the evening. Calls between 08:00 and 11:59 accounted for 28.2% of the annual total, compared with 11.6% for the overnight window 00:00–05:59.

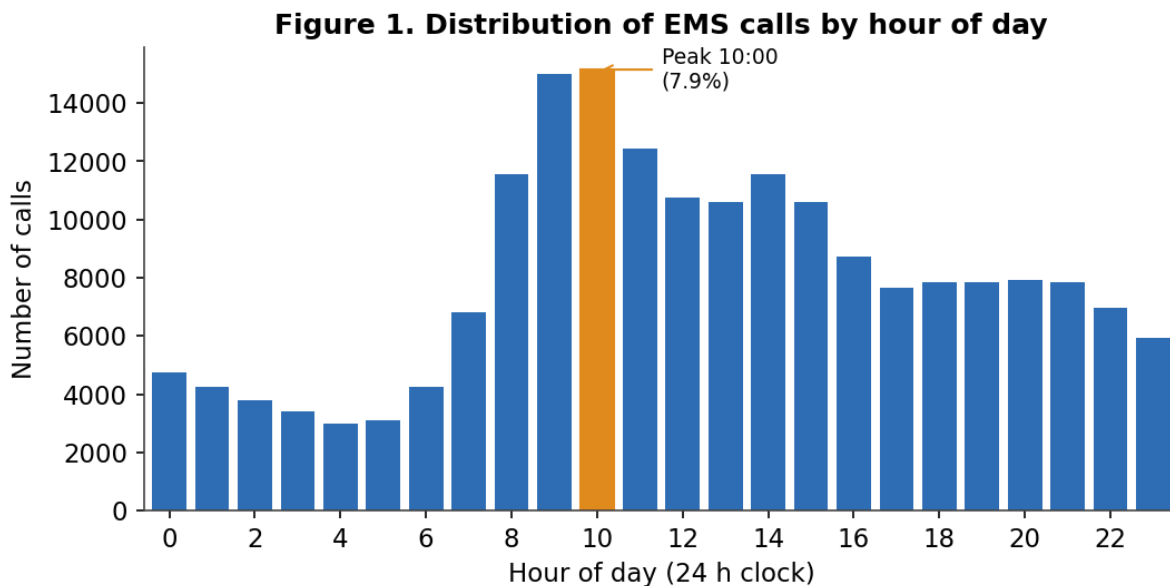


Figure 1. Hourly distribution of EMS calls across the 24-hour day, Wuhan, 2024. Bars show the percentage of all annual calls originating in each clock hour. Demand reaches a nadir at 04:00 and a single pronounced peak at 10:00.

Monthly variation was comparatively modest (**Figure 2**). The busiest month was December (9.2% of annual calls) and the quietest was June (7.9%). Across the week, call volume was highest on Monday (15.0%) and lowest at the weekend (Saturday 13.8%, Sunday 13.3%).

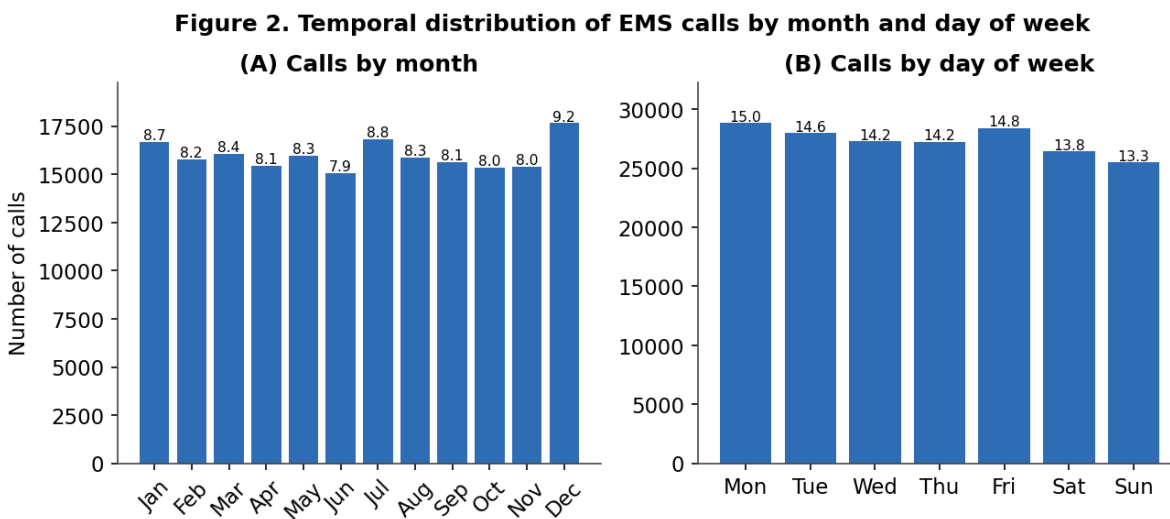


Figure 2. Monthly (left) and day-of-week (right) distribution of EMS calls, Wuhan, 2024, each expressed as a percentage of all annual calls. Seasonal variation is modest, with a December peak; weekday volume modestly exceeds weekend volume.

3.3 Presenting complaints

The distribution of dispatcher-assigned presenting complaints is shown in **Figure 3**. Trauma and injury were the single most common reason for calling. When grouped, injury-related complaints—other trauma/injury (18.3%) together with traffic and fall-from-height injury (8.4%)—accounted for more than one quarter of all calls. Altered consciousness or other neurological symptoms were the next most frequent presentation (15.1%), followed by cardiac or chest symptoms (7.8%) and stroke/cerebrovascular symptoms (6.9%). Alcohol intoxication accounted for 5.0% of all calls. Non-specific symptoms and entries that could not be assigned to a specific complaint together made up a further fifth of calls.

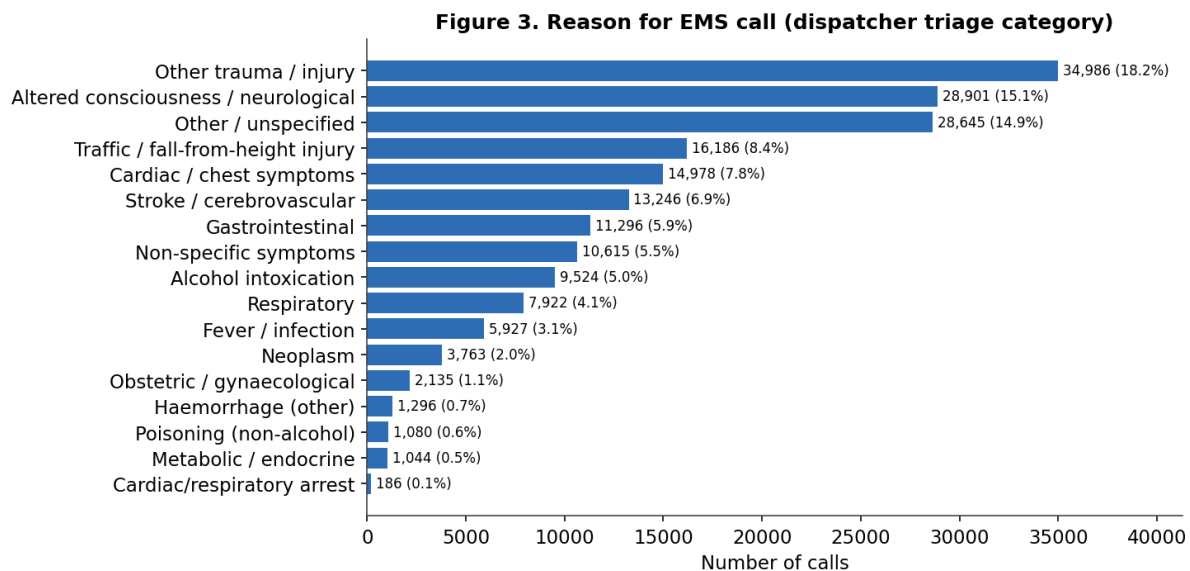


Figure 3. Distribution of presenting complaints (dispatcher online triage) for EMS calls, Wuhan, 2024. Bars show the percentage of all calls in each complaint category, ordered by frequency.

3.4 Field diagnoses

Field diagnoses recorded by attending physicians, grouped by ICD-10 chapter, are shown in **Figure 4**. Injury (S00–T14) was the leading diagnostic group, accounting for 24.9% of all dispatches. Symptoms and ill-defined conditions (R00–R99) formed the second-largest group (20.5%), reflecting the high proportion of patients whose definitive diagnosis could not be established in the prehospital setting. Cerebrovascular disease (I60–I69) accounted for 8.5% of cases, digestive disorders (K00–K93) for 6.8%, and toxic effects including alcohol (T36–T65) for 5.7%. Cardiac arrest was recorded in 8,748 dispatches (4.6%). Together, the circulatory-system groups (cerebrovascular disease plus other circulatory disease, I00–I52) accounted for 11.9% of dispatches.

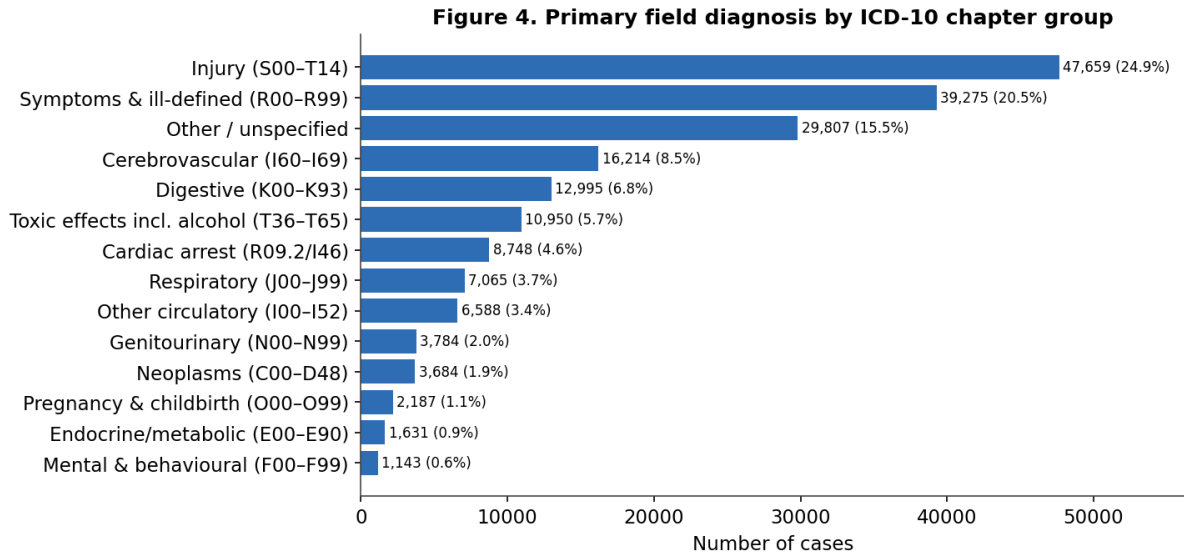


Figure 4. Distribution of primary field diagnoses grouped by ICD-10 chapter, Wuhan, 2024. Bars show the percentage of all dispatches in each diagnostic group, ordered by frequency.

3.5 Variation of presenting complaints with age

Presenting complaints varied strongly across age groups (**Figure 5**). In adolescents and young adults, injury and alcohol intoxication dominated the case-mix, whereas in the oldest age bands these were progressively displaced by neurological symptoms, cardiac and chest symptoms, stroke, and respiratory complaints. Obstetric and gynaecological calls were, as expected, concentrated in women of reproductive age (25–34 years). The association between age group and presenting complaint was statistically significant ($\chi^2 = 45,859$, $df = 128$, $p < 0.001$), with a Cramér's V of 0.173 indicating a modest but consistent age gradient (**Table 2**).

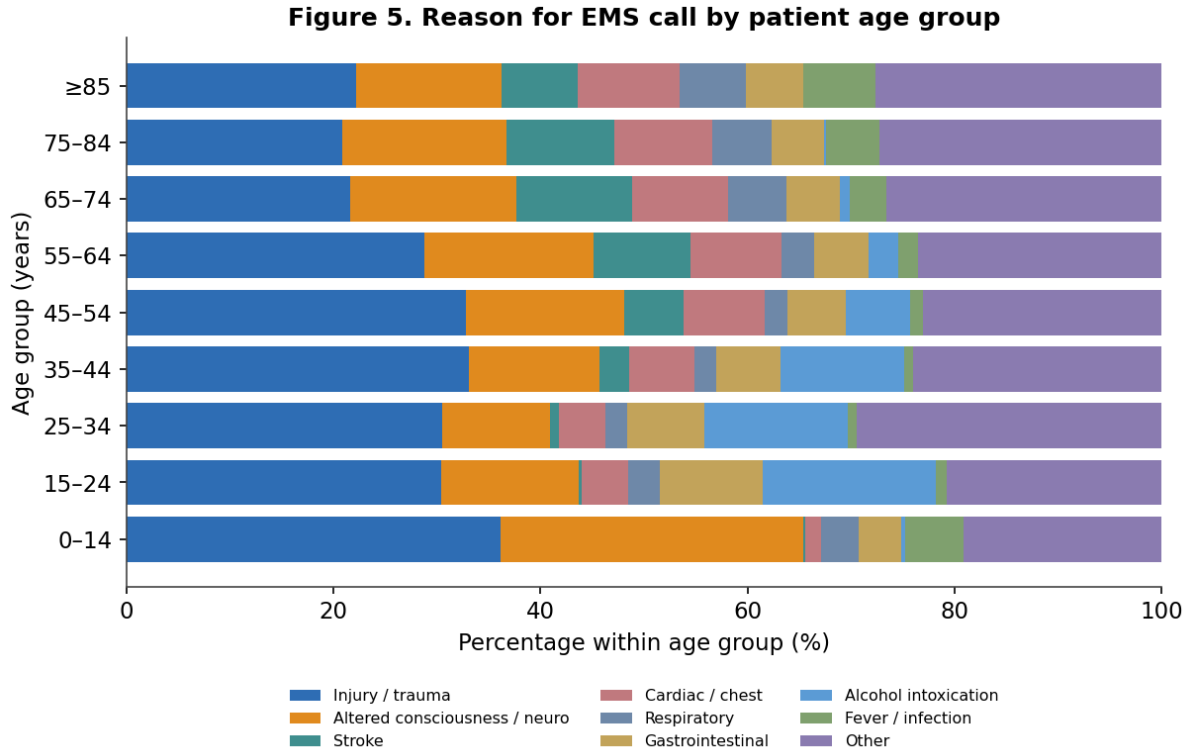


Figure 5. Presenting complaints by patient age group, Wuhan, 2024, shown as 100% stacked bars (the percentage contribution of each complaint within each age band). Injury and alcohol intoxication predominate in younger groups; neurological, cardiac, stroke, and respiratory complaints rise with age.

3.6 Association between age and disease

The same age structure was evident for field diagnoses (**Figure 6**). The column-percentage heat map shows that injury and toxic effects (including alcohol) were concentrated in young and middle-aged adults, whereas cerebrovascular disease, other circulatory disease, respiratory disease, and cardiac arrest increased steeply across successive age bands. The association between age group and diagnosis was highly significant ($\chi^2 = 46,247$, $df = 104$, $p < 0.001$; Cramér's $V = 0.174$). Sex was also significantly associated with diagnosis ($\chi^2 = 6,615$, $df = 13$, $p < 0.001$; Cramér's $V = 0.186$), reflecting the male predominance of injury, alcohol-related, and cardiac presentations. The χ^2 results are summarised in **Table 2**.

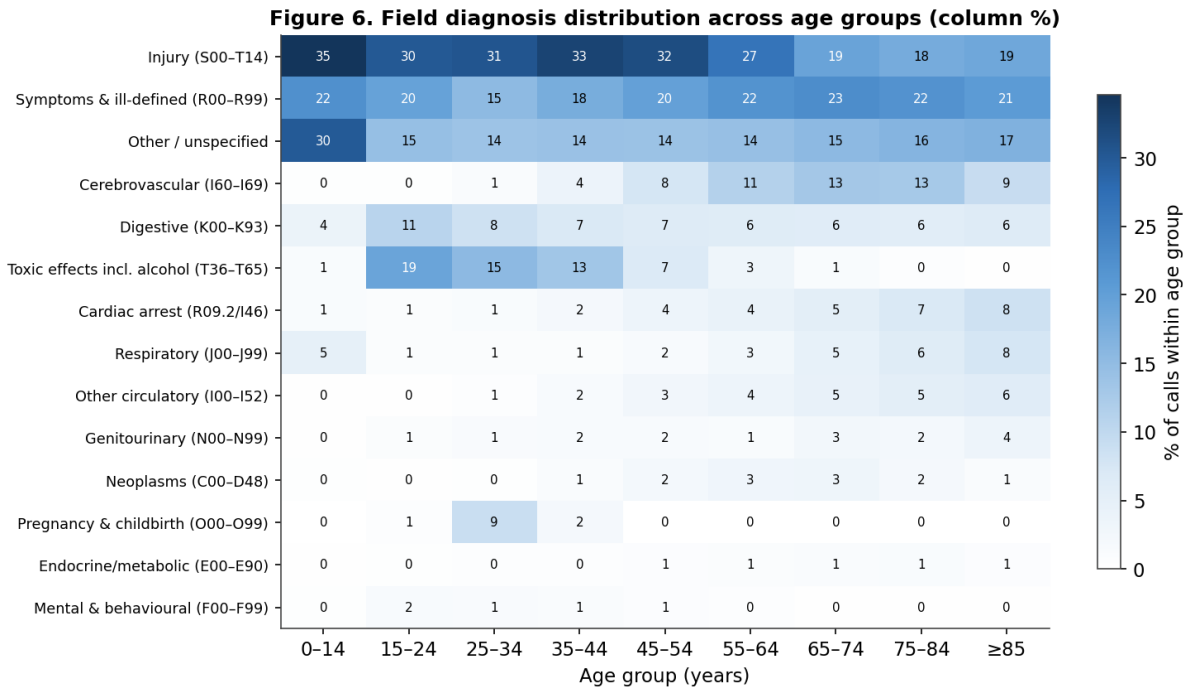


Figure 6. Field diagnosis by patient age group, Wuhan, 2024, displayed as a heat map of column percentages (the percentage of dispatches within each age band falling in each diagnostic group). Darker cells indicate a higher within-age-group share. The age gradient in injury, alcohol, cerebrovascular disease, and cardiac arrest is clearly visible.

Table 2. Association between patient characteristics and disease category (Pearson χ^2 tests).

Association tested	χ^2	df	Cramér's V	p
Age group × diagnosis	46,247	104	0.174	< 0.001
Age group × presenting complaint	45,859	128	0.173	< 0.001
Sex × diagnosis	6,615	13	0.186	< 0.001

df, degrees of freedom. All tests were two-sided; $N = 191,730$ for each test. Cramér's V quantifies the strength of association (0 = none, 1 = perfect).

3.7 Scene and transport mortality by age

Recorded death before or during transport increased monotonically with patient age (**Figure 7**), from 0.46% among patients aged 0–14 years to 4.54% among those aged 85 years or older—an almost tenfold gradient across the age range. This pattern is consistent with the rising share of cardiac arrest and acute cardiovascular and respiratory emergencies among older callers.

Figure 7. Proportion of calls with death recorded, by age group

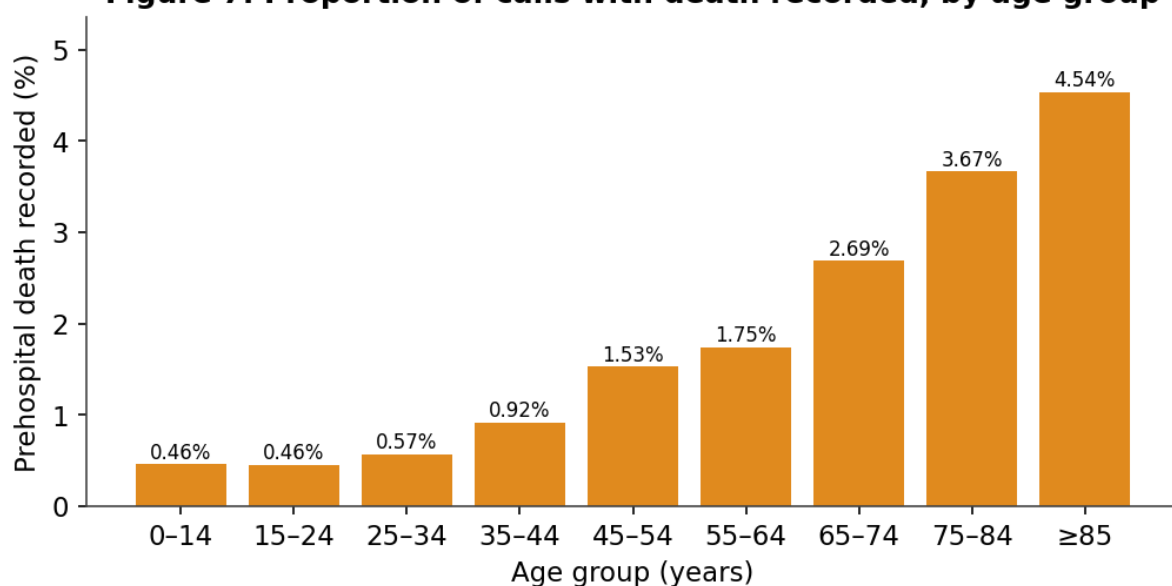


Figure 7. Scene/transport mortality by patient age group, Wuhan, 2024. Bars show the percentage of dispatches in each age band in which death before or during transport was recorded. Mortality rises steeply and monotonically with age.

3.8 Prehospital time intervals

The median response interval (call to arrival on scene) was 10.3 minutes (IQR 7.2–14.7). Decomposed along the prehospital timeline (**Figure 8**), the median activation interval was 2.0 minutes (IQR 1.4–2.8), the travel-to-scene interval 8.1 minutes (IQR 5.0–12.5), the on-scene interval 10.2 minutes (IQR 5.8–15.9), and the transport interval 12.8 minutes (IQR 6.8–22.6). The median total prehospital interval, from call to hospital arrival, was 36.2 minutes (IQR 27.0–49.9). Of all responses, 47.9% reached the scene within 10 minutes and 76.2% within 15 minutes; 31.5% arrived within 8 minutes.

Figure 8. Prehospital time intervals

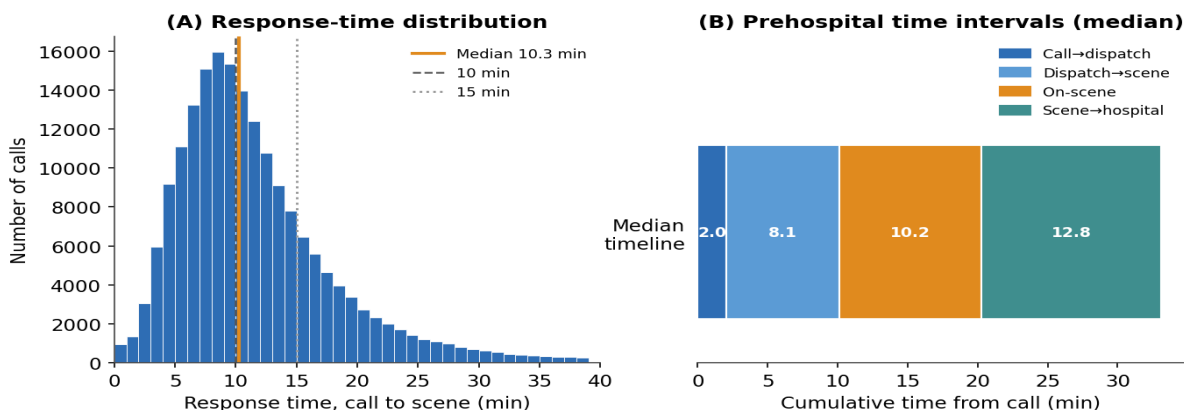


Figure 8. Prehospital time intervals, Wuhan, 2024. (A) Distribution of the response interval (call to scene arrival), with the median and the 10- and 15-minute marks indicated. (B) Median duration of successive segments of the prehospital timeline (activation, travel to scene, on-scene care, and transport to hospital).

3.9 Variation of response time by time of day and acuity

The response interval varied with the time of day in a pattern mirroring call volume (**Figure 9**). Response was fastest during the low-volume overnight hours (median 9.4–9.8 minutes between 22:00 and 05:00) and slowest during the high-volume morning and daytime period (median 10.7–10.8 minutes between 07:00 and 11:00), indicating a modest erosion of responsiveness when demand was greatest. In contrast, the response interval was essentially uniform across clinical acuity grades (**Table 3**): the median was 9.8 minutes for cardiac/respiratory-arrest calls, 10.4 minutes for critical calls, 10.3 minutes for emergent calls, and 10.0 minutes for non-emergent calls. On-scene time, however, differed by acuity and by diagnosis, being shortest for toxic/alcohol-related (median 7.7 minutes) and injury (8.6 minutes) presentations and longest for respiratory (13.5 minutes), cerebrovascular (13.2 minutes), and neoplastic (13.9 minutes) presentations.

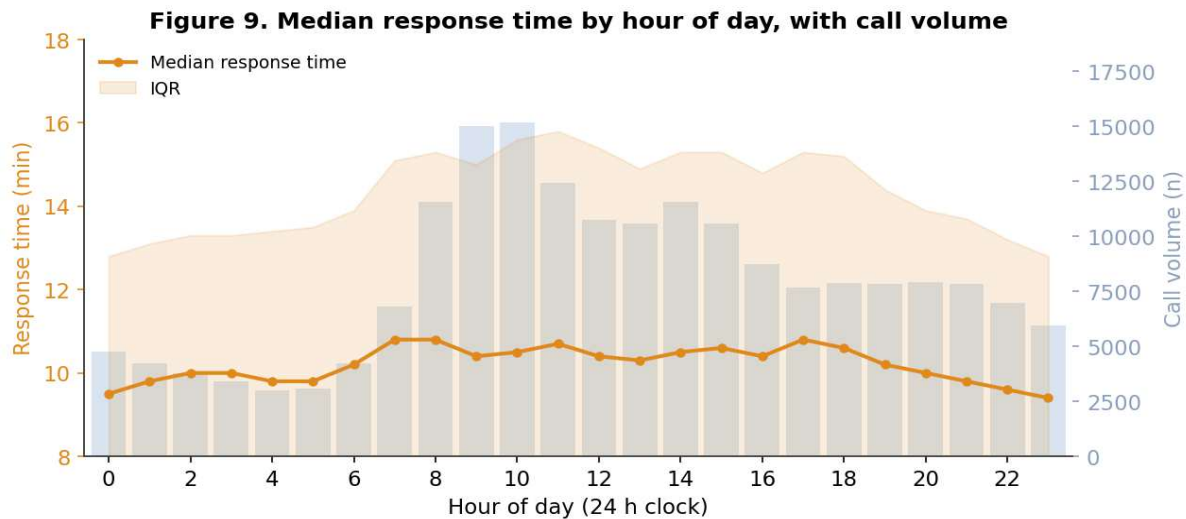


Figure 9. Median response interval by hour of day (line, with the interquartile range shaded), overlaid on hourly call volume (bars), Wuhan, 2024. Response is slowest during the high-volume daytime hours and fastest overnight.

Table 3. Response interval, on-scene interval, and hospital-transport rate by clinical severity grade.

Severity grade	n	Response, min (IQR)	On-scene, min (IQR)	Transported, %
Cardiac/resp. arrest	8,636	9.8 (7.4–13.5)	11.2 (6.4–19.2)	29.8
Life-threatening	1,781	10.5 (6.4–17.5)	15.7 (8.4–31.1)	84.9
Critical	18,727	10.4 (6.8–15.7)	12.5 (7.8–20.4)	87.2

Severity grade	n	Response, min (IQR)	On-scene, min (IQR)	Transported, %
Emergent	126,737	10.3 (7.5–14.4)	9.1 (5.0–14.1)	86.8
Non-emergent	35,819	10.0 (5.8–15.4)	13.3 (8.6–20.4)	79.2

IQR, interquartile range. The response interval is the time from call to arrival on scene. Transport rate is the percentage of dispatches in each grade resulting in hospital transport.

3.10 Hospital transport outcomes

Overall, 158,821 dispatches (82.8%) resulted in transport of the patient to hospital, while 32,909 (17.2%) did not; death before or during transport was recorded in 3,582 of the non-transported patients. The transport rate was broadly similar across most diagnostic groups, ranging from 81% to 88% (**Figure 10A**). The striking exception was cardiac arrest, of which only 30.1% were transported—the remainder being patients who were pronounced dead at the scene—consistent with the low transport rate observed for the cardiac/respiratory-arrest acuity grade (29.8%; **Table 3**). The transport rate declined steadily with patient age, from 87.5% among children aged 0–14 years to 80.1% among those aged 85 years or older (**Figure 10B**), mirroring the rising on-scene mortality in the oldest groups.

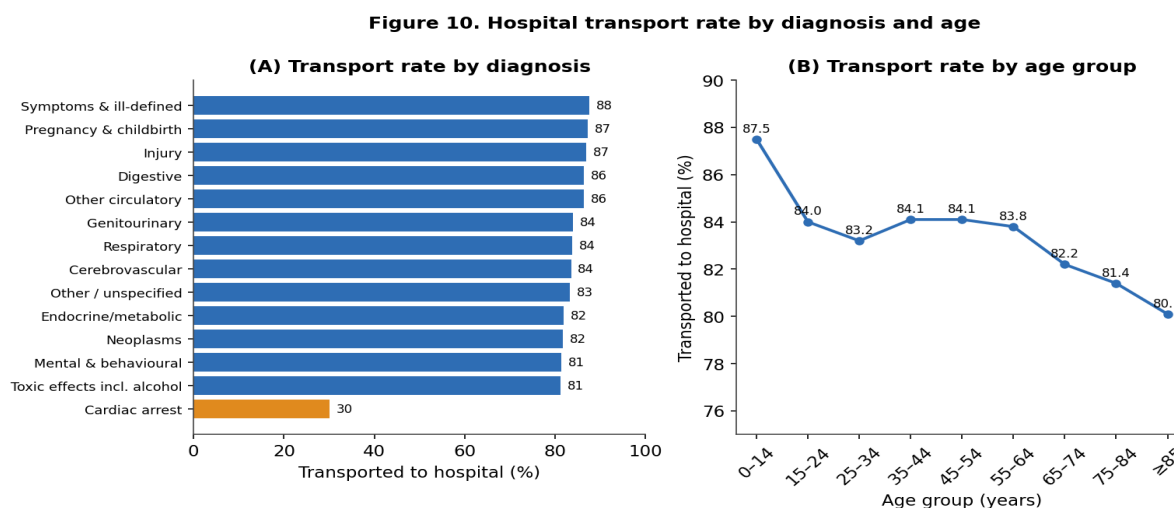


Figure 10. Hospital transport rate, Wuhan, 2024. (A) Percentage of dispatches resulting in hospital transport by diagnostic group; cardiac arrest (highlighted) is markedly lower than all other groups. (B) Transport rate by patient age group, showing a steady decline with advancing age.

3.11 Prehospital interventions by diagnosis

At least one of the ten recorded prehospital interventions was performed in 50.2% of dispatches. The pattern of interventions was strongly diagnosis-dependent and clinically coherent (**Figure 11**). Oxygen therapy was the most frequent intervention overall and was concentrated in respiratory (64.8% of cases), other circulatory (52.6%), and cerebrovascular (46.9%) presentations. IV access was most common in toxic/alcohol-related

(30.1%), symptom-based (29.9%), and digestive (26.9%) presentations, and bedside blood-glucose testing was most frequent for symptom-based (19.2%) and cerebrovascular (12.0%) presentations, reflecting the assessment of altered consciousness. CPR (33.3%) and defibrillation (9.4%) were almost entirely confined to cardiac-arrest cases, while wound dressing (19.5%) and fracture immobilisation (6.1%) were specific to injury. Mechanical ventilation was most frequent in respiratory presentations (6.0%). The concentration of resuscitative interventions in cardiac arrest and of trauma care in injury confirms the internal consistency of the diagnostic categorisation.

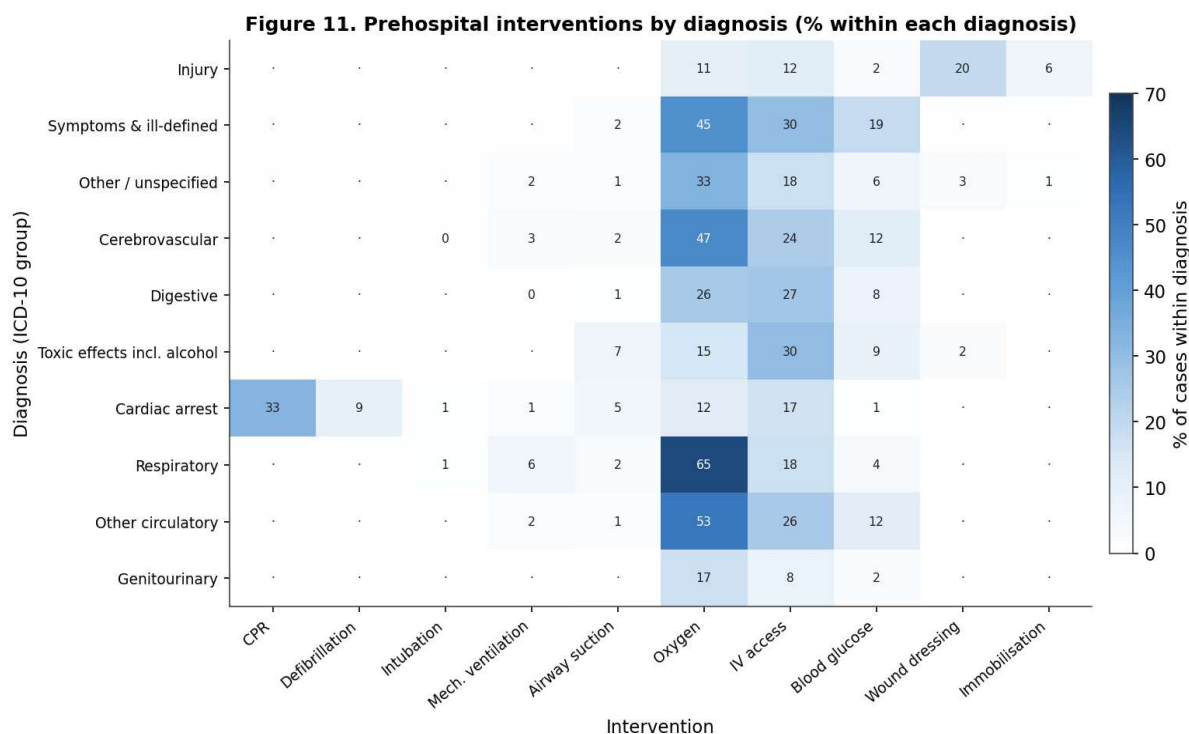


Figure 11. Prehospital interventions by diagnostic group, Wuhan, 2024, shown as a heat map of the percentage of cases within each diagnosis receiving each intervention. Darker cells indicate more frequent use. Resuscitative interventions concentrate in cardiac arrest, oxygen in respiratory and circulatory disease, and wound dressing and immobilisation in injury.

3.12 Non-emergency transport and resource utilisation

Classified by dispatch type, 138,286 calls (72.1%) were emergency responses and 53,444 (27.9%) were non-emergency transport (**Figure 12A**). The latter comprised inter-hospital transfers (31,746; 16.6% of all dispatches), discharge transport home (19,609; 10.2%), long-distance transport (2,068; 1.1%), and a small number of planned-admission and simple-transport calls. Although non-emergency transport accounted for 27.9% of calls, it consumed an estimated 43,090 of 112,733 annual ambulance-hours—**38.2% of total vehicle-time** (**Figure 12B**)—because these journeys were substantially longer than emergency responses (median total

prehospital interval 49.3 vs 33.0 minutes; median transport interval 21.3 vs 11.0 minutes).

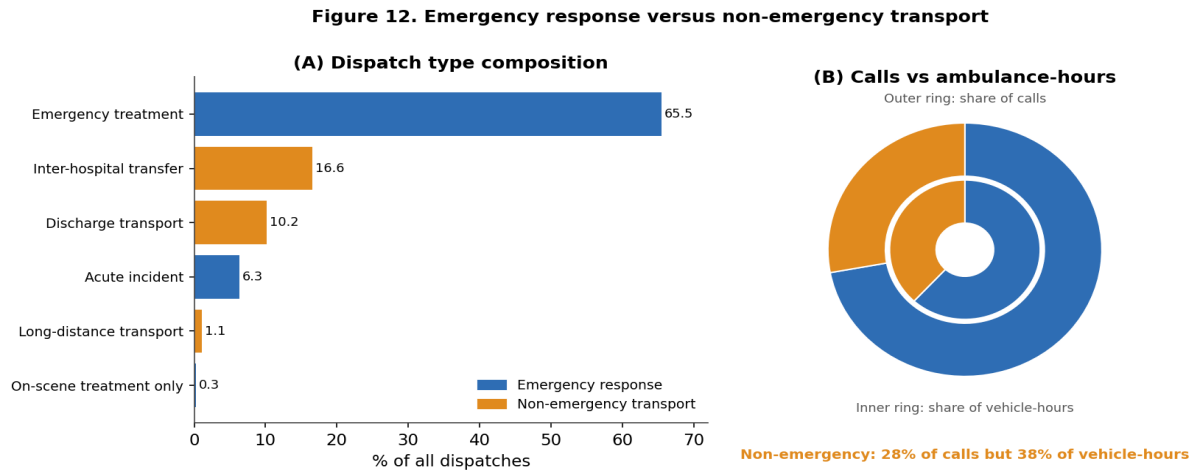


Figure 12. Emergency response versus non-emergency transport, Wuhan, 2024. (A) Composition of dispatches by operational dispatch type, coloured by group. (B) Non-emergency transport represented 27.9% of calls (outer ring) but 38.2% of estimated ambulance-hours (inner ring).

The two groups differed sharply in clinical acuity (**Figure 14**). Half of non-emergency transports (49.7%) were graded non-emergent and a further 31.0% emergent, with cardiac/respiratory arrest essentially absent (0.1%); recorded mortality was 0.09%, compared with 3.02% for emergency responses. A minority (17.3%) of transports were graded critical, consistent with a subset of genuinely necessary higher-level-care transfers. Resource and acuity profiles by subtype are summarised in **Table 4**. Discharge transport was the lowest-acuity category (81.6% non-emergent; median patient age 75 years), whereas long-distance transport, though few in number, was extremely resource-intensive (median total interval 197.6 minutes, i.e., more than three hours per call). Among non-emergency transports, specific low-acuity reasons identifiable in the free text included follow-up or re-examination (424 calls), rehabilitation (433), urinary-catheter management (270), dialysis (256), tracheostomy-tube care (233), gastric-tube or nasogastric feeding (104), and dressing change (40); because these fields are inconsistently completed, these counts substantially understate the true volume, which is better reflected by the structured transfer and discharge categories above.

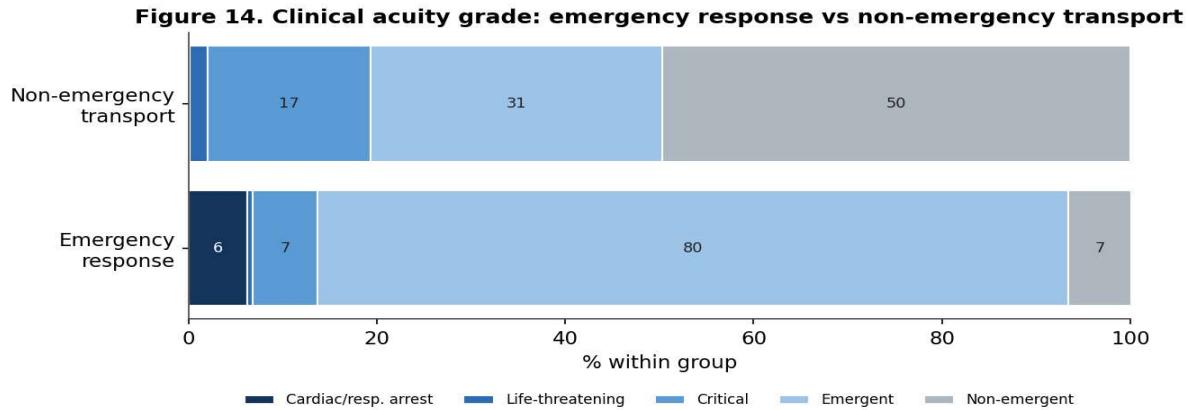


Figure 14. Clinical acuity-grade composition of emergency responses versus non-emergency transports, Wuhan, 2024 (percentage within each group). Non-emergency transport is dominated by non-emergent and emergent grades, with negligible cardiac arrest.

Critically, non-emergency transport was concentrated in daytime hours and coincided with peak emergency demand (**Figure 13**). Of all non-emergency transports, 84.0% occurred between 08:00 and 17:59 (versus 50.0% of emergency responses), and the share of hourly activity attributable to non-emergency transport rose to approximately 50% during the 10:00–11:00 demand peak. Non-emergency transport was also more frequent on weekdays (29–30% of calls) than at weekends (23–25%). Thus the prominent mid-morning peak in total call volume was driven substantially by non-emergency transport competing for the same ambulances as acute emergencies at the busiest time of day.

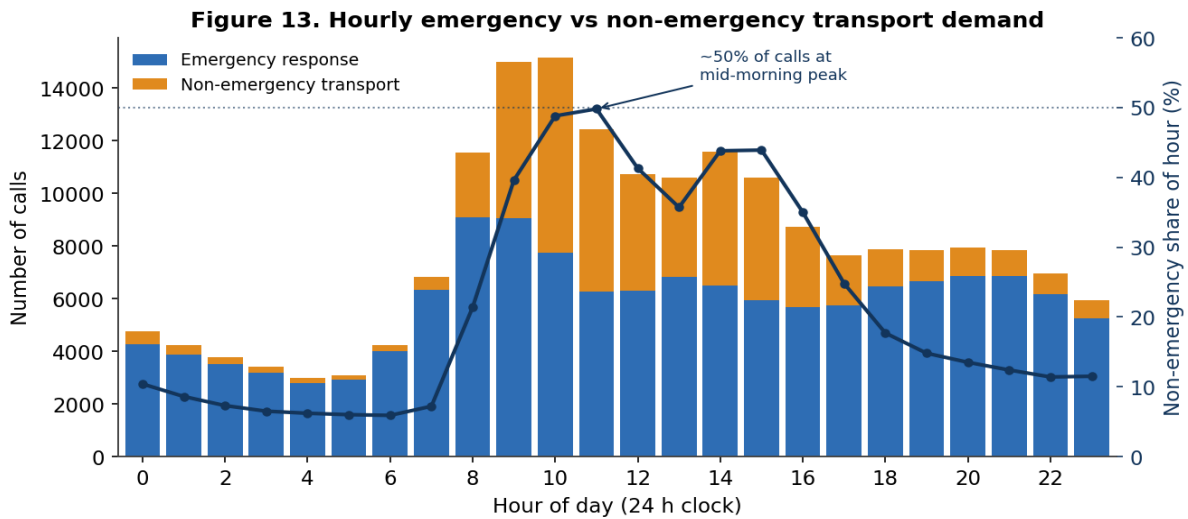


Figure 13. Hourly emergency-response and non-emergency-transport volume (stacked bars, left axis) and the non-emergency share of each hour's calls (line, right axis), Wuhan, 2024. Non-emergency transport peaks in mid-morning and approaches half of all calls at the 10:00–11:00 demand peak.

Table 4. Volume, acuity, and resource use of emergency response versus non-emergency transport subtypes.

Dispatch category	n	% of all	Median age	Non-emergent %	Deaths %	Median total interval, min
Emergency response	138,286	72.1	59	6.7	3.02	33.0
Non-emergency transport (all)	53,444	27.9	69	49.7	0.09	49.3
Inter-hospital transfer	31,746	16.6	64	31.8	0.03	50.1
Discharge transport home	19,609	10.2	75	81.6	0.06	45.9
Long-distance transport	2,068	1.1	62	22.6	1.40	197.6

Total interval is the median time from call to hospital arrival. The “all” row includes small planned-admission and simple-transport categories not shown separately. Non-emergency transport consumed an estimated 38.2% of annual ambulance-hours despite representing 27.9% of calls.

4. Discussion

In this analysis of nearly 192,000 EMS dispatches over a full calendar year, prehospital demand in a large Chinese city was characterised by four salient features: a population of callers skewed towards older age, a case-mix dominated by injury and a small set of time-critical medical emergencies, a pronounced morning-weighted diurnal cycle, and a strong, statistically significant relationship between patient age and disease category. Each has direct operational and public-health implications.

The age profile—median 62 years, with 46.4% of patients aged 65 years or older—mirrors the ageing of EMS users reported in other Chinese cities and internationally^{5,10}. A recent long-term analysis from Handan similarly described injury as the dominant category alongside rising demand from older adults⁵, and the multi-year Chengdu series documented both the scale of urban EMS activity and shifting demand structure over time⁴. Our single-year, city-wide snapshot complements these trend analyses by quantifying the joint age–time–diagnosis structure of demand.

Injury was the leading presenting complaint and the leading field diagnosis (S00–T14; 24.9%), consistent with EMS call-pattern studies from Shenzhen³. Road-traffic injury remains a major contributor to this burden, and the World Health Organization has highlighted the disproportionate toll of road-traffic injury in low- and middle-income settings¹³. The concentration of injury in young and middle-aged men in our data reinforces the case for targeted road-safety enforcement and workplace-injury prevention in these groups.

A distinctive finding was the clear alcohol-related signature: 9,524 calls (5.0%) were coded as alcohol intoxication, with a median age of 34 years, a male-to-female ratio of 4.15, and 63.9% occurring between 20:00 and 01:00. This nocturnal, young-male clustering is consistent with the established relationship between alcohol

and acute ambulance demand¹¹ and with the broader harms quantified in the WHO global status report on alcohol¹⁴. The temporal concentration of these calls is operationally relevant, as it coincides with the overnight period when staffing is typically lowest.

The strong diurnal cycle, with a single sharp peak at 10:00 and an overnight nadir, closely matches international descriptions of EMS demand by time of day and day of week⁸. The morning concentration of demand—more than a quarter of all calls between 08:00 and 12:00—argues for morning-weighted ambulance availability and crew scheduling, while the alcohol-driven overnight caseload suggests that flat overnight staffing may understate real need at weekends. Day-of-week variation was modest, with a slight weekday excess.

The large proportion of dispatches assigned to symptoms and ill-defined conditions (R00–R99; 20.5%) is an expected feature of prehospital data, where a definitive diagnosis frequently cannot be established at the scene. Rather than discarding these records, we retained them as an explicit category; their size underscores the diagnostic uncertainty inherent in EMS work and the importance of syndromic, protocol-driven prehospital care. The steep age gradient in cerebrovascular disease and cardiac arrest is consistent with the high national stroke burden described in the NESS-China survey¹² and with the incidence and poor outcomes of out-of-hospital cardiac arrest reported by the BASIC-OHCA registry⁷. Together with the monotonic rise in scene/transport mortality with age, these findings support age-tailored prehospital protocols and the pre-positioning of advanced cardiac and stroke-ready resources for older patients.

Taken together, the significant age $\times$ diagnosis and age $\times$ complaint associations (both $p < 0.001$) confirm that EMS case-mix is not uniform across the lifespan but follows a predictable structure that can be exploited for planning: injury- and alcohol-oriented resources for younger populations and night-time peaks, and cardiac-, stroke-, and respiratory-oriented resources for the growing older population. The modest Cramér's V values (≈ 0.17 – 0.19) indicate that, although highly significant given the large sample, age and sex explain only part of the variation in case-mix, and other factors—comorbidity, socioeconomic status, ambient temperature, and access to care—warrant further study¹¹.

The temporal chain of care provides a further operational lens. The median response interval of 10.3 minutes, with fewer than half of responses reaching the scene within 10 minutes, is broadly comparable to call-pattern data from other large Chinese cities such as Shenzhen³ but exceeds the targets adopted by some high-income EMS systems. Two findings have direct service-design relevance. First, the response interval lengthened during the high-volume daytime hours and shortened overnight, indicating that demand peaks modestly outstrip capacity at the busiest times and reinforcing the case for morning- and daytime-weighted resourcing identified from the call-volume curve⁸. Second, the response interval was essentially uniform across acuity grades, including for cardiac arrest, suggesting that the system did not differentially expedite the most time-critical calls; given the strong dependence of cardiac-arrest survival on the interval to first response⁷, this is an actionable target for dispatch prioritisation and for community-based interventions such as dispatcher-assisted CPR and

public-access defibrillation. On-scene time, by contrast, varied appropriately with clinical need—shortest for alcohol-related and injury calls amenable to a “load-and-go” approach and longest for respiratory and cerebrovascular emergencies requiring on-scene stabilisation.

Most dispatches (82.8%) ended in hospital transport, a proportion consistent with the predominantly emergent case-mix. The principal departure from this pattern was cardiac arrest, of which only about 30% were transported because the remainder were pronounced dead on scene; this is concordant with the high out-of-hospital cardiac-arrest burden and poor outcomes reported by the BASIC-OHCA registry⁷. The steady decline in transport rate with advancing age, alongside the parallel rise in on-scene mortality, likely reflects a combination of higher case fatality and a greater frequency of end-of-life situations among the oldest patients, and underscores the importance of clear prehospital protocols for resuscitation and non-transport decisions in an ageing population¹⁰. Finally, the spectrum of prehospital interventions mapped closely onto the diagnostic case-mix—resuscitation and defibrillation in cardiac arrest, oxygen in respiratory and circulatory disease, glucose testing in patients with altered consciousness, and wound care and immobilisation in injury—both validating the categorisation internally and quantifying the clinical capabilities that prehospital crews in this setting must maintain.

Perhaps the most policy-relevant finding is the magnitude of non-emergency transport. More than a quarter of dispatches (27.9%) were inter-hospital transfers, discharge journeys, or long-distance transport rather than responses to acute emergencies, and because these journeys were roughly half as long again as emergency responses they absorbed an estimated 38.2% of annual ambulance-hours. Their very low acuity (half graded non-emergent; mortality 0.09%, more than thirty-fold lower than emergency responses) indicates that much of this activity—particularly discharge transport home, of which over four-fifths was non-emergent—did not require the clinical capability of an emergency ambulance. This is consistent with long-standing concerns that emergency ambulances in China are used for a substantial volume of routine medical transport, including follow-up visits, dressing changes, and catheter or feeding-tube management. Importantly, the burden is not uniformly avoidable: a meaningful minority of transfers (17.3% graded critical) represent clinically necessary movement of seriously ill patients to higher-level care, and long-distance transport, though infrequent, is highly resource-intensive (median engaged time exceeding three hours per call). The temporal pattern compounds the problem: non-emergency transport was overwhelmingly a daytime, weekday activity and approached half of all calls at the mid-morning emergency peak, so it competes directly with acute demand for the same vehicles at the worst possible time. Diverting eligible non-emergency transport to a dedicated, lower-cost medical-transport fleet, introducing clinical eligibility criteria for emergency-ambulance use, and scheduling planned transfers outside peak hours are plausible levers to release emergency capacity; quantifying this displaced volume is a prerequisite for such reform, and the present analysis provides a baseline for this city.

4.1 Limitations

Several limitations should be considered. First, this was a single-city, single-year analysis, and the patterns

described may not generalise to rural areas or to cities with different demographic or service structures. Second, presenting complaints and diagnoses were drawn from operational dispatcher triage and field physician impressions rather than from a validated diagnostic gold standard; prehospital diagnoses are provisional and subject to misclassification. Third, despite systematic categorisation, approximately 15% of complaints and diagnoses fell into an “Other/unspecified” group, which limits granularity. Fourth, call times were derived from the encoded dispatch identifier; although this was validated against recorded call times with close agreement, residual error cannot be entirely excluded. Fifth, we did not have population denominators and therefore report the distribution of calls rather than population incidence rates. Finally, the outcome available to us was limited to death before or during transport, so in-hospital outcomes and the full severity spectrum could not be assessed. In addition, transport status and the prehospital time intervals were derived from operational timestamps: hospital transport was inferred from the presence of a recorded hospital-arrival time, and a minority of records lacked one or more timestamps, so estimates for the later segments of care (notably the transport interval, available for 82.8% of records) should be read with this incompleteness in mind, and recorded interventions reflect documented field actions and may be under-recorded. Lastly, the emergency versus non-emergency classification relied on the operational dispatch-type label rather than an independent clinical adjudication of necessity, ambulance-hours were approximated by the call-to-hospital interval (excluding the return-to-base time and therefore underestimating true vehicle commitment), and the specific low-acuity transport reasons were drawn from inconsistently completed free text and represent lower bounds.

5. Conclusions

EMS requires higher-efficiency call triage and ambulance deployment tailored to the characteristics of each emergency request in China. In a large Chinese city in 2024, EMS demand was concentrated in older adults and dominated by injury and a small number of time-critical medical emergencies, with a pronounced morning peak in call volume and a clear, statistically significant dependence of case-mix on patient age and sex. Injury and alcohol intoxication clustered in young and middle-aged adults and at night, whereas cerebrovascular disease, cardiac arrest, and respiratory -inter-hospital transfers and discharge journeys—accounted for more than a quarter of dispatches and a disproportionate share of ambulance-time concentrated at the mid-morning emergency peak, identifying the diversion of such transport to a dedicated service as a key opportunity to release emergency capacity. Together these findings establish a baseline against which future changes in this city's prehospital emergency demand and performance can be measured.

Declarations

Ethics approval and consent to participate. The study was approved by Medical Ethics Committee of Wuhan University Zhongnan Hospital, approval number [Approval No.: :2026026K]. The requirement for individual

informed consent was waived owing to the retrospective use of anonymised, routinely collected data.

Consent for publication. Not applicable.

Availability of data and materials. The data that support the findings of this study are not publicly available because they are operational EMS records.

Competing interests. The authors declare that they have no competing interests.

Funding. Hubei Clinical Research Center for Emergency and Resuscitation(Award/grant number: NA).

Authors' contributions.

Hao Zou: Statistical data collection, Analysis of data, Study design,

Guanguan Luo: Manuscript preparation, Literature search, Study design,

Cheng Jiang: Study design; Review of manuscript.

Jing Wan: Study design; Review of manuscript;

Yong Zou: Data collection;

Jian Xia: Statistical method, Review of manuscript, Literature search, Study design

Acknowledgements. The authors thank the staff of the Wuhan 120 Emergency Medical Dispatch Centre for maintaining the records analysed in this study.

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