

## Review Paper

# Adaptive Strategies of the Emergency Medical Services Against Climate Change: A Scoping Review Protocol



Seyed Hossein Hosseini<sup>1</sup> , Nasir Amanat<sup>2,3\*</sup> , Reza Habibisaravi<sup>1,4</sup> , Mojgan Gholitabar Omrani<sup>1</sup> , Sedigheh Khalili Shomia<sup>1</sup> , Fatemeh Pashaei Sabet<sup>5</sup>

1. Department of Paramedicine, Amol School of Paramedical Sciences, Mazandaran University of Medical Sciences, Sari, Iran.
2. Social Determinants of Health Research Center, Semnan University of Medical Sciences, Semnan, Iran.
3. Nursing Care Research Center, Semnan University of Medical Sciences, Semnan, Iran.
4. Pre-hospital Emergency Medical Services and Disaster Management Center at Mazandaran Province, Sari, Iran.
5. Department of Community Health Nursing, School of Nursing and Midwifery, Shahid Beheshti University of Medical Sciences, Tehran, Iran.



**Citation** Hosseini SH, Amanat N, Habibisaravi R, Gholitabar Omrani M, Khalili Shomia S, Pashaei Sabet F. Adaptive Strategies of the Emergency Medical Services Against Climate Change: A Scoping Review Protocol. *Health in Emergencies and Disasters Quarterly*. 2024; 9(4):249-254. <http://dx.doi.org/10.32598/hdq.9.4.258.4>

**doi** <http://dx.doi.org/10.32598/hdq.9.4.258.4>

### Article info:

Received: 23 May 2024

Accepted: 13 Jun 2024

Available Online: 01 Jul 2024

### ABSTRACT

**Background:** Emergency medical services (EMS) play a crucial role as the first line of defense during emergencies and disasters. Given the current impact of climate change, EMS will need to employ innovative strategies to cope with changing conditions. This scoping review investigates how EMS can adapt to climate change in pre-hospital emergencies.

**Materials and Methods:** In this study, peer-reviewed studies and texts on adaptive strategies of pre-hospital emergency systems published in 2023 were reviewed. Accordingly, online databases, including Web of Science, PubMed, Scopus, and Google Scholar as a search engine were searched. The selected keywords were as follows: “Medical technician,” “paramedic,” “ambulance,” “climate change,” “global warming,” “adaptation,” “mitigation,” and “resiliency” (and synonyms).

**Conclusion:** No wide-ranging study has been conducted on the adaptation strategies of EMS against climate change and this is the first study in this field. In this study, elements and adaptation strategies against climate change were investigated. Extracting these cases and using them to improve the readiness and resilience of the pre-hospital emergency system will be effective against this phenomenon.

### Keywords:

Climate change, Adaptation, Emergency medical services (EMS), Strategy

### \* Corresponding Author:

Nasir Amanat, Assistant Professor.

Address: Social Determinants of Health Research Center, Semnan University of Medical Sciences, Semnan, Iran.

E-mail: [nasir23a@hotmail.com](mailto:nasir23a@hotmail.com)



Copyright © 2024 The Author(s).  
This is an open access article distributed under the terms of the Creative Commons Attribution License (CC-BY-NC: <https://creativecommons.org/licenses/by-nc/4.0/legalcode.en>), which permits use, distribution, and reproduction in any medium, provided the original work is properly cited and is not used for commercial purposes.

## Introduction

**P**re-hospital emergency medical services (EMS) are the front line of providing health services in accidents and disasters. It has a fundamental position in reducing the consequences of disaster, and the [World Health Organization \(WHO\)](#) has considered it one of the important pillars of the healthcare system [1].

Climate change is one of the greatest threats to humanity in the 21<sup>st</sup> century [2, 3]. Climate action has been recognized as one of the areas of sustainable development toward fighting climate change and its consequences [4]. Many studies and evidence have shown an increase in a wide range of direct and indirect health-related problems caused by this phenomenon, such as heat stress, illness and death caused by heat, increase in accidents, skin problems, dehydration, exacerbation of heart and lung diseases [5-12]. In addition to the mentioned cases that indirectly increase the workload of EMS, this phenomenon also directly affects EMS, which includes increased health and safety risks, fatigue and mental health disorders, and increased vulnerability of employees and volunteers [9, 13]. Healthcare professionals are required to mitigate the effects of climate change, and EMS, as pathfinders in the medical field, has a central role to play in this community [4]. As a result of the consequences and direct and secondary impacts of climate change on the performance of the EMS, we are forced to plan and adapt to this phenomenon [14, 15]. Adaptive capacity is the process of actively adjusting the climate and its expected effects. Adaptive processes and approaches are utilized to collect accurate information from multiple sources through active learning methods to reduce uncertainty over time and adjust the system according to changes [16]. In risk management, adaptation includes increasing preparedness and improving response, reducing existing vulnerabilities, and emphasizing prevention [9]. Prehospital systems are typically skilled at managing risk. However, the unpredictable and potentially disastrous effects of climate change can present challenges that go beyond traditional risk management strategies [9]. To adapt to these new challenges, organizations must be willing to explore new opportunities and develop innovative strategies. However, this can be difficult due to a lack of knowledge or information about the specific outcomes of climate change, in addition to organizational and resource limitations [9, 17, 18].

Despite the abundance of evidence about the results of climate change and its outcomes on pre-hospital emergency, there is not much study that systematically reports the adaptation strategies of the pre-hospital emergency system. This scoping review study looks for the dimensions and adaptive strategies of the EMS against climate change to increase knowledge in the path of resilience of this system.

## Materials and Methods

For this scoping review, the research will adhere to the preferred reporting items for systematic review and meta-analysis protocols 2020, which has been crafted based on the principles of the preferred reporting items for systematic review and meta-analysis framework [19].

## Inclusion and exclusion criteria

In this review, all studies and documents in English that have a precise methodology, including primary studies (interventional, observational, and qualitative studies), and secondary studies (narrative review, systematic review and meta-analysis), which are about the adaptation strategies of the EMS against climate change were included from the beginning until 2022. The methodologically weak studies, including letters to the editor, reports, and case series, studies that are not related to the research topic, articles whose full text is unavailable or not in English, as well as traffic accidents and chemical, biological, radiological, nuclear and explosive events or disasters unrelated to climate change are excluded.

## Search methods to select the articles

Important databases, including [Web of Science](#), [PubMed](#), [Scopus](#), and particular sites associated with climate change, including the [United Nations Environment Program website](#), [Water Change Convention website](#), and [World Meteorological Organization website](#) will be searched to obtain documents. In addition, [Google Scholar](#) will also be used for additional searches. Once identified, keywords are first selected, followed by the utilization of MeSH to pinpoint appropriate synonyms. In the next step, all the keywords and their synonyms will be investigated in the mentioned databases with title, abstract, and keyword from the beginning to the end of 2023. Keywords and their synonyms are as follows:

Medical technician\*, paramedic\*, emergency paramedic\*, "emergency medicine technician\*", "emergency medical technician\*", "emergency prehospital provider\*", prehospital\*, "prehospital emergency care\*",

ambulance\*, "emergency mobile unit\*", "emergency medical dispatch", "medical dispatch", "911 dispatch"

"climate change \*", "global warming \*" adapt\*, adopt\*, mitigat\*, cop\*, resilien\*, accomodat\*, adjust\*, acclimat\*, compatibl\*, "risk reduction", cease\*, tackle\*, address\*, fight\*, strateg\*, implementation\*, action\*, effort\*, attempt\*, policy\*, framework\*, plan\*, approach\*, response\*, model\*

The syntax of the search in databases is described below.

### PubMed syntax

("Medical technician \*[tiab] OR paramedic \*[tiab] OR "emergency paramedic \*[tiab] OR "emergency medicine technician \*[ tiab] OR "emergency medical technician \*[tiab] OR "emergency prehospital provider \*[tiab] OR prehospital \*[tiab] OR "prehospital emergency care \*[tiab] OR ambulance \*[tiab] OR "emergency mobile unit \*[tiab] OR ambulance \*[tiab] OR "emergency medical dispatch"[tiab] OR "medical dispatch"[tiab] OR "911 dispatch"[tiab] OR "9-1-1 dispatch"[tiab]) AND ("climate change \*[tiab] OR "global warming \*[tiab]) AND (adapt\*[tiab] OR adopt\*[tiab] OR mitigat\*[tiab] OR cop\*[tiab] OR resilien\*[tiab] OR accomodat\*[tiab] OR adjust\*[tiab] OR acclimat\*[tiab] OR compatibl\*[tiab] OR "risk reduction"[tiab] OR cease\*[tiab] OR tackle\*[tiab] OR address\*[tiab] OR fight\*[tiab] OR strateg\*[tiab] OR implementation\*[tiab] OR action\*[tiab] OR effort\*[tiab] OR attempt\*[tiab] OR policy\*[tiab] OR framework\*[tiab] OR plan\*[tiab] OR approach\*[tiab] OR response\*[tiab] OR model\*[tiab])

### Scupos syntax

(TITLE-ABS-KEY [medical technician\*] OR TITLE-ABS-KEY [paramedic\*] OR TITLE-ABS-KEY [emergency paramedic\*] OR TITLE-ABS-KEY [emergency medicine technician\*] OR TITLE-ABS-KEY [emergency medical technician\*] OR TITLE-ABS-KEY [emergency prehospital provider\*] OR TITLE-ABS-KEY [prehospital\*] OR TITLE-ABS-KEY [prehospital emergency care\*] OR TITLE-ABS-KEY [ambulance\*] OR TITLE-ABS-KEY [emergency mobile unit\*] OR TITLE-ABS-KEY [ambulance\*] OR TITLE-ABS-KEY [emergency medical dispatch\*] OR TITLE-ABS-KEY [medical dispatch\*] OR TITLE-ABS-KEY [911 dispatch\*] OR TITLE-ABS-KEY [9-1-1 dispatch\*]) AND (TITLE-ABS-KEY [climate change\*] OR TITLE-ABS-KEY [global warming\*]) AND (TITLE-ABS-KEY [adapt\*] OR TITLE-ABS-KEY [adopt\*]OR TITLE-

ABS-KEY [mitigat\*] OR TITLE-ABS-KEY [Cop\*] OR TITLE-ABS-KEY [resilien\*] OR TITLE-ABS-KEY [accomodat\*] OR TITLE-ABS-KEY [adjust\*] OR TITLE-ABS-KEY [acclimat\*] OR TITLE-ABS-KEY [compatibl\*] OR TITLE-ABS-KEY [risk reduction\*] OR TITLE-ABS-KEY [cease\*] OR TITLE-ABS-KEY [tackle\*] OR TITLE-ABS-KEY [address\*] OR TITLE-ABS-KEY [fight\*] OR TITLE-ABS-KEY [strategy\*] OR TITLE-ABS-KEY [implementation\*] OR TITLE-ABS-KEY [action\*] OR TITLE-ABS-KEY [effort\*] OR TITLE-ABS-KEY [attempt\*] OR TITLE-ABS-KEY [policy\*] OR TITLE-ABS-KEY [framework\*] OR TITLE-ABS-KEY [plan\*] OR TITLE-ABS-KEY [approach\*] OR TITLE-ABS-KEY [response\*] OR TITLE-ABS-KEY [model\*])

### Web of science

(TS=[medical technician\*] OR TS=[paramedic\*]OR TS=[emergency paramedic\*] OR TS=[emergency medicine technician\*] OR TS=[emergency medical technician\*] OR TS=[emergency prehospital provider\*] OR TS=[prehospital\*] OR TS=[prehospital emergency care\*] OR TS=[ambulance\*] OR TS=[emergency mobile unit\*] OR TS=[ambulance\*] OR TS=[emergency medical dispatch\*] OR TS=[medical dispatch\*] OR TS=[911 dispatch\*] OR TS=[9-1-1 dispatch\*]) AND (TS=[climate change\*] OR TS=[global warming\*]) AND (TS=[adapt\*] OR TS=[adopt\*] OR TS=[mitigat\*] OR TS=[cop\*] OR TS=[resilien\*] OR TS=[accomodat\*]OR TS=[adjust\*] OR TS=[acclimat\*]OR TS=[address\*] OR TS=[fight\*] OR TS=[strateg\*]OR TS=(implementation\*) OR TS=(action\*) OR TS=[effort\*] OR TS=[attempt\*] OR TS=[policy\*] OR TS=[framework\*] OR TS=[plan\*] OR TS=[approach\*]OR TS=(response\*) OR TS=[model\*])

### Methods for study selection

After completing the database search, all duplicate articles were removed. Subsequently, an evaluation of titles and abstracts was undertaken to identify pertinent research. After this stage, two proficient researchers within the specified domain individually scrutinized the full texts of the studies. Any discrepancies were mitigated through group consultation and consensus. If necessary, a third party was engaged in the resolution process. To uncover further relevant studies, references from the identified research will be cross-referenced utilizing the snowball technique. Important publications within the field of study over the past 15 years will be manually inspected. In addition to these approaches, reference materials, and legal documents will also be examined for relevant content.

## Methods for data extraction

After the search phase, data extraction and collection from the full text of the studies were done by the researchers. Each person individually extracts databases on two pre-designed forms. The first form includes the following variables: Country, type of study, name of the first author, publication date, purpose of the study, and study methodology, and the second form includes the elements, strategies, and measures used by the EMS in dealing with climate change.

## Risk of bias

Given the various methodologies employed in the studies, a specific tool for evaluating methodological quality cannot be implemented at this juncture. Therefore, the assessment of study quality was carried out using the tool outlined in the strengthening of the reporting of observational studies in epidemiology guidelines, tailored to the specific study type. Each study underwent an evaluation by two independent researchers using the appropriate assessment instruments. In cases of disagreement between the two researchers, consensus will be reached through the consensus method; if needed, a third researcher was consulted for input on the study's quality.

## Discussion

Climate change is inevitable in the world [9, 20, 21]. Various studies have mentioned health problems caused by climate change and its consequences [22-24]. EMS, as one of the important components of the health system, is directly and indirectly affected by this phenomenon [14, 25]. Therefore, this system is forced to take appropriate measures and take measures to adapt and reduce the effects [9]. To the best of our knowledge, there has not been a comprehensive study on the strategies and solutions of the pre-hospital emergency system against climate change. This study searched for EMS adaptation elements and strategies against climate change.

## Ethical Considerations

### Compliance with ethical guidelines

There were no ethical considerations to be considered in this research.

### Funding

This research did not receive any grant from funding agencies in the public, commercial, or non-profit sectors.

## Authors' contributions

All authors equally contributed to preparing this article.

## Conflict of interest

The authors declared no conflict of interest.

## References

- [1] Ciottone GR. Introduction to disaster medicine. In: Ciottone G, editor. *Ciottone's disaster medicine*. Amsterdam: Elsevier; 2024. [DOI:10.1016/B978-0-323-80932-0.00001-X]
- [2] Curtis S, Fair A, Wistow J, Val DV, Oven K. Impact of extreme weather events and climate change for health and social care systems. *Environmental Health*. 2017; 16(Suppl 1):128. [DOI:10.1186/s12940-017-0324-3] [PMID]
- [3] Lim V, Stubbs JW, Nahar N, Amarasena N, Chaudry ZU, Weng SCK, et al. Politicians must heed health effects of climate change. *Lancet (London, England)*. 2009; 374(9694):973-. [DOI:10.1016/S0140-6736(09)61641-X]
- [4] Mashallahi A, Ardalan A, Nejati A, Ostadtaghizadeh A. Climate adaptive hospital: A systematic review of determinants and actions. *Journal of Environmental Health Science and Engineering*. 2022; 20(2):983-1013. [DOI:10.1007/s40201-022-00810-5] [PMID]
- [5] Manangan AP, Uejio CK, Saha S, Schramm PJ, Marinucci GD, Hess JJ, et al. Assessing health vulnerability to climate change: A guide for health departments. Georgia: Centers for Disease Control and Prevention; 1914. [Link]
- [6] Clayton S. Climate anxiety: Psychological responses to climate change. *Journal of Anxiety Disorders*. 2020; 74:102263. [DOI:10.1016/j.janxdis.2020.102263] [PMID]
- [7] Romanello M, Di Napoli C, Drummond P, Green C, Kennard H, Lampard P, et al. The 2022 report of the Lancet Countdown on health and climate change: health at the mercy of fossil fuels. *The Lancet*. 2022; 400(10363):1619-54. [DOI:10.1016/S0140-6736(22)01540-9] [PMID]
- [8] Abbas A, Ekowati D, Suhariadi F, Fenitra RM. Health implications, leaders societies, and climate change: A global review. In: Chatterjee U, Akanwa AO, Kumar S, Singh SK, Dutta Roy A, editors. *Ecological footprints of climate change*. Cham: Springer; 2022. [DOI:10.1007/978-3-031-15501-7\_26]
- [9] Rickards L, Keating A. Implications of climate change for emergency services operations-insights from the literature. Australia: Bushfire and Natural Hazards CRC; 2021. [Link]
- [10] Xiang J, Bi P, Pisaniello D, Hansen A, Sullivan T. Association between high temperature and work-related injuries in Adelaide, South Australia, 2001-2010. *Occup Environ Med*. 2014; 71(4):246-52. [DOI:10.1136/oemed-2013-101584] [PMID]

- [11] Manser CN, Paul M, Rogler G, Held L, Frei T. Heat waves, incidence of infectious gastroenteritis, and relapse rates of inflammatory bowel disease: A retrospective controlled observational study. *American Journal of Gastroenterology*. 2013; 108(9):1480-5. [DOI:10.1038/ajg.2013.186]
- [12] Silverberg JJ, Hanifin J, Simpson EL. Climatic factors are associated with childhood eczema prevalence in the United States. *Journal of Investigative Dermatology*. 2013; 133(7):1752-9. [DOI:10.1038/jid.2013.19] [PMID]
- [13] Thornton R. Prescribed burning in Australasia, the science, practice and politics of burning the bush. Melbourne: Australasian Fire and Emergency Service Authorities Council; 2011. [Link]
- [14] Hess JJ, Heilpern KL, Davis TE, Frumkin H. Climate change and emergency medicine: Impacts and opportunities. *Academic Emergency Medicine*. 2009; 16(8):782-94. [DOI:10.1111/j.1553-2712.2009.00469.x] [PMID]
- [15] Pan C, Chang Y, Wen J, Tsai M. EMS adaptation for climate change. Washington: American Geophysical Union, Fall Meeting 2010, abstract id. NH51B-1232; 2010. [Link]
- [16] World Health Organization. Operational framework for building climate resilient health systems. Geneva: World Health Organization; 2015. [Link]
- [17] Eisenack K, Moser SC, Hoffmann E, Klein RJ, Oberlack C, Pechan A, et al. Explaining and overcoming barriers to climate change adaptation. *Nature Climate Change*. 2014; 4(10):867-72. [DOI:10.1038/nclimate2350]
- [18] Bosomworth K, Owen C, Curnin S. Addressing challenges for future strategic-level emergency management: Reframing, networking, and capacity-building. *Disasters*. 2017; 41(2):306-23. [DOI:10.1111/disa.12196] [PMID]
- [19] 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. *International Journal of Surgery*. 2021; 88:105906. [DOI:10.1016/j.ijssu.2021.105906] [PMID]
- [20] Meehl GA, Zwiers F, Evans J, Knutson T, Mearns L, Whetton P. Trends in extreme weather and climate events: issues related to modeling extremes in projections of future climate change. *Bulletin of the American Meteorological Society*. 2000; 81(3):427-36. [DOI:10.1175/1520-0477(2000)081<0427:TI EWAC>2.3.CO;2]
- [21] Melillo JM, Richmond T, Yohe G. Climate change impacts in the United States. Third National Climate Assessment. U.S. Global change research program. Washington, DC: Government Printing Office; 2014. [DOI:10.7930/J0Z31WJ2]
- [22] Romanello M, McGushin A, Di Napoli C, Drummond P, Hughes N, Jamart L, et al. The 2021 report of the Lancet Countdown on health and climate change: Code red for a healthy future. *The Lancet*. 2021; 398(10311):1619-62. [DOI:10.1016/S0140-6736(21)01787-6] [PMID]
- [23] Chen F, Zhang X, Chen Z. Behind climate change: Extreme heat and health cost. *Structural Change and Economic Dynamics*. 2023; 64:101-10. [DOI:10.1016/j.strueco.2022.12.007]
- [24] Khraishah H, Alahmad B, Ostergard RL Jr, AlAshqar A, Albaghdadi M, Vellanki N, et al. Climate change and cardiovascular disease: Implications for global health. *Nature Reviews Cardiology*. 2022; 19(12):798-812. [DOI:10.1038/s41569-022-00720-x] [PMID]
- [25] Pan CL, Chiu CW, Wen JC. Adaptation and promotion of emergency medical service transportation for climate change. *Medicine*. 2014; 93(27):e186. [DOI:10.1097/MD.0000000000000186] [PMID]

This Page Intentionally Left Blank