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The Impact of On-Scene Time on Patient Outcomes in Prehospital Emergency Medical Services: A Targeted Narrative Review

مركزة سردية مراجعة :المرضى نتائج على الحادث موقع في الإسعافية الفرق بقاء زمن تأثير

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Abstract:

Background: The on-scene interval, defined as the period between the arrival of emergency medical services (EMS) at a patient and departure from the scene, is a potentially modifiable component of prehospital care. Shorter intervals may expedite definitive treatment, whereas longer intervals may permit lifesaving stabilization. The optimal balance remains uncertain and may vary by clinical condition.

Objective: To synthesize published evidence on associations between EMS on-scene time, prehospital clinical interventions, and patient outcomes in trauma, out-of-hospital cardiac arrest (OHCA), and acute stroke, while distinguishing mixed-stroke cohorts from ischemic stroke-only samples.

Methods: This targeted narrative review drew on selected English-language observational studies published from 2010 to 6 November 2026 and located in PubMed-indexed literature and accessible publisher records. Thirteen studies were organized by condition and critically interpreted with attention to the exposure definition, study population, potential confounding, and outcome relevance. Evidence directly relating scene duration to outcomes was distinguished from stroke studies primarily examining care-process associations. The search was purposive rather than exhaustive, and no meta-analysis or formal risk-of-bias scoring was performed.

Results: Thirteen selected primary studies were discussed: six trauma studies, five out-of-hospital cardiac arrest (OHCA) studies, and two stroke studies. Several large trauma registries associated longer scene time with higher mortality, although a North American cohort reported no association and a selected intensive care cohort reported an association in the opposite direction. In OHCA, associations during ongoing resuscitation differed from those observed after return of spontaneous circulation (ROSC); longer post-ROSC stabilization was associated with less transport re-arrest in one cohort. Stroke studies primarily linked shorter scene intervals or better dispatcher recognition with faster evaluation or reperfusion processes, without establishing improved long-term function from a change in scene time itself.

Conclusion: Scene time should be interpreted according to the clinical pathway rather than as a universal, diagnosis-independent performance threshold. Avoidable delays should be minimized without compromising necessary stabilization or transport safety; observational associations do not establish that altering scene duration alone will change patient outcomes.

Keywords: on-scene time; scene time interval; prehospital care; emergency medical services; paramedics; trauma; out-of-hospital cardiac arrest; stroke; patient outcomes.

الملخص:

الخلفية :يُعرَّف زمن البقاء في موقع الحادث بأنه الفترة الممتدة بين وصول خدمات الطوارئ الطبية (EMS) إلى المريض ومغادرة الموقع، ويُعد أحد المكونات القابلة للتعديل في الرعاية الطبية قبل المستشفى. وقد تسهم الفترات الأقصر في تسريع الحصول على العلاج النهائي، في حين قد تتيح الفترات الأطول إجراء تدخلات تثبيت الحالة المنقذة للحياة. ولا يزال تحديد التوازن الأمثل بينهما أمرًا غير محسوم، وقد يختلف باختلاف الحالة السريرية.

الهدف :تهدف هذه الدراسة إلى تجميع الأدلة المنشورة حول العلاقة بين زمن بقاء خدمات الطوارئ الطبية في موقع الحادث، والتدخلات السريرية قبل المستشفى، ونتائج المرضى في حالات الإصابات الرضحية، والتوقف القلبي خارج المستشفى (OHCA)، والسكتة الدماغية الحادة، مع التمييز بين الدراسات التي تناولت عينات مختلطة من حالات السكتة الدماغية وتلك التي اقتصرت على السكتة الدماغية الإقفارية.

المنهجية :اعتمدت هذه المراجعة السردية الموجّهة على مجموعة مختارة من الدراسات الرصدية المنشورة باللغة الإنجليزية خلال الفترة من عام 2010 وحتى 6 نوفمبر 2026، والتي جرى تحديدها من خلال الأدبيات المفهرسة في قاعدة بيانات PubMed وسجلات الناشرين المتاحة. ونُظمت ثلاث عشرة دراسة وفقًا للحالة المرضية، مع تحليلها نقديًا ومراعاة تعريف المتغير المدروس، وخصائص مجتمع الدراسة، والعوامل المربكة المحتملة، ومدى ارتباط النتائج بالمخرجات الصحية. كما جرى التمييز بين الأدلة التي تناولت العلاقة المباشرة بين مدة البقاء في موقع الحادث والنتائج الصحية، ودراسات السكتة الدماغية التي ركزت بصورة

أساسية على الارتباطات المتعلقة بعمليات تقديم الرعاية. وكان البحث هادفًا وليس شاملًا لجميع الدراسات المتاحة، ولم يُجرَ تحليل تلوي أو تقييم رسمي لمخاطر التحيز.
النتائج :تناولت المراجعة ثلاث عشرة دراسة أولية مختارة، شملت ست دراسات حول الإصابات الرضحية، وخمس دراسات حول التوقف القلبي خارج المستشفى(OHCA) ، ودراستين حول السكتة الدماغية. وأظهرت عدة دراسات واسعة النطاق، استندت إلى سجلات الإصابات الرضحية، وجود ارتباط بين طول مدة البقاء في موقع الحادث وارتفاع معدلات الوفيات، في حين لم يُظهر أحد الأبحاث التي أُجريت في أمريكا الشمالية وجود علاقة بينهما، وأظهرت دراسة أخرى شملت عينة مختارة من مرضى وحدات العناية المركزة ارتباطًا في الاتجاه المعاكس. وفي حالات التوقف القلبي خارج المستشفى، اختلفت الارتباطات خلال استمرار الإنعاش القلبي الرئوي عنها بعد استعادة الدورة الدموية التلقائية(ROSC) ، إذ ارتبطت فترات التثبيت الأطول للحالة بعد استعادة الدورة الدموية بانخفاض احتمالية حدوث توقف القلب مجددًا أثناء النقل، وذلك في إحدى الدراسات. أما دراسات السكتة الدماغية، فقد ربطت بصورة أساسية بين تقليل مدة البقاء في موقع الحادث أو تحسين دقة التعرف على الحالة من قِبل موظفي استقبال البلاغات وتسريع عمليات التقييم أو إعادة التروية، دون إثبات أن تقليل زمن البقاء في موقع الحادث بحد ذاته يؤدي إلى تحسين الوظائف الصحية على المدى الطويل.
الخلاصة :ينبغي تفسير زمن البقاء في موقع الحادث وفقًا لمسار الرعاية السريرية لكل حالة، بدلًا من اعتباره معيارًا موحدًا للأداء ينطبق على جميع التشخيصات المرضية. وينبغي تقليل التأخيرات التي يمكن تجنبها، دون المساس بالتدخلات الضرورية لتثبيت حالة المريض أو بسلامة نقله. كما أن الارتباطات المستخلصة من الدراسات الرصدية لا تثبت أن تعديل مدة البقاء في موقع الحادث وحده سيؤدي إلى تغيير النتائج الصحية للمرضى.

الكلمات المفتاحية :زمن البقاء في موقع الحادث؛ الفاصل الزمني للبقاء في موقع الحادث؛ الرعاية الطبية قبل المستشفى؛ خدمات الطوارئ الطبية؛ المسعفون؛ الإصابات الرضحية؛ التوقف القلبي خارج المستشفى؛ السكتة الدماغية؛ نتائج المرضى.

Introduction

Emergency medical services connect the earliest assessment of acute illness or injury with access to definitive hospital-based treatment. During this interval, paramedics simultaneously make diagnostic, therapeutic, logistical, and transport decisions. Among operational measures, the time between EMS arrival and scene departure is uniquely important because it is influenced by clinical interventions, patient extraction, family communication, equipment preparation, transport coordination, and environmental constraints. Measuring it is straightforward in most electronic EMS records; interpreting it as a quality indicator is considerably more difficult.

A shorter scene interval can facilitate earlier hemorrhage control in hospital, surgical intervention, reperfusion therapy, or specialist care. Conversely, immediate transport without addressing an obstructed airway, catastrophic external hemorrhage, a reversible cause of shock, or the hazards of moving an unstable patient may worsen care. Traditional expressions such as the “golden hour” or “platinum ten minutes” underscore urgency but should not be interpreted as universally validated causal thresholds. Newgard et al. (2010), for example, did not find a mortality association with overall or component EMS intervals in a prospective North American trauma registry.

The clinical meaning of on-scene time differs substantially across patient groups. In severe trauma, rapid access to surgery or blood products may be pivotal. In OHCA, time on scene may include high-quality cardiopulmonary resuscitation (CPR), defibrillation, airway procedures, medication administration, and the pursuit of return of spontaneous circulation (ROSC). After ROSC, an additional stabilization interval is conceptually different from ongoing resuscitation. For suspected stroke, essential assessment, last-known-well identification, glucose measurement, and prenotification must be performed without avoidable delay to reperfusion pathways.

Published studies also yield apparently contradictory associations because treatment intensity, illness severity, transport distances, hospital capability, and selection criteria affect both scene duration and outcome. This review therefore evaluates time as part of a clinical pathway rather than assuming that the shortest measurable interval necessarily produces the best result. Its objectives are to (1) describe reported associations between scene duration and outcomes; (2) assess the competing needs for on-scene treatment and early transport; and (3) develop implications for EMS performance measurement and further research, including Saudi prehospital systems.

Literature Review

Defining scene time within the prehospital pathway

Scene time is generally measured from the arrival of EMS at the scene or patient side to departure from the scene, although individual registries differ in their starting timestamp. It must be distinguished from call processing, response, transport, and total prehospital intervals. In the North American trauma analysis, Newgard et al. (2010) reported a median on-scene interval of 19 minutes while finding no significant adjusted association between interval duration and in-hospital mortality. Differences in interval definitions and timestamp capture can create apparent disagreement even when operational practices are similar.

Trauma: the competing mechanisms of transport and stabilization

Trauma evidence includes substantial multicenter cohorts. Waalwijk et al. (2022) reported an adjusted relative risk of 1.029 per additional on-scene minute for 24-hour mortality and 1.013 for 30-day mortality among 22,525 moderately or severely injured patients; scene times of at least 20 minutes also showed elevated mortality. Nilsbakken et al. (2023) identified a comparable positive association between longer scene times and mortality in a nationwide Norwegian registry of 28,988 trauma cases. A more recent Pan-Asian cohort by Usawasuraiin et al. (2026) found an adjusted mortality odds ratio of 1.03 per additional on-scene minute among 8,968 patients, while explicitly acknowledging potential severity-related confounding.

Not all trauma studies support the same direction. Newgard et al. (2010) found no measurable association between scene time and death after adjustment in 3,656 patients with physiologic abnormalities. Bui Van et al. (2022), using 1,874 major-trauma patients admitted to intensive care, reported higher adjusted survival odds with intermediate (9–16 minutes) and long (>16 minutes) intervals than with a short interval (0–8 minutes). Because the latter analysis only included ICU-admitted patients, selection on survival to admission and the nature of interventions may substantially influence findings. In a smaller 104-person cohort of major trauma, Siripakarn et al. (2023) reported higher 24-hour mortality where scene time exceeded 10 minutes, but sample size and residual confounding restrict causal interpretation.

Out-of-hospital cardiac arrest: resuscitation versus post-ROSC stabilization

Studies of OHCA illustrate why a single scene-time target is potentially misleading. In the CARES registry, Coute et al. (2021) studied 67,237 bystander-witnessed arrests and found greater adjusted odds of poor neurological outcome with each additional minute of scene time (OR 1.035; 95% CI 1.027–1.044). Jang et al. (2021) reported poorer neurological outcomes with an on-scene advanced-life-support interval of 19 minutes or more among 4,548 patients. Jung et al. (2022) likewise reported lower survival and neurological recovery with longer intervals, particularly in witnessed arrests and those with initially shockable rhythms. Kim et al. (2017) identified complex, nonuniform associations by prehospital ROSC status, reinforcing the importance of patient selection and timing definitions.

By contrast, the 2023 British Columbia analysis by Khan et al. evaluated a different exposure: time between on-scene ROSC and scene departure among 1,653 patients. A longer interval did not significantly improve favourable neurological outcome but was associated with lower odds of transport re-arrest and greater hospital-discharge survival in its longest quartile. This finding does not imply that delaying transport during ongoing cardiac arrest is beneficial; it concerns stabilization after circulation had already returned.

Stroke: scene performance as a link to definitive therapy

For stroke, available evidence is often directed at process outcomes rather than proving a direct causal effect on long-term disability. Oostema et al. (2024) linked 5,707 EMS stroke records to hospital data and observed that maintaining scene time at 15 minutes or less independently predicted door-to-CT within 25 minutes (adjusted OR 1.6; 95% CI 1.4–1.9). Leto et al. (2025) compared cases with and without dispatcher recognition of stroke; the recognized group had shorter scene time (median 11 versus 15 minutes), shorter door-to-needle intervals, and higher thrombolysis rates, but

there was no statistically significant difference in 90-day functional independence. These studies highlight an important distinction between faster care delivery and demonstrated long-term patient benefit.

Population clarification: The Oostema et al. (2024) cohort comprised 5,707 EMS-transported confirmed stroke records, including 4,732 ischemic stroke/TIA/unspecified stroke cases, 169 subarachnoid hemorrhages, and 806 intracerebral hemorrhages. It should not be described as an acute ischemic stroke-only cohort. The analysis of Leto et al. (2025) compared dispatcher recognition of stroke, rather than experimentally isolating scene time as an intervention.

Methods

Review Design and Reporting

This article is a targeted narrative review of selected primary studies, not a systematic review. Its objective is to interpret potentially competing consequences of the time spent on scene across trauma, out-of-hospital cardiac arrest, and stroke. The narrative design permits condition-specific contextual interpretation of evidence identified through purposive literature searching. No protocol was registered, and systematic-review completeness or adherence to a PRISMA screening process is not claimed.

Review Question and Evidence Scope

The review question was: Among patients attended by prehospital EMS teams, how does duration of the on-scene interval, including time spent on clinical stabilization before departure, relate to mortality, neurological recovery, access to definitive care, and other clinical outcomes?

Population: adult patients attended by ground-based EMS for major trauma, out-of-hospital cardiac arrest, or suspected/confirmed acute stroke. For stroke, studies may include ischemic stroke, intracerebral/subarachnoid hemorrhage, unspecified stroke, or TIA where relevant prehospital outcomes are reported; mixed cohorts must be identified as such rather than classified as ischemic stroke-only evidence.

Exposure: on-scene time, scene time interval, time from EMS patient-side arrival to transport departure, or post-ROSC on-scene stabilization measured as a separate interval.

Comparators: shorter versus longer intervals, time-based categories, or risk estimates per additional minute. No uniform cutoff was imposed.

Outcomes: early or in-hospital mortality, survival to discharge, 30-day mortality, neurological or functional status, re-arrest during transport, diagnostic or reperfusion treatment times, and treatment rates.

Study types: original quantitative observational studies with a directly relevant measure; English-language primary literature published from 1 January 2010 through 6 November 2026.

Editorials, commentaries, exclusively in-hospital studies, and reports assessing only response time without separable scene time were not counted as core evidence. Reviews, practice guidelines, and other pathway studies were used only for context, not as independent patient cohorts.

Literature Identification and Search Scope

Relevant publications were identified by targeted searches of PubMed-indexed records and accessible publisher/article pages. Search concepts included “on-scene time,” “scene time interval,” “prehospital,” “emergency medical services,” “trauma,” “cardiac arrest,” “stroke,” “mortality,” “survival,” and “neurological outcome,” used in combinations appropriate to the clinical condition. Records published in English between 1 January 2010 and 6 November 2026 were considered. Bibliographic details, available sample descriptions, and key reported estimates were checked against accessible abstract or article information. Search logs recording exact execution dates, platform-specific Boolean strings, and yields were not preserved, so the retrieval cannot be described as exhaustive or fully reproducible.

Searches of Embase, Scopus, Web of Science, CINAHL, and trial registries were not documented. Consequently, this review summarizes selected studies that illuminate the question; it does not

establish the number or distribution of all eligible published studies. This limitation is considered when interpreting apparently consistent findings.

Study Selection and Evidence Directness

Reports were selected purposively when they provided a distinct observational cohort, a measurable prehospital scene interval or post-ROSC stabilization interval, and a relevant patient or care-process outcome. Thirteen primary studies met the scope of this narrative synthesis: six trauma, five OHCA, and two stroke studies. Two stroke studies were retained as indirect contextual evidence because their principal analyses evaluated combinations of EMS quality metrics or dispatcher stroke recognition rather than an isolated effect of changing scene duration. Selection was not undertaken through independent dual-reviewer screening, and full screening denominators and exclusion counts are unavailable. Accordingly, the 13 articles represent a selected evidence set, not the output of a systematic eligibility census.

Evidence Extraction and Classification

The summary captured each study's setting, clinical population, sample size, definition or comparison of scene duration, reported association or process outcome, and principal interpretive limitation. Findings were grouped by trauma, ongoing OHCA, post-ROSC stabilization, and stroke. Studies were classified as direct when they analyzed a scene-time interval in relation to clinical outcomes, and indirect when scene time was embedded in a broader process or dispatcher-recognition comparison. Data were taken from the information summarized in the cited publications; no individual-patient dataset was used and no new effect estimates were computed.

Descriptive Critical Appraisal

A structured, descriptive appraisal considered the clarity of the exposure definition, patient selection, outcome relevance, sample size, control of confounding, potential reverse causation, and possible overlap between registry populations. The study-by-study considerations appear in Table 2. Particular attention was given to survivor selection in ICU-only trauma cohorts, restriction to patients achieving ROSC, differences in EMS system geography, and the distinction between patient-important outcomes and process endpoints. This appraisal is a narrative assessment of the information available for the selected studies; it is not a completed, independently adjudicated item-by-item JBI or QUIPS assessment (Joanna Briggs Institute, 2017; Hayden et al., 2013), and formal risk-of-bias categories are not assigned.

Approach to Narrative Synthesis

A condition-stratified synthesis was used because populations, scene-time definitions, comparator thresholds, adjustment strategies, and outcomes differed markedly. Trauma, active OHCA resuscitation, post-ROSC stabilization, and stroke process measures were considered separately. No meta-analysis was attempted because the assembled studies do not share a sufficiently uniform exposure and outcome framework, and this targeted evidence set cannot support an exhaustive pooled estimate.

Results

Characteristics and Directness of the Selected Studies

Thirteen selected observational studies were summarized: six trauma cohorts (2010–2026), five OHCA cohorts (2017–2023), and two stroke studies (2024–2025). Sample sizes ranged from 104 patients in a major-trauma cohort to 67,237 bystander-witnessed arrests. Eleven studies analyzed a defined scene-time or post-ROSC interval as an exposure or primary comparison for clinical outcomes. The two stroke studies mainly informed the association between prehospital processes and faster definitive care, rather than the causal effect of scene time. Some Korean OHCA analyses may include overlapping registry participants, so their denominators should not be added together. The studies were not randomized to predefined scene durations.

Trauma Outcomes

The six trauma cohorts did not support a uniform dose–response relationship. Among 22,525 patients, Waalwijk et al. (2022) associated each additional minute on scene with 24-hour mortality (RR 1.029; 95% CI 1.018–1.040) and 30-day mortality (RR 1.013; 95% CI 1.008–1.017). In Norway, Nilsbakken et al. (2023) reported greater adjusted mortality with longer scene intervals, and Usawasuraiin et al. (2026) reported an adjusted in-hospital mortality OR of 1.03 (95% CI 1.02–1.05) per additional scene minute in 8,968 patients. Siripakarn et al. (2023) observed 24-hour deaths in 33.3% of those above 10 minutes versus 8.7% of those at or below 10 minutes, although only 104 cases were included.

Contrasting findings were clinically relevant. Newgard et al. (2010) found an adjusted scene-time OR of 1.00 (95% CI 0.99–1.01) for death in a North American prospective trauma registry. In the selected population of severely injured ICU-admitted patients, Bui Van et al. (2022) reported greater survival with intermediate scene time (adjusted OR 1.21; 95% CI 1.07–1.38) and long scene time (adjusted OR 1.74; 95% CI 1.55–1.96) than with the shortest category. These findings are not directly interchangeable because the latter cohort is conditioned on ICU admission and may overrepresent patients who survived long enough to be included.

Out-of-Hospital Cardiac Arrest Outcomes

Four studies examining overall or on-scene resuscitation intervals (Kim et al., 2017; Coute et al., 2021; Jang et al., 2021; Jung et al., 2022) generally associated longer intervals with worse neurological outcomes, but the apparent optimal windows differed by EMS system and ROSC characteristics. In the CARES study, scene time exceeded approximately 20 minutes in the region where the slope of poor outcome steepened, whereas Jang et al. (2021) reported poorer outcome with intervals of at least 19 minutes (adjusted OR 2.00; 95% CI 1.40–2.88 for poor neurological outcome). These are observational cut points and should not be converted into absolute resuscitation termination rules. The published corrigendum to Jang et al. corrected the reversed Figure 1 and Figure 2 legends; it did not report a replacement effect estimate (Jang et al., 2022).

Kim et al. (2017) reported adjusted odds ratios for good cerebral performance (CPC 1–2) of 0.74 (95% CI 0.58–0.95), 0.51 (0.39–0.67), and 0.45 (0.33–0.61) for scene intervals of 4.0–7.9, 8.0–11.9, and 12.0–59.9 minutes, respectively, compared with 0.0–3.9 minutes (model without the prehospital ROSC interaction). The findings differed when prehospital ROSC status was incorporated into the analysis; these odds ratios should not be interpreted as causal effects of prolonging or shortening care.

Khan et al. (2023) analyzed a clearly distinct phase after on-scene ROSC in 1,653 patients. The median post-ROSC scene interval was 18.8 minutes. Relative to the shortest quartile, the longest was associated with hospital-discharge survival (adjusted OR 1.73; 95% CI 1.05–2.85), with lower re-arrest during transport also observed for the two longest quartiles. No statistically significant improvement in favourable neurological outcome was found. This evidence supports individualized stabilization after ROSC rather than an unqualified policy of the fastest possible scene departure.

Stroke Outcomes

Oostema et al. (2024) identified scene time of 15 minutes or less as one of several linked EMS quality indicators associated with faster hospital imaging, but its multicomponent quality score did not isolate a causal effect of scene duration on disposition. Leto et al. (2025) observed a four-minute median difference in scene time (11 versus 15 minutes) by dispatcher stroke recognition and improvements in treatment metrics, yet 90-day functional independence was not significantly different. These results support efficient recognition, prenotification, and organized transfer while leaving uncertainty about the independent long-term effect of scene time.

Interpretation of the stroke evidence requires two qualifications. First, Oostema et al. (2024) studied a mixed-stroke cohort; its scene-time ≤15-minute metric was associated with timely CT among several quality indicators, not proof of a direct effect on long-term disability. Second, Leto et al. (2025) evaluated dispatcher suspicion of acute ischemic stroke and downstream processes (median

scene time 11 vs 15 minutes; higher thrombolysis use), not a randomized or isolated change in scene duration; 90-day functional independence was not significantly different.

Evidence Summary and Study-Level Appraisal

Table 1. Selected studies of scene duration and prehospital outcomes, organized by publication year.

Study	Setting and sample	Scene-time definition	Outcome summary	Evidence type and caveat
Newgard et al. (2010)	North America | Trauma | n=3,656	Scene time per minute	Mortality aOR 1.00 (95% CI 0.99–1.01); no association	Direct; unmeasured severity may remain
Kim et al. (2017)	South Korea | OHCA | n=41,054	0.0–3.9 (reference), 4.0–7.9, 8.0–11.9, 12.0–59.9 min	Good CPC aORs: 0.74, 0.51, 0.45 vs shortest interval	Direct; ROSC interaction changes subgroup interpretation
Coute et al. (2021)	United States | OHCA | n=67,237	Each additional scene minute	Poor neurological outcome aOR 1.035 per minute (95% CI 1.027–1.044)	Direct; bystander-witnessed arrests only
Jang et al. (2021)	South Korea | OHCA | n=4,548	<19 vs ≥19 min on-scene ALS	≥19 min: worse neurological outcome; aOR 2.00	Direct; on-scene ALS interval and ROSC complexity
Waalwijk et al. (2022)	Netherlands | Trauma | n=22,525	Each extra scene minute	24-hour death RR 1.029; 30-day death RR 1.013 per minute	Direct; severity-related confounding
Bui Van et al. (2022)	Multinational Asia | Trauma ICU | n=1,874	0–8; 9–16; >16 min	Longer categories associated with higher survival	Direct; selection conditional on ICU admission
Jung et al. (2022)	South Korea | OHCA | n=44,195	≤12; 13–16; 17–30 min	Longer intervals linked with poorer survival/neurological outcomes	Direct; potential Korean registry overlap
Nilsbakken et al. (2023)	Norway | Trauma | n=28,988	Continuous scene interval	Longer intervals associated with higher adjusted mortality	Direct; geography and remoteness may confound

Study	Setting and sample	Scene-time definition	Outcome summary	Evidence type and caveat
Siripakarn et al. (2023)	Thailand | Trauma | n=104	≤10 vs >10 min	24-hour mortality: 8.7% vs 33.3% (p=0.031)	Direct; small cohort and dichotomized interval
Khan et al. (2023)	Canada | Post-ROSC OHCA | n=1,653	Scene time after ROSC	Less transport re-arrest; improved discharge survival in longer interval	Direct, distinct post-ROSC exposure; survivor selection
Oostema et al. (2024)	United States | Mixed stroke | n=5,707	Scene time ≤15 min within EMS quality metrics	Faster door-to-CT with ≤15 min; aOR 1.6 (1.4–1.9)	Indirect for patient outcomes; mixed diagnoses, process metric
Leto et al. (2025)	Norway | Acute ischemic stroke | n=771	11 vs 15 min by dispatcher suspicion	Faster treatment; no significant 90-day functional difference	Indirect; comparison is dispatcher stroke recognition
Usawasuraiin et al. (2026)	Pan-Asian | Trauma | n=8,968	Each additional scene minute	In-hospital death aOR 1.03 per minute (1.02–1.05)	Direct; multinational observational case mix

Abbreviations: aOR, adjusted odds ratio; ALS, advanced life support; CI, confidence interval; CPC, cerebral performance category; CT, computed tomography; EMS, emergency medical services; ICU, intensive care unit; OHCA, out-of-hospital cardiac arrest; ROSC, return of spontaneous circulation; RR, relative risk; TIA, transient ischemic attack.

Table 2. Descriptive appraisal of the 13 selected studies and relevance to the review question.

Study	Evidence relation	Appraisal consideration and interpretive limitation
Newgard et al. (2010)	Direct	Prospective trauma cohort with a null adjusted scene-time estimate; residual injury-severity differences and timestamp definitions remain relevant to interpretation.
Kim et al. (2017)	Direct	Intervals were grouped, and estimates differed by consideration of prehospital ROSC; comparison with other Korean OHCA datasets may involve overlapping populations.
Coute et al. (2021)	Direct	Large cohort restricted to bystander-witnessed OHCA; differences in resuscitation course and patient selection may influence the per-minute association.

Study	Evidence relation	Appraisal consideration and interpretive limitation
Jang et al. (2021)	Direct	Evaluated on-scene advanced-life-support time, not an identical interval to every registry; treatment complexity and ROSC timing may confound the ≥19-minute comparison.
Waalwijk et al. (2022)	Direct	Large trauma cohort with adjusted per-minute estimates; severity requiring extra intervention can be associated independently with both time and mortality.
Bui Van et al. (2022)	Direct	Analysis restricted to ICU-admitted major-trauma patients; conditioning on hospital/ICU survival creates a substantial selection concern.
Jung et al. (2022)	Direct	Large OHCA analysis varies by witness status and rhythm; potential overlap with other national registry populations precludes treating cases as wholly independent.
Nilsbakken et al. (2023)	Direct	Geography and urban–remote service characteristics may determine both travel/scene processes and patient prognosis despite adjustment.
Siripakarn et al. (2023)	Direct	Small major-trauma sample (n=104) and a single 10-minute threshold limit precision and generalizability; residual severity confounding remains possible.
Khan et al. (2023)	Direct, post-ROSC	Included only patients with on-scene ROSC; exposure is post-resuscitation stabilization, and findings cannot be transferred to ongoing CPR time.
Oostema et al. (2024)	Indirect for patient benefit	A mixed-stroke cohort used scene time as one quality indicator; door-to-CT is a care-process outcome rather than long-term disability or mortality.
Leto et al. (2025)	Indirect	Dispatcher stroke recognition was the main comparison; shorter scene time and reperfusion processes did not demonstrate a significant difference in 90-day independence.
Usawasuraiin et al. (2026)	Direct	Multinational retrospective trauma analysis may retain confounding by injury severity, case mix, geography, and variation in EMS timestamp practices.

Narrative Synthesis: Time Is a Marker of Both Care and Severity

Across conditions, prolonged scene time can have at least three different meanings: (1) avoidable operational delay; (2) the necessary time to perform effective prehospital care; or (3) a consequence of severe illness, difficult extrication, or failed resuscitation. Observational studies often cannot separate these mechanisms even with multivariable adjustment. The direction of association therefore should not automatically be translated into a recommended causal time limit. In addition, studies reporting adjusted odds ratios per minute cannot be averaged with categorical odds ratios or relative risks without a clearly specified harmonization method.

Discussion

Interpretation of Findings

The results favor a patient-centered rather than stopwatch-centered model of scene management. For major trauma, the weight of several contemporary large registries suggests that delays in starting transport can matter, especially when hospital-based definitive hemorrhage control, operative care, and transfusion are required. Nevertheless, associations are neither unanimous nor proof that any individual on-scene intervention is unnecessary. The selected ICU population in Bui Van et al. (2022) illustrates a critical possibility: a longer interval may coincide with beneficial early interventions or with selection of patients who survived to hospital admission.

In cardiac arrest, an undifferentiated "scene time" variable may conflate no-flow/low-flow resuscitation, procedural decision-making, and stabilization after ROSC. The observed association between longer ongoing resuscitation and poorer outcomes could reflect unsuccessful resuscitation rather than injury caused by time on scene itself. Equally, the lower risk of transport re-arrest after longer post-ROSC stabilization reported by Khan et al. (2023) is not evidence that patients with ongoing arrest should wait longer at all costs. Sound EMS policy must distinguish these phases explicitly.

In acute ischemic stroke, prehospital delay can narrow treatment opportunities, but time-efficiency must coexist with accurate recognition, glucose testing, severity identification, selection of an appropriate destination, and prenotification. The finding that faster scene times correlated with better process metrics but not with statistically significant 90-day independence in one study warns against substituting operational speed for clinical benefit.

Confounding, Reverse Causation, and Measurement

Confounding by severity is central: more critically ill patients may require prolonged ventilation, vascular access, spinal precautions, complex extrication, or repeated resuscitation attempts and may independently have poor prognosis. Conversely, patients judged unlikely to benefit from further care may be transported immediately, or not transported at all. Excluding patients who die before hospital arrival, restricting analysis to ICU admissions, and conditioning on ROSC can induce additional selection bias. These differences can produce conflicting estimates even in well-conducted registries.

Measurement variation complicates cross-study comparisons. Some registries begin the clock when the ambulance reaches the address; others when clinicians reach the patient. Extractions from multi-story buildings, traffic access, on-scene triage during mass-casualty events, and wait times for a transport vehicle may be registered as clinical scene time. Studies rarely quantify how much of the interval was spent on effective care compared with non-beneficial delay.

Balance Between Clinical Interventions and Rapid Transport

The operational question is not simply "How many minutes were spent at the scene?" but "What patient-important benefit was achieved during those minutes, and what definitive-care opportunity was delayed?" The best-supported approach is to prioritize interventions that are immediately lifesaving or indispensable for safe transport, perform transport-compatible tasks en route where safely possible, and avoid repeating assessments or procedures without a clear decision-making purpose. Teams should make an early destination and transport decision while simultaneously progressing through rapid primary assessment and critical intervention.

Implications for Saudi Red Crescent Authority and Similar EMS Systems

For the Saudi Red Crescent Authority and other geographically diverse ambulance systems, these findings suggest a need for locally validated, diagnosis-specific scene-time dashboards rather than a single agency-wide upper limit. Urban centers, long-distance rural transfers, hazardous road environments, and multiple-casualty incidents present materially different operational constraints. A useful dashboard would report scene time alongside clinical category, injury severity, intervention type, extrication time, geographic distance, transport interval, destination level, and patient outcomes.

A prospective local study could link EMS electronic patient records with emergency department, trauma-registry, resuscitation, or stroke-registry outcomes and distinguish dispatch-to-arrival, patient-side-to-departure, and post-ROSC stabilization. Prespecified analyses should test non-linear associations and effect modification by hemodynamic instability, entrapment, trauma type, shockable rhythm, ROSC, transport distance, and hospital capability. No Saudi-specific effect sizes are inferred here because the present evidence set does not provide an eligible Saudi cohort directly estimating this association.

Strengths and Limitations

This review compares reports with divergent findings and differentiates time devoted to ongoing resuscitation from stabilization after ROSC. It also distinguishes mortality and neurological outcomes from intermediate care-process measures. Important limitations remain: literature identification was purposive and not exhaustive; exact search strings, retrieval dates, and screening denominators were unavailable; no independent full-text JBI or QUIPS appraisal was completed; and a formal certainty-of-evidence assessment was not performed. The underlying studies are observational and heterogeneous in case mix, timing definitions, confounder adjustment, and outcomes. Possible overlap among Korean OHCA registries further limits any impression that cohorts are independent. The study-level observations in Table 2 guide cautious interpretation but do not replace a validated risk-of-bias assessment. Therefore, associations cannot be interpreted as causal time targets, and neither a pooled effect nor the direction of an overall causal effect can be established from this selected literature.

Future Research Directions

1. Prospective multi-EMS cohorts should collect synchronized patient-side arrival, intervention timestamps, departure times, transport times, and definitive-treatment times.
2. Analyses should separate time spent performing specific lifesaving interventions from extrication, administrative, and other potentially avoidable delays.
3. Patient-focused outcomes should include early and 30-day mortality, neurological function, complications, disability, and quality of life rather than process metrics alone.
4. Causal methods, including appropriately designed target-trial emulation and sensitivity analyses for unmeasured severity, should be considered before issuing fixed time thresholds.
5. Condition- and geography-specific research in Saudi Arabia should assess whether time-outcome associations vary by trauma mechanism, shock, OHCA phase, destination, and urban-versus-rural setting.

Conclusion

The association between prehospital on-scene time and patient outcomes is clinically important but not uniform. Several contemporary studies of major trauma suggest that prolonged scene time accompanies higher mortality, while other cohorts show no association or an apparent benefit when on-scene care and patient selection differ. In OHCA, longer total resuscitation intervals frequently correlate with poorer neurological outcomes, yet stabilization after ROSC may reduce transport re-arrest and support survival. For stroke, efficient scene management is associated with improved access to timely diagnostic and reperfusion care, although its independent effect on long-term function remains uncertain. The most appropriate operational objective is therefore to reduce avoidable delay without withholding interventions essential for safe and effective care.

Recommendations

1. Use diagnosis-specific scene-time indicators: distinguish major trauma, ongoing OHCA, post-ROSC care, and suspected stroke rather than applying an identical time target to every patient.
2. Implement early, team-based transport planning while promptly performing essential airway, bleeding-control, defibrillation, shock-management, and other justified scene interventions within local clinical protocols.
3. Record the reason for extended scene time using clinically interpretable categories (critical intervention, extrication, unsafe access, destination coordination, equipment/system delay).
4. Evaluate time together with patient outcomes and the care pathway: mortality, functional recovery, transport re-arrest, time to definitive treatment, and appropriateness of hospital destination.
5. Provide crew feedback through case-based quality reviews that examine the clinical value of scene actions rather than penalizing delay in isolation.
6. Evaluate proposed scene-time benchmarks prospectively and separately by clinical group; consider patient severity, intervention type, transport distance, and outcomes before adopting operational thresholds.

References

Bui Van, D., Song, K. J., Shin, S. D., Ro, Y. S., Jeong, J., Le Bao, H., Nguyen Duc, C., & Kim, K. H. (2022). Association between scene time interval and survival in EMS-treated major trauma admitted to the intensive care unit: A multinational, multicenter observational study. Prehospital Emergency Care, 26(4), 600–607. https://doi.org/10.1080/10903127.2021.1992053

Coute, R. A., Nathanson, B. H., Kurz, M. C., McNally, B., Mader, T. J., & CARES Surveillance Group. (2021). The association between scene time interval and neurologic outcome following adult bystander witnessed out-of-hospital cardiac arrest. The American Journal of Emergency Medicine, 46, 628–633. https://doi.org/10.1016/j.ajem.2020.11.059

Hayden, J. A., van der Windt, D. A., Cartwright, J. L., Côté, P., & Bombardier, C. (2013). Assessing bias in studies of prognostic factors. Annals of Internal Medicine, 158(4), 280–286. https://doi.org/10.7326/0003-4819-158-4-201302190-00009

Jang, D.-H., Jo, Y. H., Park, S. M., Lee, K. J., Kim, Y. J., & Lee, D. K. (2021). Association of the duration of on-scene advanced life support with good neurological recovery in out-of-hospital cardiac arrest. The American Journal of Emergency Medicine, 50, 486–491. https://doi.org/10.1016/j.ajem.2021.09.006

Jang, D.-H., Jo, Y. H., Park, S. M., Lee, K. J., Kim, Y. J., & Lee, D. K. (2022). Corrigendum to "Association of the duration of on-scene advanced life support with good neurological recovery in out-of-hospital cardiac arrest". The American Journal of Emergency Medicine, 58, 356. https://doi.org/10.1016/j.ajem.2022.05.046

Joanna Briggs Institute. (2017). Critical appraisal checklist for cohort studies. https://jbi.global/sites/default/files/2019-05/JBI_Critical_Appraisal-Checklist_for_Cohort_Studies2017_0.pdf

Jung, E., Ryu, H. H., Ro, Y. S., & Shin, S. D. (2022). Association between scene time interval and clinical outcomes according to key Utstein factors in out-of-hospital cardiac arrest. Medicine, 101(51), e32351. https://doi.org/10.1097/MD.0000000000032351

Khan, L., Hutton, J., Yap, J., et al. (2023). The association of the post-resuscitation on-scene interval and patient outcomes after out-of-hospital cardiac arrest. Resuscitation, 188, 109753. https://doi.org/10.1016/j.resuscitation.2023.109753

Kim, K. H., Shin, S. D., Song, K. J., Ro, Y. S., Kim, Y. J., Hong, K. J., & Jeong, J. (2017). Scene time interval and good neurological recovery in out-of-hospital cardiac arrest. The American Journal of Emergency Medicine, 35(11), 1682–1690. https://doi.org/10.1016/j.ajem.2017.05.049

Leto, N., Farbu, E., Barach, P., et al. (2025). Reducing time delays and enhancing reperfusion eligibility related to stroke suspicion by the Emergency Medical Dispatch Centre: A registry-based observational study. Emergency Medicine Journal, 42(9), 599–605. https://doi.org/10.1136/emermed-2024-214294

Newgard, C. D., Schmicker, R. H., Hedges, J. R., et al. (2010). Emergency medical services intervals and survival in trauma: Assessment of the "golden hour" in a North American prospective cohort. Annals of Emergency Medicine, 55(3), 235–246.e4. https://doi.org/10.1016/j.annemergmed.2009.07.024

Nilsbakken, I. M. W., Cuevas-Østrem, M., Wisborg, T., Sollid, S., & Jeppesen, E. (2023). Effect of urban vs. remote settings on prehospital time and mortality in trauma patients in Norway: A national population-based study. Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine, 31, 53. https://doi.org/10.1186/s13049-023-01121-w

Oostema, J. A., Nickles, A., Allen, J., Ibrahim, G., Luo, Z., & Reeves, M. J. (2024). Emergency medical services compliance with prehospital stroke quality metrics is associated with faster stroke evaluation and treatment. Stroke, 55(1), 101–109. https://doi.org/10.1161/STROKEAHA.123.043846

Siripakarn, Y., Triniti, L., & Srivilaithon, W. (2023). Association of scene time with mortality in major traumatic injuries arrived by emergency medical service. Journal of Emergencies, Trauma, and Shock, 16(4), 156–160. https://doi.org/10.4103/jets.jets_35_23

Usawasuraiin, P., Angkurawaranon, C., Tangsuwanaruk, T., et al. (2026). Association between prehospital time and trauma outcomes: A multicenter cohort study from the Pan-Asian Trauma Outcomes Study (PATOS). The American Journal of Emergency Medicine, 106, 115–123. https://doi.org/10.1016/j.ajem.2026.05.013

Waalwijk, J. F., van der Sluijs, R., Lokerman, R. D., et al. (2022). The impact of prehospital time intervals on mortality in moderately and severely injured patients. Journal of Trauma and Acute Care Surgery, 92(3), 520–527. https://doi.org/10.1097/TA.0000000000003380

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