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PROTOCOL STUDY

Factors Contributing to the Development of Air Ambulance Base: A Protocol for Systematic Review

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ABSTRACT

Introduction: Determining the proper locations of air ambulance bases is of great importance as it is the optimal solution for providing health services with maximum population coverage in minimum time, distance, and with reduced infrastructure costs. Hence, a systematic literature review is necessary to identify the factors affecting the air ambulance base development.

Methods and Analysis: |This study provides a protocol for identifying the factors affecting the development of air relief bases by browsing six international databases (Web of Science, PubMed, ProQuest, Scopus, ScienceDirect, and Google Scholar), that comprises two steps: (a) selection and categorization of articles based on the PRISMA guidelines for systematic review studies; and a(b) thematical analysis of the study results and extraction of categories and sub-categories.

KEYWORDS:
air ambulance; development; systematic review; bases

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ETHICS APPROVAL

The study was approved by the Ethics Committee of Shahid Beheshti University of Medical Sciences (IR.SBMU.PHNS.REC.1398.075).

INTRODUCTION

Air ambulance, a component of the emergency medical system,[1] is the fastest and the most efficient instrument in transporting the injured

and patients in emergency events, natural disasters, and road traffic injuries. It can overcome geographical obstacles such as mountains, high traffic, and long roads and lifts patients from inaccessible areas.[2,3]

Many experts believed that the first 60 min after an incident is the golden hour, as this hour decides the patient or injurer's survival.[4,5]

Reduced transportation time and providing more appropriate medical services at a minimum time after the event or disaster are vital requirements.[6] The air ambulance plays a critical role in these circumstances.[7]

The emergency medical system seeks to achieve rapid and high-quality responses by minimizing time and cost with maximum population coverage demands.[8] The proper location of air ambulance bases is pivotal.[9] The optimal development of air an ambulance base reduces response time and increases coverage.[10,11]

Proper location of emergency medical services is the optimal solution for providing health services because it maximizes the coverage, reduces the time, distance, and infrastructure expenditure.[12]

One of the most critical tools for achieving these goals is to locate air ambulance bases and allocate proper facilities.[8] However, the main challenge is to develop air ambulance bases optimally. This protocol aims to systematically identify the factors affecting the development of air ambulance bases.

METHODS AND ANALYSIS

INCLUSION CRITERIA

All English-language articles related to the functional factors on the development of air ambulance bases published in various formats from 1990 until January 2020 was browsed. The searched articles included original quantitative research (case report, case series, cross-sectional, etc.); qualitative research (content analysis, phenomenology analysis, graded theory, etc.); and review studies (narrative, comprehensive, or systematic) in the six electronic databases: Web of Science, PubMed, ProQuest, Scopus, ScienceDirect, and Google Scholar, and reports published by the World Health Organization and National Report on the development of air ambulance.

EXCLUSION CRITERIA

The exclusion criteria included: All articles without access to the full-text, those published in languages other than English, letters to the editor, conferences abstract, and studies focusing solely on the issue of the air ambulance without referring to the factors affecting the optimal development of air ambulances.

INFORMATION SOURCES

The search was conducted, following consultations with medical and health experts. The syntax writing for all the six databases used the AND/OR Boolean operators and is recorded in Appendix 1. To increase the probability of identification, all relevant literature keywords: air ambulance, bases, development of previous studies relating to the development air ambulance were used, based on the agreement of three researchers (ZGH, ZE, and SS). The included studies needed to contain the search words in either their titles, abstracts, or keywords..

SEARCH STRATEGY

Our initial search syntax for five databases (ProQuest, PubMed, Scopus, ScienceDirect, and Web of Science) is described in Table 1.

STUDY RECORDS

SELECTION PROCESS

Initial screening of the studies was conducted by two independent investigators (ZGH and ZE), based on the information present in the article title and abstracts. The articles were re-evaluated by the third investigator (SS) when there was a disagreement between the initial investigators. The decision of the third investigator (SS) was final.

DATA MANAGEMENT

The reviewed studies were transferred to the EndNote software version 7, and duplications were removed. The initial investigators then independently screened the included study articles by reviewing their titles and abstracts and sorted them into three groups: relevant, irrelevant, and unsure. Irrelevant articles were excluded. Later each reviewer screened the full text of the remaining articles based on the inclusion and exclusion criteria and disagreements and discrepancies for selecting final articles were among the research team. The approved studies were evaluated using the critical appraisal quality assessment tool.

DATA ITEMS

Data were extracted and recorded in the data extraction sheet prepared for two domains: (1) descriptive and (2) thematic content analysis. The former was related to the general specifications of the article (ID/first author, year of publication, country/method/scope of study/year of study) and the latter consisted of the analysis of the factors influencing the development of air ambulance bases. The research team performed the final article's evaluation.

RISK OF BIAS IN INDIVIDUAL STUDIES

Quality of all the selected articles were assessed, using critical appraisal tools like critical appraisal skill program (CASP), New Castle Ottawa scale (NOS), and strengthening the reporting of observational studies in epidemiology. (STROBE). The NOS contains eight options rating as 0 or 1. CASP checklist comprised three sections and a total of 10 questions, with the answers: 'No, Cannot tell, and Yes'. The STROBE checklist

Table 1 Syntax steps to identify factors contributing to the development of air ambulance bases for different electronic databases.

Row	Data base	Syntax
1	ProQuest	(ALL (“Health Planning”) OR ALL (Development)) AND (ALL (Base) OR ALL(Bases)) AND (ALL (“Air Ambulance”) OR ALL (“Emergency Helicopters”) OR ALL(“Emergency Helicopter”) OR ALL (“Helicopter Ambulances”) OR ALL (“Helicopter Ambulance”) OR ALL (Helicopter) OR ALL (“Aircraft”) OR ALL (HEMS) OR ALL (Hems) OR ALL (“Locating helicopter”) OR ALL ("Helicopter Transport") OR ALL ("Helicopter Utilization") OR ALL OR ALL (“Air Ambulance base”) OR ALL ("Air medical") OR ALL ("Air Emergency medical") OR ALL ("Helicopter Ambulance Stations") OR ALL ("Multi-period facility location problem") OR ALL ("Aero medical") OR ALL (“air Ambulance base locations”) OR ALL (“Air medevac”) OR ("Location-coverage models") OR ALL (“Air Medevac”) OR ALL (“Location model for air ambulance” and Helicopter) OR ALL (“Air Ambulance location problem”) OR ALL (“Helicopter Emergency Medical Service”)) AND YR(2000101-20200101)
2	PubMed	((“Health Planning”) OR (Development)) AND ((Base) OR (Bases)) AND ((“Air Ambulance”) OR (Ambulance AND Air) OR (“Emergency Helicopters”) OR (“Emergency Helicopter”) OR (Helicopter AND Emergency) OR (Helicopters AND Emergency) OR (“Helicopter Ambulances”) OR (Ambulance AND Helicopter) OR (Ambulances AND Helicopter) OR (“Helicopter Ambulance) OR (Helicopter) OR (Aircraft) OR (HEMS) OR (Hems) OR (“Locating helicopter”) OR("Helicopter Transport") OR ("Helicopter Utilization") OR (“Air Ambulance base”) OR ("Air medical") OR ("Air Emergency medical")OR ("Helicopter Ambulance Stations") OR ("Multi-period facility location problem") OR ("Aero medical") OR ("Location-coverage models") OR (“air Ambulance base locations”) OR(“Helicopter Emergency Medical Service”) OR (“Air medevac”) OR (“Location – Allocation model for air ambulance” and Helicopter) (“Air Ambulance location problem”)) AND (2000/01/01:2020/01/02[dp]))
3	Scopus	(ALL (“Health Planning”) OR ALL (Development)) AND (ALL (Base) OR ALL(Bases)) AND (ALL (“Air Ambulance”) OR ALL (“Emergency Helicopters”) OR ALL(“Emergency Helicopter”) OR ALL(Helicopter AND Emergency) OR ALL (Helicopters AND Emergency) OR ALL (“Helicopter Ambulances”) OR ALL (Ambulance AND Helicopter) OR ALL (Ambulances AND Helicopter) OR ALL (“Helicopter Ambulance”) OR ALL (Helicopter) OR ALL (“Aircraft”) OR ALL (HEMS) OR ALL (Hems) OR ALL (“Locating helicopter”) OR ALL ("Helicopter Transport") OR ALL ("Helicopter Utilization") OR ALL OR ALL (“Air Ambulance base”) OR ALL ("Air medical") OR ALL ("Air Emergency medical") OR ALL ("Helicopter Ambulance Stations") OR ALL ("Multi-period facility location problem") OR ALL ("Aero medical") OR ALL (“air Ambulance base locations”) OR ALL (“Air medevac”) OR ("Location-coverage models") OR ALL (“Air Medevac”) OR ALL (“Location model for air ambulance” and Helicopter) OR ALL (“Air Ambulance location problem”) OR ALL (“Helicopter Emergency Medical Service”)) AND (PUBYEAR < 2020 PUBYEAR > 1990)
4	Science Direct	((“Health Planning”) OR (Development)) AND ((Base) OR (Bases)) AND ((“Air Ambulance”) OR (Ambulance AND Air) OR (“Emergency Helicopters”) OR (“Emergency Helicopter”) OR (Helicopter AND Emergency) OR (Helicopters AND Emergency) OR (“Helicopter Ambulances”) OR (Ambulance AND Helicopter) OR (Ambulances AND Helicopter) OR (“Helicopter Ambulance) OR (Helicopter) OR (Aircraft) OR (HEMS) OR (Hems) OR (“Locating helicopter”) OR("Helicopter Transport") OR ("Helicopter Utilization") OR (“Air Ambulance base”) OR ("Air medical") OR ("Air Emergency medical")OR ("Helicopter Ambulance Stations") OR ("Multi-period facility location problem") OR ("Aero medical") OR ("Location-coverage models") OR (“air Ambulance base locations”) OR(“Helicopter Emergency Medical Service”) OR (“Air medevac”) OR (“Location – Allocation model for air ambulance” and Helicopter) (“Air Ambulance location problem”)) AND PY = (2000-2020))
5	Web of science	(TS = (“Health Planning”) OR TS = (Development)) AND (TS = (Base) OR TS = (Bases)) AND (TS = (“Air Ambulance”) OR TS = (Ambulance AND Air) OR TS = (“Emergency Helicopters”) OR TS = (“Emergency Helicopter”) OR TS = (Helicopter AND Emergency) OR TS = (Helicopters AND Emergency) OR TS = (“Helicopter Ambulances”) OR TS = (Ambulance AND Helicopter) OR TS = (Ambulances AND Helicopter) OR TS = (“Helicopter Ambulance”) OR TS = (Helicopter) OR TS = (Aircraft) OR TS = (HEMS) OR TS = (Hems) OR TS = (“Locating helicopter”) OR TS = ("Helicopter Transport") OR TS = ("Helicopter Utilization") OR TS = (“Air Ambulance base”) OR TS = ("Air medical") OR TS = ("Air Emergency medical")OR TS = ("Helicopter Ambulance Stations") OR TS = ("Multi-period facility location problem") OR TS = ("Aero medical") ORTS = ("Location-coverage models") OR TS = (“air Ambulance base locations”) OR TS = (“Helicopter Emergency Medical Service”) OR TS = (“Air medevac”) OR TS = (“Location – Allocation model for air ambulance” and Helicopter) OR TS = (“Air Ambulance location problem”))

consists of 22 questions that cover all aspects of the study. The chosen studies were scored between 0 and 44.

STRENGTHS AND LIMITATIONS

1. The study was the first of its type in Iran.
2. The syntax used in this study only considered the three dimensions of the air ambulance, development, and bases.
3. The study only reviewed articles of the last three decades.
4. This protocol reduced the possibility of duplication and gave transparency to the methods and processes that can be used to develop an air ambulance.
5. The articles of countries that privately operated air ambulances were difficult to access.

CONCLUSION

This systematic review provides evidence that support the determination of the factors affecting the development of effective and efficient air ambulance bases services. Researchers expect the review results to be for a future national proposal for the development of air ambulance bases. In summary, the present review is a strong evidence for the factors influencing the location selection of the air ambulance bases.

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