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Epidemiological disaster management: Literature survey and analysis

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Abstract

Epidemiological disasters can cause significant suffering and change lives, but how they are handled can have just as much of an impact. This research aims to shed light on epidemiological disaster management literature from multidisciplinary perspectives and analyze its development and trends. A total of 365 scholarly articles were analyzed for this study using a number of databases from various academic disciplines. Search Keywords included “pandemic disaster management,” “pandemic planning,” “pandemic preparedness,” “pandemic response,” and “pandemic recovery.” Consequently, this paper surveys the literature and presents a brief background on epidemiological disasters and their management, a descriptive and inferential analysis of studies on the subject matter, a discussion of relevant issues, and suggested potential research directions for those interested. The analysis reveals that traditional methods for managing epidemiological disasters primarily rely on medical principles and policies, with medical sciences accounting for the great majority of studies, followed by social sciences. Moreover, the majority of the research has focused on response and preparedness, while recovery has gotten relatively little attention in favor of these earlier phases. Accordingly, based on various strategies/approaches exploited by different countries to deal with the COVID-19 pandemic and the trend of the existing body of research identified in this study, a paradigm shift in epidemiological disaster management is inevitable.

Keywords: Epidemics, Epidemiological disaster management, Literature survey, Pandemic analysis, Pandemic disaster management, Pandemic planning, Pandemic strategy, Pandemics.

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1. Introduction

It is unlikely that epidemiological disasters will be an anomaly incident, and because they can spread rapidly across continents and trigger pandemics without warning, they are among the most difficult to manage. In addition, they will almost certainly continue to occur as a result of climate change, urbanization, and modern technologies that allow pathogens to spread faster than ever before [1]. Once struck, an epidemiological disaster not only can put enormous strain on a country's health resources but can also have severe economic, social, psychosocial, and political ramifications, to name

a few, based on how it is handled [2]. The COVID-19 pandemic, for example, has swept across the globe swiftly in a short period of time, putting tremendous strain on all healthcare systems, resulting in over 500 million confirmed cases and more than 6.3 million deaths as of May 2022 [3]. Moreover, due to the nonpharmaceutical response measures, such as lockdowns and social distancing adopted by governments worldwide, the COVID-19 pandemic has posed the greatest threat to the global economy since the meltdown of 2008-2009 [4]. However, as a consequence of these response measures, severe mental stress/disorder could have developed, which poses a risk to human health Atalan [2] and Banerjee and Nair [5]; Marchi, et al. [6]. On the contrary, some countries such as Sweden, Singapore, and South Korea, have had success stories in fighting the COVID-19 pandemic despite implementing a much less restrictive and stringent response strategy than the widely adopted ones Yan, et al. [7] and Bhatia, et al. [8]. Therefore, despite the "one-size-fits-all" strategy adopted by most governments to enforce harsh lockdowns, there appears to be more than one approach to handling such calamities. Although epidemiological disasters can cause significant suffering and change lives, how they are handled can have just as much of an impact.

The risk of mismanaging a large-scale epidemiological disaster such as the COVID-19 pandemic remains high, and the bewilderment in dealing with it has been evident worldwide. Therefore, it is critical that the authorities can implement the necessary actions and create an optimal strategy in a timely manner, commensurate with the scale of the event and with the least possible damage. To this end, it is essential to expand awareness and knowledge of epidemiological disaster management, shed light on the scholarly studies about managing it, and formulate effective sound policies and strategies. As a result, we believe a literature survey can help answer the following questions in current research and address many of the above concerns regarding epidemiological disaster management:

Q1: What has been the focus of epidemiological disaster management research in relation to the various phases of the disaster management cycle, and what distinct perspectives and research methodology have been used in each phase?

Q2: What is the contribution of different academic disciplines to the field of epidemiological disaster management, what perspectives have those academic disciplines taken in their epidemiological disaster management research, and where do they tend to focus their attention in relation to the different phases of the disaster management cycle?

The paper begins with a brief history and background on epidemiological disasters and their management, followed by the methodology of the survey process, an analysis of the surveyed literature sample, and then a discussion of the findings. In its conclusion, the paper proposes a few future research directions.

2. Background and Historical Development

2.1. Epidemiological Disasters

Epidemiological disasters can refer to pandemics or epidemics, which are two words that can be easily used interchangeably since they both refer to a disease that is spreading quickly. The term "pandemic" comes from the Greek word pan- meaning to affect all and demos meaning people [9]. Thus, a pandemic is most commonly referred to as an epidemic that has spread worldwide, but it is also used to describe regionally extensive epidemics that cross over some geographical region and affect a substantial number of people.

Table 1.
List of epidemiological disasters.

Name	Disease	Duration	Location	Number of death
Third plague pandemic	Bubonic plague	1855 - 1960	Worldwide	12 - 15 million
Congo basin African trypanosomiasis epidemic	African trypanosomiasis	1896 - 1906	Congo Basin	500,000
Sixth cholera pandemic	Cholera	1899 - 1923	Europe, Asia, Africa	800,000
African trypanosomiasis epidemic	African trypanosomiasis	1900 -1920	Uganda	200,000 - 300,000
Encephalitis lethargica pandemic	Encephalitis lethargica	1915 - 1926	Worldwide	500,000
Spanish flu	Influenza A/H1N1	1918 - 1920	Worldwide	17 - 100 million
Russia typhus epidemic	Typhus	1918 - 1922	Russia	2 - 3 million
Psittacosis pandemic	Psittacosis	1929 - 1930	Worldwide	100,000 +
Asian flu	Influenza A/H2N2	1957 - 1958	Worldwide	1 - 4 million
Hong Kong flu	Influenza A/H3N2	1968 - 1969	Worldwide	1- 4 million
Russian flu	Influenza A virus subtype H1N1	1977 - 1979	Worldwide	700,000
HIV/AIDS global pandemic	HIV/ AIDS	1981 - present	Worldwide	35 + million
Avian influenza epidemic	Influenza a virus subtype H5N1	2003 - 2019	China, Southeast Asia, and Egypt	2 - 7.2 million
Swine flu pandemic	Influenza a virus subtype H1N1	2009 - 2010	Worldwide	151,700 - 575,400
COVID-19 pandemic	COVID-19	2019 - present	Worldwide	6 + million

Source: List of Epidemics [10].

An epidemic is typically more localized, affecting only a particular country or region, whereas a pandemic has a global impact Dicker, et al. [11] and Kelly [12]. Nevertheless, this classical description of a pandemic ignores the severity of the spreading disease or societal immunity, so there is no consensus on what constitutes a pandemic, and different schools of thought exist based on these limitations [12, 13]. Some argue that the name should be based on the severity of the disease and the number of deaths, while others believe it should be based on its spread rate. However, although many epidemiological disasters have occurred throughout history, the literature and the development of administrative plans and standards for managing such disasters were not codified until recently Pennisi [14] and Patriarca and Cox [15]. This paper focuses on studies that have theoretically or practically contributed to the management of epidemiological disasters over the past fifty years. The 50-year time horizon was chosen due to the fact that it contains rich literature about disaster events. Table 1 summarizes the major epidemiological disasters that have claimed hundreds of thousands of lives during the last and current centuries, including their length, spread location, and death toll.

Epidemiological disasters are mainly caused by the transmission of pathogens, which are microorganisms such as bacteria, viruses, fungi, and protozoa that cause disease, from animals to humans and vice versa [16]. Although population growth, ease of transportation, and increased urbanization are primary causes of pathogen transmission, other reasons include environmental factors such as global warming and climate change, which force animals or insects carrying a disease to move outside their normal habitat [17]. Even though epidemiological disasters fall under the natural biological disasters category in most classifications, they can also be man-made through intentionally manipulated and targeted spread of artificial viruses or accidentally leaked during laboratory experiments [18]. In this case, epidemiological disasters should more appropriately be included within both the natural and hybrid disaster categories, which, according to Shaluf [19] and Shaluf [20], are the result of both human and natural forces.

2.2. Epidemiological Disaster Management Strategies

Epidemiological control strategies are classified into pharmaceutical and nonpharmaceutical approaches. The former involves using vaccinations, antivirals, antimicrobials, and antiparasitic drugs, while the latter incorporates measures that are not primarily based on medications (e.g., quarantine), though they are both used in conjunction during such situations [21]. Nonpharmaceutical interventions are the oldest and probably most widely used methods of combating epidemiological outbreaks. The most well-known has been quarantine, a phrase coined after the Bubonic plague struck Europe in the middle of the 14th century, in which infected people were isolated for a period of time. Originally, quarantine came from the Italian word “Quaranta,” which specifies a quarantine period of forty days [22]. The quarantine strategy has evolved into a more urbanized procedure of lockdowns and social distancing, in which most government and private institutions are closed, and everyone is required to stay where they are and maintain a particular physical distance while in contact with others. Another well-known nonpharmaceutical method of containing epidemiological outbreaks is the use of face masks in the community, dating back to the Manchurian plague of 1910 [23]. However, despite their success (and occasionally ineffectiveness) in reducing the spread of a disease [24, 25], relying on such approaches without considering their social, healthcare, and economic impacts could be highly detrimental to society. Consequently, developing appropriate control strategies necessitates an interdisciplinary, comprehensive, and broad perspective.

Modern public health laws and regulations regarding epidemiological disasters began to take shape in the fourteenth century after the Black Death pandemic in Europe [26]. However, despite the devastating effects and mass casualties of numerous historical epidemiological disasters, including the Spanish flu pandemic of the early 20th century, documented preparedness plans for dealing with such events have been scarce until very recently. For example, the first attempts to develop an official pandemic response strategy were made only after the 1976 novel swine flu pandemic, when US public health officials produced 150 million vaccine doses and vaccinated 45 million individuals Patriarca and Cox [15]; Kaiser [27] and Iskander, et al. [28]. Since then, many attempts have been made worldwide to develop guidelines for epidemiological disaster planning, influencing and shaping current public health policies.

To assist countries in developing their pandemic preparedness plans, the World Health Organization (WHO) created a checklist in 1999 of essential and desirable elements that define the phases of pandemic preparedness and appropriate actions for each phase, which was then revised in 2005 [29]. Although the WHO discussed legal and ethical considerations that could jeopardize fundamental individual rights and freedoms in their document [30], most published pandemic plans failed to adhere to public health ethics during an emergency response [31]. Prior to the 2009 H1N1 pandemic and the massive spread of the avian influenza H5N1 virus, WHO urged its members to create new strategies for a new coming pandemic among humans [32]. Finally, in response to the COVID-19 pandemic, WHO released its most recent pandemic preparation strategy in 2020 [33]. Interestingly, in 2004, WHO virologist Klaus Stohr reported that only 15 nations have preparedness strategies for a pandemic outbreak [27]. Nonetheless, according to the Global Health Security Index (GHSI) 2021 report from the Johns Hopkins Center for Health Security, which evaluates the state of health security worldwide, this aspect of countries' lack of preparedness persists even recently [34].

According to the GHSI 2021 report, not only are all countries critically underprepared to deal with future epidemiological outbreaks, but also 65% of countries lack a comprehensive national public health emergency response strategy for similar events [34]. The analytical study of the GHSI report comprises six categories: Prevention, Detection and Reporting, Rapid Response, Health System, Compliance with Global Norms, and Risk Environment. Each of the six index scores has a 100-point range. For the six categories, the GHSI results reveal a startling overall average score of 38.9 out of 100 and individual category scores of 28.4, 32.3, 37.6, 31.5, 47.8, and 55.8, respectively. According to the report’s results, the fact that four categories received less than 40 points while none received more than 55.8 points indicates

substantial weakness in global health systems and is a worrying sign. Moreover, the GHSI stated that even high-income countries have not committed resources to improving epidemiological disaster preparedness. The average score out of 100 for the different world regions' preparedness level in the event of a global biological catastrophe, as developed by the GHSI, is shown in Figure 1, with North America being the highest with a score of 76.3 and Sub-Saharan Africa being the lowest with a score of 19.8.

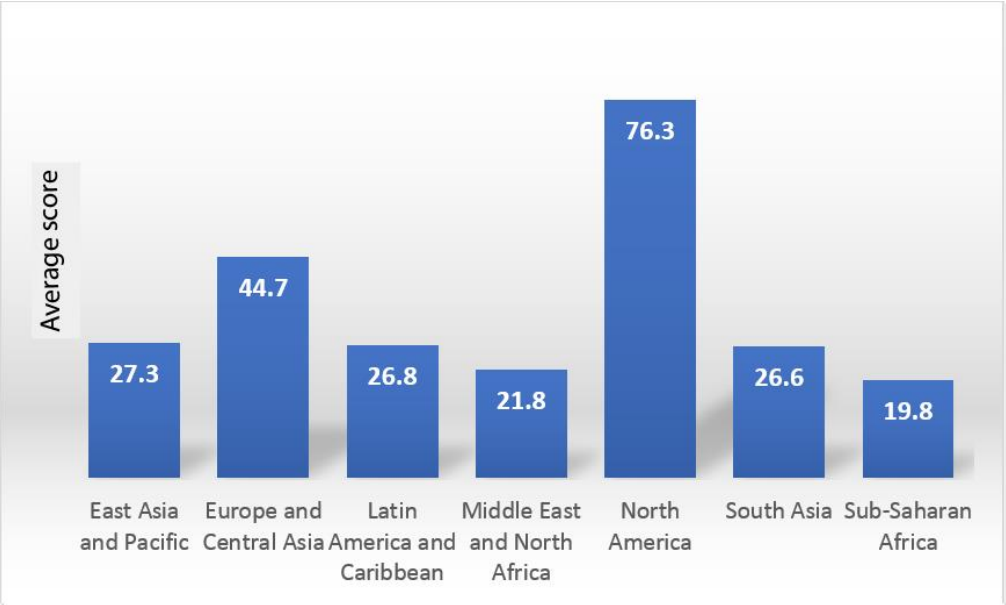

Figure 1.
The average level of preparedness for a globally catastrophic biological event
Source: Global Health Security Index [34].

As infectious diseases have become more prevalent and rapidly evolving, traditional response approaches have proven ineffective in preventing and managing them [35]. Consequently, the field of epidemiological disaster management has historically been overlooked and undermined but is now becoming increasingly important as the frequency of epidemiological disasters has increased over the last decade, particularly in light of the recent COVID-19 outbreak. Thus, more than ever, epidemiological disaster management practices must be reviewed, addressed, improved, and implemented to mitigate or perhaps prevent future pandemics.

3. Methodology

A variety of databases were used to provide an overview and analyze research on the management of epidemiological disasters from a multidisciplinary perspective, including Academic Search Complete, American Psychological Association (APA), Directory of Open Access Journal, Gale Academic OneFile, HeinOnline, Journal Storage (JSTOR), Medical Literature Analysis and Retrieval System Online (MEDLINE), PubMed, and Scopus. Keywords "pandemic disaster management," "pandemic planning," pandemic preparedness," pandemic response," and "pandemic recovery" were searched in the title, abstract, and body of the text of journal articles published in English. Extending the search to include relevant article citations brought more publications directly connected to the subject area. The determination of whether or not a given article qualifies as epidemiological disaster management research involves an element of subjectivity. The inclusion criteria of this literature survey were limited to peer-reviewed journal articles that dealt with and contributed to the topic of epidemiological disasters from the management perspective and their consequences, excluding practitioner magazines, conference proceedings, and books. Moreover, since the primary focus of this study is on disaster management, papers that primarily focused on medical and therapeutic aspects of epidemiology or only narrated disastrous epidemiological events from a historical point of view were excluded from the review process. The time period of the search was limited to 1970 onward because that was when the literature began to show interest in the topic.

By its very nature, research on epidemiological disaster management requires collaboration across a variety of disciplines and functions. As a result, this kind of research has been published in a wide range of academic publications. Therefore, although journals with a disaster management perspective were this study's primary focus, non-traditional disaster management outlets were not excluded from the search to stimulate multidisciplinary research. This search strategy yielded fairly comprehensive articles published in a variety of academic areas. The preliminary search of the literature turned up thousands of papers in the domains of medicine, public health, social sciences, business, economics, engineering, natural sciences, political sciences, and other academic disciplines. A manual investigation of the articles was carried out by analyzing the titles and abstracts to eliminate duplications and further exclusions due to the metaphorical presence of the keywords in unrelated contexts such as " disaster in the financial market" or "organizational disaster," bringing the number of articles down to a more manageable level. After this search and elimination strategy, a total of 365 articles were surveyed. Thus, while this literature survey is by no means an exhaustive bibliography of epidemiological disaster management research, it does provide a relatively representative sample of what has been published in the field.

4. Analysis and Results

Two types of analysis were performed for the objectives of this literature survey: descriptive and inferential. The reviewed papers were analyzed based on characteristics related to publication information, such as the year of publication, the researcher's field of specialization based on the primary author, and the origin of the study based on the primary author. Other characteristics are related to the nature of the study, such as the disaster phase, research method, and research perspective, which will be discussed subsequently in more detail.

4.1. Descriptive Analysis Results

This section attempts to provide an overview of statistical key characteristics and features that quantitatively describe the literature on the epidemiological disaster management field. An initial key finding from the literature sample surveyed is the number of publications before and after the COVID-19 pandemic. Prior to the COVID-19 pandemic, the publications in research relevant to the management of epidemiological disasters have been quite negligible, as shown in Figure 2, averaging 1-2 studies per year. Nonetheless, there was a moderate increase in the number of publications on the topic after the H5N1 Avian Flu pandemic of 2003 and the H1N1 Swine Flu pandemic of 2009. However, evident from the number of publications following the emergence of the COVID-19 pandemic, there has been a sharp surge in interest in the management of epidemiological disaster research, with 101 published papers in 2020 and 109 in 2021.

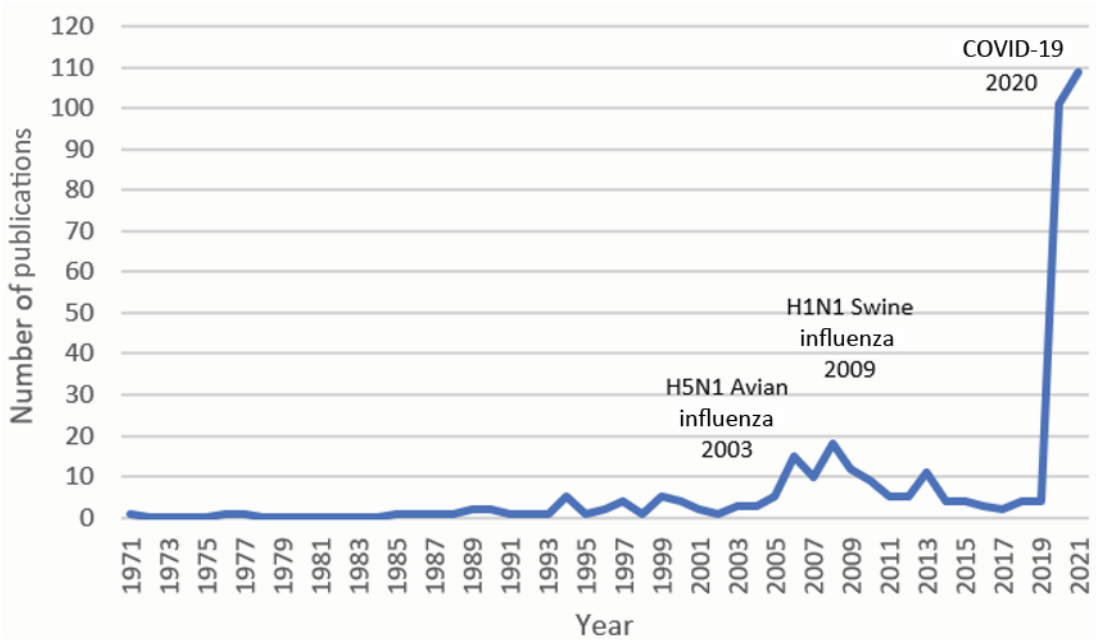

Figure 2.
Number of studies focused on the management of epidemiological disasters.

The United States dominated the research by a large margin regarding the number of publications, accounting for more than 31% of total studies. Canada and Australia came in second with approximately 8%, followed by China and India, holding the third position with about 6.5%, and the United Kingdom fourth with around 5.2% of total studies. The remainder of the studies were distributed almost evenly among other nations.

Figure 3 demonstrates the contribution of scholars from various disciplines to the study of epidemiological disaster management. Figure 3 indicates that the vast majority of research was undertaken by scholars in *Medical* and *Social Sciences*, accounting for 44% and 29% of the total studies, respectively. This could possibly be attributed to the direct association of *Medical Sciences* with epidemiology and the *Social Sciences'* involvement and contribution to the disaster management field in general. The disciplines of *Natural Sciences*, including biology, chemistry, and physics, are in third place with their contribution of 6% to epidemiological disaster management. Surprisingly, *Administrative Sciences* (e.g., business administration, hospitality management, and operations management) rank third with a 5% contribution, as do *Computer Sciences* disciplines such as information systems, data sciences, and computer science. *Engineering* and *Mathematical Sciences* have also contributed to the field, notably with modeling and simulation methodologies, accounting for 3% of the overall studies. Moreover, disciplines such as architecture, agricultural science, aviation, communications, and urban science (labeled in Figure 4 as *Others*) have also contributed to epidemiological disaster management studies, with a combined total of 3%. Lastly, *Pharmaceutical Sciences* have contributed only 1% to the total studies.

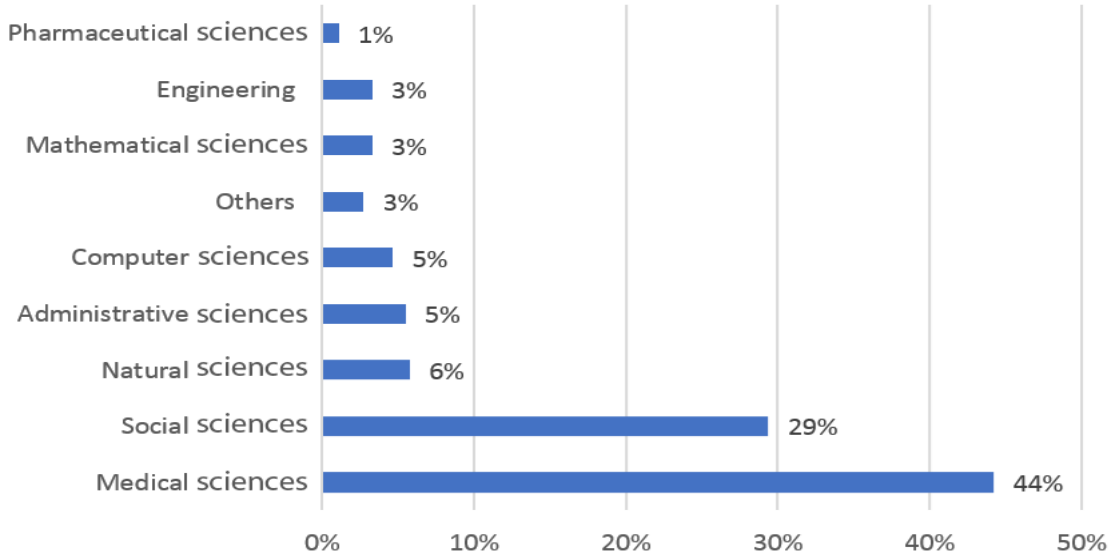

Figure 3.
Participation rates for various disciplines in epidemiological disaster management studies.

Another point to note is the concentration of the reviewed studies on the disaster management cycle phases. According to the literature, the disaster management cycle is divided into four distinct phases: mitigation, preparedness, response, and recovery [36]. The relationship between the four phases is often portrayed in the manner seen in Figure 4, and all types of disasters follow the same pattern of progression through the four phases of disaster management. Therefore, the reviewed studies were classified based on which phase of the disaster management cycle they focused on predominantly.

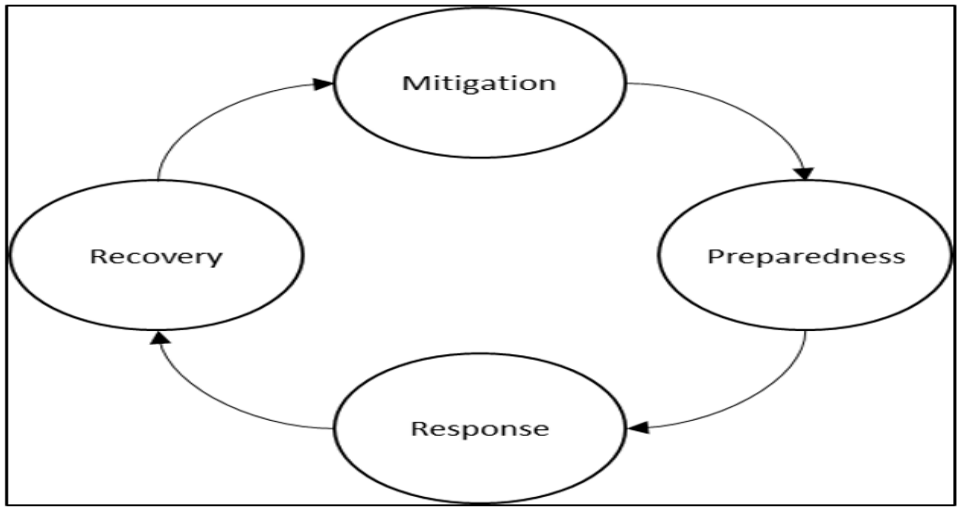

Figure 4.
The four phases of disaster management.

Based on the reviewed studies, a description of the phases of the disaster management cycle from the epidemiological disaster perspective is proposed and summarized in Table 2.

Table 2.
Perspectives of epidemiological disaster management phases.

Phase	Explanation
Mitigation	Sustained measures to mitigate the impact of a pandemic including the development of new infrastructure and the modification of existing facilities, the development of information technology systems to facilitate new healthcare procedures, and the development of laws and regulations to cope with pandemic emergency responses
Preparedness	Activities include preparing action plans for delivering medical treatment, teaching medical professionals, law enforcement, and the general public to cope with crises, and preparing medical equipment and supplies and ensuring their availability
Response	A wide range of pharmaceutical and non-pharmacological measures taken to prevent the spread of the disease, including the use of drugs, vaccines, lockdowns, and social distancing
Recovery	The measures taken to assist in a speedy recovery on all fronts (physical, psychological, and social) and to aid in eradicating pandemic threats and the return to normal life

It is interesting to note that a large majority (61%) of the reviewed studies are concerned with the *Response* phase and its implications, as shown in Figure 5. Furthermore, the focus of the research on the *Preparedness* and *Mitigation* phases is about 27% and 8%, respectively. The *Recovery* phase received the least attention from the scholars, with a focus of about 3%. Only a few studies (about 1%) focused either on a *Holistic* approach (covering all four phases of the disaster management cycle) or presented a *General* view of the management of an epidemiological disaster without indicating any particular phase.

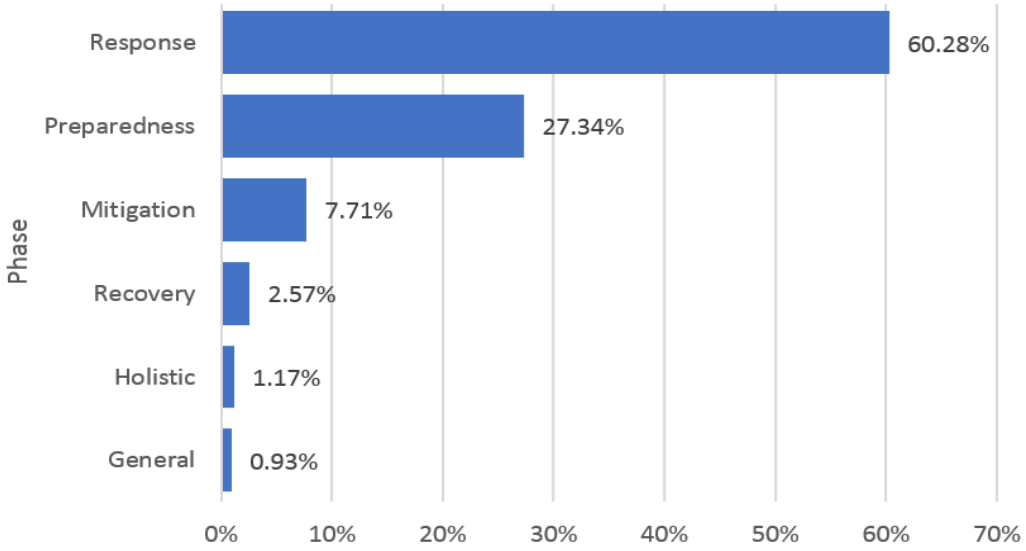

Figure 2.
Percent distribution of the focus of the reviewed studies for the phases of the disaster management cycle.

The reviewed studies were also classified based on the research method carried out. As illustrated in Figure 6, the vast majority of the reviewed studies are of *Conceptual* types, accounting for about 40% of total studies. In other words, most studies do not involve practical experimentation; rather, they rely on the researcher assessing available information on a particular epidemiological event and proposing new concepts, methods, or arguments. *Data review and analysis*, which is one of the widely used approaches, accounts for about 19% of total studies. It is a qualitative research approach in which the researcher examines and analyses various reports, documents, and raw data from multiple sources to generate eligible results and develop conclusions [37]. *Statistical analysis/Survey* procedures are the third most often utilized research approach, accounting for around 12% of total studies, using various statistical techniques and tests. *Simulation*, *Mathematical modeling*, and *Literature review* account for roughly equal percentages of total studies (9 - 8%). Finally, *Interviews* and the process of asking open-ended questions is another qualitative research approach that has been utilized to collect data and draw conclusions, accounting for approximately 5% of total studies.

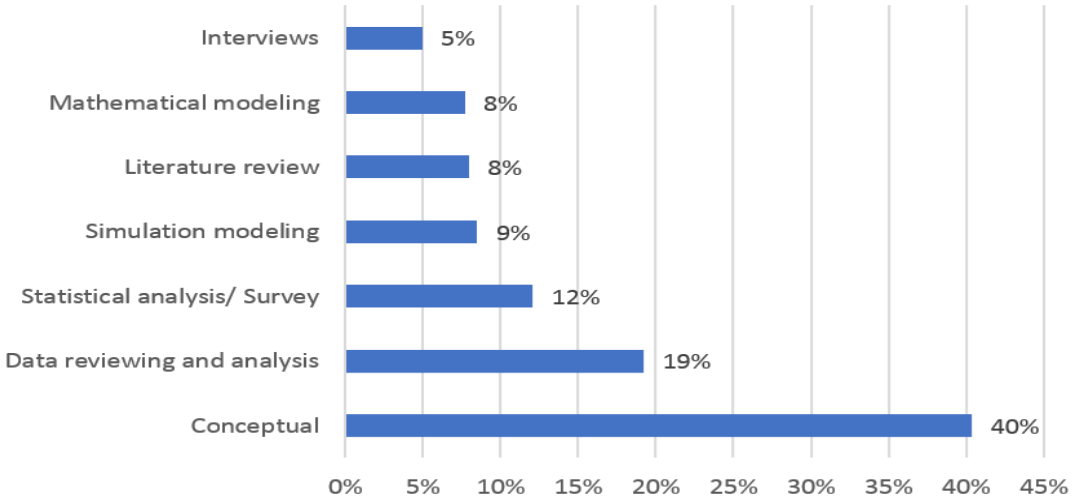

Figure 3.
Research methodologies used in epidemiological disaster management studies.

Even though this literature review focuses on epidemiological disaster management studies, the subject has been approached from various perspectives. Specifically, based on the review, studies in epidemiological disaster management are mainly focused on ten distinct perspectives, as shown and summarized in Table 3.

Table 3.
Perspectives of epidemiological disaster management studies.

Perspective	Explanation
Pandemic planning	Tips and recommendations for developing mitigation, preparedness, response, or recovery strategies to combat pandemics
Government policies and performance	Review and evaluate government performance and its mitigation, preparedness, response, and recovery strategies
Social/ Psychosocial impact	The social and/or psychological impact on individuals and communities, and how they can be mitigated, prepared for, responded to, or recovered from
Pandemic decision-making improvement	Improve the effectiveness of decision-making by studying, analyzing, and evaluating various variables and factors related to pandemics
Health impact	Major public health consequences, as well as issues pertaining to public health systems, policies, and decisions
Pandemic ethics	Ethical issues related to the infringement and limitation of public liberties and constitutional laws.
Economic impact	The financial impact of pandemic management on governments, specific industries, sectors, or companies
Pandemic understanding	Understanding epidemiological strains and new epidemiological concepts, how epidemic disasters develop, and what is the knowledge and attitude of the people about pandemics and the way they are managed
Education impact	A description of how pandemic management affects education and students, and how to mitigate, prepare for, respond to, or recover from it
Environmental impact	The adverse and beneficial effects of pandemics and pandemic planning and response on the environment

As shown in Figure 7, the vast majority of studies (37%) focused on the *Pandemic planning* of an epidemiological event, proposing tips and recommendations for new approaches to either mitigate, prepare for, respond to, or recover from such events. Approximately, 23% of total studies were concerned with *Government policies and performance* toward various epidemiological events, evaluating their strategies throughout the different phases of the disaster management cycle. *Social/Psychosocial impact* and *Pandemic decision-making improvement* each accounted for 11% of total studies, with the former exploring the effects of epidemiological disaster management on individuals and communities and the latter investigating techniques to improve the decision-making process during epidemiological outbreaks. Furthermore, 9% of total studies were related to *Health Impact* and the discussion of issues pertaining to public health systems, policies, and decisions. Another key topic that drew scholars' attention and accounted for 7% of total studies is *Pandemic ethics*, particularly during the COVID-19 pandemic when governments worldwide implemented strict preventive measures of lockdowns and social distancing. *Economic impact* and *Pandemic understanding* each accounted for 6% of the total studies. While *Economic impact* addressed the financial and economic turmoil caused by government policies, *Pandemic understanding* discusses people's attitudes and knowledge of epidemiological outbreaks and related policies. Finally, the topics that did not attract much attention from the scholars were *Education impact* with 2%, and *Environmental impact* with 1% of total studies. The former addresses the influence of epidemiological outbreak policies on the education sector (i.e., schools and students), while the latter addresses the impact of such policies on the environment.

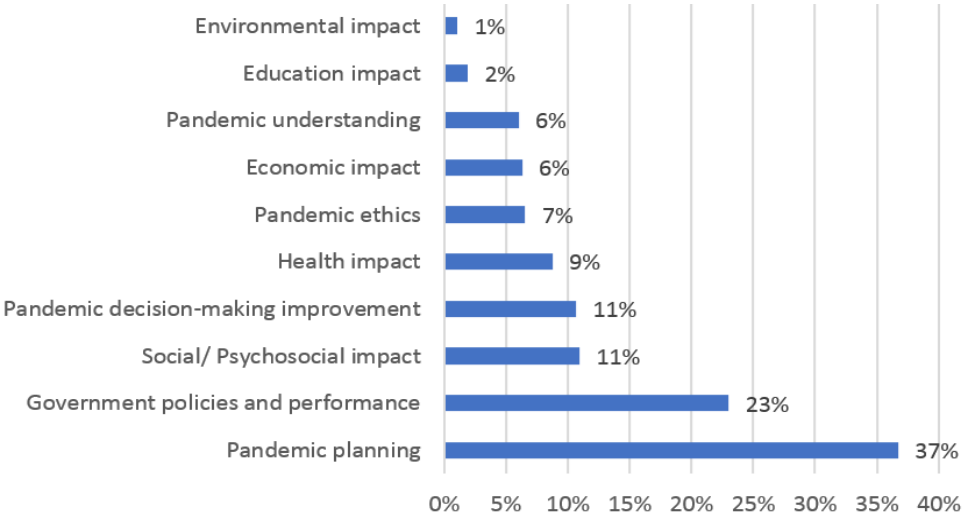

Figure 4.
Perspectives of the epidemiological disaster management studies.

4.2. Inferential Analysis Results

This section aims to investigate whether any specific patterns or relationships exist between the categorical variables of the reviewed studies. By identifying these patterns or relationships, perhaps some new lessons can be learned, and some explanations of certain phenomena can be offered. To this end, the Chi-Square test of independence was performed to compare the observed categorical variables' patterns to those expected and investigate whether potential interdependencies exist across the *Field*, *Phase*, *Perspective*, and *Methodology* categories. Based on the Chi-Square test of independence, a significant relationship exists at a 95% confidence level among the tested categorical variables. Table 4 shows the Chi-Square test results between *Field* with *Phase*, *Field* with *Perspective*, *Field* with *Methodology*, *Phase* with *Perspective*, *Phase* with *Methodology*, and *Perspective* with *Methodology*.

Table 4.
Chi-square test results between the categorical variables of the reviewed studies.

Categorical variables	Chi-square	Degrees of freedom	Cramér's V	p-value
Field with *Phase*	36.96	21	0.18	0.017
Field with *Perspective*	236.87	63	0.29	<0.001
Field with *Methodology*	141.73	42	0.25	<0.001
Phase with *Perspective*	85.03	27	0.25	<0.001
Phase with *Methodology*	37.51	18	0.17	0.004
Perspective with *Methodology*	395.83	54	0.4	<0.001

The Chi-Square test results in Table 4 indicate that all of the relationships between the compared categorical variables have a p-value of less than 5%, implying a significant association and thus rejecting the null hypothesis that they are not related. More specifically, a relationship exists between *Field* and all other variables, *Phase* and all other variables, and between *Perspective* and *Methodology* at a 95% confidence level. Moreover, as evidenced by Cramer's V values of 0.4, there is a strong association between *Perspective* and *Methodology*. On the contrary, Cramer's V values ranging from 17% to 29% for the other Chi-Square tests indicate a moderate relationship between the variables indicated in Table 4.

Figure 8 provides information about the test results between *Field* and *Phase*. The test results between *Field* and *Phase* Figure 8 indicate the number of studies conducted in each field in each disaster management cycle phase. As previously stated, the *Response* phase has received the greatest attention, especially from medical and social science researchers, accounting for approximately 53% and 69% of their total studies. The other disaster management cycle phase that has received significant attention from scholars is the *Preparedness* phase, which has accounted for approximately 35% of the *Medical Sciences* studies, 28% of *Administrative Sciences*, 26% of *Natural Sciences*, 20% of *Social Sciences*, and 15% of *Computer Sciences*. *Pharmaceutical Sciences* have primarily focused on the *Preparedness* and *Responses* phases, with about 50% dedicated to each.

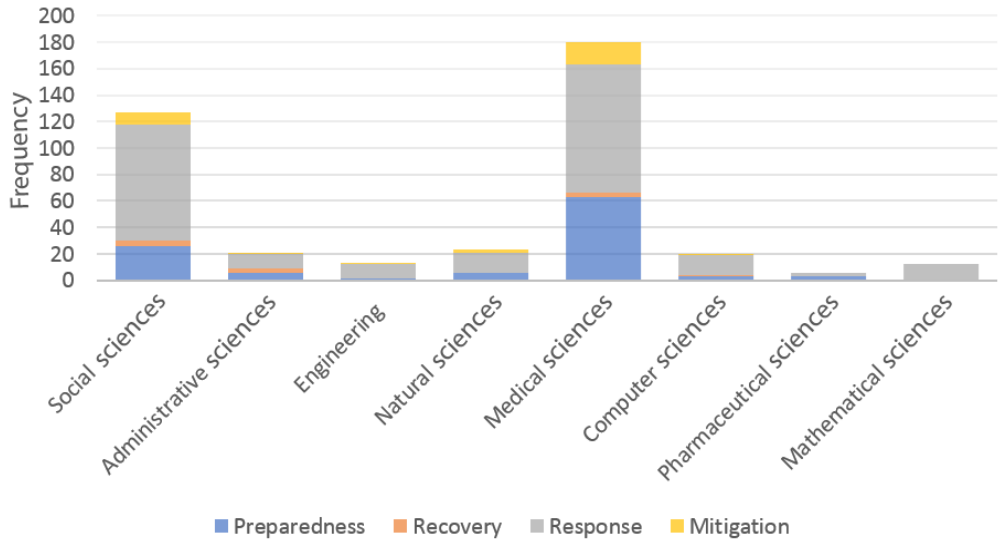

Figure 5.
The field with phase association test result.

Figure 9 depicts the *Field* with *Perspective* test analysis findings, demonstrating how many studies each field performed in the various epidemiological disaster management perspectives. Although the *Medical Sciences* and *Social Sciences* fields have primarily concentrated on the *Pandemic Planning* perspective, with 35% and 30% of their total studies, respectively, other fields have focused on different perspectives. For instance, around 33% of the *Computer Sciences* studies and almost 91% of the *Mathematical Sciences* studies were concentrated on the *Pandemic decision-making improvement* perspective. Furthermore, of the 23 studies conducted in the *Administrative Sciences* field, about 34% focused on the *Economic impact* and 30% on *Pandemic planning*. Also, scholars in the *Engineering* field have focused

equally on *Government policies and performance* and *Pandemic planning*, with 53% of their overall studies and 20% on *Pandemic understanding*.

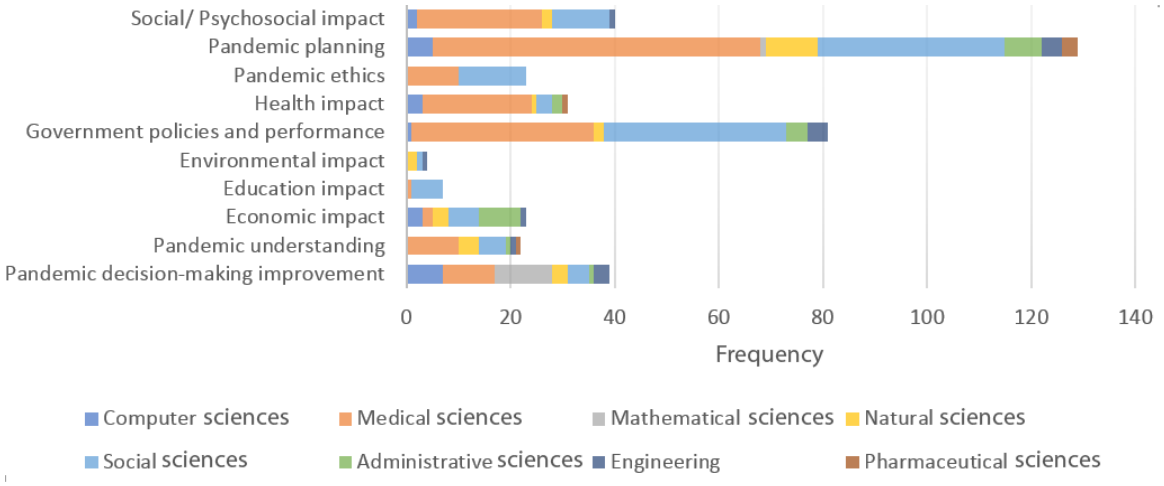

Figure 6.
The field with perspective test results.

In Figure 10, the *Field* with *Methodology* test analysis results reveals that some fields performed most of their studies utilizing the *Conceptual* approach, such as 61% of *Natural Sciences*, 46% of *Medical Sciences*, and 32% of *Social Sciences*. On the contrary, fields such as the *Mathematical Sciences* performed most of their studies utilizing the *Mathematical modeling* approach, 58%, and *Computer sciences* carried out most of their studies using the *Simulation modeling* approach, about 35%.

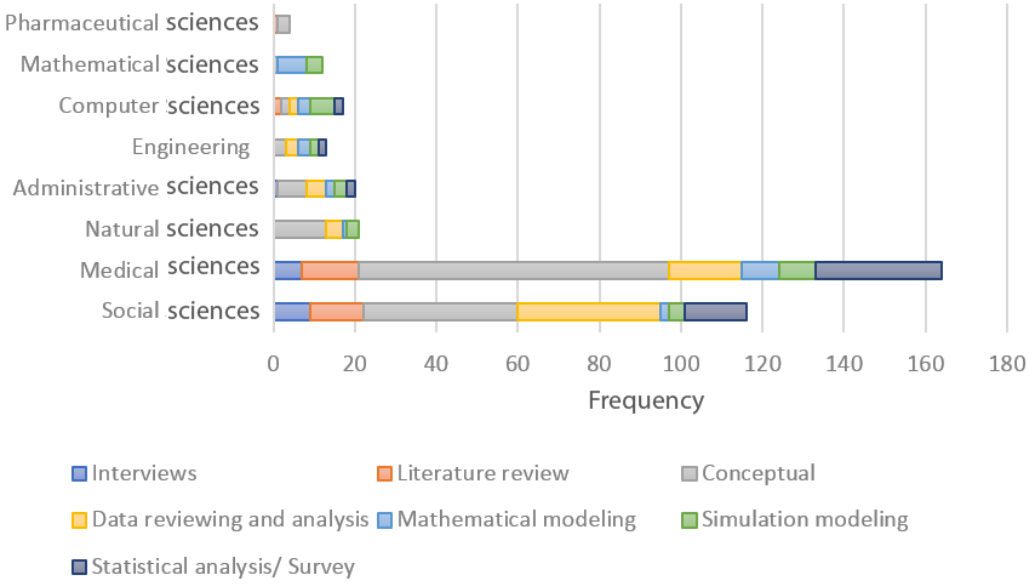

Figure 7.
The field with methodology test results.

The results of the *Phase* with *Perspective* test analysis, illustrated in Figure 11, indicate that the perspectives discussed in the reviewed studies are primarily concerned with the *Response* phase, accounting for around 62% of the total studies. In addition, under the *Response* phase, the perspectives that drew the most attention from scholars are *Pandemic planning*, *Government policies and performance*, and *Social and Psychosocial impact*, accounting for around 26%, 22%, and 13%, respectively. Although the *Preparedness* phase received the second-most attention, accounting for about 26% of total studies, *Pandemic planning* and *Government policies and performance* perspectives remain the most frequently addressed issues, accounting for approximately 50% and 17%, respectively. The *Health impact* perspective in the *Preparedness* phase, on the other hand, was the third most prevalent issue, accounting for around 7% of all studies. Finally, while the *Recovery* phase drew the least attention in academics, the *Pandemic planning* and *Economic impact* perspectives were the most studied concerns within this phase, accounting for 23% of the total studies. The *Social and Psychosocial impact*, as well as the *Education impact*, each accounted for around 15% of all studies. Lastly, *Pandemic decision-making improvement*, *Government policies and performance*, and *Health impact* were the least studied issues within this phase, each accounting for about 7% of the total studies.

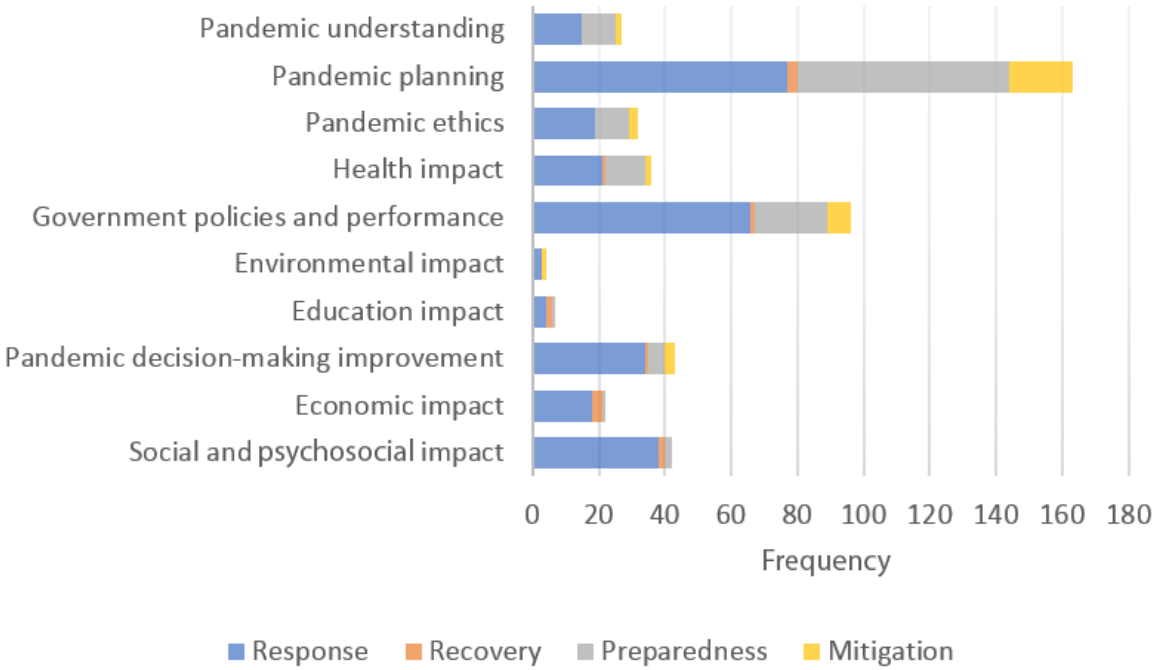

Figure 8.
The phase with perspective test results.

The *Phase* with *Methodology* test results, presented in Figure 12, indicate that in the predominant phase, the *Response* phase, about 32% of the conducted studies were of *Conceptual* type research, 20% used *Data reviewing and analysis*, and 17% used *Statistical analysis and Survey* methodology. However, in the *Preparedness* phase, about 52% were of *Conceptual* type, 16% used *Data reviewing and analysis*, and 9% used *Statistical analysis and Survey* methodology. While the *Conceptual* type of research is still the dominant approach even in the *Mitigation* phase, the studies that used *Simulation modeling* methodology were the second most prevalent, accounting for about 15%, followed by the *Literature review* approach with 8% of the total studies. Finally, in the *Recovery* phase, although there are significantly fewer studies, the type of research method varied without significant differences in the number of one approach over the others.

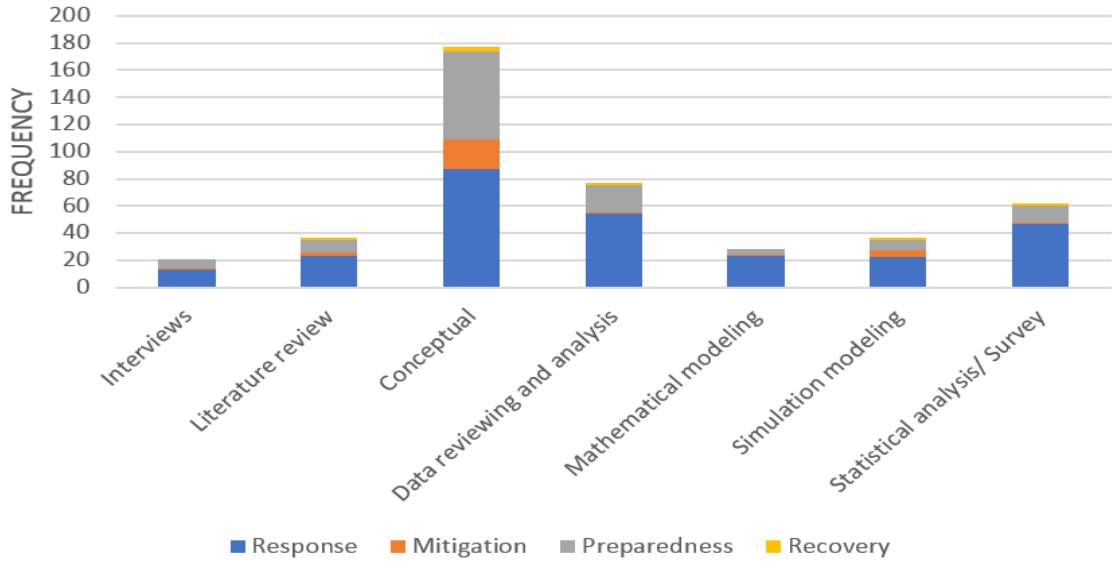

Figure 9.
The phase with methodology test results.

In *Perspective* with *Methodology* test results, shown in Figure 13, the *Conceptual* studies are dominant when discussing *Pandemic planning*, accounting for approximately 67% of the total studies examining this perspective, while *Simulation modeling* and *Mathematical modeling* are the least prevalent, accounting for only 2% of the total studies. On the other hand, s*imulation modeling* and *Mathematical modeling* seem to be the dominant type of research approaches when discussing *Pandemic decision-making improvement*, accounting for approximately 47% of each of the total studies in this perspective. Another notable finding is that in studies related to *Government policies and performance*, the dominating research approaches are *Data reviewing and analysis*, and *statistical analysis/Survey*, accounting for around 40% and 20% of all studies, respectively. Moreover, from the *Social/Psychosocial impact* perspective, most studies were carried out

using *Statistical analysis/Survey*, accounting for around 47% of total studies. Finally, most studies with the *Economic impact* perspective followed the *Data analysis and review* research methodology, accounting for about 39% of total studies.

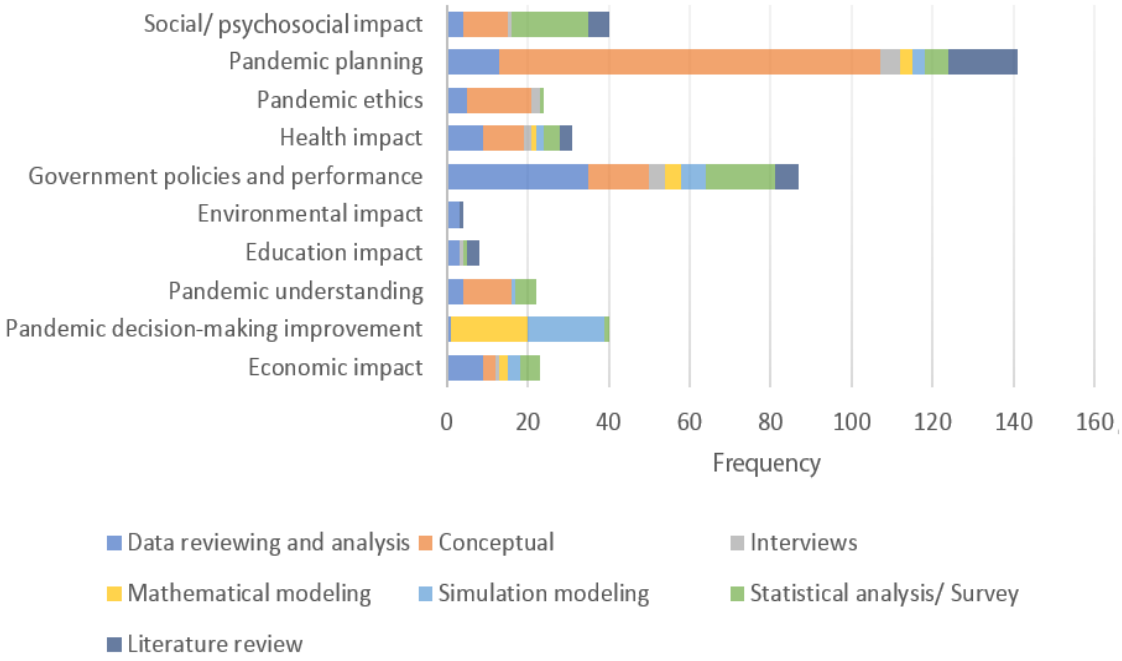

Figure 10.
The perspective with methodology test results.

5. Discussion

This paper presents a survey of research on epidemiological disaster management and its implications published up to December 2021. In the last two years alone, 210 studies in this area that satisfied the inclusion criteria of this survey were published, accounting for 57% of all surveyed papers. This highlights the significance of the subject and the urgent need for its further advancements, particularly in light of the recent COVID-19 outbreak.

Despite the undeniable role of the medical field in managing epidemiological disasters and the number of publications, it has contributed to this topic (44 % of the surveyed sample's studies), the management of epidemiological disasters should not be based solely on medical approaches and policies but should be viewed from a disaster management perspective [38]. Epidemiological disaster management is the process of preventing, preparing for, responding to, and recovering from a pandemic/epidemic event. It requires collaboration among professionals in different fields of expertise to gather information on the environmental, social, economic, logistical, and political factors relevant to a particular outbreak. An important finding of this literature sample surveyed is that dealing with an epidemiological disaster is thus a complex, comprehensive, and integrated multidisciplinary process that needs to extend beyond medical treatments alone.

For instance, just as medicine plays a crucial role in preventing and controlling the spread of a disease through treatment and vaccine development, social-behavioral science can be used to understand the public health implications of an epidemiological event and how the general public will react and be affected by the adapted response [39, 40]. In addition, operations and logistics management could help organizations develop strategic plans to manage risks, develop rapid mass production strategies of necessary medical equipment, and optimally allocate and distribute resources for prophylactic and therapeutic purposes [41, 42]. On the other hand, politics and economics play a significant role in epidemiological disaster management when developing new policies for countries and their healthcare systems, international trades, and preventing economic crises [43, 44]. Accordingly, a complete picture of handling a rapidly spreading epidemiological disaster can be provided when a multidisciplinary approach is applied.

Based on the literature, traditional methods for epidemiological disaster management have focused primarily on medical principles, with mass vaccination programs, lockdowns, and social distance, in an effort to reduce morbidity and mortality. However, these approaches have been implemented with little regard for their social, economic, or political consequences Chakraborty and Maity [4]; Dubey, et al. [45] and Kelso, et al. [46]; Singhal [47]. Moreover, the unprecedented adoption of lockdowns and social distancing regulations throughout many countries during the COVID-19 pandemic demonstrates that these medical interventions may not be efficient, even if they are effective in controlling the spread of an outbreak [48, 49]. In other words, the primary goal of disaster management is to alleviate people's suffering rather than exacerbate it. Thus, managing a disaster by creating new problems is the exact opposite of what disaster management stands for.

Furthermore, while the medical and social sciences literature is replete with epidemiological disaster management publications (73% of the surveyed literature sample), academic disciplines such as operations research, operations management, management sciences, decision sciences, and mathematical and computer sciences have yet to contribute and develop a sufficiently effective amount. In reality, these disciplines are more involved with decision-making sciences through systematic approaches such as mathematical modeling and simulation techniques. Consequently, it is crucial that

they are given more space and a stronger voice in disaster management chains of command. Ideally, when it comes to epidemiological disasters, the chain of command needs to be bolstered by multidisciplinary committees, particularly with decision-making specialists.

Finally, while managing epidemiological disasters is a cyclical process, including the management of several phases, each with its own set of obstacles and complexities, the literature still lacks sufficient studies on the recovery phase (2.57% of the surveyed literature sample). Academics have overlooked this crucial phase for some inexplicable reason. One may argue that the lack of research on the recovery phase is related to the fact that the world is still in pandemic mode with reference to COVID-19. However, the scarcity of studies on the recovery phase of an epidemiological disaster is evident even in studies on earlier outbreaks. Moreover, many fields recognized as being involved in epidemiological disaster management studies, such as engineering, mathematical, natural, and pharmaceutical sciences, have not yet published any research on this phase. In regard to research perspectives, studies on the environmental impact, pandemic ethics, and understanding of pandemics were still lacking during the recovery phase of the management process of pandemics. Lastly, the pandemic recovery phase was not studied using interviews or mathematical modeling techniques. Consequently, it is critical to understand not only how to plan for and respond to an outbreak, but also how to recover and resume ordinary everyday life. Accordingly, it may be time to reconsider epidemiological disaster management methods, as this paper seeks to contribute to this effort through this literature survey.

Limitations of this study may exist due to the multidisciplinary character of the survey process and the fact that it is based on a vast number of published databases and particular search phrases; as a result, relevant research publications may have been overlooked. In addition, due to the multidisciplinary nature of the topic, considerable heterogeneity in the perspectives, designs, quality, and data analysis and reporting of the surveyed literature may hinder a meta-type of analysis.

6. Conclusion

Though the world has experienced various epidemiological disasters throughout history, and recent efforts have been made to plan an appropriate response to such events, managing epidemiological disasters remains a significant challenge. The recent outbreak of COVID-19 has brought to light not just flaws in healthcare systems throughout the world but also the lack of clarity over how to manage such incidents.

Based on the surveyed literature sample, academic disciplines with more decision-making capabilities, such as operations research, operations management, management sciences, decision sciences, and mathematical and computer sciences, should be further involved in epidemiological disasters research to help the medical and social sciences with their effort in better managing such outbreaks. The involvement of such fields can help develop and solve mathematical and simulation models that reflect a particular issue, evaluate the outcomes of various decisions and determine the optimal solution without the need to experiment in the real world. For example, given the severity and transmission rate of a disease, mathematical and simulation models may be constructed to estimate whether or not a lockdown is necessary, how long it should last, and its financial and societal repercussions. However, even though there have been a number of studies along these lines [50, 51] there is still more work to be done before current approaches to the management of epidemiological disasters can be significantly altered and improved.

Another area of research that should be further explored in epidemiological disaster management is the recovery phase and how to set a strategy to resume everyday life after an outbreak. Based on the surveyed literature sample, most of the research on epidemiological disaster management has been focused on the preparedness and response phases of the management cycle, but little research, across all academic disciplines, has been on the recovery phase. Therefore, if better epidemiological disaster management strategies are to be developed, scholars must pay more attention to the recovery phase in their future research.

In this study, epidemiological disaster management literature has been surveyed to provide an overview, descriptive and inferential analysis of current research, issues worthy of further investigation, and problems that have not been adequately addressed. Epidemiological disaster management is a unique and challenging area in which a significant paradigm shift is vital. Therefore, we hope this literature survey is a step in the right direction to get us there.

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