RIASE
REVISTA IBERO-AMERICANA DE SAÚDE E ENVELHECIMENTO
REVISTA IBERO-AMERICANA DE SALUD Y ENVEJECIMIENTO

MATERNAL-FETAL RISKS IN UNEXPECTED PRE-HOSPITAL DELIVERIES: AN INTEGRATIVE LITERATURE REVIEW

RISCOS MATERNO-FETAIS EM PARTOS INESPERADOS NO PRÉ-HOSPITALAR: UMA REVISÃO INTEGRATIVA DA LITERATURA

RIESGOS MATERNO-FETALES EN PARTOS PREHOSPITALARIOS INESPERADOS: UNA REVISIÓN INTEGRADORA DE LA LITERATURA

Susana Manageiro Pereira[1], Ana Castelo de Carmo Castela[2], Jorgelina Rodrigues[3], João Alves de Barros[4], Ana Salgueirinho dos Santos[5].

[1]Instituto Nacional de Emergência Médica, Delegação Regional de Lisboa Vale do Tejo e Alentejo, Lisboa, Portugal. [2]Hospital de Cascais Dr. José de Almeida, Departamento de Obstetrícia, Cascais, Portugal. [3]Unidade Local de Saúde Lisboa Ocidental, Unidade de Cuidados na Comunidade Saudar, Oeiras, Portugal. [4]Hospital das Forças Armadas, Departamento Médico Ala B, Lisboa, Portugal. [5]Santa Casa da Misericórdia de Lisboa, Unidade de Saúde de Telheiras, Lisboa, Portugal.

Received/Recebido: 2025-10-14 Accepted/Aceite: 2026-02-12 Published/Publicado: 2026-04-21

DOI: http://dx.doi.org/10.60468/r.riase.2026.12(01).802.7-22

VOL. 12 NO. 1 APRIL 2026

Abstract

Background: The functioning of maternity hospitals in Portugal faces significant challenges due to the shortage of health professionals and the centralisation of services, which can increase the incidence of unexpected births in a pre-hospital environment. **Aim:** To identify the risks to maternal-fetal safety associated with unexpected births during pre-hospital transport, analysing recent scientific evidence on the assistance provided by emergency teams. **Methodology:** An integrative literature review was conducted using the following databases: PubMed, MedLine, CINAHL, Nursing & Allied Health Collection: Comprehensive, and MedicLatina. After a preliminary review of the phenomenon under study, a systematic search was performed using a combination of natural and indexed terms in English, as consulted in the Health Sciences Descriptors (DeCS) and Medical Subject Headings (MeSH). The terms used were: ("birth before arrival" OR "unplanned out-of-hospital birth" OR "out-of-hospital delivery" OR "unplanned pre-hospital birth") AND ("complications" OR "safety" OR "risk" OR "outcomes") AND ("ambulance" OR "emergency medical services"). In addition, a second search equation was applied: (TI "birth before arrival" OR TX "birth before arrival") AND TI "prehospital emergency care" OR TX "prehospital emergency care". Ten studies evaluating maternal and neonatal complications were analyzed. **Results:** The main complications identified include postpartum hemorrhage, shoulder dystocia, abnormal presentation of the fetus and nuchal cord. For newborns, prematurity, hypoxia, hypothermia, infection, polycythemia, hypoglycemia and higher neonatal mortality stand out. The lack of specific training for emergency teams and the inadequacy of equipment in ambulances compromise maternal-fetal safety. **Conclusion:** Measures such as continuous training for professionals, regular audits and the standardisation of protocols are essential for improving safety and the quality of care provided.

Keywords: Birth Before Arrival; Obstetric Labor Complications; Patient Safety; Prehospital Care; Risk.

Resumo

Enquadramento: O funcionamento das maternidades em Portugal enfrenta desafios significativos devido à escassez de profissionais de saúde e à centralização dos serviços, o que pode aumentar a incidência de partos inesperados em ambiente pré-hospitalar. **Objetivo:** Identificar os riscos para a segurança materno-fetal associados aos nascimentos inesperados durante o transporte pré-hospitalar, analisando a evidência científica recente sobre a assistência prestada pelas equipas de emergência. **Metodologia:** Foi realizada uma revisão integrativa da literatura, com recurso às seguintes bases de dados: PubMed, MedLine, CINAHL, Nursing & Allied Health Collection: Comprehensive e MedicLatina. Após uma revisão preliminar sobre o fenómeno em estudo, foi realizada a pesquisa sistemática utilizando uma combinação de termos naturais e indexados em inglês, conforme consulta aos Descritores em Ciências da Saúde (DeCS) e ao Medical Subject Headings (MeSH). Os termos utilizados foram: ("birth before arrival" OR "unplanned out-of-hospital birth" OR "out-of-hospital delivery" OR "unplanned pre-hospital birth") AND ("complications" OR "safety" OR "risk" OR "outcomes") AND ("ambulance" OR "emergency medical services"). Além disso, foi aplicada uma segunda equação de pesquisa: (TI "birth before arrival" OR TX "birth before arrival") AND TI "prehospital emergency care" OR TX "prehospital emergency care". Foram analisados dez estudos que avaliam complicações maternas e neonatais. **Resultados:** As principais complicações identificadas incluem hemorragia pós-parto, distócia de ombros, apresentação anómala do feto e as circulares cervicais do cordão umbilical. Para o recém-nascido, destacam-se prematuridade, hipóxia, hipotermia, infeção, policitemia, hipoglicemia e maior mortalidade neonatal. A falta de formação específica das equipas de emergência e a inadequação de equipamentos no transporte pré-hospitalar comprometem a segurança materno-fetal. **Conclusão:** Medidas como a formação contínua dos profissionais, auditorias regulares e a padronização de protocolos são essenciais para melhorar a segurança e a qualidade dos cuidados prestados.

Palavras-chave: Assistência Pré-hospitalar; Complicações do Trabalho de Parto; Nascimento Antes de Chegar; Risco; Segurança do Paciente.

Resumen

Marco contextual: El funcionamiento de los hospitales de maternidad en Portugal enfrenta importantes desafíos debido a la escasez de profesionales de la salud y la centralización de los servicios, lo que puede aumentar la incidencia de nacimientos inesperados en un entorno prehospitalario. **Objetivo:** Identificar los riesgos para la seguridad materno-fetal asociados a partos inesperados durante el transporte prehospitalario, analizando evidencia científica reciente sobre la asistencia brindada por los equipos de emergencia. **Metodología:** Se realizó una revisión integradora de la literatura en las siguientes bases de datos: PubMed, MedLine, CINAHL, Nursing & Allied Health Collection: Comprehensive y MedicLatina. Tras una revisión preliminar del fenómeno en estudio, se realizó una búsqueda sistemática combinando términos naturales e indexados en inglés, según se consulta en los Descriptores de Ciencias de la Salud (DeCS) y los Encabezados de Materia Médica (MeSH). Los términos utilizados fueron: ("birth before arrive" OR "unplanned out-of-hospital birth" OR "out-of-hospital delivery" OR "unplanned pre-hospital birth") AND ("complications" OR "safety" OR "risk" OR "outcomes") AND ("ambulance" OR "emergency medical services"). Además, se aplicó una segunda ecuación de búsqueda: (TI "birth before arrive" OR TX "birth before arrive") AND TI "prehospital emergency care" OR TX "prehospital emergency care". Se analizaron diez estudios que evaluaron complicaciones maternas y neonatales. **Resultados:** Las principales complicaciones identificadas incluyen hemorragia posparto, distocia de hombros, presentación anormal del feto y cinturas cervicales del cordón umbilical. En los recién nacidos destacan la prematuridad, la hipoxia, la hipotermia, la infección, la policitemia, la hipoglucemia y la mayor mortalidad neonatal. La falta de formación específica de los equipos de emergencia y la insuficiencia del equipamiento de las ambulancias comprometen la seguridad materno-fetal. **Conclusión:** Medidas como la formación continua de los profesionales, auditorías regulares y la estandarización de protocolos son esenciales para mejorar la seguridad y calidad de la atención brindada.

Descriptores: Atención Prehospitalaria; Complicaciones del Trabajo de Parto; Nacimiento Antes de Llegar; Riesgo; Seguridad del Paciente.

Introduction

The networked operation of maternity hospitals in Portugal, since 2022, has faced several challenges that compromise its full functioning, reflecting on access to and quality of maternal and fetal care. The shortage of healthcare professionals, particularly Gynecology/Obstetrics doctors, is a reality observed internationally, including in Portugal, which, according to the forecasts of the World Health Organization (WHO), will persist in the medium term[1]. In this context of reorganization of the Gynecology/Obstetrics service network, with a reduction in the number of maternity hospitals in operation and a consequent increase in the distances traveled by pregnant women in labor, an increase in unexpected births in the pre-hospital environment would be expected, either at home or during transport to the hospital unit. However, the scarcity of records from entities that provide pre-hospital care (INEM, Firefighters and Portuguese Red Cross) makes it difficult to obtain accurate data on the real incidence of these events, limiting the assessment of the impact on maternal and fetal safety.

At the end of 2022, the Ministry of Health, through the Executive Directorate of the National Health Service, launched the "Safe Birth in the NHS" operation, for promoting the safety and confidence of pregnant women and families, seeking to safeguard the principles of equity, quality, promptness, humanization and predictability of care provided in the NHS. In 2024, within the scope of this operation, the NHS PREGNANT helpline[2] was created to provide support to pregnant women and ensure a rapid response in emergency situations, including imminent births, through referral to INEM. This initiative aims to ensure access for all pregnant women to immediate and adequate assistance, regardless of their geographical location. In parallel, an organized and coordinated response was implemented at the regional level of the Gynecology/Obstetrics services, adjusting the provision of care to the availability of human resources.

The temporary or permanent closure of some hospital units has generated constraints and concerns regarding the NHS's ability to respond to obstetric emergencies, potentially increasing the risk of complications associated with out-of-hospital births. International literature confirms that the centralization of maternity wards has contributed to an increase in the prevalence of births before arrival at the hospital, with estimated incidences of 0.15% in urban areas and 3% in rural areas[3,4]. Although pre-hospital care plays a fundamental role in these cases, variability in the training of emergency teams and the absence of continuous training or recertification of professionals working in a pre-hospital setting can compromise maternal-fetal safety.

The environment within the sanitary cell of a pre-hospital transport vehicle differs significantly from a Delivery Room, especially due to limitations in space, equipment, and human resources, which can compromise maternal-fetal quality and safety. A study conducted in Finland[5] revealed that perinatal mortality and morbidity rates are significantly higher in newborns born outside the hospital setting compared to those born in an in-hospital setting. Another study, conducted in France, underlines that unexpected pre-hospital births have a higher incidence of adverse events compared to births that occur in the hospital and planned home births[6].

Several studies on this topic have identified postpartum hemorrhage, breech, transverse, foot or face presentation, umbilical cord prolapse and preterm birth as the main obstetric complications[6]. With regard to the newborn, the main reported complications include the need for admission to a neonatal unit[4,6], polycythemia, hypoglycemia, seizures[4], hypothermia, infections, low birth weight and an APGAR score of seven or less[6].

Pillar 5 of the National Patient Safety Plan 2021–2026 (PNSD 2021–2026), concerning safe practices in safe environments, emphasizes that the context and conditions in which healthcare is provided directly influence its safety and effectiveness[7]. In the case of unexpected pre-hospital births, the absence of an optimized environment for labor and delivery assistance can increase the risk of maternal-fetal complications. The WHO has developed the Safe Childbirth Checklist[8], an instrument that could be adapted to guide care in the pre-hospital setting, reinforcing the need for strategies to ensure the safety of care in this context.

Given the current scenario in Portugal and the expected increase in unexpected pre-hospital births, it is imperative to systematize the available scientific knowledge on the risks associated with these events. The scarcity of specific evidence in the Portuguese context, coupled with the absence of a consolidated registration system, justifies carrying out this integrative literature review. The systematic identification of maternal-fetal risks, the most frequent complications, and the challenges faced by emergency teams is essential to support training strategies, action protocols, and health policies that ensure the safety of the care provided. Thus, this review aims to provide an evidence base to support clinical decision-making and the management of pre-hospital emergency services in Portugal.

This article aims to identify the risks to maternal-fetal safety associated with unexpected births during pre-hospital transport, analyzing recent scientific evidence on the care provided by emergency teams.

Methodology

This article consists of an integrative literature review, a method that allows for the synthesis of knowledge from studies with different methodological approaches, providing a more comprehensive understanding of the phenomenon under analysis. The integrative review allows for the combination of data from theoretical and empirical literature, contributing to a deeper understanding of the topic under investigation.

The research question was constructed following the PICo (Population, Interest, Context) methodology. The population (P) was defined as pregnant/parturient women and newborns; the interest (I) as risks to maternal-fetal safety, including maternal and neonatal complications; and the context (Co) as unexpected births during transport by emergency teams in the pre-hospital setting. The specification of the context as births assisted by professional emergency teams deliberately excludes home births assisted by other professionals (such as doulas) or by non-professionals, focusing on the response of pre-hospital emergency services. This structuring resulted in the following research question: "What are the risks to maternal and fetal safety associated with unexpected births during transport by emergency teams in a pre-hospital setting?".

Table 1: Structuring the research question according to the PICo methodology.

Acronym	Component	Description
P	Population.	Pregnant women/women in labor and newborns.
I	Interest.	Risks to maternal and fetal safety, including maternal and neonatal complications.
Co	Context.	Unexpected births during transport by emergency teams in the pre-hospital setting.

The research was initially guided by a preliminary review of the phenomenon under study, followed by a systematic search using a combination of natural and indexed terms in English, as consulted in the Health Sciences Descriptors (DeCS) and Medical Subject Headings (MeSH). The terms used were: ("birth before arrival" OR "unplanned out-of-hospital birth" OR "out-of-hospital delivery" OR "unplanned pre-hospital birth") AND ("complications" OR "safety" OR "risk" OR "outcomes") AND ("ambulance" OR "emergency medical services"). In addition, a second search equation was applied: (TI "birth before arrival" OR TX "birth before arrival") AND TI "prehospital emergency care" OR TX "prehospital emergency care".

The electronic search was conducted in the following databases: PubMed, MedLine, CINAHL, Nursing & Allied Health Collection: Comprehensive, and MedicLatina.

Articles published in the last five years, in Portuguese, English, and Spanish, with full text access, addressing maternal-fetal safety in the pre-hospital setting, in deliveries performed by emergency teams, were included. Exclusion criteria included articles reporting home births assisted by professionals outside the context of emergency teams, births performed by non-healthcare professionals (such as doulas), as well as those addressing aspects related to training or simulation.

The time limitation to the last five years (2019–2024) is justified by the need to capture recent evidence on the reorganization of obstetric health systems, particularly relevant in the Portuguese post-COVID–19 pandemic context and in light of structural changes in the maternity network. This decision, while it may have excluded previous seminal studies, allows us to focus on evidence that reflects the current reality of emergency services and contemporary pre-hospital care practices.

From the two search equations, 45 articles were identified, of which 3 were excluded due to duplication. In the first phase, the titles and abstracts were read, selecting 14 articles that met the inclusion criteria or required further clarification. After a full reading of the articles, 10 were selected for inclusion in the review. The flowchart representing the selection process, according to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) methodology[9], and detailing each of the phases up to obtaining the final number of included articles, is shown in Figure 1.

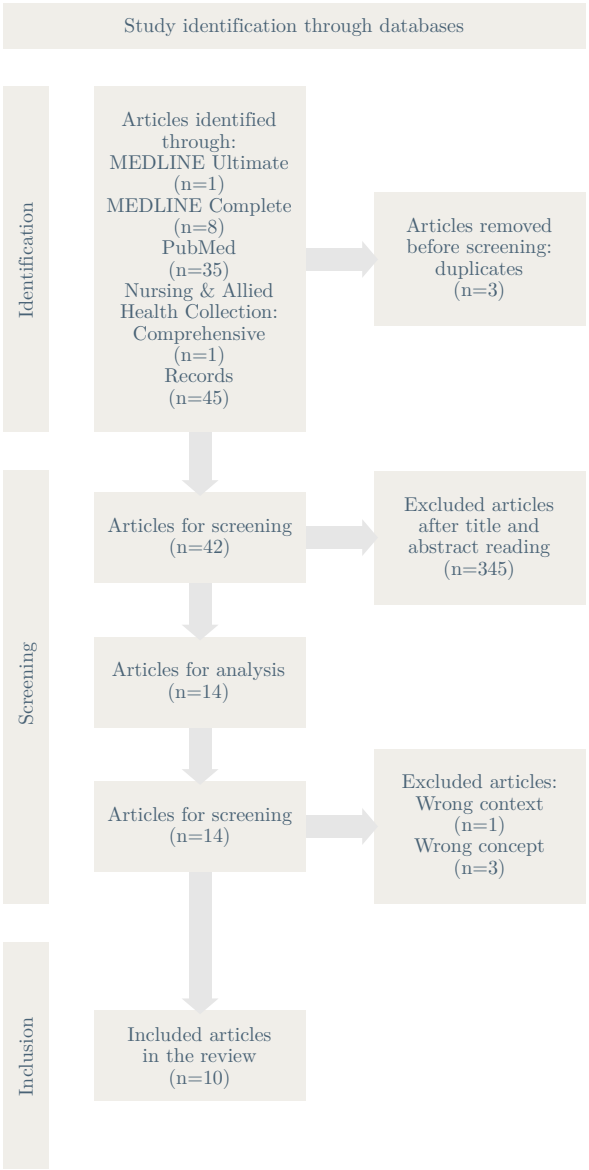

Figure 1: PRISMA flowchart for article selection.

Results

Results presentation

A structured data extraction tool was developed to logically map the key information from each included publication. The extracted information included: database, title, authors, journal, year of publication, country, type of study, aims, results, and conclusions relevant to the research question.

The extraction was performed independently by five reviewers. Two reviewers extracted data from all articles, while three additional reviewers validated the extraction. The discrepancies identified were resolved by consensus through discussion among the reviewers. The extracted data were compiled into a synthesis matrix and analyzed narratively.

The data synthesis was performed through narrative analysis, following a thematic approach. After data extraction, the following steps were taken:

1. In-depth reading of the extracted data,
2. Identification of recurring patterns and themes,
3. Categorization of complications by type and relative frequency,
4. Identification of convergent risk factors among the studies,
5. Analysis of common recommendations,
6. Structured narrative synthesis by emerging thematic categories.

This narrative synthesis approach is appropriate for integrative reviews that include studies with different methodological designs, allowing the integration of qualitative and quantitative evidence.

The data extraction tool is represented in Table 2, which contains the descriptive synthesis of the included studies.

The protocol for this integrative review was not previously registered on a public platform (such as PROSPERO or Open Science Framework), which constitutes a limitation regarding methodological transparency and the prevention of publication bias. However, the review process rigorously followed the criteria established at the beginning of the study.

Complementary research was conducted through the analysis of reference lists of the included articles (cross-referencing) to identify additional relevant studies that may not have been captured by the database search. Systematic research in grey literature (theses, dissertations, unpublished reports) was conducted only in the preliminary review phase on the phenomenon under study.

The methodological quality of the included studies was independently assessed by two reviewers, using tools appropriate to the type of study. For observational studies (cohort, case-control, cross-sectional), the NIH Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies was used, which assesses 14 criteria including clarity of the research question, adequacy of the design, representativeness of the sample, measures of exposure and outcome, and control of confounders. For qualitative studies, the Critical Appraisal Skills Programme (CASP) Qualitative Checklist was applied, evaluating methodological rigor, design adequacy, and credibility of findings. For the scoping review, the JBI Critical Appraisal Checklist for Systematic Reviews was used.

The studies were classified as “Good/High,” “Fair/Moderate,” or “Poor/Low” quality, as shown in Table 3. Disagreements in the assessment were resolved by consensus through discussion among the reviewers.

Table 2: Descriptive summary of the included studies.

Database/Journal/ Year/Country	Title and Authors	Study type and Objective	Results	Conclusions
PubMed Central. British Paramedic Journal, 2023, The United Kingdom.	*Displaced risk. Keeping mothers and babies safe: a UK ambulance service lens.* Stephanie Heys, Camella Main, Aimee Humphreys, Rachel Torrance.	Qualitative study (analysis of practices and challenges faced by pre-hospital transport services). Critical analysis of the risk involved in transporting pregnant women and newborns using pre-hospital transport services in the United Kingdom.	It was identified that the lack of specific training for emergency medical professionals compromises the quality of childbirth care. The absence of standardized protocols for pre-hospital deliveries results in inconsistent approaches. There is an increased risk of neonatal and maternal complications, especially in areas with limited access to hospitals.	Maternal and fetal safety in pre-hospital births depends on specialized training, clear protocols, and better coordination between pre-hospital and hospital services. Recognition of the pre-hospital transport service as an important provider of urgent and emergency care for postpartum women and newborns in the pre-hospital environment, but that in this context pregnant women and newborns have an exponential risk of adverse perinatal outcomes. A more collaborative approach between health services and systems is needed to minimize this risk and ensure high-quality care at all points of contact, ensuring equity in access to services for pregnant women, postpartum women, and newborns.
PubMed Central. BMJ Open, 2024, India.	*Association of the distance travelled, and the call to hospital arrival time with early neonatal mortality in neonates born to mothers using emergency medical services at term gestation: a retrospective observational study.* Richie Dalai, Keshav K Pathak, Sudipta Sahoo.	Retrospective observational study (analysis of data on transport time and neonatal mortality). To evaluate the relationship between transport time to the hospital and early neonatal mortality (0–7 days postnatal age) in neonates born from term pregnancies of mothers who used emergency medical services.	A transport time of 120 minutes was associated with a lower risk of neonatal death and, according to the geographical proximity indicator, is among the main global health indicators of the WHO. A transport with a distance of 60 km tended to minimize the risk of neonatal death when compared to a greater distance traveled. These results may be attributed to regional variations in the quality of medical care and to the underlying risk factors in the study participants included.	Reducing transport times and improving the efficiency of emergency services are essential measures to decrease early neonatal mortality. The need for region-specific observational studies to explore appropriate transport points near healthcare facilities has been identified, aiming to provide pregnant women with better care.
PubMed Central; MEDLINE Complete. Cureus, 2022, The United States of America.	*Describing Prehospital Deliveries in the State of Michigan.* David Eisenbrey, Robert B. Dunne, William Fales, Kristopher Torossian, Robert Swor.	Cross-sectional study (analysis of birth records from pre-hospital emergency teams in the state of Michigan). To analyze the frequency, characteristics, and complications of births assisted by pre-hospital emergency teams in the state of Michigan.	223 pre-hospital births were identified in 1.6 million records. The majority of births were vaginal and without complications (65.4%). More than a third occurred before the arrival of emergency teams (24.7%). Maternal or fetal complications occurred in 31% of cases. Births assisted by midwives had a high complication rate (61.3%). There was an inverse correlation between the frequency of pre-hospital births and the socioeconomic level of the women giving birth.	Births outside of a hospital setting are rare, but often complicated, especially when attended by midwives. The training of emergency professionals should be strengthened to handle these situations, particularly in lower-income communities.
PubMed Central. PLoS One, 2020, France.	*Out-of-maternity deliveries in France: A nationwide population-based study.* Evelyne Combier, Adrien Roussot, Jean-Louis Chabernaud, Jonathan Cottenet, Patrick Rozenberg, Catherine Quantin.	Retrospective population study (analysis of births occurring outside of maternity wards in France between 2012 and 2014). To assess the incidence of births outside of maternity wards in France, identify the main risk factors, and evaluate their impact on maternal mortality and neonatal morbidity and mortality.	Births outside the maternity ward represent a small percentage of total births, but they have an increased risk of complications. The increased distance to the obstetrics unit was the main factor associated with births outside the maternity ward. Unexpected births outside the maternity ward were associated with higher maternal mortality (6.5 times higher) and neonatal mortality (1.9 times higher), as well as other neonatal complications, including hypothermia (5.9 times higher) and polycythemia (4.8 times higher).	The closure of maternity wards has increased the incidence of unexpected births outside the hospital, with negative impacts on maternal and neonatal health. The preparation of emergency teams and improvements in access to maternity wards and more efficient triage during prenatal care should be optimized to reduce the risks.
PubMed Central. PLoS One, 2022, Japan.	*Risk of infection in neonates born in accidental out-of-hospital deliveries.* Chia-Jung Chang, Hsin Chi, Wai-Tim Jim, Nan-Chang Chiu, Lung Chang.	Retrospective cohort study (analysis of the risk of neonatal infections in pre-hospital births in the capital of Taiwan). To determine the infection rate of the pre-hospital group compared to that of the hospital birth group.	Neonatal infection was 11 times higher than in hospital births, and low birth weight was the only independent factor associated with the risk of infection in the pre-hospital setting. The isolated pathogens were similar to those in babies born in the pre-hospital setting.	These measures must be optimized to reduce the risks. It has been shown that the infection rate was higher in pre-hospital births than in hospital births, and that the infection rate was associated with low birth weight. It is essential to reinforce asepsis protocols and optimize neonatal care in pre-hospital births to minimize the risk of infection.
PubMed Central; MEDLINE Complete. BMJ Open, 2024, The United Kingdom.	*Inequalities in birth before arrival at hospital in South West England: a multimethods study of neonatal hypothermia and emergency medical services call-handler advice.* Laura Goodwin, Kim Kirby, Graham McClelland, Emily Beach, Adam Bedson, Jonathan Richard Benger, Toity Deave, Ria Osborne, Helen McAdam, Roisin McKeon-Carter, Nick Miller, Hazel Taylor, Sarah Voss.	Two-phase multimethod study (quantitative record analysis and qualitative analysis of emergency counseling). To examine inequalities in birth before arrival at the hospital in South West England. To understand which groups are most likely to give birth before arrival at the hospital and how this relates to hypothermia and outcomes (phase A). To investigate opportunities for improvement in temperature management by pre-hospital emergency teams and during emergency calls related to birth before arrival at the hospital in the United Kingdom (phase B).	There is a correlation between neonatal hypothermia and higher rates of admission to an Intensive Care Unit, and the incidence of neonatal hypothermia was higher in neonates born before arrival at the hospital. Women with less access to obstetric care were more likely to give birth before arriving at the hospital. There is a higher probability of women in Southwest England having preterm births, such as premature newborns, firstborns, born to mothers with disabilities, or with documented concerns at the time of scheduling pregnancy appointments after 13 weeks of gestation. There is a correlation between neonatal hypothermia and higher rates of admission to a Neonatal Intensive Care Unit, and more than 56% of babies born outside the hospital were hypothermic.	Factors associated with pre-hospital births and neonatal hypothermia after birth have been identified. Improvements in equity of access to health services, emergency telephone assistance, and the reduction of geographical and social barriers can decrease the incidence of births before reaching the hospital and neonatal risks such as hypothermia.
PubMed Central; MEDLINE Complete. Prehosp Emerg Care, 2024, The United States of America.	*Epidemiology of emergency medical services-attended out-of-hospital deliveries and complications in the United States.* Rebecca E. Cash, Anjali J. Kaimal, Margaret E. Samuels-Kalow, Krislyn M. Boggs, Maeve F. Swanton, Carlos A. Camargo Jr.	Cross-sectional epidemiological study (analysis of national data from pre-hospital emergency teams between 2018 and 2019). To analyze the epidemiology of pre-hospital deliveries assisted by emergency services in the USA and the main associated complications.	Records were found of 8614 out-of-hospital births, 1712 childbirth complications, and 5749 newborns. Of the complications, 94% were due to hemorrhage, 6% to abnormal presentation, 0.2% to shoulder dystocia, and 0.4% to nuchal cord. Births attended by teams without obstetric training had worse neonatal outcomes.	Potential disparities were identified in the level of clinical care provided and in access to definitive care. The need to improve record-keeping for a better understanding and monitoring of the quality of care was identified. A review and standardization of clinical protocols and regulations for pre-hospital emergency teams was also deemed necessary.
PubMed Central. Acta Obstetricia et Gynecologica Scandinavica, 2023, The United Kingdom.	*Early antenatal risk factors for births before arrival: An unmatched case–control study.* Talia Rose Hubble, Manisha Nair, Christina Y. L. Aye, Sam Mathewlynn, Catherine Greenwood, Lawrence Impey.	Retrospective non-comparative case-control analytical study (between January 2014 and October 2019). To identify risk factors for premature birth before arrival, which can be determined at the first prenatal visit.	Factors significantly associated with en route birth at the hospital were multiparity, distance from the hospital, family receiving social support, smoking during pregnancy, as well as psychiatric disorder, ethnicity, and unemployment.	Hospital obstetrics teams can identify cases where there is a risk of premature birth before arrival at the hospital, thus creating potential to reduce their incidence. Socioeconomic vulnerability is a root cause of births en route to the hospital. Improving obstetric monitoring and access to prenatal services can reduce the incidence of births before arrival at the hospital.
PubMed Central BMC Emergency Medicine, 2024, Iran.	*The challenges of delivery in pre-hospital emergency medical services ambulances in Iran: a qualitative study.* Rahim Ali Sheikhi, Mohammad Heidari.	Qualitative study (interviews and data analysis using MAXQDA/10 software). To gather perceptions from Emergency Medical Technicians, midwives, and pregnant women to examine the causes of childbirth during pre-hospital transport and the challenges they face during labor.	Analysis of the interviews revealed two main categories: the factors that trigger labor during pre-hospital transport and the challenges involved. The factors include cultural issues, inefficient management, and inaccessibility to healthcare facilities. The challenges consist of fear and anxiety, native culture, and lack of resources.	Training for professionals should address the topics of natural childbirth and complicated deliveries, namely postpartum hemorrhage, abnormal presentation of the newborn, umbilical cord prolapse, and shoulder dystocia, as well as neonatal resuscitation. The implementation of ongoing training and the creation of guidelines for pre-hospital childbirth care can improve clinical outcomes.
MEDLINE. MedRxiv, 2024, Australia.	*Out-of-hospital births and the experiences of emergency ambulance clinicians and birthing parents: A scoping review of the literature.* Michella G. Hill, Alecka Miles, Belinda Flanagan, Sara Hansen, Brennen Mills, Luke Hopper.	Scoping review. Explores physician involvement in prehospital transport for out-of-hospital births and the experiences of patients and physicians with childbirth in a prehospital setting.	Ninety-nine complications were described in the literature, ranging from relatively minor illnesses such as nausea and vomiting to life-threatening situations such as cardiorespiratory arrest. Professionals reported emotional and technical difficulties in assisting births outside the hospital. Parents described feelings of anxiety and lack of information about what to expect.	Unexpected births outside of a hospital require specialized assistance and ongoing training to improve the clinician's safety and confidence. It is essential to provide psychological support to emergency teams and better prepare families for obstetric emergencies.

Table 3: Summary of the methodological quality assessment of the articles.

Study	Country	Year	Method	Quality	Main Limitations
Heys *et al*	UK	2023	Qualitative	Moderate	Unspecified sample
Dalai *et al*	India	2024	Observational	Fair	Confusing factors, context
Eisenbrey *et al*	EUA	2022	Transversal	Fair	Recording bias
Combier *et al*	France	2020	Populacion	Good	Retrospective
Goodwin *et al*	UK	2024	Multimethods	Moderate	Limited details
Hill *et al*	Australia	2024	Scoping review	Moderate	No quality assessment.
Sheikhi & Heidari	Iran	2024	Qualitative	Moderate	Transferability
Cash *et al*	EUA	2024	Epidemiological	Fair	Insufficient information
Chang *et al*	Taiwan	2022	Cohort	Fair–Good	Limited details
Hubble *et al*	UK	2023	Control Case	Fair	Unmatched design

The assessment revealed that 1 study (10%) was of good quality, 9 studies (90%) were of fair to moderate quality, and no study was classified as low quality. The main methodological limitations identified across the board included: predominance of retrospective designs (70%), inadequate control of confounders, variability in operational definitions, reliance on administrative records with possible documentation bias, and specific geographic contexts limiting transferability.

Findings from studies of higher methodological quality were given preferential treatment in the synthesis of results, recognizing that evidence from studies with more substantial limitations should be interpreted with greater caution.

General Characterization of the Included Studies

Ten studies published between 2019 and 2024 were included. The geographical distribution shows a predominance of studies in developed countries: France (n = 1), United Kingdom (n = 2), United States of America (n = 2), Finland (n = 1), India (n = 1), Iran (n = 1) and Australia (n = 1). The absence of studies carried out in Portugal or other Portuguese-speaking countries stands out, constituting an important gap in knowledge about this issue in the national context.

Regarding methodological designs, retrospective observational studies predominate (n = 6), followed by qualitative studies (n = 2), a prospective cohort study (n = 1) and a scoping review (n = 1). This methodological diversity reflects different approaches to understanding the phenomenon of pre-hospital births, combining quantitative analyses of large databases with qualitative explorations of experiences and challenges faced.

Sample sizes varied substantially, from qualitative studies focused on in-depth analysis of practices[10,11] to population studies with thousands of cases[12,13].

Regarding data collection periods, three studies (30%) explicitly reported periods between 2012–2019[13–15]. The remaining seven studies (70%) did not specify data collection periods in the publications. Nevertheless, given that the studies were published between 2020 and 2024, it is reasonable to infer that the data largely reflect the reality of pre-hospital emergency systems in the last decade, although this is an estimate based on publication years and not on explicitly reported information.

Incidence and Characteristics of Pre-Hospital Deliveries

Pre-hospital delivery is an infrequent event, usually unplanned and potentially high-risk[12]. The incidence of pre-hospital deliveries varies considerably between contexts, reflecting geographical differences and the organization of health systems[12–14]. There is a consistent urban-rural gradient, with a significantly higher incidence in rural or remote areas, attributable to the greater distances to hospital units.

The demographic and obstetric characteristics identified include: multiparity, absence or inadequacy of prenatal care, low socioeconomic level and inequality in access to health care[14–16]. The inverse correlation between socioeconomic level and frequency of pre-hospital deliveries[14] highlights important health inequalities.

Regarding the circumstances of births, one article reported that 24.7% occurred before the arrival of the teams; the majority (65.4%) were vaginal deliveries without complications[14]. The increased distance to maternity care has emerged as a factor consistently associated with higher risk[13,17], with maternity ward closures identified as contributing to increased incidence[13].

Main Maternal Complications

The articles analyzed describe and discuss the main risks and complications of childbirth when performed by pre-hospital emergency teams, highlighting vaginal hemorrhage as the most frequent complication[10,12–14,18]. Despite the potential severity of this occurrence, oxytocin administration occurred in only 1% of women and tranexamic acid administration occurred even less frequently[12].

Other maternal and/or childbirth-related complications include abnormal newborn presentation, shoulder dystocia, umbilical cord entanglement, higher rate of extensive birth canal lacerations and higher risk of uterine rupture, hypovolemic shock and retained placenta[10,12–14,18].

Of particular concern, the population study[13] identified that maternal mortality was 6.5 times higher in births outside the maternity ward compared to hospital births.

Main Neonatal Complications

For the newborn, documented risks and complications included non-viable fetus due to delivery before 20 weeks of gestation, neonatal death, non-transient apnea, extreme prematurity, high rates of respiratory distress syndrome, hypoxia, infection, hypoglycemia, hypothermia and the need for resuscitation, factors which contributed to a considerably higher probability of the need for hospitalization of these newborns[10,13,14,18]. Neonatal mortality was 1.9 times higher in births outside the maternity ward[13].

Admission to Neonatal Intensive Care Units (NICU) is more prevalent in births that occur in the pre-hospital setting, and is associated with a more complex prognosis[18]. International studies highlight the severity of pre-hospital births. In Japan, the rate of neonatal infection in pre-hospital births was found to be eleven times higher when compared to births performed in the hospital, being cited as the most common cause of neonatal mortality in developing countries[18]. In the United Kingdom, a study that aimed to understand the probability of birth before arrival at the hospital and its relationship with hypothermia in newborns on admission, showed that 5% of newborns transported to the hospital presented hypothermia on arrival, most of them requiring admission to the NICU[16].

Risk Factors Identified

The maternal and neonatal mortality rate is one of the main indicators of a country's development[10]. Factors such as geographical distance from health units, socioeconomic vulnerability and multiparity have been frequently mentioned in the literature as barriers to access to specialized care, which, although not the main focus of our question, allowed us to reflect on the impact on maternal-fetal safety.

Studies have consistently identified distance to the health unit as a major risk factor for pre-hospital births[13,16,17]. The closure or reduction of maternity capacity has been specifically associated with an increased incidence of unexpected births outside the hospital[13]. In the United Kingdom, research on maternal-fetal mortality indicates that inequalities in access to health care mainly affect women living in areas with limited resources, leading to greater dependence on emergency services[16]. Similarly, a study conducted in India analyzed the relationship between transport time and adverse outcomes, concluding that longer journeys to the hospital unit are associated with a significant increase in early neonatal mortality[17]. Rural or geographically remote areas present a substantially higher risk compared to urban areas.

A population-based retrospective observational study, based on data from the French hospital system between 2012 and 2014, showed a positive correlation between the increase in distance traveled in pre-hospital transport to the hospital unit and the incidence of unexpected births outside the maternity ward. During that period, there were four maternal deaths during transport to the hospital unit. There was also a significant increase in adverse outcomes for newborns, and it was understood that the risk of birth outside the hospital increased significantly with the distance to the maternity ward[13].

In the studies analyzed, the authors recurrently refer to disparities in births performed outside the hospital, highlighting inequalities in access to timely and specialized maternal-fetal care. However, in some studies, the data are less robust. Among the main

factors associated with unexpected out-of-hospital births, the absence of prenatal care, lack of access to or geographical proximity to hospitals with obstetric emergencies and delivery rooms, and socioeconomic vulnerability stand out[12,14,15]. In addition, this occurrence was also associated with births in multiparous women[15,18]. Advanced maternal age, premature birth, and high-risk pregnancy were significantly correlated with adverse outcomes for both women and newborns[13]. One study suggests that data collected at the first prenatal visit, combined with the prediction of birth through the estimated due date[11], may have a relevant predictive role in identifying the occurrence of births before arrival at the hospital[15]. These results reinforce the importance of prenatal education as an essential strategy to reduce unexpected births outside the hospital environment [14].

Challenges in the Delivery of Care

While some complications are not treatable, such as in the case of non-viable fetuses, others represent complex clinical challenges for pre-hospital emergency teams. In the United States, data from the State of Michigan indicate that although most pre-hospital births only require supportive care, the occurrence of complications poses challenges to emergency teams such as the care of the postpartum woman, the newborn, or both simultaneously[14].

The main challenges identified for pre-hospital teams include the need for specialized training in this area and continuous training, as well as the provision of pre-hospital transport vehicles with adequate equipment for the assessment, monitoring, and treatment of term and preterm newborns.

In particular, preterm births are described as challenging events for pre-hospital emergency teams, given the scarcity of professional experience due to low case numbers and the lack of specific resources in pre-hospital transport vehicles. The lack of experience of these teams in this context, as well as the identified need for more effective training, has not been properly addressed through practical and continuous training programs[14,19]. In a qualitative study, professionals report that what they learned in a simulated context did not translate into what it is like to assist in childbirth in reality, especially in an environment with limited space, poor lighting and poor air conditioning, as well as a lack of more experienced teams to provide support[19].

Internationally, there are some asymmetries in the training of professionals who perform their duties in pre-hospital care. In some regions, such as Iran, training on childbirth is not formally included in the curriculum of pre-hospital emergency professionals, compromising the quality of care provided. These professionals are not trained to provide safe care to mothers during their transport to hospitals or equipped health centers[10].

The frequency of maternal-fetal incidents in the pre-hospital setting, compared to calls unrelated to the transport of pregnant women, is associated with complications, as well as a decrease in clinical confidence in the care provided in this context. The gaps identified, such as the lack of training and experience of pre-hospital teams and the lack of appropriate equipment in the pre-hospital transport vehicle, compromise maternal-fetal safety, often resulting in prolonged times at the scene and/or during the transport of the pregnant/parturient woman to the hospital unit[11].

The asymmetry of differentiation existing in emergency services at the national level is similar to that observed in other countries and has been shown to have an impact on the care provided. The articles analyzed mention difficulties such as the unavailability of some obstetric and pediatric medical devices, including neonatal oximeters, the inadequacy of the size of certain equipment for low birth weight or premature newborns, and the unavailability of analgesia to administer to the pregnant woman[11,16,19].

Summary of Recommendations from the Original Studies

With increasing challenges in providing safe and personalized care, prehospital care is recognized as playing a crucial role in maternal-fetal care. To ensure safety in the transport of the maternal-fetal population, it is essential that health services and systems collaborate in identifying and mitigating the risks involved.

Consistently, studies recommend the implementation of continuous and specific training programs for prehospital emergency professionals in obstetric and neonatal resuscitation skills[10,11,14,19]. Training should include management of obstetric complications (postpartum hemorrhage, shoulder dystocia), newborn assessment, and neonatal resuscitation. The need for regular recertification and simulation training was also emphasized.

The standardization of clinical protocols for prehospital childbirth care emerges as a priority recommendation[11,16,19]. Protocols should be clear, evidence-based, and adapted to the reality of available resources in the pre-hospital setting, including guidelines for specific situations such as abnormal presentations and umbilical cord complications.

The guarantee of appropriate equipment in prehospital transport is mentioned by the authors, including complete delivery kits, warming material for newborns, neonatal resuscitation equipment, and devices for managing postpartum hemorrhage[10,12,14].

The results also highlight the need for reflection on the importance of rapid, equitable, and efficient access to health services as an essential element for reducing maternal and neonatal mortality. Studies point to the need for a systemic approach that recognizes the importance of quality care at all points of contact with the pregnant and newborn population[11]. In line with the Health and Social Care Committee's publication (2021), The Safety of Maternity Services in England, the recommendations in both publications dictate how essential it is to ensure personalized, multidisciplinary, and woman-centered care, as well as to ensure adequate training of healthcare teams and the availability of appropriate equipment and protocols to improve the quality of care provided and safety in pre-hospital care[12].

Discussion of results

This integrative review identified that unexpected deliveries in the pre-hospital setting are associated with substantially higher maternal-fetal risks, evidenced by a 6.5-fold increase in maternal mortality, a 1.9-fold increase in neonatal mortality, and an 11-fold increase in the risk of neonatal infection. Important operational challenges related to team training, equipment adequacy, and the absence of standardized protocols were also identified.

Systematic comparative analysis reveals clinically significant differences in outcomes. One population study documented 6.5 times higher maternal mortality and 1.9 times higher neonatal mortality in deliveries outside the maternity ward[13]. Another study reported an 11-fold higher risk of neonatal infection, attributable to the absence of an aseptic environment, the impossibility of applying prevention protocols, and exposure to adverse conditions[18]. Neonatal hypothermia was 5.9 times higher and polycythemia 4.8 times higher[13]. Other authors reported complications in 31% of pre-hospital births, rising to 61.3% when assisted by professionals with less training[14].

These differences are explained by: absence of a controlled environment (temperature, asepsis, space); equipment limitations (no immediate access to oxytocin, surgical materials, incubators, blood); less experience of the teams in obstetrics; impossibility of advanced interventions (cesarean section, transfusion, neonatal intensive care); and adverse environmental conditions (inadequate temperature, vibrations, confined space).

However, it is important to reflect on these findings with interpretive caution, since pre-hospital births often involve populations with greater social vulnerability and less access to prenatal care, becoming confounding factors that can amplify the observed differences. Nevertheless, the consistency and magnitude of the associations in multiple contexts suggest an impact independent of the pre-hospital environment.

The most frequent maternal complications include postpartum hemorrhage, shoulder dystocia, and abnormal presentations[10,12–14,18]. Neonatal complica-

tions include infection, hypothermia, hypoxia, need for resuscitation, and neonatal hospitalization[10,13,14,16,18].

Identified risk factors include: geographical distance to the maternity ward, low socioeconomic status, multiparity, and inadequate prenatal care[13–15]. These factors act through interconnected mechanisms. The closure of maternity wards increases distances, disproportionately affecting vulnerable populations[13].

The operational challenges identified include a lack of specific training in obstetric emergencies, the absence of standardized protocols, inadequate or unavailable equipment, and difficulties in accessing maternity wards[10–12,14,16,19].

The scarcity of records from entities providing pre-hospital care in Portugal (INEM, Firefighters, Portuguese Red Cross) prevents the quantification of incidence, epidemiological characterization, monitoring of complications, evaluation of the quality of care, national research, and international comparison. This gap results from a multiplicity of entities without a unified system, a lack of specific documentation protocols, and insufficient recognition of the importance of this data.

The proposed solutions involve the creation of a national registration system that can be used by all pre-hospital care professionals, with standardized and quick-to-fill fields, allowing interoperability with existing systems and enabling the transmission of information to medical regulation centers (CODU) and hospital units. On the other hand, the training and recertification of professionals, as well as monitoring or audits, becomes increasingly important. Finally, it is crucial the provision of equipment that allows them to act on the most frequent complications and for the care of newborns, particularly in cases of neonatal resuscitation.

The findings of this review highlight the need for specific and continuous training of pre-hospital emergency teams in hemorrhage management, shoulder dystocia, and neonatal resuscitation, based on high-fidelity simulation, with regular recertification. At the level of emergency service management, it is imperative to ensure that pre-hospital transport vehicles are equipped with appropriate equipment for obstetric and neonatal emergencies, including delivery kits, equipment for warming newborns, and resuscitation equipment, as well as implementing standardized protocols, direct communication systems with maternity wards, and a culture of debriefing after events.

The implications for health policies are substantial, particularly in the context of the reorganization of the maternity network in Portugal. Decisions regarding the restructuring of maternity wards should incorporate a rigorous analysis of the potential impact on pre-hospital births, including geographic modeling and mitigation strategies. Investment in training should be recognized as a cost-effective prevention strategy, and the Directorate-General for Health should consider developing national technical standards and extending the 2021–2026 National Health Strategy to the pre-hospital setting.

The complete absence of national studies among those included constitutes a fundamental limitation for the applicability of the results to the Portuguese context. National specificities — including geographic asymmetries between coastal and inland areas, ongoing reorganization of the maternity ward network, heterogeneity in the training of professionals among service providers, and socioeconomic inequalities — require urgent national research to quantify the actual incidence, characterize the affected populations, evaluate the results in the context of the National Health Service, and support policies and practices based on Portuguese evidence.

Study limitations

Systematic assessment of methodological quality revealed that one study had good quality (Combier *et al*), nine studies had fair to moderate quality, and none were classified as low quality. This heterogeneity has important implications for the interpretation of the results.

Most studies (70%) used retrospective designs, presenting inherent limitations such as selection bias, data incompleteness, and variability in the quality of registration. A critical cross-sectional methodological limitation is the inadequate control of confounding

factors. Most studies do not adequately control for detailed socioeconomic status, quality of prenatal care, maternal comorbidities, and risk behaviors. Given that these factors are associated with both the risk of pre-hospital delivery and adverse outcomes, some of the observed differences may result from residual confounding not adequately adjusted in the analyses.

In addition, the absence of a standardized definition of "pre-hospital delivery" across studies makes valid comparisons of incidence and characteristics difficult. Contextual variability constitutes another important limitation, given that the studies come from very different contexts regarding health systems, professional training, and geographical characteristics, requiring caution in extrapolating results to Portugal.

A critical gap identified is the absence of intervention studies that rigorously assess the effectiveness of training programs, standardized protocols, or specialized equipment. Consequently, the recommendations formulated are based on logical reasoning and expert opinion, not on evidence of demonstrated effectiveness.

Notwithstanding these limitations, the convergence of findings among multiple studies from different geographical and methodological contexts lends robustness to the main conclusions. The certainty in the conclusions varies according to the finding: high certainty for the association between pre-hospital births and high risks of mortality and morbidity, as well as for the identified challenges related to training and equipment; moderate certainty for the exact magnitudes of the reported risks; and low certainty for the effectiveness of specific interventions and for direct applicability to the Portuguese context, given the total absence of national studies.

This integrative review also presents its own methodological limitations that should be considered. The protocol was not previously registered on a public platform (such as PROSPERO or Open Science Framework), which limits the transparency and verifiability of the process. The search was limited to literature published in academic databases, not including grey literature (theses, technical reports, conference papers), potentially omitting relevant data. The linguistic restriction to Portuguese, English, and Spanish may have excluded relevant studies published in other languages. Additionally, the temporal limitation to the last five years, although justified by the need for recent evidence, may have excluded earlier seminal studies.

Conclusion

This integrative review confirmed that unexpected births in the pre-hospital setting are associated with substantially higher maternal-fetal risks, including a significant increase in maternal and neonatal mortality, as well as serious complications such as postpartum hemorrhage, neonatal hypothermia, and infection. The risk factors identified convergently include geographical distance to the maternity ward, low socioeconomic status, multiparity, and inadequate prenatal care. The main operational challenges relate to a lack of specific training for pre-hospital emergency teams, the absence of standardized protocols, and inadequate obstetric and neonatal equipment.

The reorganization of the Gynecology/Obstetrics Hospital Referral Network in Portugal, with the centralization of deliveries and the closure or reduction of capacity of maternity wards in the interior and regions with lower population density, may increase distances and transport times for geographically remote or socioeconomically vulnerable populations, increasing the risk of unexpected pre-hospital births. The complete absence of national studies constitutes a critical gap that prevents the precise quantification of incidence, characterization of affected populations, and evaluation of outcomes in the specific context of the National Health Service (NHS), currently limiting the direct applicability of international findings and highlighting the urgency of national research.

The findings highlight specific needs for clinical practice in pre-hospital emergency care. It is imperative to implement structured continuing education programs for all pre-hospital emergency professionals in critical obstetric and neonatal competencies, including management of postpartum hemorrhage, resolution of shoulder dystocia, assistance in abnormal

presentations, management of umbilical cord complications, and neonatal resuscitation. This training should be based on high-fidelity simulation whenever possible and include regular recertification for competency maintenance. At the operational level, all pre-hospital transport vehicles must be equipped with appropriate equipment, including sterile delivery kits, newborn warming equipment, and neonatal resuscitation equipment. The implementation of standardized, evidence-based clinical protocols for pre-hospital childbirth care, complication management, and decision criteria regarding transport versus local care is a priority. Direct communication systems between pre-hospital teams and destination maternity hospitals should be established, allowing for early alerting, transmission of clinical information, and access to specialized support in real time. Creating a systematic debriefing culture after each obstetric event, geared towards learning and continuous improvement, is essential for developing organizational competencies.

The implications for health policies are substantial and urgent in the Portuguese context. Decisions regarding the reorganization of the maternity network must incorporate a rigorous analysis of the potential impact on pre-hospital births, including geographic modeling, estimation of pregnancies at risk, and definition of mitigation strategies. Efficient pre-natal care is fundamental for the early identification of risk situations and the mitigation of complications. Public investment in structured training of pre-hospital emergency professionals in obstetric and neonatal competencies should be recognized as a cost-effective strategy for preventing avoidable mortality and morbidity, justifying the allocation of specific funding for curriculum development, specialized trainers, simulation infrastructure, and certification processes.

The Directorate-General of Health, in coordination with INEM (National Institute of Medical Emergency), relevant scientific societies, the Order of Nurses, and representatives of firefighters and the Portuguese Red Cross, should consider developing a standard or guideline on childbirth care in a pre-hospital setting, national standards for mandatory obstetric and neonatal equipment in ambulances, and a standardized national training curriculum in obstetric and neonatal emergencies. Pillar 5 of the National Patient Safety Plan 2021–2026, which emphasizes safety in safe environments, should be explicitly extended to the pre-hospital obstetric context, formally recognizing this environment as a risk context that requires specific attention, legitimizing prioritization, resource allocation, and inclusion in national patient safety monitoring.

The implementation of an integrated national system for registering pre-hospital births is imperative. This system should unify data from INEM (National Institute of Medical Emergency), fire departments, and the Portuguese Red Cross into a national electronic platform with essential standardized fields, integration with Birth Certificate Systems and hospital clinical processes, quick and pragmatic offline data entry, mandatory professional training, and clear governance through DGH/INEM coordination.

The need for research in the Portuguese context emerges as an absolute priority. The absence of national studies on pre-hospital births represents a critical gap that must be filled through rigorous research.

The findings should be interpreted considering the identified methodological limitations, particularly the heterogeneity in the quality of the included studies, the inadequate control of confounders, and the absence of Portuguese research. Nevertheless, the convergence of findings among multiple studies from different geographical and methodological contexts, and the presence of at least one population-based study of good methodological quality supporting the most critical risks, lend robustness to the central conclusions and underscore the urgency of action.

Maternal and fetal safety in pre-hospital births represents an opportunity to promote health equity and quality of care for all women. Regardless of place of residence, socioeconomic status, or circumstances of labor, ensuring safe and quality care is fundamental. Promoting rapid, predictable, and equitable access to health services contributes to reducing disparities in maternal and fetal care and improving safety in the pre-hospital setting. Policy decisions on the reorganization of maternity wards benefit from an approach that integrates operational efficiency with safeguard-

ing the safety of all populations, particularly the most vulnerable. Investment in adequate preparation of pre-hospital emergency services, rigorous research in the Portuguese context, and continuous monitoring of results are essential components for the continuous improvement of the quality and safety of maternal and fetal care.

References

1. Direção Executiva do Serviço Nacional de Saúde. Deliberação n.º DE-SNS 050/2023 de 25/05/2023. Operação Nascer em Segurança no Serviço Nacional de Saúde — Região de Lisboa e Vale do Tejo — junho/setembro de 2023. Available from: https://www.sns.min-saude.pt/wp-content/uploads/2023/05/Deliberacao.LVT_.Blocos-parto.Verao_.5_signed.pdf

2. Governo de Portugal. Plano de Emergência da Saúde [Internet]. Ministério da Saúde. 2024 [cited 2025 Feb 10]. Available from: https://www.sns.gov.pt/wp-content/uploads/2024/06/Plano-de-Emergencia-da-Saude.pdf

3. Ovaskainen K, Ojala R, Tihtonen K, Gissler M, Luukkaala T, Tammela O. Unplanned out-of-hospital deliveries in Finland: A national register study of incidence, characteristics and maternal and infant outcomes. Acta Obstet Gynecol Scand [Internet]. 2020 Jun 20 [cited 2025 Jan 12]; 99:1691–99. Available from: https://doi.org/10.1111/aogs.13947

4. Gutvirtz G, Wainstock T, Landau D, Sheiner E. Unplanned Out-of-Hospital Birth—Short and Long-Term Consequences for the Offspring. JCM. 2020 Jan 25 [cited 2025 Jan 12]; 9(2):339. Available from: https://doi.org/10.3390/jcm9020339

5. Ovaskainen K, Ojala R, Gissler M, Luukkaala T, Tammela O. Is birth out-of-hospital associated with mortality and morbidity by seven years of age? Schumann B, organizador. PLoS ONE. 2021 Apr 21 [cited 2025 Jan 12]; 16(4):e0250163. Available from: https://doi.org/10.1371/journal.pone.0250163

6. Javaudin F, Hamell V, Legrand A, Goddet S, Templier F, Potiron C, Pes P, Bagou G, Montassier E. Unplanned out-of-hospital birth and risk factors of adverse perinatal outcome: findings from a prospective cohort [Internet]. 2019 Mar 2 [cited 2025 Jan 12]; 27(26):1–7. Available from: https://doi.org/10.1186/s13049-019-0600-z

7. Despacho n.º 9390/2021, de 24 de setembro do Gabinete do Secretário de Estado Adjunto e da Saúde (2011). Diário da República n.º 187/2021, Série II de 2021-09-24. Available from: https://diariodarepublica.pt/dr/detalhe/despacho/9390-2021-171891094

8. Organização Mundial de Saúde. Guia de Implementação da Lista de Verificação da OMS para Partos Seguros: melhorar a qualidade dos partos realizados em unidades de saúde para as mães e os recém-nascidos [Internet]. OMS, 2017 [cited 2025 Feb 10]. Available from: https://iris.who.int/bitstream/handle/10665/199177/9789248549458-por.pdf?sequence=5

9. Page MJ, Mckenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021;371:n71. Available from: https://doi.org/10.1136/bmj.n71

10. Sheikhi RA, Heidari M. The challenges of delivery in pre-hospital emergency medical services ambulances in Iran: a qualitative study. BMC Emergency Medicine [Internet]. 2024 [cited 2025 Jan 26]; 24:156. Available from: https://doi.org/10.1186/s12873-024-01073-z

11. Heys S, Main C, Humphreys A, Torrance R. Displaced risk. Keeping mothers and babies safe: a UK ambulance service lens. British Paramedic Journal [Internet]. 2023 Sep 1 [cited 2025 Jan 26]; 8(2):52–56. Available from: https://doi.org/10.29045/14784726.2023.9.8.2.52

12. Cash RE, Kaimal AJ, Samuels-Kalow ME, Boogs KM, Swanton MF, Camargo Jr CA. Epidemiology of emergency medical services-attended out-of-hospital deliveries and complications in the United States. Prehosp Emerg Care [Internet]. 2024 [cited 2025 Jan 26]; 28(7):890–897. Available from: https://doi.org/10.1080/10903127.2023.2283892

13. Combier E, Roussot A, Chabernaud J-L, Cottenet J, Rozenberg P, Quantin C. Out-of-maternity deliveries in France: A nationwide population-based study. PLoS ONE [Internet]. 2020 Feb 24 [cited 2025 Jan 26]; 15(2):e0228785. Available from: https://doi.org/10.1371/journal.pone.0228785

14. Eisenbrey D, Dunne RB, Fales W, Torossian K, Swor R. Describing Prehospital Deliveries in the State of Michigan. Cureus [Internet]. 2022 Oct 7 [cited 2025 Jan 26]; 14(7):e26723. Available from: https://doi.org/10.7759/cureus.26723

15. Hubble TR, Nair M, Aye CY, Mathewlynn S, Greenwood C, Impey L. Early antenatal risk factors for births before arrival: An unmatched case–control study. Acta Obstet Gynecol Scand [Internet]. 2023 Oct 25 [cited 2025 Jan 26]; 103(2):294–303. Available from: https://doi.org/10.1111/aogs.14720

16. Goodwin L, Kirby K,McClelland G, Beach E, Bedson A, Benger JR, Deave T, Osborne R, McAdam H, McKeon-Carter, Miller N, Taylor H, Voss S. Inequalities in birth before arrival at hospital in South West England: a multimethods study of neonatal hypothermia and emergency medical services call-handler advice. BMJ Open [Internet]. 2024 Mar 18 [cited 2025 Jan 26]; 14:e081106. Available from: https://doi.org/10.1136/bmjopen-2023-081106

17. Dalai R, Pathak KK, Sahoo S. Association of the distance travelled, and the call to hospital arrival time with early neonatal mortality in neonates born to mothers using emergency medical services at term gestation: a retrospective observational study. BMJ Open [Internet]. 2024 Oct 16 [cited 2025 Jan 26]; 14:e090491. Available from: https://doi.org/10.1136/ bmjopen-2024-090491

18. Chang CJ, Chi H, Jim WT, Chiu NC, Chang L. Risk of infection in neonates born in accidental out-of-hospital deliveries. PLoS ONE [Internet]. 2022 Feb 10 [cited 2025 Jan 26]; 17(2):e0263825. Available from: https://doi.org/10.1371/journal.pone.0263825

19. Hill MG, Miles A, Flanagan B, Hansen S, Mills B, Hopper L. Out-of-hospital births and the experiences of emergency ambulance clinicians and birthing parents: A scoping review of the literature. medRxiv [Internet]. 2024 [cited 2025 Jan 26]; 11.09.24316932. Available from: https://doi.org/10.1101/2024.11.09.24316932

Corresponding Author/Autora Correspondente
Susana Manageiro Pereira — Instituto Nacional de Emergência Médica, Portugal.
susana.m.pereira@inem.pt

Authors' contributions/Contributo dos Autores
SP: Study coordination, study design, data collection, storage and analysis, review and discussion of results.
AC: Study design, data collection, storage and analysis, review and discussion of results.
JR: Data analysis, review and discussion of results.
JB: Data analysis, review and discussion of results.
AS: Data analysis, review and discussion of results.
All authors have read and agreed with the published version of the manuscript.

Ethical Disclosures/Responsabilidades Éticas
Conflicts of Interest: The authors have no conflicts of interest to declare.
Financial Support: This work has not received any contribution, grant or scholarship.
Provenance and Peer Review: Not commissioned; externally peer reviewed.
Conflitos de Interesse: Os autores declararam não possuir conflitos de interesse.
Suporte Financeiro: O presente trabalho não foi suportado por nenhum subsídio ou bolsa.
Proveniência e Revisão por Pares: Não comissionado; revisão externa por pares.