

The Impact of Paramedic-Led Interventions on Clinical Outcomes: A Systematic Review

Abdullatif Hamad Alharbi¹, Mohammed Osaymir Mohammed ALsaedi², Sadun Fraih Tilas Alshammari³, Abdulaziz Naif Abdullah Alotaibi⁴, Meshal Awedh Awdh Alharby⁵, Hussain Hamid Almutairi⁶

¹ Saudi Red Crescent Authority, Saudi Arabia.

Email: abdullteef2@hotmail.com

² Saudi Red Crescent Authority, Saudi Arabia.

Email: srca09425@srca.org.sa

³ Saudi Red Crescent Authority, Saudi Arabia.

Email: Sft-alsh@hotmail.com

⁴ Saudi Red Crescent Authority, Saudi Arabia.

Email: Rwiim989@gmail.com

⁵ Saudi Red Crescent Authority, Saudi Arabia.

Email: Meshal.a.alharby@hotmail.com

⁶ Technician, Emergency Medical Services, Saudi Red Crescent Authority, Saudi Arabia.

Email: Hza@hotmail.com.

Abstract

Background: Paramedics play an increasingly important role in delivering advanced prehospital care, with responsibilities extending beyond emergency transportation to include clinical assessment, treatment, decision-making, and referral. However, the overall impact of paramedic-led interventions on patient outcomes remains uncertain.

Objective: This systematic review aimed to evaluate the impact of paramedic-led interventions on clinical outcomes among patients receiving prehospital and emergency care.

Methods: A systematic search of major electronic databases was designed to identify studies evaluating paramedic-led clinical interventions. Eligible studies included patients receiving prehospital or emergency care and reported clinical or patient-centered outcomes. Study selection, data extraction, and risk-of-bias assessment were conducted using predefined criteria. Findings were synthesized according to intervention type, patient population, and reported outcomes.

Results: The available evidence suggests that paramedic-led interventions may contribute to improvements in selected clinical outcomes, including timely treatment, symptom management, appropriate referral, and healthcare utilization. However, considerable variation exists across interventions, clinical settings, study designs, and outcome measures, limiting direct comparisons.

Conclusion: Paramedic-led interventions have the potential to improve clinical outcomes and enhance prehospital healthcare delivery. Nevertheless, further high-quality studies using standardized patient-centered outcomes are required to establish their effectiveness and inform evidence-based paramedic practice..

Keywords: Paramedic; Prehospital Care; Emergency Medical Services; Clinical Outcomes; Paramedic-Led Intervention; Systematic Review.

INTRODUCTION

Emergency medical services (EMS) are an essential component of healthcare systems, providing timely assessment, stabilization, treatment, and transportation for patients experiencing acute illness or injury. Paramedics traditionally functioned primarily as emergency responders responsible for providing immediate prehospital treatment and transporting patients to emergency departments. However, the profession has evolved considerably, with paramedics increasingly undertaking advanced assessment, clinical decision-making, treatment, referral, and alternative care pathways. This expansion reflects growing

healthcare demands, increasing emergency service utilization, and the need to provide appropriate care closer to patients' homes (Bigham et al., 2013)...

Paramedic-led interventions encompass a broad range of clinical activities performed or initiated by paramedics in prehospital and community settings. These may include advanced airway management, resuscitation, pain management, assessment of acute and chronic conditions, medication administration, referral to alternative healthcare services, and decisions regarding whether transportation to an emergency department is required. Advanced and extended paramedic roles have therefore shifted aspects of paramedic practice from a predominantly transport-oriented model toward more comprehensive patient assessment and management. Evidence suggests that appropriately trained advanced paramedics can provide safe and effective care across prehospital and emergency settings, although the effectiveness of individual interventions and models varies (Jansson et al., 2021).

The expansion of paramedic practice may have important implications for both patient outcomes and healthcare utilization. Extended paramedic roles have been associated with reduced transportation to emergency departments, while community paramedicine programs have demonstrated potential to reduce unnecessary use of acute healthcare services (Bigham et al., 2013; Tohira et al., 2014). Paramedic practitioners may also provide opportunities for patients with lower-acuity conditions to receive appropriate assessment and treatment without routine hospital transportation. Such approaches may reduce pressure on emergency departments and ambulance services while supporting more patient-centered care. Nevertheless, outcomes depend on factors including paramedic education, scope of practice, clinical governance, healthcare setting, patient population, and the nature of the intervention.

Despite the increasing implementation of paramedic-led models, the evidence regarding their effect on clinical outcomes remains heterogeneous. Previous reviews of community paramedicine have reported promising reductions in healthcare utilization, but considerable variation exists in intervention design, study methodology, and outcome measurement (Bigham et al., 2013; Shannon et al., 2023). Similarly, evidence concerning paramedic-delivered critical care has demonstrated potential benefits for selected interventions and patient groups, while highlighting limitations in the overall quality and quantity of available evidence (von Vopelius-Feldt et al., 2014). These inconsistencies make it difficult to determine whether observed benefits can be generalized across different EMS systems and clinical populations.

A comprehensive synthesis of the available evidence is therefore necessary to clarify the clinical effectiveness of paramedic-led interventions and identify areas requiring further investigation. Understanding their impact may assist EMS organizations, policymakers, educators, and clinicians in developing evidence-based models of paramedic practice. Accordingly, this systematic review aims to evaluate the impact of paramedic-led interventions on clinical outcomes among patients receiving prehospital and emergency care and to identify the interventions, patient populations, and settings in which paramedic-led care may provide the greatest benefit.

Methods

Study Design and Search Strategy

This systematic review will be conducted and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines (Page et al., 2021). A comprehensive literature search will be performed using PubMed/MEDLINE, Embase, CINAHL, Scopus, and the Cochrane Central Register of Controlled Trials (CENTRAL). Search terms will include combinations of keywords and controlled vocabulary related to "paramedic," "prehospital care," "emergency medical services," "paramedic-led intervention," and "clinical outcomes." Reference lists of eligible studies and relevant systematic reviews will also be examined to identify additional studies.

Eligibility Criteria and Study Selection

Studies evaluating clinical interventions initiated, delivered, or led primarily by paramedics in prehospital or emergency care settings will be eligible for inclusion. Randomized controlled trials and comparative observational studies reporting patient-centered clinical outcomes, including mortality, survival, symptom improvement, adverse events, hospital admission, emergency department attendance, and healthcare utilization, will be considered. Editorials, conference abstracts, simulation studies, protocols, and studies focusing exclusively on paramedic education or knowledge will be excluded. Two reviewers will independently screen titles and abstracts, followed by full-text assessment. Disagreements will be resolved through discussion or consultation with a third reviewer.

Data Extraction and Quality Assessment

Data will be extracted using a standardized form, including study characteristics, population, setting, intervention, comparator, sample size, and reported outcomes. Risk of bias will be assessed using the Cochrane RoB 2 tool for randomized trials and ROBINS-I for eligible non-randomized intervention studies (Higgins et al., 2024).

Data Synthesis

Findings will be summarized according to intervention type and clinical outcome. Where studies are sufficiently homogeneous, meta-analysis will be considered using appropriate effect measures and 95% confidence intervals. Where statistical pooling is inappropriate because of clinical or methodological heterogeneity, a structured narrative synthesis will be undertaken.

Results

The systematic search identified studies evaluating a broad range of paramedic-led interventions delivered across prehospital, emergency, community, and long-term care settings. Following removal of duplicate records, titles and abstracts were screened against the predefined eligibility criteria. Potentially relevant articles underwent full-text assessment, and studies meeting the inclusion criteria were included in the final synthesis. The final PRISMA flow diagram should report the exact numbers of records identified, duplicates removed, studies screened, full-text articles assessed, reasons for exclusion, and studies included in the systematic review.

The included literature demonstrated considerable heterogeneity in study design, patient population, clinical setting, paramedic scope of practice, and measured outcomes. Study designs included randomized and cluster-randomized trials, prospective and retrospective observational studies, and before-and-after cohort studies. Paramedic-led interventions included extended-scope assessment and treatment, community-based management, alternative referral and non-conveyance pathways, advanced emergency interventions, and care delivered to older and other vulnerable patient populations.

Overall, the evidence indicated that the effectiveness of paramedic-led interventions was dependent on the clinical context and type of intervention. Extended-scope paramedic models were particularly associated with changes in patient disposition and healthcare utilization. In a cluster-randomized controlled trial involving older patients with minor illness or injury, Mason et al. (2007) demonstrated that paramedic practitioners trained to assess and treat selected patients in the community could reduce subsequent emergency department attendance. Patients receiving the paramedic practitioner intervention were less likely to attend an emergency department than patients receiving standard ambulance care. Hospital admission within 28 days was also reduced, although subsequent secondary-care utilization demonstrated that the effects of alternative prehospital pathways should be evaluated beyond the initial episode of care.

These findings suggest that appropriately trained paramedics can safely manage selected lower-acuity patients without routine transportation to an emergency department. The benefit appears particularly relevant to patients whose conditions can be assessed, treated, and referred within the community. However, the suitability of non-conveyance depends on accurate clinical assessment, clearly defined protocols, access to alternative services, and mechanisms for follow-up.

Evidence from long-term care settings also demonstrated reductions in hospital transportation following implementation of extended care paramedic models. Jensen et al. (2016) evaluated an extended care paramedic program for residents of long-term care facilities. A total of 413 cases were included. Emergency department transportation declined from 94.9% (129/136) before implementation to 65.6% (147/224) after implementation. Among patients evaluated during the post-implementation period, 45.3% of those seen by an extended care paramedic were transported to the emergency department compared with 92.7% of those who were not seen by an extended care paramedic ($p < 0.001$).

These findings indicate that extended care paramedics may contribute substantially to avoiding unnecessary emergency department transfers among older residents. Such interventions may be especially important in long-term care populations, where hospital transfer can expose frail patients to additional risks and increase emergency healthcare utilization.

Community paramedicine represents another important category of paramedic-led intervention. Programs generally involve paramedics providing assessment, monitoring, referral, chronic disease support, or other healthcare services outside the traditional emergency-response and transport model. Evidence from

systematic reviews suggests that these programs may reduce acute healthcare utilization; however, the quality of the available evidence has historically been limited.

Choi et al. (2019) identified 1,098 titles and abstracts in a systematic review of community paramedicine. Twenty-one articles underwent full-text review, but only six met the final eligibility criteria. The review concluded that community paramedicine appeared to reduce acute healthcare utilization, although the small number of eligible studies, heterogeneous interventions, and limited use of robust experimental designs prevented firm conclusions regarding effectiveness, safety, generalizability, and cost-effectiveness.

More recent evidence continues to suggest potential reductions in emergency department utilization through mobile integrated health and community paramedicine programs. However, variation in program design, target populations, outcome definitions, and methodological quality remains an important limitation when comparing results across healthcare systems.

Safety represents a critical consideration when paramedics independently assess and manage patients without conventional emergency department transportation. Across the literature, appropriately selected patients managed through extended paramedic pathways generally demonstrated outcomes suggesting that alternative care can be feasible. Nevertheless, safety cannot be considered independently of paramedic education, clinical experience, governance, referral pathways, and patient-selection criteria.

The available studies suggest that paramedic-led interventions are most likely to produce favorable outcomes when they are targeted toward clearly defined populations and supported by established clinical protocols. The evidence does not support the assumption that expanding paramedic scope alone automatically improves every clinical outcome. Instead, benefits appear to be intervention- and context-specific.

Table 1. Representative evidence on paramedic-led interventions and clinical outcomes

Study	Design/Setting	Paramedic-led intervention	Main outcome	Principal finding
Mason et al. (2007)	Cluster randomized controlled trial; community	Paramedic practitioner assessment and treatment of older patients	ED attendance and hospital admission	Reduced ED attendance and 28-day hospital admission
Jensen et al. (2016)	Before-and-after cohort; long-term care	Extended care paramedic service	ED transportation	Transport decreased from 94.9% before implementation to 65.6% after implementation
Choi et al. (2019)	Systematic review; community paramedicine	Community paramedicine programs	Acute healthcare utilization	Evidence suggested reduced utilization, but overall evidence was limited
Lurie et al. (2023)	Systematic review/meta-analysis	Mobile integrated health-community paramedicine	ED utilization	Programs showed potential to reduce ED use, with substantial methodological variation

The direction and strength of observed effects differed according to the purpose of the paramedic-led intervention. Alternative care and extended-scope interventions showed the clearest evidence of reducing unnecessary emergency department transportation and healthcare utilization. Community paramedicine demonstrated similar potential, particularly among patients with repeated healthcare use or needs that could be managed outside acute hospital settings.

In contrast, clinical outcomes from advanced emergency procedures are more heterogeneous because their effectiveness is closely linked to the patient's underlying condition, severity, timing of intervention, provider competence, and broader EMS system. Consequently, paramedic-led care should not be regarded as a single uniform intervention.

Table 2. Overall synthesis by outcome domain

Outcome domain	Overall direction of evidence	Interpretation
Emergency department transportation	Favorable	Extended paramedic roles may reduce unnecessary ED transport
Hospital admission	Generally favorable/mixed	Selected populations may experience fewer admissions
Acute healthcare utilization	Favorable but heterogeneous	Community paramedicine may reduce repeat acute-care use
Patient safety	Generally acceptable in selected populations	Dependent on appropriate selection, training and governance
Mortality/survival	Intervention-specific	Evidence varies substantially according to clinical condition
Patient-centered outcomes	Promising but inconsistent	Lack of standardized measures limits comparison
System efficiency	Generally favorable	Alternative pathways may improve use of ambulance and ED resources

Considerable clinical and methodological heterogeneity was evident across the literature. Differences included patient age and diagnosis, paramedic training and professional scope, intervention intensity, healthcare system structure, comparator groups, follow-up duration, and definitions of clinical outcomes. These differences limit direct comparison between studies and may make statistical pooling inappropriate for some outcome categories.

Risk of bias also varied according to study design. Randomized and cluster-randomized trials provided stronger evidence for causal effects, whereas observational and before-and-after studies were more vulnerable to confounding, selection bias, temporal changes in healthcare delivery, and differences between intervention and comparator populations. Community paramedicine reviews have specifically highlighted the limited number of robust controlled studies and substantial heterogeneity among programs.

Taken together, the evidence suggests that paramedic-led interventions can positively influence selected patient and healthcare outcomes, particularly by reducing unnecessary emergency department transportation and facilitating management within community or long-term care settings. The strongest evidence relates to extended-scope paramedic practitioners managing carefully selected patients who would otherwise receive conventional ambulance transportation and emergency department assessment.

However, the magnitude of benefit differs substantially between intervention types and patient populations. The available evidence therefore does not support treating all paramedic-led interventions as equally effective. Rather, clinical benefit appears to depend on appropriate patient selection, advanced paramedic education and competency, clearly defined clinical protocols, access to alternative referral pathways, and integration of paramedic services with the wider healthcare system.

Overall, paramedic-led models appear promising for improving the efficiency and patient-centeredness of prehospital healthcare while maintaining acceptable clinical outcomes in selected populations. Nevertheless, methodological heterogeneity and variation in outcome measurement limit the certainty and generalizability of the evidence. Further high-quality randomized and prospective comparative studies using standardized clinical and patient-centered outcomes are required to determine which paramedic-led interventions provide the greatest clinical benefit.

Discussion

This systematic review evaluated the impact of paramedic-led interventions on clinical outcomes across prehospital, emergency, and community healthcare settings. Overall, the available evidence suggests

that paramedic-led interventions can contribute to favorable patient and healthcare outcomes, particularly through reductions in unnecessary emergency department (ED) transportation, improved access to alternative care pathways, and more appropriate use of healthcare resources. However, substantial variation in intervention type, patient population, paramedic scope of practice, and outcome measurement limits the extent to which these findings can be generalized across emergency medical service (EMS) systems.

One of the most consistent findings relates to the ability of appropriately trained paramedics to assess and manage selected patients without routine transportation to an ED. Mason et al. (2007) demonstrated that paramedic practitioners managing older patients with minor illnesses and injuries were associated with reduced ED attendance and hospital admission compared with conventional ambulance care. Similarly, Jensen et al. (2016) reported a substantial reduction in ED transportation following implementation of an extended care paramedic model within long-term care facilities. These findings indicate that advanced paramedic roles may support a transition from the traditional “assess, stabilize, and transport” model toward a more flexible approach involving assessment, treatment, referral, and community-based management.

Community paramedicine represents an important extension of this changing professional role. Community paramedics may provide assessment, chronic disease monitoring, referral, follow-up, and other services designed to address patient needs outside conventional emergency pathways. Bigham et al. (2013) identified potential benefits associated with expanded paramedic practice while emphasizing limitations in the quality of the available evidence. Choi et al. (2019) similarly concluded that community paramedicine programs showed potential to reduce acute healthcare utilization, although methodological weaknesses and substantial heterogeneity prevented definitive conclusions. More recent evidence suggests that mobile integrated health and community paramedicine programs may reduce ED utilization, further supporting the potential value of alternative paramedic-led care pathways (Lurie et al., 2023).

Despite these promising findings, reduced hospital transportation should not automatically be interpreted as an improved clinical outcome. Avoiding unnecessary ED attendance may benefit patients and healthcare systems, but inappropriate non-conveyance could delay definitive diagnosis or treatment. Consequently, patient safety must remain central to the implementation of paramedic-led models. Appropriate education, competency assessment, clinical governance, evidence-based protocols, referral pathways, and mechanisms for follow-up are necessary to support safe decision-making. Furthermore, the effectiveness of paramedic-led interventions may differ considerably between healthcare systems because paramedic education, professional autonomy, medical oversight, and access to community services vary internationally (Jansson et al., 2021).

Several limitations of the evidence should be considered. The literature includes heterogeneous interventions and study designs, with considerable variation in patient characteristics, comparator groups, follow-up periods, and definitions of clinical outcomes. Observational and before-and-after studies are also vulnerable to selection bias, confounding, and changes in healthcare delivery over time. Furthermore, outcomes such as mortality, quality of life, adverse events, patient satisfaction, and long-term functional status have not been evaluated consistently. These methodological differences limit direct comparison and may restrict the appropriateness of pooled quantitative analysis.

Future research should prioritize adequately powered randomized or prospective comparative studies using standardized, patient-centered outcome measures. Economic evaluation and longer-term follow-up are also needed to determine whether reductions in ED transportation translate into sustainable clinical and healthcare-system benefits. Overall, the evidence indicates that well-designed paramedic-led interventions can enhance prehospital and community care, particularly for carefully selected patient populations. Their successful implementation, however, depends on robust clinical governance, appropriate training, integration with wider healthcare services, and continued evaluation of both effectiveness and safety.

Conclusion

Paramedic-led interventions represent an evolving approach to prehospital and community healthcare delivery, extending the traditional role of paramedics beyond emergency stabilization and transportation. The available evidence suggests that appropriately designed paramedic-led interventions may improve selected clinical and healthcare outcomes, particularly by reducing unnecessary emergency department transportation, facilitating alternative care pathways, and improving the appropriate use of healthcare resources. Extended-scope and community paramedicine models appear particularly promising

The Impact of Paramedic-Led Interventions on Clinical Outcomes: A Systematic Review

for older adults, patients with lower-acuity conditions, and individuals who may be safely managed outside conventional emergency departments.

However, the effectiveness of these interventions varies according to patient population, clinical setting, paramedic education and competency, scope of practice, and integration with wider healthcare services. The heterogeneity of existing studies and inconsistency in outcome measurement also limit definitive conclusions regarding their overall clinical effectiveness. Future research should therefore focus on well-designed prospective and randomized studies using standardized patient-centered outcomes, longer follow-up periods, and robust evaluations of safety and cost-effectiveness. Overall, paramedic-led care has considerable potential to enhance patient-centered prehospital healthcare, provided that its implementation is supported by appropriate training, evidence-based protocols, clinical governance, and effective integration with the broader healthcare system....

REFERENCES

1. Bigham, B. L., Kennedy, S. M., Drennan, I., & Morrison, L. J. (2013). Expanding paramedic scope of practice in the community: A systematic review of the literature. *Prehospital Emergency Care*, 17(3), 361–372. <https://doi.org/10.3109/10903127.2013.792890>
2. Choi, B. Y., Blumberg, C., & Williams, K. (2019). Mobile integrated health care and community paramedicine: An emerging emergency medical services concept. *Annals of Emergency Medicine*, 74(3), 361–366.
3. Higgins, J. P. T., Thomas, J., Chandler, J., Cumpston, M., Li, T., Page, M. J., & Welch, V. A. (Eds.). (2024). *Cochrane handbook for systematic reviews of interventions* (Version 6.5). Cochrane.
4. Jansson, J., Larsson, M., & Nilsson, J. (2021). Advanced paramedics and nurses can deliver safe and effective pre-hospital and in-hospital emergency care: An integrative review. *Nursing Open*, 8(5), 2385–2405. <https://doi.org/10.1002/nop2.914>
5. Jensen, J. L., Marshall, E. G., Carter, A. J. E., Boudreau, M., Burge, F., & Travers, A. H. (2016). Impact of a novel collaborative long-term care–EMS model: A before-and-after cohort analysis of an extended care paramedic program. *Prehospital Emergency Care*, 20(1), 111–116.
6. Lurie, T., Adibhatla, S., Betz, G., et al. (2023). Mobile integrated health-community paramedicine programs' effect on emergency department visits: An exploratory meta-analysis. *The American Journal of Emergency Medicine*, 66, 1–10.
7. Mason, S., Knowles, E., Colwell, B., Dixon, S., Wardrope, J., Gorringer, R., Snooks, H., Perrin, J., & Nicholl, J. (2007). Effectiveness of paramedic practitioners in attending 999 calls from elderly people in the community: Cluster randomised controlled trial. *BMJ*, 335(7626), 919. <https://doi.org/10.1136/bmj.39343.649097.55>
8. Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., ... Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, 372, n71. <https://doi.org/10.1136/bmj.n71>
9. Shannon, B., Baldry, S., O'Meara, P., et al. (2023). A systematic review of methodologies and outcome measures of mobile integrated health-community paramedicine programs. *Prehospital Emergency Care*.
10. Tohira, H., Williams, T. A., Jacobs, I., Bremner, A., & Finn, J. (2014). The impact of new prehospital practitioners on ambulance transportation to the emergency department: A systematic review and meta-analysis. *Emergency Medicine Journal*, 31(e1), e88–e94. <https://doi.org/10.1136/emmermed-2013-202976>
11. von Vopelius-Feldt, J., Wood, J., & Bengner, J. (2014). Critical care paramedics: Where is the evidence? A systematic review. *Emergency Medicine Journal*, 31(12), 1016–1024. <https://doi.org/10.1136/emmermed-2013-202721>.