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Procedures of the Emergency Regulation Center for Stroke Calls: integrative review

Condutas da Central de Regulação das Urgências aos Chamados de Acidente Vascular Encefálico: revisão integrativa

Procedimientos del Centro de Regulación de Emergencias para Llamadas por Accidente Círc: revisión integrativa

ABSTRACT

Objective: To analyze scientific evidence regarding the procedures adopted by Emergency Regulation Centers in response to calls involving patients with suspected stroke. **Methods:** An integrative literature review was conducted using the PubMed, Scopus, Cochrane Library, and LILACS databases, including studies published between 2020 and 2025 in Portuguese, English, and Spanish. After applying eligibility criteria, four studies were included in the sample. **Results:** Evidence showed that failures in identifying symptom onset, limitations in telephone triage, and communication difficulties can delay stroke care. Conversely, standardized protocols, telemedicine, and interprofessional communication helped reduce response times and improve the quality of pre-hospital care. **Conclusion:** The Emergency Regulation Center plays a vital role in the stroke care pathway. Strengthening regulation protocols, team training, and the use of technology can optimize pre-hospital care and contribute to better clinical outcomes.

Keywords: Medical emergencies; Pre-hospital services; Stroke.

RESUMO

Objetivo: Analisar as evidências científicas sobre as condutas da Central de Regulação das Urgências frente aos chamados de pacientes com suspeita de AVE. **Método:** Revisão integrativa da literatura realizada nas bases PubMed, Scopus, Cochrane Library e LILACS, incluindo estudos publicados entre 2020 e 2025, nos idiomas português, inglês e espanhol. Após aplicação dos critérios de elegibilidade, quatro estudos

compuseram a amostra. **Resultados:** As evidências demonstraram que falhas na identificação do início dos sintomas, limitações na triagem telefônica e dificuldades de comunicação podem atrasar o atendimento ao AVE. Em contrapartida, protocolos padronizados, telemedicina e comunicação interprofissional favoreceram a redução do tempo-resposta e a qualificação da assistência pré-hospitalar. **Conclusão:** A Central de Regulação das Urgências desempenha papel essencial na linha de cuidado ao AVE. O fortalecimento dos protocolos de regulação, da capacitação das equipes e do uso de tecnologias pode otimizar o atendimento pré-hospitalar e contribuir para melhores desfechos clínicos.

Palavras-chave: *Urgências médicas; Serviços pré-hospitalar; Acidente vascular encefálico.*

RESUMEN

Objetivo: Analizar la evidencia científica sobre la actuación del Centro de Regulación de Emergencias (CRE) ante llamadas de pacientes con sospecha de ictus. **Métodos:** Se realizó una revisión bibliográfica integradora utilizando las bases de datos PubMed, Scopus, Cochrane Library y LILACS, incluyendo estudios publicados entre 2020 y 2025, en portugués, inglés y español. Tras aplicar los criterios de elegibilidad, se seleccionaron cuatro estudios para la muestra. **Resultados:** La evidencia demostró que las dificultades en la identificación del inicio de los síntomas, las limitaciones en el triaje telefónico y las dificultades de comunicación pueden retrasar la atención del ictus. Por el contrario, los protocolos estandarizados, la telemedicina y la comunicación interprofesional favorecieron la reducción del tiempo de respuesta y la mejora de la atención prehospitalaria. **Conclusión:** El Centro de Regulación de Emergencias desempeña un papel fundamental en la atención del ictus. El fortalecimiento de los protocolos de regulación, la formación de los equipos y el uso de tecnologías pueden optimizar la atención prehospitalaria y contribuir a mejores resultados clínicos.

Descriptores: *Emergencias médicas; Servicios prehospitalarios; Accidente cerebrovascular.*

INTRODUCTION

Stroke is characterized by a sudden interruption of cerebral blood flow and can be classified as ischemic or hemorrhagic, resulting in neurological deficits that may be temporary or permanent¹.

This condition is one of the leading causes of death, with a significant impact on health systems, patients' quality of life, and the social costs associated with long-term care and rehabilitation².

According to the *Global Burden of Disease*³, study, published by the World Health Organization (WHO) and the *Institute for Health Metrics and Evaluation* (IHME), stroke is the second leading cause of death and the third leading cause of disability-adjusted life years worldwide. It is estimated that, each year, more than 12 million people suffer a first stroke worldwide, resulting in approximately 6.5 million deaths. Advanced age is known to be one of the non-modifiable conditions that may contribute to the onset of stroke⁴.

In Brazil, stroke is one of the main causes of hospitalization and among the leading causes of death, with more than 109,000 deaths in 2023 and approximately 85,000 deaths in 2024, making it a public health problem of great magnitude. Therefore, the response to stroke requires an integrated, rapid, and evidence-based approach, from the recognition of signs and symptoms to the transfer of the patient to definitive treatment at referral centers⁵.

The time between symptom onset and therapeutic intervention, especially in cases where thrombolysis or thrombectomy is indicated, is a decisive factor for prognosis. In this sense, the role of the Emergency Regulation Center (ERC) becomes essential to ensure that patients with suspected stroke receive care within the so-called therapeutic window, minimizing neurological damage and optimizing the available care resources⁶.

Emergency Regulation Centers operate based on clinical protocols and specific guidelines, carrying out qualified call listening, assessment of the reported signs, classification of the severity of the clinical condition, and allocation of mobile emergency resources, such as ambulances of the Mobile Emergency Care Service (SAMU)⁷.

In addition, ERCs are responsible for coordinating the referral of the patient to the most appropriate hospital, considering the complexity of the case and bed availability. This efficient coordination is especially critical in stroke cases, where minutes can mean the difference between recovery and permanent disability⁵.

Despite the strategic importance of medical regulation in the stroke care chain, there is still a scarcity of studies that systematically describe the procedures adopted by regulation centers in response to neurological emergency calls. Understanding these procedures is essential to identify critical points, promote the improvement of care pathways, and support public policies aimed at enhancing the quality of pre-hospital care.

Therefore, this article aims to analyze the scientific evidence on identification, triage, communication, the use of telemedicine, dispatch, and care

pathways in the pre-hospital care of patients with suspected stroke, with emphasis on the role of regulation centers and the integration among regulators, mobile teams, and referral services.

METHODS

This is an integrative literature review developed using, as its methodological framework, the stages proposed by Mendes, Silveira, and Galvão⁷: 1) definition of the research question; 2) establishment of the inclusion and exclusion criteria; 3) categorization of the studies; 4) critical analysis of the studies included in the review; 5) interpretation; and 6) presentation of the results.

The *Population, Variables and Outcomes* (PVO) strategy was used to formulate the guiding question: What procedures do emergency medical regulation professionals adopt in response to stroke calls in the context of pre-hospital care to ensure safe care? Where P: Patients with stroke; V: Procedures of emergency medical regulation professionals; O: Safe care and transport.

Primary articles in English, Spanish, or Portuguese published between 2020 and 2025 were included. Monographs, theses, dissertations, editorials, and articles that did not answer the research question were excluded.

The search was conducted from November 2024 to June 2025 using the following descriptors from the *Medical Subject Headings (MeSH)*: *Stroke [Mesh]*, *emergency medical service communication systems [Mesh]*, *telemedicine emergency care [Mesh]*, *emergency medical dispatch [Mesh]*, *prehospital care [Mesh]*, *emergency medical calls [Mesh]*, *transportation of patients [Mesh]*, in the *National Library of Medicine* (PubMed), Scopus (Elsevier), *The Cochrane Library*, Latin American and Caribbean Health Sciences Literature (LILACS) databases, using the advanced search method and the title, abstract, and subject fields. The descriptors were combined according to the logic *population AND variables AND outcomes*, with the aid of the Boolean operators *AND* and *OR* (Chart 1).

The search strategy used was: ((stroke) AND (emergency medical service communication systems) OR (telemedicine emergency care) OR (emergency medical dispatch) OR (prehospital care) OR (emergency medical calls) AND (transportation of patients)).

Chart 1 – MeSH subject descriptors identified for the components of the research question according to the PVO strategy. Fortaleza, CE, 2025.

Strategy items	Question components	Descriptors
Population	Patients with stroke	<i>Stroke</i>
Variable of interest	Procedures of emergency medical regulation professionals	<i>Emergency medical service communication systems, telemedicine emergency care, emergency medical</i>

		<i>dispatch, prehospital care, emergency medical calls</i>
Outcome	Safe care and transport	<i>Transportation of patients</i>

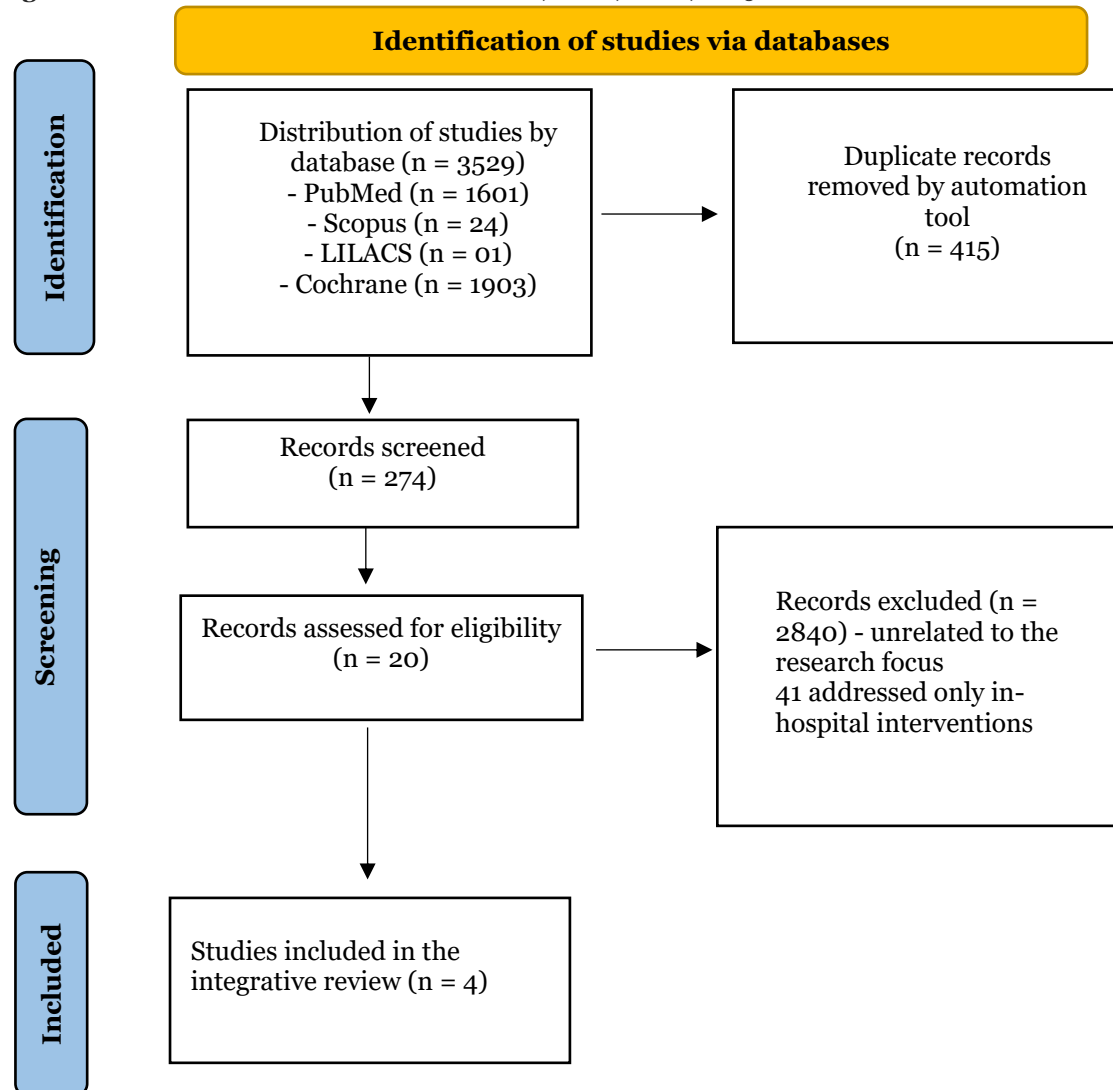
Source: Research data, 2025.

Data search and extraction were performed in pairs by two independent authors. Disagreements were resolved by a third reviewer.

Of the 3,529 articles found, 415 were duplicates, 2840 were excluded because they were unrelated to the topic, and 274 were selected for abstract analysis. Of these, 20 were selected for full-text reading. After full-text reading, four were selected for the final sample.

The *Preferred Reporting Items for Systematic Review and Meta-Analyses* (PRISMA)⁸ instrument was used to illustrate the study search and selection process, as shown in Figure 1 below.

Figure 1 – Flowchart of selected articles. Fortaleza, Ceará, Brazil, 2025.



Source: Prepared by the authors, 2025.

RESULTS

A total of 3,529 articles were identified in the databases searched, of which only four fully met the eligibility criteria and made up the final sample of the review (Figure 1). The marked reduction between the studies initially identified and those included can be explained by the specificity of the object of this investigation, since most of the retrieved publications, although related to the general topic, did not directly address the phenomenon of interest, particularly with regard to the interventions performed by the Emergency Regulation Center in response to stroke-related calls. Thus, the systematic application of the inclusion and exclusion criteria was essential to ensure the relevance of the selected studies to the guiding question of the review.

The small number of eligible studies, therefore, does not diminish the relevance of the topic; on the contrary, it reveals an important gap in the available scientific literature. The scarcity of investigations specifically addressing the role of the Emergency Regulation Center in response to stroke calls reinforces the need to expand the production of evidence on this component of emergency care, considering its role in identifying severe situations, in decision-making, and in timely coordination with the health care network. In this sense, the four included studies represent the scientific output that, within the period and conditions established for this review, directly corresponded to the object investigated.

The levels of evidence were classified according to the hierarchy proposed by Melnyk and Fineout-Overholt⁹, in which single descriptive or qualitative studies correspond to level VI (Chart 2).

Quadro 2 – Characterization of the selected studies on the interventions of the Emergency Regulation Center in response to stroke calls. Fortaleza-CE, 2025.

	Title	Year	Objectives	Main results	Number of participants or patients	Care time or intervals	Level of evidence
10	Pre-hospital Care for Suspected Stroke Patients, Cared for by Mobile Emergency Care Units in Northern Minas Gerais	2021	To characterize the pre-hospital care provided to patients with suspected stroke by the Mobile Emergency Care Service (SAMU) through a descriptive case study.	The lack of information on the time of symptom onset is a critical issue, as it directly affects eligibility for treatments such as thrombolysis. Although response times are relatively reasonable for a region with logistical challenges, effective access to specialized centers remains limited. The results highlight the importance of investing in training for clinical record-keeping, triage protocols, and expansion of the specialized care network.	556 cases identified; sample analyzed: 299 patients seen in the pre-hospital setting.	Medians: call to ambulance arrival, 18 min (IQR 14–33); transport, 12 min (IQR 6–23.5); total response, 57 min (IQR 45.5–91).	VI
11	Communication and teamwork during telemedicine-enabled stroke care in an ambulance	2022	To understand communication among care teams during telemedicine-enabled stroke consultations in an ambulance.	The study highlights that effective communication and teamwork are critical to the success of stroke care in mobile telemedicine settings. Communication problems and interruptions can compromise patient safety and response time, which are crucial factors in stroke care.	39 professionals (13 nurses, 13 neurologists, and 13 paramedics), 10 standardized patients, and 1 emergency technician; 13 simulations.	Consultation: mean of 12.45 ± 2.72 min, ranging from 6.73 to 16.73 min.	VI
12	Telephone triage and dispatch of ambulances to patients with suspected and	2024	To describe how patients with acute stroke were identified, prioritized, and	Telephone triage showed limited performance in correctly identifying strokes, with many patients assigned a lower priority than appropriate. This indicates	1,298 patients.	Median pre-hospital delay: 43 min 47 s in true positives and 54 min 38 s in false negatives (11 additional min).	VI

	Title	Year	Objectives	Main results	Number of participants or patients	Care time or intervals	Level of evidence
	verified acute stroke - a descriptive study		dispatched through emergency telephone triage, based on data from the emergency medical service in Oslo, Norway.	a need to improve triage systems to ensure a rapid and appropriate response to stroke.			
13	The impact of video consultation on interprofessional collaboration and professional roles: a simulation-based study in prehospital stroke chain of care	2024	To explore how the introduction of video consultations between ambulance nurses and neurologists affects interprofessional collaboration and professional roles in the pre-hospital stroke chain of care.	The results indicated that video consultation had a significant impact on collaboration between teams, fostering better understanding among the different professionals. Participants considered video a valuable complement to verbal information. However, challenges were also identified, such as loss of focus on the patient during the consultation.	10 professionals: 8 ambulance nurses, organized into 4 pairs, and 2 neurologists; 8 simulated scenarios.	Not reported in the article.	VI

Source: Prepared by the authors, 2025.

All selected articles were published in English, mostly from developed countries. Regarding the year of publication, two articles were published between 2021 and 2022, and the others in 2024.

DISCUSSION

The articles addressed different components of pre-hospital care for patients with suspected stroke, notably the recognition of signs and symptoms, triage and priority classification, resource dispatch, communication among professionals, the use of telemedicine, and the definition of the care pathway and hospital destination. Despite methodological and contextual differences, the studies converged in demonstrating that early identification and adequate coordination among the different components of the pre-hospital chain are decisive in reducing delays and promoting timely referral to the reference service.

The study conducted in northern Minas Gerais¹⁰ characterized the pre-hospital care provided to patients with suspected stroke by the Mobile Emergency Care Service (SAMU), revealing important limitations related to the recognition and documentation of clinical signs, the determination of the time of symptom onset, and the definition of the care destination. A total of 299 patients were analyzed, with motor deficits, speech disturbances, and facial asymmetry being the main reasons for requesting care. Notably, however, in 76.3% of cases the time of symptom onset could not be determined or properly recorded. Although 72.9% of patients were classified as highest priority, the Cincinnati Prehospital Stroke Scale was recorded in only 22.1% of cases. The median time between the call and ambulance arrival was 18 minutes, while the total care time was approximately 57 minutes. Furthermore, only 34% of patients were referred to a reference hospital for specialized stroke care. The findings highlighted the need for ongoing team training, greater standardization in case identification, and improved coordination between mobile care and reference services.

From a similar perspective, the study by Jamtli et al.¹² investigated the triage performed by an Emergency Medical Communication Centre (EMCC) for patients with suspected or confirmed stroke, allowing a specific analysis of the relationship between initial recognition, dispatch, and the pre-hospital pathway. A total of 1,298 patients were evaluated, and the stroke criteria used by the communication center showed a sensitivity of 77% and a positive predictive value of 16%. Among the patients later confirmed to have had a stroke, 23% had initially been dispatched under criteria unrelated to stroke. More than two-thirds of these cases were subsequently recognized as suspected strokes by ambulance crews at the scene, highlighting the importance of the clinical assessment performed by the mobile team as a step complementary to the triage carried out by the emergency center. Patients initially misclassified had a longer total pre-hospital time, with a median of 54 minutes and 38 seconds, compared with 43 minutes and 47 seconds among those correctly identified, a statistically significant difference. The study also identified a high number of cases initially classified as suspected stroke that were not subsequently diagnosed as such, demonstrating

the simultaneous occurrence of undertriage and overtriage. The authors therefore emphasized that inadequate initial triage may affect care time and resource use, underscoring the importance of integration between the communication center and the teams responsible for the in-person assessment of the patient.

The two studies that investigated the use of telemedicine^{11,13} added a dimension related to communication and integration among the professionals involved in pre-hospital care. Omran et al.¹³ analyzed, through contextualized simulations, the collaboration between ambulance nurses and neurologists during video consultations in the pre-hospital stroke chain of care. The results indicated that the audiovisual resource was perceived as an important complement to verbal communication, since it enabled the neurologist to observe the patient directly and follow the clinical assessments performed by the mobile team. This mode of communication favored information sharing and the integration of the generalist knowledge of ambulance professionals with the specialized expertise of the neurologist. Challenges were also identified regarding role definition, leadership during the consultation, hierarchical differences, and the need for a common terminology. Another relevant aspect was the potential shift in the focus of care from a patient-centered approach to one more oriented toward the demands of the medical assessment. The authors also highlighted the need to establish clear guidelines for the use of the technology, including the definition of responsibilities, the conduct of the consultation, and the balance between performing additional assessments and the risk of prolonging pre-hospital time.

In addition, Joseph et al.¹¹ investigated communication and teamwork during simulated telemedicine-supported stroke care inside an ambulance. Thirteen simulated consultations were analyzed, in which interactions among paramedics, neurologists, and patients were observed. Verbal communication accounted for 82% of the identified interactions, with the neurologist initiating 48% of verbal interactions. Interruptions were observed in 8% of interactions, and communication-related problems were present in 44% of these interruption episodes. The results showed that the use of video and audio systems changes team dynamics and requires mechanisms capable of supporting both verbal and nonverbal communication. In this regard, the study reinforces that incorporating telemedicine into pre-hospital care depends not only on technological availability but also on the organization of communication, the definition of professional roles, and the ability to share information among those involved in care.

Thus, the four studies showed that pre-hospital care for patients with suspected stroke is a process that depends on coordination among different stages and professionals. The findings of the Brazilian study¹⁰ revealed difficulties related to the recognition of signs, the recording of the time of symptom onset, priority classification, and referral to the reference service. The study by Jamtli et al.¹² deepened the discussion on the role of the communication center, showing that undertriage may be associated with longer pre-hospital times and that the assessment performed by the mobile team can correct some of the limitations of

initial triage. In turn, the telemedicine studies^{11,13} indicated that audiovisual communication can enhance integration between the pre-hospital team and the specialist, favoring shared assessment and decision-making, although it also introduces challenges related to communication, leadership, professional roles, and care time.

Accordingly, the performance of the SAMU Emergency Regulation Center in response to stroke calls is decisive for the effectiveness of the care pathway, given the time-dependent nature of the condition. Swift and accurate decisions directly affect patients' functional prognosis and survival⁵.

The integrated analysis of these findings with the literature reinforces that the time of symptom onset (*ictus*) remains the main critical bottleneck in the pre-hospital phase of stroke. The finding of the northern Minas Gerais study that more than three-quarters of medical records lacked an accurate record of the *ictus* reflects a reality common to many developing countries. This scenario is often aggravated by the general population's lack of knowledge of stroke warning signs and by delays in activating emergency services¹⁴. Studies indicate that continuous community-oriented educational campaigns, combined with systematic training of SAMU call-center operators in the use of standardized tools such as the FAST score (*Face, Arm, Speech, Time*), are proven effective strategies to increase early recognition rates and shorten the interval between the ischemic event and the first medical contact¹⁵.

Moreover, the simultaneous occurrence of undertriage and overtriage identified by Jamtli et al.¹², together with the finding that only a minority of Brazilian patients were taken directly to specialized stroke centers, highlights weaknesses in the design of emergency care networks. When the regulation center fails at initial triage, resulting in referrals to general hospitals lacking stroke units or the capacity to perform thrombolytic therapy and mechanical thrombectomy, the total time to treatment is significantly prolonged due to avoidable secondary transfers¹⁶. To mitigate this disconnect, direct referral protocols (hospital *bypass* to prepared units) based on strict pre-hospital algorithms and hospital pre-notification by the emergency team have been recommended as the gold standard by international guidelines¹⁷.

Finally, the potential and challenges identified in the studies on mobile telehealth relate directly to the need for digital transformation in pre-hospital care. As demonstrated in robust clinical trials, real-time audio and video support between the mobile team and the vascular neurologist not only refines the neurological diagnosis *in loco*, reducing uncertainties inherent to audio-only triage, but also makes it possible to begin assessing eligibility for reperfusion during transport^{18,19}. However, as cautioned by Omran et al.¹³ and Joseph et al.¹¹, the success of this modality requires overcoming behavioral and organizational barriers. Investments in standardizing interprofessional language, clearly defining clinical leadership during video consultations, and simulation training focused on team dynamics are essential to ensure that the use of advanced

technologies does not lead to an inappropriate increase in on-scene time, thus preserving the speed and safety of care for critically ill patients.

The adoption of telemedicine in the pre-hospital setting, as highlighted by the authors^{11,13}, also needs to be accompanied by well-defined institutional protocols. The absence of specific guidelines for the use of telephone communication in critical situations increases the risk of failures in information exchange and loss of focus on direct patient care. It is important to note that technological challenges, such as unstable connectivity in ambulances and insufficient equipment, also hinder the consolidation of an ideal model of pre-hospital care. This reinforces the need for public policies that ensure the minimum infrastructure required to implement the recommendations of the stroke care pathway throughout the country¹³.

The absence of specific guidelines for the initial management of stroke patients by the Emergency Regulation Center reveals an important gap in networked care and in the effectiveness of the stroke care pathway.

Research aimed at understanding and improving the initial care provided through medical regulation is essential, because it is at this stage that the pathways, timeframes, and critical decisions that directly affect patient prognosis and survival are defined. Investigating how to optimize communication among the caller, the regulator, and field teams, as well as establishing standardized, evidence-based protocols, may help reduce delays in the recognition and referral of suspected cases.

Thus, the synthesis of the studies points to the importance of a structured chain of care in which the initial identification of stroke signs is followed by appropriate triage, timely dispatch, qualified clinical assessment by the mobile team, effective communication with specialized professionals, and early definition of the care destination. The results also suggest that communication technologies, especially video telemedicine, can serve as tools for integrating the different points of the chain, provided they are combined with protocols, a clear definition of responsibilities, and mechanisms that prevent unnecessary additions to pre-hospital time. However, part of the available evidence derives from observational, retrospective, or simulation studies, indicating the need for clinical research evaluating the implementation of these strategies in real-world settings and their effects on care times, appropriate destination, specialized treatment, and outcomes of stroke patients.

CONCLUSION

Given the advances in pre-hospital care strategies for patients with suspected stroke, the central role of emergency regulation center physicians as key coordinators in the care pathway becomes evident.

The studies analyzed demonstrate that the work of these professionals, through effective clinical triage, the use of communication technologies (such as video calls), and teamwork with mobile care units, has a direct impact on reducing response times and on the appropriate allocation of resources.

This specialized coordination contributes to more accurate and earlier decision-making, which is essential for effective treatment in cases of ischemic stroke, where time is a critical factor.

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