

# Pre-hospital extracorporeal cardiopulmonary resuscitation: models of care and a narrative review.

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## Background

Out-of-hospital cardiac arrest (OHCA) is a significant cause of mortality affecting over 600,000 people in Europe and the United States [1]. Duration of low-flow time is a critical factor for OHCA survival with one study finding that survival to hospital discharge decreased by 13% for every minute pre-hospital CPR was provided [2]. The delivery of extracorporeal cardiopulmonary resuscitation (ECPR) in the pre-hospital setting is thought to improve the chances of survival by reducing duration of low-flow time through earlier implementation of ECPR. However, such programs are often resource-intensive and require complex interaction between multiple systems and services. This narrative review was conducted to describe the various methods of pre-hospital ECPR delivery and the evidence surrounding these programs.

## Aim

To describe and compare current pre-hospital ECPR practices including models for delivery, associated challenges, and outcomes.

## Method

A systematic literature search of MEDLINE (Ovid) and Embase was performed. The abstracts of the studies were screened and full texts of relevant articles were reviewed. Information regarding pre-hospital ECPR models and outcomes including survival rate and time to ECPR were extracted.

## References

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## Results

Different models of pre-hospital ECPR throughout the world were summarised and compared from original research, predictive modelling studies, reviews and case studies. The predominant pre-hospital ECPR model present in the literature was ground-based delivery in metropolitan centres. Other studies examined pre-hospital ECPR in regional settings and helicopter-based ECPR.

Across 11 ground-based pre-hospital ECPR studies, the overall survival rate to hospital discharge was 28.2% (173/613). The mean low-flow time was 56.5 minutes while the shortest low-flow time was 31 minutes and the longest was 110 minutes [3,4]. There was a variety of team compositions and systems to activate ECPR teams across different countries.

Helicopter-emergency services (HEMS)-based pre-hospital ECPR previously demonstrated a median low flow time of 110 minutes, achieving a 15.1% survival rate with good neurological outcomes (CPC 1-2), despite an average distance of 41 km to OHCA locations [5]. When comparing eligibility for ECPR, ground-based pre-hospital ECPR doubled the number of eligible OHCA patients, while HEMS-based pre-hospital ECPR quadrupled eligibility [6].

## Conclusion

Ground-based pre-hospital ECPR remains the most studied model of care for managing refractory OHCA, demonstrating encouraging outcomes. However, emerging HEMS-based pre-hospital ECPR programs have shown promise in expanding patient eligibility and achieving favourable neurological outcomes in regional settings. Further research is needed to standardise ECPR protocols, optimise outcomes and enhance access to ECPR services, particularly as helicopter-based and hybrid models continue to evolve.