

# The Need for Emergency Management Models

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**Abstract:** Emergency agencies can use emergency management models to enable them to better prepare for and respond to emergencies. This qualitative study aims to undertake a critical examination of emergency management models by thematic analysis to determine their significance to emergency management. A review and analysis of the existing literature were used in the study. The models were studied to explore their role in

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 OPEN ACCESS

*Journal of Emergency Management and Disaster Communications*, Vol. 4, No. 1, 1–15

© Journal of Emergency Management and Disaster Communications

DOI: [10.1142/S2689980923500021](https://doi.org/10.1142/S2689980923500021)

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emergency management and to identify any significant constraints or challenges which could limit the ability of the emergency management model to carry out appropriate actions. The study found that such models are indispensable because they simplify and improve emergency management. Additionally, they may support planners, managers, and practitioners in reaching proper decisions, making them a valuable and necessary decision-making support tool. The study also showed that each model has an advantage that distinguishes it from the other models. Consequently, a comprehensive emergency management model should be designed to suit all cases and circumstances. The findings also confirmed the doubts raised about the limitations and concerns associated with the models. Concerns included future events' unpredictability, the models' prescriptive nature, the event's cultural context, and the impact on businesses. The findings also indicated that certain planners, managers, and practitioners had a limited understanding of the use of models in emergency management. As such, they appear to have overlooked the use of models while dealing with emergencies. Hence, the study recommends that the models should be employed in all emergency management activities. The study also recommends that the findings are utilized as a basis for further research into the potential use of emergency management models.

*Keywords:* Emergency; management; models; significance; emergency management models.

## 1. Introduction

Despite the availability of several emergency management models, emergencies are frequently managed inefficiently. Asgary<sup>1</sup> states that emergency management is a newly developed discipline and profession. Thus, those in charge of managing emergencies should continue to improve their models so that it remains a professional and scientific discipline. Accordingly, researchers have attempted to develop models for emergency management over the years. Models help to understand the activities and elements of the emergency management phases. The adage that "prevention is better than cure" supports what was mentioned above about emergency management models.<sup>2</sup>

The term "model" is defined as "a system of functions and conditions that yield formal results" (Ref. 3, p. 243). Some researchers and experts

believe that models are necessary for effective emergency management.<sup>4</sup> Several models have been formed to help governments and emergency agencies prepare for and respond to emergencies.<sup>5</sup> According to Ref. 6, Kelly<sup>7</sup> was the first to advocate using models in emergency management to explain, understand, describe, and investigate emergencies.

The authors of this study do not intend to offer a new model for emergency management; rather, they aim to further existing knowledge on emergency management models. Through qualitative analysis as a research method, this study investigates the existing literature on the importance of using models in emergency management. Thus, this study seeks to explore the need for emergency management models.

### 1.1. Motivation

The literature shows that researchers have proposed several models of emergency management, but they have always been criticized. According to Ref. 8, models have not progressed significantly because victims of emergencies have not decreased enough themselves. Other factors include the absence of large-scale technology transfers, and inadequate emergency response. In a later study, Alexander<sup>9</sup> discusses the problems that researchers, scholars, and practitioners tend to face when exploring or planning for emergencies. He believes that the emergency theory requires a substantial revision to account for trends in the contemporary world.

According to Ref. 6 all models created have deficiencies and weaknesses. Some models failed to provide an acceptable answer to the issues and challenges each emergency confronts. For example, while comprehensive risk analyses tend to be emphasized, it appears that the unpredictable nature and scale of future emergencies make prediction complicated. Furthermore, they tend to take a “one-size-fits-all” approach, ignoring the variables specific to each emergency, including cultural variations, governments, and resources, possibly in an effort to be universally compatible. Moreover, the models’ prescriptive, step-by-step design ignores emergencies’ complex and frequently chaotic features, which, by their very nature, seldom go as planned.<sup>5</sup>

Despite an increase in emergency frequency, the use of models continues to be misunderstood. Platt<sup>10</sup> argues that emergency managers and practitioners rarely employ models. Some of them are skeptical about the role of models in emergency management. They also don’t seem to have

enough information about using and implementing the models. Therefore, it is assumed that the approach to emergency management, in general, has been less successful and effective because of the models not being used or understood.

Therefore, this study assumes that governments and communities will continue to incur massive losses if models are not used or are deemed unsuitable for emergency management. As a result, the importance of using models in emergency management has to be strengthened.

## 2. Methodology

### 2.1. Research strategy

It is important to thoroughly examine the study's aims, objectives, and questions before deciding on a research methodology. As a result, the authors have adopted constructivist and interpretivist theories related to ontological and epistemological perspectives. A qualitative method is the most suitable methodology for getting the information required to answer the study questions for the following reasons:

First, the author's epistemological and ontological perspectives demand it. For example, Schwandt<sup>11</sup> states that humans generate or create knowledge rather than find or discover it. Furthermore, according to Ref. 11, who cites Guba and Lincoln,<sup>12</sup> knowledge generation is an attempt to understand an experience. Therefore, there is a need for a qualitative method of investigation because of the assumption that knowledge may be obtained by collecting, analyzing, and interpreting qualitative data to test hypotheses or develop new theories.

Second, the study claims to be investigating a complicated reality. According to Ref. 13, the qualitative method seeks to be unique and time-consuming in its pursuit of information. Third, a qualitative method makes it possible for the data to be linked, collected and analyzed and for conclusions to be obtained. Lastly, since emergencies are based on instability, non-linearity, and complexity, they require a qualitative method.

Thus, the study will adopt a qualitative approach that will begin with a literature review and then move on to content analysis. Therefore, the authors will conduct a literature review to understand the role of models in emergency management. According to Ref. 14, a literature review is a popular qualitative method used for analyzing literature that may comprise

texts or images, and where researchers employ content analysis as a tool to analyzing trends in texts in a systematic method.<sup>15</sup> It is primarily focused on what words, phrases, or sentences mean, what they mean to other people, and what they signify in context.<sup>16</sup> In addition, it is focused on the link between text and the cause for its recurrence, which is what content analysis is all about.<sup>17</sup>

## **2.2. Inclusion and Exclusion Criteria**

A detailed review of literature in scientific databases was conducted. Google Scholar and Scopus were the primary scientific databases used for examining the scientific content. Journal papers and articles, as well as books, conference presentations, and other pertinent publications, were also analyzed. Emergency management models, the structure of emergency management, emergency management plans, and emergency management frameworks were among the keywords used to find the required emergency management models. Publications that did not include the keywords listed above were excluded.

## **2.3. Evaluation of Publications**

Many emergency management models were created and developed by emergency management experts. It was noted that many of these models related to a specific place or type of emergency. In the first phase, more than 30 emergency management models were collected. In the second phase, the analysis was conducted; thus, models related to detailed technical aspects or case studies of a specific emergency in a place that could not be applied to other cases of the same location or type were excluded.

## **2.4. Data Analysis**

Through a survey of the literature and analysis of the various papers, it was noted that no article or book included all emergency management models. Therefore, in order to explore all known emergency management models, a three-stage methodology was adopted. The first-stage comprised collecting emergency management models, followed by the second stage, which included analyzing and classifying the models and identifying any similarities and differences. Finally, the third-stage discussed the models. Figure 1

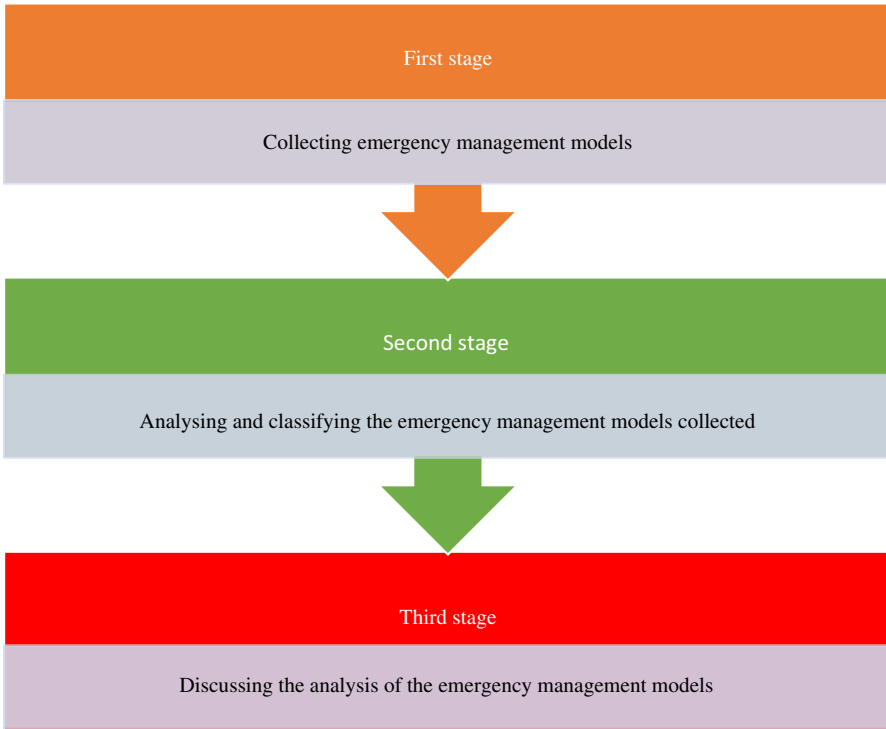


Figure 1. Research methodology for exploring emergency management models.

illustrates these stages and the research methodology used for exploring the emergency management models.

### 3. Results

Literature that included emergency management models has been reviewed and analyzed. It was found that Asghar *et al.*<sup>6</sup> describe four types of models: logical, causal, integrated, and uncategorized. However, Nojavan *et al.*<sup>18</sup> argue that some models were not suitable to be included in any of the previous groups, so a fifth group was proposed, which was called “combinatorial models”; these were made up of a mixture of logical, causal and integrated models. As a result, this study divides emergency management models into five categories: logical models, causal models, integrated models, combinatorial models, and uncategorized models. These five groups are illustrated in Figure 2.

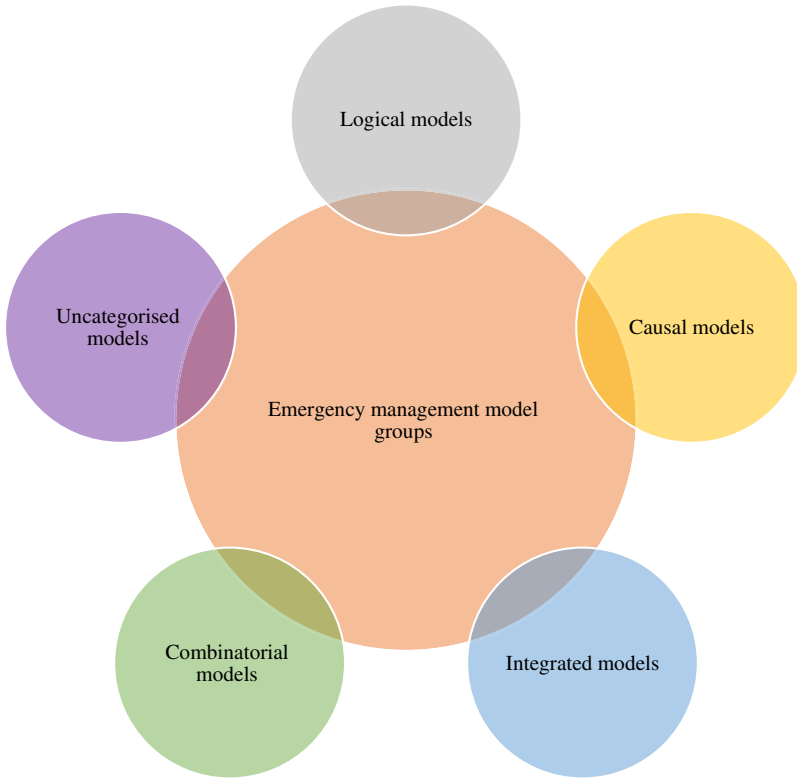


Figure 2. Classification of emergency management model groups.

Since this study does not aim to review and discuss some emergency management models in detail, only a number of models belonging to these five groups were analyzed. The chosen models are displayed in the following tables.

The first group is logical models. They are defined as being simple designs of the main phases of emergency management that emphasize the essential procedures. The traditional model (1998) is one of the most popular and well-known logical models. The emergency management process is divided into three phases in the traditional model: before, during, and after an emergency. The pre-emergency phase includes mitigation, prevention, and preparedness. Activities during an emergency include response and reaction. Post-emergency activities include recovery, repairing infrastructure, and restoring public services.<sup>19</sup>

The second group is causal models. These models are concerned with understanding the underlying causes of emergencies. One of the most popular causal models is the Crunch cause model (2000), which proposed a framework for understanding emergency causes. This model is built on the principle that emergency vulnerability can be influenced by a variety of factors. Lives, property, infrastructure, and the environment are examples of elements at risk. Due to this, the model identifies community vulnerability and its underlying causes and estimates risky situations.<sup>18</sup>

The third group is integrated models. An integrated model is a method for organizing the necessary tasks to guarantee effective and efficient performance, and it has four components: risk assessment, hazard management, mitigation, and preparedness.<sup>18</sup> The Manitoba Health model<sup>20</sup> is one of the most common integrated models. It is made up of six major parts: a strategy plan, risk assessment, hazard management, mitigation, preparedness, and monitoring and evaluation. Each of these parts has its own actions and tasks. This model clearly separates the emergency management phases, which allows emergencies to be managed effectively. It also provides flexible links between processes and activities of emergency management.<sup>18</sup>

Combinatorial models are the fourth type of model, and they combine logical, causal, and integrated models to develop a new emergency management model. The Cuny comprehensive model,<sup>21</sup> which combines the advantages of the three aforementioned model groups, is one of the combinatorial models.

Finally, models that do not meet the criteria of the previous four groups fall within the scope of the fifth group, which is known as uncategorized models. These models are referred to as “uncategorized” since their design and format do not fall into any of the previous groups. Ibrahim *et al.*<sup>22</sup> model is one of the most common uncategorized models. It focuses on technological emergency management. It is divided into eight stages: occurrence of an error; increasing number of errors; warning; correction failure; upcoming disasters; triggering events; an emergency stage; and the emergency itself.

#### 4. Discussion

The results of this study are examined in this section. It begins with a discussion of the importance of emergency management models, which is then followed by a discussion on the benefit of using them.



#### 4.1. *The Importance of Emergency Management Models*

Models may be quite valuable in emergency management, as they reduce risks to individuals and communities. Models can make the emergency management process easier for planners, managers, and practitioners to understand. Emergency management models are founded on the principle that emergencies disrupt development and that it is the responsibility of emergency planners, managers, and practitioners to take adequate measures to recover development.<sup>23</sup> This implies that they are in charge of adopting and implementing these models. Yet, if models are not correctly implemented, even good models could be rendered ineffective. Kelly<sup>7</sup> outlines four key reasons why emergency management models are needed:

- (1) A model can help to simplify complicated situations by assisting in the differentiation of important aspects. In addition, it becomes more considerable when dealing with emergencies with strict time limits.
- (2) When real conditions are compared to a theoretical model, it is possible to better understand the present situation, which may help produce a more effective emergency planning process.
- (3) An emergency management model is an effective tool for measuring emergency activities.
- (4) An emergency management model supports the formation of a shared understanding among all parties concerned. It also makes it possible to integrate emergency management activities effectively.

By carefully examining the four main reasons for the need for models presented by Ref. 7, one could be led to conclude that the employment of models is necessary and unavoidable. Effective emergency management models can clearly identify emergency activities and actions. As a result, if models are correctly applied, they can be quite valuable and helpful in emergency management.

#### 4.2. *Are Emergency Management Models Beneficial?*

A model's utility as a practical emergency management tool cannot be overstated. Emergencies can be better understood by comparing them to a theoretical model, which can lead to improved emergency planning and response. It has been noticed that in certain cases when emergency management models have been used, the models were shown to be relevant and

highly effective. For example, in its instructions for its “participatory capacity and vulnerability analysis” (PCVA), Oxfam employed various models as a framework for their emergencies analysis.<sup>24</sup>

Models are not only used in small-impact emergencies but have also been employed to deal with large-scale emergencies. According to Ref. 25, an emergency recovery model was used in the aftermath of Saudi’s 2009 earthquake (Al-Airs earthquake). Decision-making in the midst of an emergency is a unique situation and can have substantial effects on people and communities<sup>26</sup>; thus, models are important for making effective decisions. Such decisions include those made by decision-makers, emergency managers, and emergency planners.<sup>10</sup> Therefore, models can be applied in the decision-making process while dealing with emergencies, due to the involvement of decision-makers, leaders, planners, and practitioners in emergency management. Thus, models may be valuable for evaluating the resilience and preparedness of governments and communities during an emergency.

Frequent hurricanes that occurred in the United States of America, for example, hurricane Katrina in 2005, hurricane Sandy in 2012, and hurricane Harvey in 2017 were another huge emergency that illustrated the need to use proper models when planning and conducting response and recovery activities. Following on from this, a model for increasing emergency preparedness in health institutions was proposed.<sup>27</sup> The model was used in the 2015 Jazzman hospital fire accident in which at least 25 were killed, and more than 100 people were injured.<sup>28</sup> This model showed the feasibility of developing emergency preparedness plans in hospitals, with a focus on hospital capacity, medical staff, and ambulances. The Saudi Arabia flash floods which took place after 2011 were also examined using the Pressure and Release model, which helped managers and practitioners find previous, current, and prospective risks and vulnerabilities.<sup>29,30</sup>

The models can also be used to help manage human-caused emergencies. The employment of emergency management models proved effective in many man-made emergencies. For example, the Chicago Tylenol murders occurred due to drug tampering in the Chicago metropolitan area in 1982. In addition, a pesticide factory in Bhopal, India, experienced a gas leak on 2 December 1984, and over 500,000 locals were affected by methyl isocyanate gas. Also, on 28 January 1986, seven astronauts were killed when the Challenger Space Shuttle exploded.<sup>31</sup> A model for coping with

industrial emergencies was proposed by Shrivastava<sup>31</sup> in the aftermath of these three emergencies. When we take a closer look at this model, it becomes evident that using Shrivastava's model in industrial emergency management could help reduce losses. For example, in Saudi Arabia, it was used in 2012 when a truck carrying fuel crashed into an intersection flyover in the east of Riyadh. The lorry hit a bridge pylon on Khureis Road, and the petrol it was carrying leaked into the surroundings, and then ignited. The blast killed 23 people and injured 135.<sup>32</sup>

In order to deal with all types of emergencies, it is essential to avoid past mistakes by providing an effective emergency model that provides proper coordination among all stakeholders at all levels.<sup>33</sup> Moreover, Moore *et al.*<sup>34</sup> state that whatever emergency management model is adopted, the agency responsible for coordination should allocate emergency response roles and activities to all stakeholders. Thus, emergency agencies should be able to determine which stakeholders need to be involved and their responsibilities and duties in such emergencies. The authors of this study believe that this approach represents a step in the right direction.

Despite the above arguments, Stetler<sup>35,36</sup> presents a strong criticism against emergency management models, asserting that they are too prescriptive, specific, and restricted. As a result, some decision-makers, planners, managers, and practitioners have questioned the usefulness of such emergency management models. Yet, the authors still claim that models for emergency management are quite beneficial and valuable.

## 5. Conclusion

Emergency management models were reviewed in this study and thematic categorization and analysis were used to achieve the aim and objectives of the study. First, existing emergency management models were collected. Second, thematic analysis was used to extract and categories the themes of each model. Lastly, the limitations of the models were highlighted.

In this study, conclusions can be derived from the results. The first conclusion is that the models appear to be beneficial in certain cases and circumstances, but it is clear that they are not generally applicable and cannot be used in all types of emergencies. Therein is the challenge. Emergencies are not the same; each emergency is unique, with its own challenges and difficulties, requiring different techniques, methods, and

management strategies. Hence, it is impossible to control emergencies using strict and rigid instructions since they often come unexpectedly and do not follow regular patterns. Their management is also complicated since they are complex and can cause cascading crises.

This study also found five groups of disaster management models. Some researchers proposed one-dimensional models of emergency management, whereas others proposed two- and even three-dimensional models. However, each model and dimension has a feature that distinguishes it from others. In addition, the focus on each model's unique context has kept them from considering all of the important factors in successful and comprehensive management. Thus, a comprehensive model should be created and used which includes all factors affecting emergency management. It can also be concluded that Kimberly's<sup>37</sup> four-phase emergency management model might not be suitable for use in developing countries because it requires large funding and a high level of experience and knowledge and is designed to deal with emergencies that occur in health facilities.

This study also concluded that there is a strong correlation between many of the emergency management models. For example, all the models try to reduce the negative effects of an emergency. Additionally, many of the models are similar in that they are designed to deal with the four main phases of emergencies. Furthermore, each emergency management model is designed to attempt to address the weaknesses of previous models. Thus, another conclusion of the study was that new emergency management models are indispensable and should continue to be developed.

Furthermore, the study also concluded that emergency management models are created to guide practitioners, managers, and policymakers before, during, and after an emergency. The rationale for this is because the economic and social consequences of an emergency on a country may be severe; thus, avoiding emergencies or, at the absolute least, responding quickly to and recovering from them, is extremely desired. However, the emergency management models analyzed in this study have limitations and deficiencies and are inappropriate for all types of emergencies.

Lastly, the authors of this study still need to do a lot of work in this field. They intend to expand on this study by doing further research into emergency management models, with the hope to encourage agencies and communities to manage emergencies through these models.

## 6. Recommendations

Based on the above conclusions, the study came up with several recommendations. First, it strongly recommends that all stakeholders use these models in emergency management. Second, it also recommends that researchers and scientists continue to develop old models and create new models for emergency management that can address the shortcomings and weaknesses of previous models. Third, it further recommends that managers and practitioners combine more than one model when managing complex emergencies. Finally, this study may be valuable and useful for governments, emergency agencies, academics, decision-makers, planners, managers, and practitioners who work in the field, and therefore, it is recommended that they use this study to explore and develop emergency management.

## Acknowledgments

The study was approved and supported by the General Directorate of Civil Defense in Saudi Arabia, the Saudi Arabian Cultural Bureau in the UK, and Institute for Risk and Disaster Reduction (IRDR) at University College London (UCL), which provided logistical and informational support. We are especially thankful to Mater Almehamdi, Adel Alharbi, and our colleagues who contributed to the study's improvement through their feedback, comments, and suggestions.

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