

Developing a conceptual model for studying various points of delays and underlying factors in the emergency healthcare system

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Abstract

To review various literature related to emergency healthcare-related delays and synthesize a conceptual framework for future research. Critical Interpretative Synthesis is employed to analyze and develop themes from selected articles. A total of 25 articles were selected for analysis after the careful selection process. Diseases including acute heart disease, stroke, pneumonia, infections, and gastrointestinal disorders were included. During analysis, three major phases of delays emerged: pre-hospital delay, in-hospital delay, and ambulance off-load delay. Various factors, including socioeconomic factors, health system factors, organizational level factors, etc., are related to delays in emergency care settings. The model evolved from this literature analysis is similar

to the 3 delays model. This review identified three significant delay segments related to emergency health care management.

Introduction

Globally the quality of emergency healthcare has substantially improved in the recent past.^{1,2} Past literature discussed the critical importance of time management in improving the quality of the emergency healthcare system.²⁻⁶ Previous studies mentioned that precise perception of illness by the victim or accompanying person and early treatment-seeking is significant.^{1,7,8} Delayed presentation during an emergency health event is a challenging issue in healthcare, leading to mortality, disability, or other chronic complications.^{4,5,7,9-11} Past studies indicated that individual, socio-cultural, and health system-related factors could delay the presentation of patients in emergency healthcare settings.^{4,5,12-18}

In the past, various studies focusing on the health-seeking behavior of victims or their family members were done.^{8,9,12,18-20} These studies are aimed to analyze the delay in health-seeking and various factors that influence the health-seeking behavior of the victims during an acute health event.^{4,5,12-18} However, most studies do not utilize any specific framework or model for studying the delay and exposing the underlying factors that lead to the delay.^{8,9,12,19-21} The main focus of these researches is understanding the reasons for the delay and at which point precisely the delay has occurred.^{6,9,10,12,16,19-22} Utilizing a conceptual model is helpful to visualize the information with clarity and identify issues of uncertainties and underlying factors, says an article published in the World Health Organization Bulletin.² One of the comprehensive models to study the delay and related attributes of emergency health care is the 3 delays model by Thaddeus and Maine.² The 3 delays model is widely used in the field of maternal and child health.

Outlined by Thaddeus and Maine in 1994, the 3 delays model is versatile for identifying various stages of delays in maternal emergency care.² The 3 delays model deciphers 3 stages of possible delay during an emergency treatment-seeking situation (Figure 1).² The first one is due to the socio-economic factors that could result in delayed decision making while seeking health care; next is the accessibility of health care facilities, which can result in delayed decision making and finding and reaching a healthcare facility. In the third phase, the delay can happen from the care center related to the quality of care provided.²

We plan to conduct survey-based research in India to understand the reasons for the delay in treatment-seeking during vascular emergencies. This review aims to study various models and information related to treatment-seeking delays and construct an updated model to apply indifferent emergency disease settings. The 3 delays model is one of the comprehensive and widely used models in maternal emergencies; hence, we utilized it as a basic model in developing codes during analysis and compared the synthesized model to understand it better.² One previous article says that the

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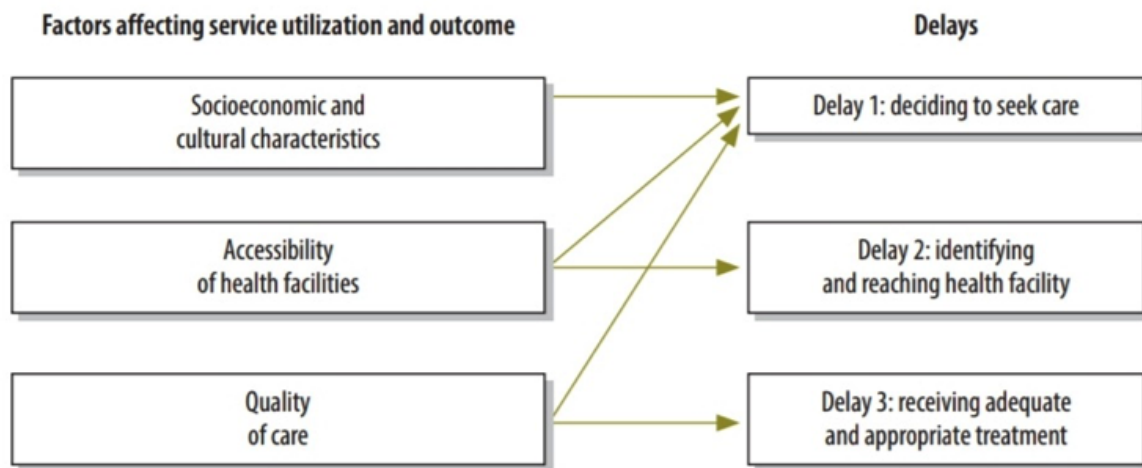


Figure 1. The 3 Delays Model.²

points of delays and various barriers in emergency treatment mentioned in the 3 delays model can be generalized to other health emergencies.² However, our challenge was the underutilization of the 3 delays model in non-maternal emergencies and the scarcity of other similar models.

Materials and Methods

Literature search and selection were made using the PRISMA reporting protocol. The study aims to review various literature related to emergency healthcare delays and develop a conceptual framework for future research.

Thematic synthesis approach was employed for a systematic qualitative review of various literature related to the study objective. Dixon Wood's Critical Interpretative Synthesis (CIS) was utilized as a framework in the whole process of review and model building. CIS is a relatively new approach that allows qualitative and quantitative-based papers in a review frame.²³ CIS mainly focuses on the comprehensive information and ideas shared by an article instead of assessing the methodology or data involved.^{23,24}

Literature search strategy

A literature search was done using the databases Google Scholar, Pub Med Central, and SCOPUS- between July 2020 and August 2020. Predefined keywords were used to harness literature (emergency + health-seeking, delays + emergency healthcare, healthcare delays, critical care + delays). Primary data included studies and scoping reviews were considered for analysis. Peer-reviewed journals from all the geographical regions published in English were included. CIS follows a convenient sampling with flexible inclusion criteria of papers (Figure 2).^{23,24}

Inclusion and exclusion criteria

Inclusion: Original research articles and scoping reviews are used for analysis and theme building. Research related to delay in healthcare seeking during emergencies or health-seeking behavior during emergency health conditions was included. Articles assess

Table 1. Five point assessment template

- 1 Are the aims and objectives of the research clearly stated?
- 2 Is the research design clearly specified and appropriate for the aims and objectives of the research?
- 3 Do the researchers provide a clear account of the process by which their findings were produced?
- 4 Do the researchers display enough data to support their interpretation and findings?
- 5 Is the method of analysis appropriate and adequately explicated?

various stages of delay during emergency health events, and the underlying socioeconomic issues were included for analysis.

Exclusion: Conference proceedings, case reports, abstract only, non-peer-reviewed literature, and full-text non-accessible papers were excluded. Literature published before peer review/without peer review and literature without a defined research framework and analysis were also excluded. Literatures published before 2015 was excluded for making a research model from recently published authentic literature.

Quality maintenance

Two researchers were involved in the selection of journals. After initial inclusion and exclusion criteria, journals were assessed by abstract screening, followed by full-text screening. This process excluded 43 journals and included 25 papers for review (Figure 2).

For quality maintenance, initially, we employed 5 point assessment template (Table 1) suggested by National Health Services (NHS) National Electronic Library for Health for the evaluation of qualitative research.²⁵

However, a final decision on literature selection was taken by both the 5 point quality appraisal tool and the paper's relevance and content. Fatally flawed articles were excluded using the 5 point questionnaire tool, and thorough reading and comprehension of papers were done to determine the relevance and clarity of each paper.²³⁻²⁵

Data analysis and model building

Data analysis started with repeated reading of papers by two researchers, followed by inductive coding. The initial pool of codes was developed from the 3 delays model, including pre-hospital delay, in-hospital delay, socioeconomic factors, cultural factors, accessibility of healthcare, and quality of care.²⁶ Two researchers independently read each paper line by line, and new codes have emerged during the analysis process. Later these codes developed by two researchers were compared to iron out disparities. This was followed by creating themes and concepts by comparing and mapping the codes across different articles.

Results

A total of 25 papers were selected to analyze and develop themes. Overall cross citations of the documents were comparatively low, probably due to the broad aspect of the subject. Articles were related to delays and health-seeking behavior during emergency medical situations, including acute coronary artery syndrome, stroke, gastrointestinal diseases, infections, maternal emergencies, and ambulance-related delays (Table 2). There are three main themes developed through qualitative synthesis. Different themes and sub-themes associated with each paper is shown below (Table 2)

Various themes and sub-themes that evolved during the delay are discussed below.

Pre-hospital delay: Delay from the onset of symptoms until the patient arrives at a healthcare facility is considered the pre-hospital phase of the delay.²⁷ Various factors are associated with the delay during the pre-hospital phase and are discussed below in the subsections. The pre-hospital delay is divided into two major segments: time until victim/family members contact the healthcare facility and delay during transport to the healthcare facility.^{10,26,27}

Delay until the patient seeks healthcare: Delay between the onset of symptoms and contacting healthcare is included in this segment. This is when the patient or the accompanying person recognizes the symptoms, followed by decision making. Various factors can influence the patient and accompanying individuals in prompt recognition of symptoms and decision making to seek health care.^{4,5,12-18} Studies mentioned that the victims or family members do not contact the healthcare provider in some situations, but they decide to reach the nearby emergency healthcare facility without prior notification.²² In this scenario, this segment is defined as the timeline between the onset of symptoms till they begin transporting the victim.

In this review, various factors that can influence the victim and family members while symptom recognition and decision making are identified. They are: i) Socio-demographic factors: Including, age, gender, education, occupation, income, type of family;^{6,11,12} ii) Behavioral factors and clinical history: Medical history, awareness about clinical symptoms, the severity of symptoms, awareness about medical facilities, trust on the healthcare provider, self-treatment, availability of contact information of healthcare facility/expert;^{6,11,12,26} iii) Health system related: They are mainly due to unavailability of specialized care, unattended/prolonged phone calls/delay in response, lack of proper information, health insurance, cost of care.^{2,6}

The delay between contacting a health facility and arrival at a health care facility: Delay during transport is due to various reasons. It includes delays due to the location of the patient (including distance and hurdles in transportation, including traffic or poor

infrastructure) and consultations in between transport (including family practitioners/alternate medicine practitioners/centers not equipped to take care of emergencies),^{2,6,13-15} Sometimes the delay can occur due to unawareness regarding available and accessible health facilities to manage the emergency.^{2,9,12,16,27}

In-hospital delay: According to past studies, door to needle time is vital in stroke or acute cardiac care, and early treatment is essential in various other health emergencies.^{7,9,19,20} Time management is crucial in critical care to plan and implement multiple activities together.^{12,28} It needs coordination between different faculties, including physicians, nurses, pharmacy, laboratory, imaging facilities, etc. Delays are usually due to poor coordination, waits at the imaging center, sample processing and reporting at the laboratory, pharmacy-related delays, in-hospital transfer delays, organizational issues, etc.^{8,21} Patient-related problems are not uncommon at this point, including delays in decision-making and financial matters are the main reasons.⁴⁻⁶

Ambulance off-loads delay: Some journals studied the delay between the arrival of an ambulance/patient's vehicle at the emergency department or hospital premises till they are attended to by paramedics or physicians of the health care facility.²⁹ Related factors that can result in a delay are lack of proper communication, unavailability of the hospital bed, overcrowding of the emergency department.^{10,12,29} Ambulance/vehicle layover delay is less studied than the other two delay segments, but studies revealed possible.²⁹ This segment emerged as a separate segment in our review and positioned between the pre-hospital and in-hospital delays based on the timeline of events.

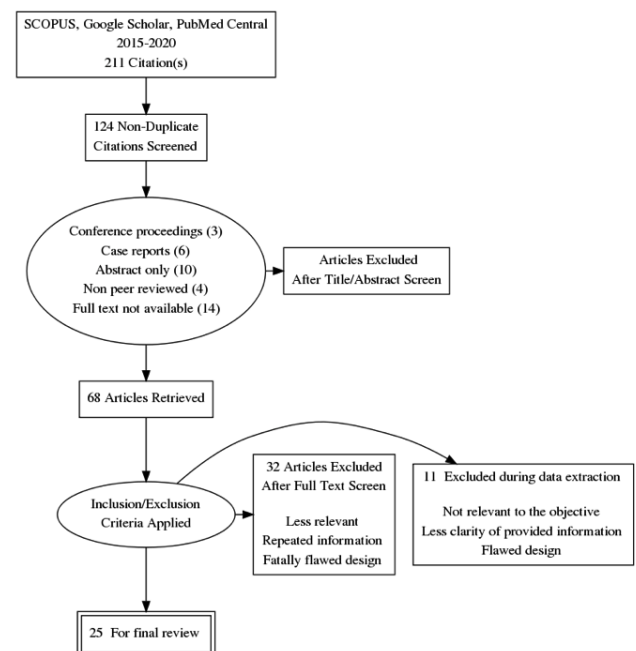


Figure 2. PRISMA flow diagram.

Table 2. Main themes and sub-themes associated with each paper.

Title	Main Theme	Sub Themes
Factors delaying hospital arrival of patients with acute stroke ¹²	Pre-hospital delay	Socioeconomic characteristics, Health system characteristics, Disease-related characteristics Independent patient factors
Antibiotic Delays and Feasibility of a 1-Hour-From-Triage Antibiotic Requirement: Analysis of an Emergency Department Sepsis Quality Improvement Database ⁹	In-hospital delay	Organizational level factors, disease-related characteristics
Incidence and root causes of delays in emergency orthopedic procedures: A single-center experience of 36,017 consecutive cases over seven years ⁵	In-hospital delay	Organizational level factors
Patient and system-related delays of emergency medical services use in acute ST-elevation myocardial infarction: Results from the third gulf registry of acute coronary events (Gulf RACE-3Ps) ¹¹	Pre-hospital delay	Health system-related factors
Determinants of delays in traveling to an emergency obstetric care facility in Herat, Afghanistan: An analysis of cross-sectional survey data and spatial modeling ¹⁹	Pre-hospital delay	Independent patient factors, Disease-related characteristics
Maternal death and delays in accessing emergency obstetric care in Mozambique ¹⁸	Pre-hospital delay	Disease-related characteristics, Health system characteristics
The effect of emergency department delays on 30-day mortality in Central Norway ²¹	In-hospital delay	Disease-related characteristics, Organizational level factors
Factors associated with emergency medical service delays in suspected ST-elevation myocardial infarction in Victoria, Australia: A retrospective study ²⁰	Pre-hospital delay	Socioeconomic characteristics, Health system characteristics, Disease-related characteristics Independent patient factors
Factors influencing time-dependent quality indicators for patients with the suspected acute coronary syndrome ³	Pre-hospital delay In-hospital delay	Socioeconomic characteristics, Health system characteristics, Disease-related characteristics
Factors influencing pre-hospital delay in patients presenting with ST-elevation myocardial infarction and the impact of pre-hospital electrocardiogram ²²	Pre-hospital delay	Socioeconomic characteristics, Health system characteristics
Factors influencing patient delay before primary percutaneous coronary intervention in ST-segment elevation myocardial infarction: The Stent for life initiative in Portugal ²⁶	Pre-hospital delay	Socioeconomic characteristics, Health system characteristics, Disease-related characteristics Independent patient factors
The influence of emergency department crowding on the efficiency of care for acute stroke patients ¹⁶	In-hospital delay	Organizational level factors
Pre-hospital delay and its associated factors in first-ever stroke registered in communities from three cities in China ²⁷	Pre-hospital delay	Socioeconomic characteristics, Health system characteristics, Disease-related characteristics Independent patient factors
Factors Associated With Delays in Seeking Medical Attention in Patients With ST-segment Elevation Acute Coronary Syndrome ¹⁰	Pre-hospital delay	Socioeconomic characteristics, Disease-related characteristics Independent patient factors
First Aid Practices and Health-Seeking Behaviors of Caregivers for Unintentional Childhood Injuries in Ujjain, India: A Community-Based Cross-Sectional Study ⁶	Pre-hospital delay	Socioeconomic characteristics, Health system characteristics, Disease-related characteristics
Healthcare-seeking behavior for infectious diseases in a community in Bangladesh ¹⁵	Pre-hospital delay	Health system characteristics, Disease-related characteristics
A population-based study on healthcare-seeking behavior of persons with symptoms of respiratory and gastrointestinal-related infections in Hong Kong ⁵	Pre-hospital delay	Health system characteristics, Disease-related characteristics Independent patient factors
Delays from first medical contact to antibiotic administration for sepsis ²⁸	In-hospital delay	Organizational level factors
Time to hospital arrival among patients with acute myocardial infarction in China: A report from China PEACE prospective study ¹⁷	Pre-hospital delay	Health system characteristics, Disease-related characteristics Independent patient factors
The prevalence and root causes of delay in seeking healthcare among mothers of under-five children with pneumonia in hospitals of Bahir Dar city, North West Ethiopia ¹³	Pre-hospital delay	Socioeconomic characteristics, Health system characteristics, Disease-related characteristics Independent patient factors
Delays in arrival and treatment in emergency departments: Women, children and non-trauma consultations the most at risk in humanitarian settings ¹¹	Pre-hospital delay In-hospital delay	Organizational level factors, Disease-related characteristics Independent patient factors
Reasons for Prehospital Delay in Acute Ischemic Stroke ¹⁴	Pre-hospital delay	Disease-related characteristics Independent patient factors, health system-related factors
Factors associated with maternal mortality in Malawi: Application of the three delays mode ²	Pre-hospital delay In-hospital delay	Socioeconomic characteristics, Health system characteristics, Disease-related characteristics Independent patient factors, organizational level factors
Are emergency medical services off-load delay patients at increased risk of adverse outcomes? ⁷	Ambulance off-load delay	Independent patient factors, organizational level factors
Off-load zones to mitigate emergency medical services (EMS) off-load delay in the emergency department: A process map and hazard analysis ²⁹	Ambulance off-load delay	Health system-related factors, organizational level factors

Discussion

The literature review developed a conceptual framework that included three main delay segments during emergency healthcare. Various factors embedded in each segment related to emergency healthcare delays are also included in the framework.

The model created from the review displays the timeline of events and related factors which can affect time management during an acute health event. This model represents distinct segments of delays instead of points of delay. Our model is aimed to fit a multitude of health events and these time segments are an adaptation to include various factors associated with the delay.

This review identified three major segments of delay and asso-

ciated factors of each segment. Two major points of delay identified from this review are pre-hospital and in-hospital delay (Figure 3). These two segments are similar to the two initial points in the 3 delays model: deciding to seek care and identifying and reaching the healthcare facility. The proposed model represents ambulance offload delay as a separate segment of delay, which is merged or not mentioned in the 3 delays model. We found studies focused solely on ambulance/vehicle layover delays and found it significant in emergency health care settings.²⁹ It is a conflicting stage of delay due to various factors like health care provider-related, patient-related, health system-related aspects, etc.²⁹ We found that most of the studies are not addressing this issue properly. Ambulance layover delay needs to be considered and studied to avoid missing links between delays during emergency healthcare

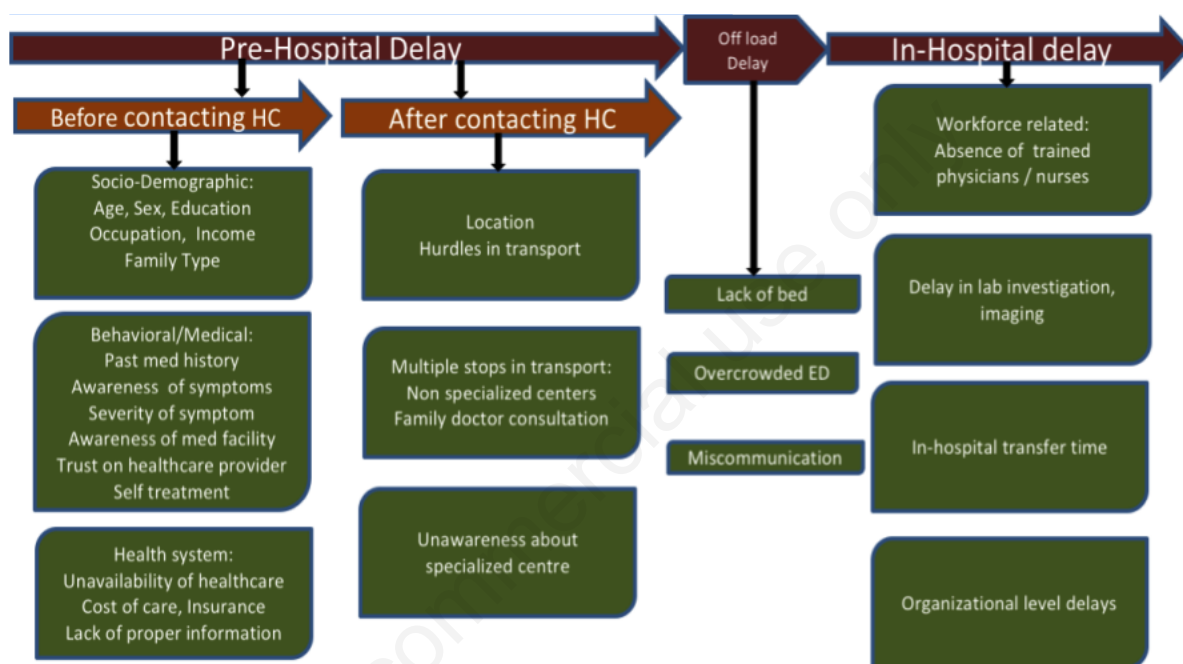


Figure 3. The conceptual model developed from the review.

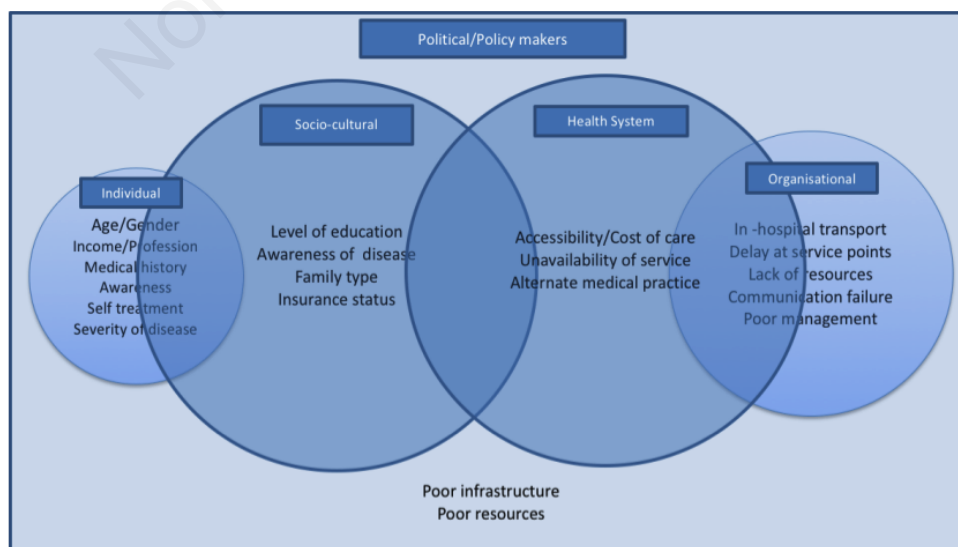


Figure 4. Various inter-related factors associated with the delay.

management.

It is observed that some studies focused on a specific segment of delay, for example, ambulance off-load delay or delay during transport.^{7,9} This review identified various delay segments and attributable factors that can influence time management during an emergency health event in detail. Hence, it is helpful to study the whole events or a particular delay segment. Below represents multiple factors associated with delay during an emergency health event and their interconnectivity (Figure 4).

Various underlying factors associated with the delay are also identified in this review and are listed in the conceptual model. The proposed model (Figure 3) identified and portrayed these factors attached to various timeline segments. However, for better understanding, these factors are categorized and mapped in Figure 4. We found many of these factors are not independent and can switch to other categories or co-exist in more than one category. The four main categories mentioned are individual, socio-cultural, health system, and organizational level factors. Individual factors mentioned are the more basic ones attached to the victims of family members.^{2-6,8,10-14,16} Figure 4 displays the interconnectivity of these factors. Factors associated with political or policy-making are broader and can influence all other factors.

The new model has some fundamental differences from the 3 delays model, including adding a new time segment of the ambulance offload delay. In the new model timeline of events is divided as time segments not points of delay. We found that decision-making during the health event and identifying and seeking healthcare can merge in some disease conditions. For example, some literature identified the location/type of health care facility available/ trust of health care facility, etc. could influence the decision making.^{3,9,12,18,19,26,30-34} In the proposed model, we tried to overcome this difficulty by clearly defining the time segments; before and after contacting the health care facility. Various factors attributed to the delays are identified and displayed in the proposed model, which we hope will guide future studies. The 3 delays model indicated fewer attributable factors than the new model, but the 3 delays model provided a strong basis for identifying and including various other factors.

Conclusions

This qualitative review aimed to create a conceptual framework for studying delays during emergency care. Three main segments of delays were identified and made a flow diagram of various segments (Figure 3). Three major delay segments are: i) prehospital delay, ii) ambulance layover delay, and iii) in-hospital delay. Pre-hospital delay is again categorized as two segments: i) delay during recognition of symptoms and decision making to seek care, and ii) delay during transport. This model is similar to the three delays model, widely used to study gynecological emergencies. However, the new model identified a new segment of delay: the ambulance or vehicle offload delay. Various inter-connected factors are also placed in this review related to the delay, which is widely distributed and associated with major emergency health events. They are classified as: i) individual factors, ii) health system-related factors, iii) socioeconomic factors, iv) organizational level factors, and v) political and strategic aspects of the community. However, these factors are not independent of each other; they are interconnected in various ways.

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