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Emergency care in cross-border settings: a scoping review

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Abstract: Emergency Medical Services (EMS) have developed from a war context into a complex scenario of rapid urbanization and great interconnectivity, which includes cross-border areas. Specificities of these areas are underrepresented in studies about EMS. The aim of this work is to provide a better comprehension of emergency care in cross-border settings. A qualitative scoping review was performed in three major databases of interest, where 29 works matched the inclusion strategy and underwent thematic analysis. Results show a consistent growing interest in this topic, even though the term 'cross-border' remains as a multidisciplinary approach with lack of clarity in its definition. These studies are more frequent in the European Union due to the 'borderless' discourse and practices, and in other specific cases, such as the US-Mexico border, building a dominant perspective from the Global North. Frequent challenges that cross-border EMS face are linguistic and sociocultural barriers, high complexity in the legal and institutional framework, financial issues, lack of standardization in recognition of professional skills, lack of interoperability of cross-border data, problems in emergency communication and missing consensus in concepts and practices. Despite all these difficulties, multiple advantages are perceived and documented, as better patient and social outcomes, increased efficiency on the utilization and management of resources, reduction on delayed responses and undertreatment, better quality of the provided services, higher patient satisfaction, creation of synergies of shared responsibilities in border areas which are usually perceived as peripheral and improvement in public health preparedness and emergency responses.

Keywords: emergency medical services, border areas, border health.

Serviços de emergência em contextos transfronteiriços: uma revisão de escopo

Resumo: Os Serviços Médicos de Emergência (SME) evoluíram de um contexto de guerra para um cenário complexo de rápida urbanização e grande interconectividade, que inclui áreas

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transfronteiriças. As especificidades destas áreas são sub-representadas nos estudos sobre SME. O objetivo deste trabalho é proporcionar uma melhor compreensão dos cuidados de emergência em ambientes transfronteiriços. Foi realizada uma revisão qualitativa de escopo em três grandes bases de dados de interesse, onde 29 trabalhos corresponderam à estratégia de inclusão e foram submetidos à análise temática. Os resultados mostram um interesse crescente e consistente neste tópico, embora o termo "transfronteiriço" continue a ser uma abordagem multidisciplinar com falta de clareza na sua definição. Estes estudos são mais frequentes na União Europeia devido ao discurso e às práticas 'sem fronteiras', e noutros casos específicos, como a fronteira EUA-México, construindo uma perspectiva dominante a partir do Norte Global. Os desafios frequentes que os SME transfronteiriços enfrentam são as barreiras linguísticas e socioculturais, a elevada complexidade do quadro jurídico e institucional, as questões financeiras, a falta de normalização no reconhecimento das competências profissionais e a interoperabilidade dos dados transfronteiriços, os problemas na comunicação de emergência e a falta de consenso nos conceitos e práticas. Apesar de todas estas dificuldades, múltiplas vantagens são percebidas e documentadas, como melhores resultados para os pacientes e a sociedade, aumento da eficiência na utilização e gestão de recursos, redução de atrasos nas respostas e do subtratamento, melhor qualidade dos serviços prestados, maior satisfação dos pacientes, criação de sinergias de responsabilidades partilhadas em zonas fronteiriças que são geralmente vistas como periféricas e melhoria na nas ações de saúde pública e nas respostas de emergência.

Palavras-chave: serviços médicos de emergência, áreas de fronteira, saúde na fronteira.

Servicios de emergencia en contextos transfronterizos: una revisión de escopo

Resumen: Los Servicios Médicos de Emergencia (SME) evolucionaron a partir de un contexto de guerra a un escenario complejo de rápida urbanización y gran interconectividad, incluyendo áreas transfronterizas. Las especificidades de estas áreas están sub-representadas en los estudios sobre SME. El objetivo de este trabajo es proporcionar una mejor comprensión de los servicios de emergencia en ambientes transfronterizos. Fue realizada una revisión cualitativa de escopo en tres bases de datos de interés, en la que 29 trabajos se encajaron en la estrategia de inclusión y fueron sometidos a análisis temático. Los resultados muestran un interés creciente y consistente en este tópico, pese a que el término "transfronterizo" continúa siendo un abordaje multidisciplinario sin una definición clara. Estos estudios son más frecuentes en la Unión Europea debido al discurso y a las prácticas 'sin fronteras', y en otros casos específicos, como la frontera EUA-México, construyendo una perspectiva dominante a partir del Norte Global. Los desafíos frecuentes que los SME transfronterizos enfrentan son las barreras lingüísticas y socioculturales, la elevada complejidad del

marco jurídico e institucional, cuestiones financieras, falta de normalización en el reconocimiento de habilidades profesionales, falta de interoperabilidad de datos transfronterizos, problemas en la comunicación de emergencia y falta de consenso en los conceptos y prácticas. A pesar de todas estas dificultades, múltiples ventajas han sido percibidas y documentadas, como mejores resultados para los pacientes y la sociedad, aumento de la eficiencia en el uso y gestión de recursos, reducción de atrasos en las respuestas y del subtratamiento, mejor calidad de los servicios prestados, mayor satisfacción de los pacientes, creación de sinergias de responsabilidades compartidas en zonas fronterizas que son generalmente vistas como periféricas y mejoría en las acciones de salud pública, así como en las respuestas a emergencias.

Palabras clave: servicios médicos de urgencia, áreas fronterizas, salud fronteriza.

Introduction

Since the first emergency care system, improvised during the Franco-Prussian war at 19th century to retire hurt soldiers from the scene[1], the idea of transporting patients facing potentially deadly threats for their health grew from the use of carriages at combat zones to the inclusion of civilian emergencies in urban environments starting the 20th century, establishing the bases for what is now known as EMS[2].

Emergency Medical Services (EMS) are a set of services that include rapid assessment, timely interventions and prompt transportation to definitive care in case of life-threatening events[3]. It rests at the point of crucial intervention and plays a vital role in reducing the rate of mortality and morbidity in case of an injury, infection, obstetric complication, chemical imbalance, or persistent neglect of a chronic disease that threatens the patient life[4].

Despite their relevance, EMS are frequently neglected in public monitoring and debate[5]. They can be the difference between life and death, but their availability in remote zones, such as border areas, may limit their efficiency and accessibility[6], even in cases when using hospital facilities in neighboring countries may constitute a great improvement in functional efficiency of the emergency care[7]. Cross-border cooperation in topics such as policing, crisis management, firefighting and EMS is especially important in sparsely populated regions or with limited resources[8].

Discussions of cross-border settings in healthcare have been centered in health services received in other countries[9] and in cooperation across borders[10]. Both terms have an underlying definition in common, as activities or arrangements in the health field that are done between two or more actors located in different countries, to transfer or exchange patients, providers, products,

services, funding or specialized knowledge across the border[11], even with support of cross-border organizations, networks or observatories that may serve as mediators or coordinators[12].

The European Union is the most frequent framework for cross-border health care discussions even since the creation of the European Community, that tried to ease the life of populations in border regions by facilitating commuting and other mobilities, which may include the use of medical services abroad[13]. Several success cases include regional projects on health promotion and collaborations in emergency care at the Euregion Meuse-Rhine (Belgium-Germany-Netherlands), and specific agreements on cross-border emergency ambulance transport such as Benelux Decision.

Little is known about EMS in cross-border settings. As these border regions are frequently peripheric in their national context and usually rely on the neighboring country to solve certain problems that may include the provision of EMS, a better comprehension of emergency care in cross-border settings is needed. How are borders conceptualized in cross-border EMS studies? Does the cross-border gaze on EMS result helpful in border areas? Can cross-border EMS be a solution for accessibility problems to emergency care in border areas? The main objective of this study is to analyze the challenges and opportunities that cross-border emergency medical services offer. A scoping review will be implemented to retrieve related studies on the matter, and thematic analysis will be applied to solve the research questions.

Methodology

A qualitative scoping review was the selected tool for this work, as it holds a structured process to synthesize the knowledge of the studies of one specific question, being a tool to determine opportunity areas, tendencies and possible future trends in research[14]. With gained visibility since the 21st century, it constitutes a method of evaluation of emergent evidence[15] that is adequate to face the increase on both complexity and multidisciplinary characteristics of the research questions in public health[16].

To construct this review, three databases were selected to develop the research: Scopus, PubMed and Web of Science. A mixed search strategy was built, as different commands were used in each database due to the particularities of each.

- For Scopus and Web of Science, two independent searches were implemented, using the commands “cross-border” AND “emergency medical services”, in addition to “cross-border” AND “ambulance”.
- For PubMed, the commands (“cross-border” AND “emergency medical services”), in addition to complementary commands OR (“cross-border” AND “ambulance”), were used in the same expression.

These search terms could be present in either the title, keywords, abstract or full text of the matching records. No timestamps were used, to have a more comprehensive analysis on the evolution of the use of "cross-border EMS" term in scientific literature. The inclusion and exclusion criteria applied to the retrieved records are resumed in the following table (1).

Table 1. Criteria for selection of records that matched the search strategy.

Inclusion criteria	Exclusion criteria
Availability of full text	No full-text available
Scientific literature	Grey literature
English	Other languages
Cross-border EMS as main topic	Study with other main topics rather than cross-border EMS

Source: elaborated by the authors.

The retrieved records were later analyzed using thematic analysis technique. Codification process is needed to extract topics and concepts that answer the research questions, while categorization helps to make this extracted data more manageable[17]. In the first step, several codes were generated manually to describe the literature, such as year of publication, journal, main topic and methodologies; later, ATLAS.ti 24 was used to aid the process, producing several codes as geographical features, provided care, and benefits, challenges and opportunities in the implementation of cross-border EMS.

Results

The implementation of the search strategy is illustrated in Appendix 1. The analysis resulted in six thematic sections: characteristics of the literature, geographical features, types of care provided in cross-border settings, benefits of cross-border EMS, difficulties, and opportunities.

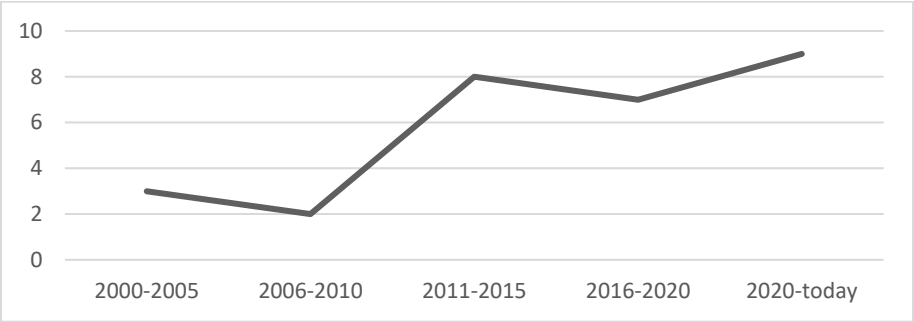
1. *Characteristics of the literature*

It was observed that very few articles tried to define what cross-border EMS is. Conceptual insights of this discussion were brought by Hermans[18], who defined cross-border health care as medical treatment received by citizens in a country different in which they pay social security contribution; and by Sommer et al[11] who defined cross-border collaboration in healthcare as an activity or arrangement undertaken by two or more cooperating actors located in different countries with the aims of transferring or exchanging patients, providers, products, services, funding or healthcare knowledge across the border that separates them.

The first work that brought together EMS and cross-border settings was published in 2000. From a legal perspective and in the European Union context, it discussed the implications for healthcare across borders after several judgments in the European Court of Justice, which stated that

health is also benefited from the freedom of movements inside the Union, and nations are forced to reimburse patients if they seek for health services abroad[18]. The first decade of the 21st century had 5 published works on cross-border EMS, but the interest grew very fast in the next decade. In the following figure (1), a timeline is presented for a broader perspective.

Figure 1. Timeline of the scientific production on cross-border EMS.



Source: elaborated by the authors.

It is observed an increasing interest in cross-borders after 2010, sustained in the following decade. The period between 2006 and 2010 had the lowest publication numbers, but presented an unfold of the topics researched: while the work of Fries et al[19] paved the way for further specialized analysis on EMS in borders with the discussion of cardiopulmonary resuscitation outcomes in the border region of Germany-Belgium-Netherlands, Elmqvist et al[20] discussed the role of policemen, fireman and ambulance personnel in pre-emergency care and understood the term 'cross-border' as the tasks that can be performed by those three different kind of professionals on emergency scenes.

In the 2011-2015 period, the works covered more topics, like management of emergency care in cross-border settings in Euregional[21], combat[22] and national context[23], the articulation of emergency responses in areas of cross-border conflict[24], articulation of emergency care for cross-border massive sport events[25] or optimization of patient flows in emergency services at cross-border settings[26].

For the next five years (2016-2020), the research topics deepened on management of patients in cross-border settings[27], with emphasis on trauma patients[28], technologies used in emergency responses[29,30] early warning and response systems in borders[31] and integration of EMS across borders in the Euregion Pomerania, integrated by northeastern Germany and northwestern Poland[32].

Since 2020, the works diversified and included topics as legal framework on cross-border EMS[33], punctual cross-border EMS collaborations in Euregion Meuse-Rhine[11] and the German-Polish border[34], regional policies on health emergencies preparedness[35], prediction of cross-border EMS

demand[36], and management of traumatic injuries across the US-Mexico border[37]. The review also showed a great variety on how the authors solved their research questions. The following table (2) resumes the methodological strategies used.

Table 2. Methodological strategies used on cross-border EMS studies.

Quantitative research		Qualitative research		Mixed methods research	
Techniques		Techniques		Techniques	
Statistical analysis	5	Descriptive analysis	4	Statistical analysis + neural network technique + two-stage survey + deep learning training	1
Statistical modelling	1	Document analysis	6	Document analysis + interviews	4
		Online surveys	1	Geospatial analysis and documental analysis	1
		Scoping literature review	1	Meetings with experts + statistical analysis	1
		Semistructured interviews	2		
		Unstructured interviews	1		
		Questionnaires	1		
Total	6	Total	16	Total	7

Source: elaborated by the authors.

It is observed that qualitative strategies dominated, as they were present in 16 of the 29 reviewed articles, with document analysis (6), descriptive analysis (4) and interviews (3) as the most used techniques. The second most used strategy was the mixed methods research, used by 7 works, where the combination of document analysis and interviews was the most frequent one (4). Finally, 6 works applied a quantitative strategy, in which 5 of them used techniques of statistical analysis. Also, the lack of cross-border health databases[38] may be part of the explanation of the dominance of qualitative strategies that generate their own data through diverse techniques, such as interviews, meetings with experts, surveys, and questionnaires.

2. Geographical features

The reviewed works brought heterogenous scales of analysis, under different political-administrative levels of organization of the EMS, but also using study cases that show different extensions of the areas of interest. This identification helped to explore the most frequent study cases where cross-border EMS were analyzed. The next table (2) presents a synthesis of the reviewed articles by geographical features.

Table 2. Geographical perspectives in the reviewed articles.

Spatial perspective	Articles	Study cases
Global	1	World
Regional	3	European Union
Euregional level	3	Enschede-Gronau, Meuse-Rhine, Pomerania
Binational case	9	Czech-German border, German-Polish border, Israel-Gaza strip border, Israeli-Egyptian border, Italian-Slovenian border, Mexico-USA border
Trinational case	3	Cambodian-Laos-Thai border region, German-Belgian-Dutch border region
National case	8	Canada, Germany, Sweden, Spain, Turkey, USA
Comparation between nations	2	Selected European countries

Source: elaborated by the authors.

In sum, the articles bring several perspectives, such as the global perspective about the relationship between populations changes, conflicts and emergency services brought by Garfield, Polonsky & Burkle[24], the interregional case with the analysis of cross-border organization of EMS due to a terrorist attack on the Israel-Egypt area brought by Leiba et al[39], and two Asian study cases, 7 works for North American cases and 18 works related to European cases.

While the work of Ran et al[22] analyzes air evacuation strategies in cross-border war settings at the Israel-Gaza strip border, Arunrat et al[36] created a model using deep learning to predict the demand of cross-border EMS logistics, which shows a short and heterogenous tendency on Asian studies about cross-border EMS. On the other hand, North American cases focused mostly on the US-Mexico border, in aspects such as outcomes of trauma patients in the cross-border area analyzed by Brito et al[28] and Kumar et al[40] for borders across states, the impacts of cross-border transportation on critical patients referred by Salgado et al[41] and the burden of injuries in trauma patients studied by Keller et al[37].

Works related to European cases used the European Union level to analyze the legal framework on cross-border healthcare[18], the syndromic surveillance at subnational level studied by Ziemann et al[42] and the preparedness for health emergencies analyzed by Wouters et al[35]; while binational cases were brought as in the article about challenges in urgency cross-border care at the Czech-German border[33], the work of Ruebsam et al[34] about joint cross-border training for health professionals at the German-Polish border, the analysis of health impacts in the same border, performed by Kuntosch et al[38] or the outcomes after the Covid-19 pandemic in the Italian-Slovenian border, analyzed by Naccarato et al[27].

For European national study cases, Ruchholz et al[26] analyzed the management of trauma patients within German regions, also showing potential collaborations with bordering countries, while Elmqvist et al[20] showed the similarities and differences in the tasks and skills of different professions

towards emergency care in Southern Sweden, Samaniego-Ocaña & Granados-Martín[43] studied the evolution of Spanish dispatch centers in the broader European Union framework and Ekmekci[31] analyzed the improvement of Turkish early warning and response systems aligned with European Union standards.

Euregional cases brought a study about standardization in emergency communications at Euregio Enschede-Gronau (Netherlands-Germany) and Euregio Meuse-Rhine, which involves parts of Belgium, Germany and the Netherlands[21]; a work on cross-border collaboration during Covid-19 pandemic at Euregio Meuse-Rhine by Sommer et al[11] and another on the training of medical workforce in cross-border settings, specifically in Euregio Pomerania, which includes part of Germany and Poland, by Ucinski et al[32].

Though, there are still inconsistencies in what is exactly the element that has the cross-border nature. Several articles described the EMS themselves as cross-border as in the works of Hermans[18], Fries et al[19], Brito et al[28], Sommer et al[11], Arunrat et al[36] and Kuntosch et al[38]; while others set that feature in the own geographic context as studied by Grier et al[23]; Garfield et al[24]; Hommels & Cleophas[21]; Salgado et al[41]; Keller et al[37], in the nature of the emergencies as assessed by Leiba et al[39]; Ran et al[22]; Ekmekci[31], or in the functionalities of different professionals in emergency care as showed by Elmqvist et al[20]; Walsh et al[44]; Hancox et al[29,30].

3. Types of care provided by cross-border EMS

Cross-border mobility in seek of health care is usually explained by the lack of resources on one side, that pushes the flow in the opposite direction, as stated by Hermans[18] in the case of countries that belong to the European Union, or Arunrat et al[36] who explain that Thailand attracts flows of patients due to more specialized resources for both treatment and diagnosis, rather than neighboring Cambodia and Laos.

In emergency situations, the neighbor country may offer the closest facility that fits the patient's needs, as in the case of El Paso, Texas, which has specialized facilities to attend stroke and cardiovascular emergencies that don't exist in neighboring Ciudad Juárez[41]. Another important feature to consider is the unavailability of beds: the study of Sommer et al[11] referred a flux of pediatric patients that were transferred from Belgium to Maastricht, in the Netherlands, during Covid-19 pandemic due to the lack of pediatric ICU and the urgent need of intensive care; the same study also described the broader ICU capacity in Germany, that facilitated the transfer of critical patients from Belgium and the Netherlands when needed, in the Euregion Meuse-Rhine area.

The work of Naccarato et al[27] also referred the management of Slovenian stroke patients in Italian hospitals during Covid-19 pandemic, linked to more specialized facilities, while the article of Psutka[33] detailed how Germany and the Czech Republic respond to emergencies in their common cross-border area; as they hold a cooperation protocol, a patient that needs emergency care can be taken to the closest hospital, despite the country of residence.

In a context of migration flows of undocumented people, the work of Keller et al[37] refers to the traumatic injuries during the crossing of borders (falls from tall heights, dehydration in desert routes, mass casualties related to illegal crossing in vehicles, drownings in river routes) that add pressure to emergency services in the receiving country and cause high morbidity and mortality among the migrants in the US-Mexico border. In this case, there are no cross-border management protocols, only if US consulate personnel working on Mexican territory have a medical emergency and require urgent treatment in the American side, as Salgado et al[41] point.

4. Benefits of the development of cross-border EMS

Better outcomes for patients in border areas was the main referred advantage of cross-border EMS. Personalized solutions for the patients' needs[20], greater potential of expedite care accessibility[40] and better survival chances[7] were cited. Another positive result of cross-border EMS was the efficiency in the use of resources. Arunrat et al[36] cited improvements in the quality of health services, reduction of risks related to untreated or delayed emergency responses, and patients' increased satisfaction, while Post[7] mentioned that the use of specialized treatments and hospital capacities in neighboring countries may bring a significative improvement in the functional efficiency on medical care, a perspective also shared by Psutka[33].

Authors as Hermans[18] and Ucinski et al[32] held a common vision on how cross-border projects of cooperation and integration in health services at the European Union improved accessibility for patients while shifting the paradigm of borders as secluding areas into a joint area where responsibilities are shared. Commonly conceived as peripheral areas, border regions may lack of proper health and emergency services, but innovative solutions can change that reality, as cross-border cooperation of EMS, institutions and hospitals can help to reduce the discrimination of people living in border regions[34].

In the field of public health preparedness and cross-border emergency responses, Grier et al[23] points that the success in managing cross-border emergencies relies on previous coordination that needs to occur in both geographical and political jurisdictions among the involved countries; while

Walsh et al[44] refer that coalitions provide a unified voice for the region, give a consistent message of joint work for mutual benefit and improve public opinion in situations of emergency or disaster.

5. Difficulties faced by EMS in cross-border settings

In general, common problems for cross-border EMS were identified despite regional context differences, as linguistic barriers and incompatible sociocultural practices as pointed by Kuntosch et al[38]; Ruebsam et al[34], time-consuming differences on regulations and guidelines for quality parameters of EMS systems as pointed by Sommer et al[11]; Kumar et al[40]; Grier et al[23]; Walsh et al[44], referral back difficulties[36], differences on licenses, attributions and tasks of the emergency staff as cited by Kumar et al[40]; Fries et al[19]; Post[7]; Kuntosch et al[38], and false calls that overload dispatch centers and endanger the lives of victims of real emergencies[43].

Several financial issues emerged from various articles, as payment concerns and lack of insurance coverage in the other country[40]; the use of significant health care resources by cross-border trauma patients which may represent an additional financial burden for the system[37], discrepancies in financial compensation concerning ambulance deployment and hospital admission[7], and lack of funding of cross-border cooperation projects[44].

Another crucial concern is about data exchange in cross-border EMS. Missing information can pose a serious threat to the health and lives of patients if not referred[36], so it's urgent to solve interoperability issues. Different approaches to processing information, like differing working and decision-making processes based on different factors[11] have as immediate consequence that data collections and information technology systems of relevant sectors across the borders do not relate to each other[31], and no comprehensive databases exist to assess the relevance and magnitude of this challenge as pointed by Kuntosch et al[38] and Hancox et al[30].

An additional layer of complexity that public health and emergency planners must consider lies in the diversity and magnitude of the various political agencies involved in responding to emergencies[23], as in most cases, the planning of medical provisions fails to include cross-border capacity requirements resulting from populous areas near the border[7]. Challenges rely on stakeholder engagement, as cooperation rests on individual initiatives when arrangements or administrative agreements are not established[44].

A critical issue relies on the vulnerability in cross-border emergency communications, as there are crucial differences in the technologies used and the dispatch rooms[21], lack of unified radio

communication system[38], lack of direct communication between command centers and Advanced Life Support providers[22] and ineffective coordination between civil protection authorities at local, regional and national levels as well as on a cross-border basis to integrate response procedures[29].

The inconsistency in defining common concepts may be considered a risk[31], so there is a need for further research on cross-border EMS[38]. Other challenge is the limited possibility of knowledge transfer among different regions due to very specific cooperation contracts in cross-border EMS[34]. There's also a lack of an exchange space of best practices[11] and of mechanisms for monitoring and evaluating the effectiveness and functionality of the cross-border cooperations[32].

Problems may arise from border regions that held inequalities on the freedom of movement across borders, as the US-Mexico border, which lacks formal procedures in place to expedite ambulance cross-border operations[41], so most transports from Mexico are unofficial and unexpected by the receiving hospital, with no prior communication between the facilities despite geographic proximity as described by Brito et al[28]. Patients are used to be transported from Mexico to the USA in passenger vehicles by friends or relatives rather than in ambulances, so the numbers may be unknown and underestimated; and the lack of communication with American ambulances to coordinate may represent a delay on the patient transfer and consequently a higher risk of death[41].

6. *Opportunities for EMS in cross-border settings*

Differences issues about common recognition of health professionals across borders, as incompatibilities in the licensing models of health professionals between the involved countries[40], the type and qualification of the personnel responding to emergencies[19], unequal regulations that may restrict effective and efficient deployment of personnel and equipment at critical moments[7], lack of joint training and barriers in planning for staff and resource-sharing across borders[44].

Despite these obstacles, there is a growing shift to a paradigm on shared responsibilities across the border, not only of ambulances but also from voluntary fire brigades, live guards on the beaches and first responders of emergencies which are also expected to meet patients and victims from the other side of the border as Kuntosch et al[38] state.

In Euregions, pathways and responses criteria for the medical staff are pre-established to define cross-border responses to emergencies, as Post[7], Fries et al[19] and Sommer et al[11] detailed for the case of the Euregion Meuse-Rhine in different historical contexts. Also, sporadic cooperations in crisis contexts, as the terrorist attacks perpetrated in Israel in 2007 that had a cross-border back-up

from Egyptian medical teams[39] or the cross-border planning for air evacuation of casualties during the Israel-Gaza Strip conflict in 2009[22] quickly set up criteria for a unified response to save lives.

Discussion

The review showed that cross-border EMS is subject of growing interest for scholars. European study cases from different political-administrative levels (European Union, Euregional, national) dominated, with emphasis on legal matters, cooperation projects and preparedness for cross-border emergencies, while Asian cases emphasized combat and terrorist circumstances, and US-Mexico border works referred mainly management of patients across the border, especially trauma and critical ones, in a context of unequal mobility through the border.

The great presence of European study cases may be partially explained by the generally accepted discourse of the European Union as 'borderless'[45], but van der Zanden, Hoebe & Horstman[46] show that the Covid-19 pandemic in fact revealed that in major cross-border health emergencies the national level centralizes the responses, and neglects regional and cross-border cooperation, perspective that Sommer et al[11] and Naccarato et al[27] also defend. These contradictions may affect the development of effective cooperations on cross-border EMS and posterior analysis on its possible advantages, challenges and effects for border populations.

Another revealing evidence brought by this study was the broad difference in the use of the term 'cross-border'. While most of the studies understood it as a geographical feature, frequently referring to the territories close to international limits between countries, but also between the states of the same country[40], others used them in a professional context, to refer to situations in which actors of emergency care –such as firemen, police, and ambulance staff– have different tasks and skills to perform in emergency responses[20].

In EMS cross-border cooperation, it may be desirable to recognize and validate the staff capacities and responsibilities from the partners across the border rather than creating unified systems, joint training and the continuity of the stakeholders that hold the negotiations across borders[6], keeping in mind that integrated care can also reduce hospitalization, demand for emergency treatment and average length of stay, as Uchimura, Silva & Viana[47] studied.

Borders all over the world have different regimes of permeability, creating a transnational stratification system built through differentiated access to passports and visas that regulate cross-border mobility, as analyzed by Davis, Wemyss & Cassidy[48]. This system indeed creates different conditions for cross-border EMS to happen, as seen in the case of wide-open borders (like the

European Union) which may held directed cooperation agreements on this matter[6], or in less permeable borders with more strict controls, as the US-Mexico border, which doesn't encourage direct cooperation due to the difference between citizenships and the rights of mobility derived from them.

Limitations

The design of a scoping review, that requires to select a few keywords related to the topic of interest, may not bring all the published works, principally due to conceptual differences that lead to the use of different keywords or concepts as assessed by Peterson et al[15]. For example, in this review it was observed the use of 'cross-border' and 'transborder' as synonyms[36], possibly related to the recent construction of the field of cross-border healthcare, which still lacks a widely accepted conceptual framework.

Also, the codification, categorization and thematic analysis are conducted by different scientists, which may consider some results as relevant while others don't, involving a frequently personal bias that may affect the reproducibility of the study as pointed by Hennink, Hutler & Bailey[17]. Generalizations may not be extracted, as the records may not be representative of all studies conducted in cross-border settings. Finally, reducing the search to works published in English and the exclusion of grey literature were practical decisions that may have excluded relevant products.

Conclusions

This study introduced a cross-border setting approach in the study of EMS that included geographical features, multiscale analysis, and the convergence of different professional skills in emergency care. The term 'cross-border' remains as a multidisciplinary and transdisciplinary perspective that is not well defined when related to EMS. These studies are more frequent in Europe due to the 'borderless´ discourse and practices, and in other specific cases around the world, as the US-Mexico border, conforming a dominant perspective from the Global North.

Frequent challenges that cross-border EMS face are linguistic and sociocultural barriers, high complexity in the legal and institutional framework, financial issues, lack of standardization in recognition of professional skills and interoperability of cross-border data, problems in emergency communication and missing consensus in concepts and practices. Despite all these difficulties, multiple advantages are perceived and documented, as better patient and social outcomes, increased efficiency on the utilization and management of resources, reduction on delayed responses and undertreatment, better quality of the provided services, higher patient satisfaction, creation of

synergies of shared responsibilities in border areas which are usually perceived as peripheral and improvement in public health preparedness and emergency responses.]

Author contributions

ADRB: conceptualization, data curation, formal analysis, writing of original draft.

EP: project administration, supervision, conceptualization, methodology, reviewing.

TK: supervision, reviewing.

HG: project administration, reviewing.

Conflict of interest

The authors state that they have no conflict of interest to declare.

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