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Global Dengue Fever Management in Health Systems: Identifying Strategies, Challenges, and Solutions - A Scoping Review Protocol

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Abstract

Introduction: Dengue fever, the fastest-spreading mosquito-borne viral disease, poses a significant global public health challenge. Over the past two decades, its rapid spread has been driven by urbanization, climate change, and international travel, particularly affecting tropical and subtropical regions. Despite its considerable economic burden, effective antiviral treatments and vaccines remain unavailable. This study aims to bridge gaps in dengue fever management by systematically identifying and analyzing strategies, challenges, and solutions adopted within health systems worldwide.

Methods and Analysis: This scoping review will adopt the methodological framework of Arksey and O'Malley. A comprehensive search will be conducted across databases including PubMed, Scopus, Web of Science and Embase, along with gray literature sources and manual reference list searches, covering the period from 2003 to 2024, limited to English-language publications. Search strategies will be developed using controlled vocabulary and key terms associated with various components of dengue fever management. Two independent reviewers will screen titles and abstracts based on predefined inclusion and exclusion criteria, followed by full text screening to determine final eligibility. A descriptive numerical analysis will summarize the characteristics of included studies, while a thematic analysis will provide an overview of the literature, encompassing strategies, challenges and Solutions.

Ethics and Dissemination: This study, approved by the Medical Ethics Committee of Mashhad University of Medical Sciences (IR.MUMS.REC.1403.142), adheres to ethical guidelines for handling publicly available data. All findings will be transparently reported and disseminated through peer-reviewed journals, relevant conferences, and stakeholder engagement.

Keywords: dengue fever, strategies, challenges, solutions.

Strengths and Limitations of this Study:

- This review will encompass a comprehensive timeframe of approximately 22 years.
- It will identify knowledge gaps and the need for further research.
- A validated methodological framework and a systematic approach will guide the study.
- The review will be limited to English-language publications.
- The quality of evidence will not be assessed (as this is a scoping review).

Introduction

Dengue fever is the fastest-growing mosquito borne disease in the world, and due to its significant disease burden, the World Health Organization (WHO) identified it as one of the top ten global health threats in 2019 (1). According to WHO reports, the global incidence of dengue has increased rapidly in recent years, with the number of cases more than eightfold over the past two decades. Additionally, reported deaths in 2015 were four times higher than in 2000 (2). It is projected that the burden of dengue fever will continue to rise due to increased vector density, rapid and unplanned urbanization, population growth, international travel, unsanitary waste disposal, and virus evolution(3, 4). Moreover, due to ongoing climate change, Aedes species mosquitoes will likely spread to many new areas. By 2070, an additional 4.7 billion people will be at risk of contracting dengue fever(1). The spread of dengue fever in countries such as China, India, and Pakistan, as well as the recent emergence of the disease in Tokyo, Japan a city that has not seen a dengue epidemic in over 70 years illustrates the shifts in the geographic distribution and ecology of vectors(5).

The highest incidence of dengue occurs in South Asia, Southeast Asia, and Latin America, with 70% of the disease burden in Asia(6, 7). Approximately 2.8 million cases of dengue were reported in Latin America in 2022, with an incidence rate of 282.64 cases per 100,000 people, and all four dengue virus serotypes were found circulating simultaneously, indicating a high transmission rate(8). While this disease primarily affects low and middle income countries, globalization and climate change have increased dengue transmission in previously unaffected regions of Asia, Europe, and North America(9).

Unlike malaria, which receded from Southern Europe in the mid 20th century, Aedes mosquitoes and potentially dengue fever are expanding into warmer areas of high-income countries, including Australia, the United States, and Southern Europe(10). While dengue fever's disease burden, mortality, and economic impact are significant, they are not directly comparable to malaria. Nevertheless, coordinated initiatives that fund regionally and globally shared research and control activities, which have been effective in addressing the global malaria burden, could yield similar success in controlling dengue fever(11). Additionally, adopting effective management models for malaria control and elimination, particularly focusing on quality improvement and participatory processes, could be beneficial in managing dengue fever(12, 13).

Dengue is a costly infection, with an estimated global cost of $8.9 billion in 2013 (14). However, later studies have shown that the global estimates by Shepard et al. did not account for indirect costs, such as lost work or school days and outpatient visits. After including these indirect costs, the global economic impact of productivity loss, mortality, and healthcare utilization in 2013 was estimated at $39.3 billion(15). The true cost of dengue fever is likely underestimated due to underreporting. For example, it was shown that India had approximately 53 million symptomatic infections in 2016, 282 times the officially reported figures with an estimated cost of $5.7 billion(16). In Malaysia, the annual household days lost due to dengue fever ranged from 11.2 to

18.7, while symptomatic patients lost an average of 7.2 to 8.8 workdays per infected individual(17). It is clear that in addition to the morbidity and mortality associated with dengue fever, the disease's economic costs and social impact are substantial. However, housing conditions, socioeconomic status, and equity likely affect disease burden and costs. However, they are not accounted for in current burden and cost calculations due to limited data(18).

Currently, treatment for dengue fever is supportive, and no antiviral therapies are available(19). Similarly, no vaccine has proven effective or safe for widespread public use against dengue(20). Without targeted treatments, effective management relies on individuals seeking timely and appropriate care when dengue fever is suspected. While the mortality rate for severe, untreated cases is around 20%, supportive care reduces this to less than 1% (21).

According to the WHO, the requirements for regional dengue management strategies include recognizing dengue as a major health problem in endemic countries, securing long-term political commitment from governments, promoting multi-sectoral collaboration, ensuring sustained national financial support for dengue prevention and control programs, developing national action plans with clear objectives to reduce dengue mortality, creating surveillance systems that include clinical, laboratory, and entomological components, supporting healthcare services to ensure early diagnosis and prompt treatment of dengue cases, enhancing national capacity for sustainable vector control and preventive actions across health and other sectors, and building national capacity for researching vectors, epidemiology, and laboratory diagnostics of infection. Surveillance, early detection, and rapid response to emerging infectious disease outbreaks require responsible policy-making, planning, education, and support by countries and health systems(19).

Recent studies in various countries have identified diverse strategies for managing dengue fever. For example, the study by Shi Hu et al. identified strategies such as source reduction, vector surveillance, community education, legislation, monitoring and control during outbreaks, risk based prevention and intervention, coordinated inter-sectoral collaboration, and the development and adoption of science and technology(22). The study by Mahmood et al. emphasized environmental management strategies(23). In contrast, the study by Manafa et al. highlighted public service accountability, effectiveness and efficiency, regulation and rule of law, community participation as stakeholders, and collaboration and partnership(24). Additionally, Modin et al. demonstrated the effectiveness of integrated vector management, emphasis on disease management, and social mobilization(25).

Countries use various models and strategies for dengue fever management based on their contexts and resources, and they continuously strive to develop and improve their management approaches. Thus, as a comprehensive and inclusive research method, a scoping review provides an opportunity to identify and examine various strategies and the challenges countries face in managing dengue fever. This approach enables researchers to systematically review and analyze

existing resources and studies, identify successful management models, and recognize existing knowledge gaps(26).

Objective

This study aims to systematically identify strategies for managing dengue fever within health systems worldwide. It seeks to address the challenges encountered in implementing these strategies and propose actionable solutions to enhance dengue fever management at local, regional, and global levels. By doing so, the study aligns with the World Health Organization's (WHO) global health priorities, particularly its goals of reducing the burden of vector-borne diseases and strengthening health systems to respond effectively to emerging public health threats.

Methods and Analysis

Scoping reviews are a relatively new method for synthesizing evidence based research, particularly in health and other disciplines(27). There is no single definition of what constitutes a scoping review, but a widely used definition is provided by Arksey and O'Malley, who describe the purpose of a scoping review as rapidly mapping the key concepts underlying a research area, as well as the main sources and types of available evidence (28). The scoping review framework developed by Arksey and O'Malley in 2005 will be applied to this study. According to this framework, we will follow five stages: (1) identifying the research question, (2) identifying relevant studies, (3) selecting studies, (4) charting the data, and (5) collating, summarizing, and reporting results(28). We will adhere to the Preferred Reporting Items for Systematic Reviews and Meta Analyses Extension for Scoping Reviews (PRISMA-ScR) guidelines, as outlined by Tricco et al.(29, 30).

Stage 1: Identifying the Research Question

In scoping reviews, research questions should be broad to encompass the breadth of evidence(28), linking a clear objective to a well defined aim. The research question formulated in this initial stage provides a solid rationale for conducting the study and facilitates decisions on study selection and data extraction in subsequent stages(31). The research question in this review is based on the Joanna Briggs Institute's PCC (Population-Concept-Context) framework(26) (Table 1). A comprehensive research question was formulated to guide the search strategy: "What strategies are used for managing dengue fever within health systems across the world?" This question enables us to capture relevant literature and allows for refining or adding sub questions throughout the study. The sub-questions are as follows:

1. At which levels of the health system are these strategies implemented?

2. How are various aspects of dengue management, prevention, treatment, and control addressed within these strategies?

3. What are the key challenges in implementing these strategies across different countries?

4. What is the appropriate solution to these challenges?

Stage 2: Identifying Relevant Studies

Our approach includes systematically searching peer reviewed studies from reputable electronic scientific databases. We will also explore the gray literature using Google. The literature search strategy will be conducted in two stages:

Stage 1: The research team will develop and execute an initial limited search in the Pubmed database with support from a research librarian specializing in systematic reviews. Titles, abstracts, and index terms will be analyzed. Guided by this preliminary search, a team of health management specialists, epidemiologists, and a librarian will review the search terms to ensure that relevant keywords are captured in the final search.

Stage 2: Based on the findings from Stage 1, the research team will refine the electronic search strategy and extend it to other electronic platforms. Searches will be conducted in the following databases: PubMed, Scopus, Web of Science and Embase. Literature search strategies will utilize Medical Subject Headings (MeSH) terms and free text words associated with dengue management. Keywords can include dengue fever and its synonyms, strategies and its synonyms, challenges and its synonyms, and solutions and its synonyms A draft of the search strategy is provided in Table 2 of the appendix.

The reference lists of included articles will be examined to capture any potentially missed articles, and the reference lists of related reviews will also be reviewed, with any identified relevant primary studies added manually. Articles published in English from 2003 to 2024 will be included. This timeframe was selected based on our knowledge of the literature, aiming to capture key publications and the first comprehensive guidelines issued by the World Health Organization, the onset of new epidemiological trends, and advancements in dengue fever management strategies. However, foundational studies published before 2003 that are frequently cited or considered influential in the included articles will be manually added to ensure the comprehensiveness of the study. Following the electronic search, data collection, and data extraction, the search results will be imported into data management software (EndNote), and duplicates will be removed. The selected studies will then be screened according to eligibility criteria. Following the electronic search, data collection, and data extraction, the search results will be imported into data management software (EndNote), and duplicates will be removed. The selected studies will then be screened according to eligibility criteria.

Study Date: The study will begin in early 2025.

Stage 3: Study Selection

Article screening will proceed in two phases. Two independent reviewers will assess article eligibility based on inclusion and exclusion criteria (Table 3) during each screening phase. Any disagreements will be resolved through discussion or consultation with a third reviewer. Reviewers will screen all titles and abstracts retrieved from the search. The first 50 articles will be screened to determine the level of inter reviewer agreement(29). The team will also discuss potential protocol adjustments and refine the screening form as necessary. A Cohen's Kappa statistic will be calculated to evaluate inter rater reliability(32). Upon reaching an 80% agreement, the initial screening phase will commence. Studies deemed relevant will advance to the second phase.

Reviewers will use a structured form to screen the full text articles in the second phase. Similar to the abstract screening phase, five initial articles will be screened to ensure optimal agreement. Any necessary adjustments will be discussed and implemented. The full text screening phase will begin once an 80% agreement is achieved between the two reviewers. Only articles meeting all inclusion criteria will be included, and the reasons for excluding any articles will be documented and reported in the scoping review. Reviewers will meet regularly to discuss any disagreements, consulting with the third reviewer as necessary to reach a consensus. The team will also convene periodically to update the guidelines and screening forms.

Stage 4: Charting Information and Data

Following Pollock et al.'s recommendations(33), the review team will conduct data extraction, analysis, and presentation, with the process documented in accessible digital records aligned with the research question and scoping review objectives. To address the research question, the research team will create a data charting form in Excel with the following features: authors, journal, year of publication, study title, study design, study objective, country studied, and key findings relevant to the review's objective. We will also extract all relevant evidence on stakeholder perceptions and experiences regarding the strategies and challenges faced in implementation and solutions. This will include qualitative, quantitative, or mixed data from participant quotes, narrative descriptive summaries, explanations and recommendations, themes, and sub themes.

As a preliminary step, reviewers will independently extract data from the first five articles using the data charting table to confirm that the data extraction approach aligns with the study's objectives. The draft data extraction tool will be refined and revised as necessary throughout the extraction process(31), with any changes detailed as part of the review methodology. Data extraction will then proceed independently by two review authors. In cases of disagreement, consultation with a third reviewer will be sought to reach a consensus. If data are incomplete or

unclear, the original authors will be contacted. If they do not respond or cannot provide the requested information, the data will be considered missing.

Stage 5: Collating, Summarizing, and Reporting Results

The steps in this scoping review are similar to those of a systematic review; however, due to the breadth and diversity of available literature, scoping reviews do not involve a detailed assessment of identified sources(34). Instead, scoping reviews collate evidence through a descriptive numerical summary and thematic analysis(28). The first summary, a descriptive numerical analysis, will be conducted by two graduate students to outline the characteristics of included studies, such as the total number of studies, types of study designs, publication years, types of strategies, and the countries where the studies were conducted. Tabular and graphical data presentations may illustrate identified results, supported by a narrative description of the data (Table 4).

The second summary will be a thematic analysis to provide an overview of the scope of the literature(28). Emerging themes from the review will be organized into a thematic matrix, facilitating easy comparison by theme. For each concept, we will prepare tables and charts. By employing a consistent approach to reporting findings, we will compare across concepts, identify similarities and differences, create a conceptual framework, and highlight gaps. Initial thematic analysis will be conducted by research team leaders and two graduate students, after which the analysis will be shared with the research team and reviewed during an in-person team meeting. In this session, the research team will determine the best approach to present the study's final output and convey the findings of the scoping review. We will also discuss the implications of these findings for future research in dengue fever management.

Review Team

The review team consists of experienced researchers with backgrounds in public health, epidemiology, healthcare management, health policy, and literature review methodologies (scoping and systematic reviews).

Patient and Public Involvement

Patients AND/OR the public were not involved in any stage of this study.

Discussion

This scoping review offers a comprehensive synthesis of global strategies for managing dengue fever, addressing the multifaceted challenges faced by health systems worldwide. By identifying strategies and effective models, the findings of this study have the potential to directly influence

key aspects of dengue fever management at various levels of health systems and beyond. Additionally, by identifying existing gaps, it can help guide the direction of future research.

Limitations

This scoping review acknowledges several limitations inherent in its design and methodology and has adopted strategies to address biases and constraints. One of these strategies is the use of a dual-reviewer system for study selection, data extraction, and analysis, which helps reduce individual biases and ensures consistency in applying inclusion and exclusion criteria. Additionally, to bridge historical knowledge with current practices, foundational and frequently cited studies, even those published before 2003, have been manually included in the review.

The study is limited to English-language publications, as translating technical content from other languages into English may lead to inaccuracies or loss of nuance. Furthermore, conducting a multilingual review would require significant resources and time, which is not feasible for this research. However, to address this limitation, summaries or translated abstracts in English, when available, have been considered.

The goal of this review is to provide an overview of the available evidence rather than assess the quality of individual studies. The findings focus more on identifying strategies, challenges, and solutions, and a systematic, transparent methodology has been used to ensure consistency and reproducibility.

Conclusion

This scoping review will provide a deeper understanding of the scope and nature of developed strategies for dengue fever management. We anticipate that the knowledge derived from this scoping review will aid health managers and policymakers in leveraging successful global experiences for the control and prevention of dengue, enabling more scientific and effective decision making to manage dengue fever and reduce its burden, especially in countries newly encountering or expected to encounter this disease. Additionally, the findings of this study will serve as a foundation for our team to develop an extensive research program to design a dengue fever management model in subsequent phases.

Ethics and Dissemination

This scoping review is part of a Ph.D. thesis in healthcare management, it has been approved by the Medical Ethics Committee at Mashhad University of Medical Sciences (IR.MUMS.REC.1403.142).

To facilitate knowledge dissemination, the findings of this scoping review will be published in a peer-reviewed journal, presented at conferences relevant to this research area, and shared with relevant stakeholders.

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Author Contributions

Conceptualization: EH , SST , JM , EMF
Methodology: EMF
Manuscript Drafting: MS , AGH
Critical Revision of the Manuscript: EMF
Supervision and Feedback: EH , EMF
Final Approval of the Version: EH , SST , JM , EMF , MS

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There are no competing interests.

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Table 1: PCC framework of our scoping review

PCC element	Definition
Participants	-
Concept	The strategies used in the management of dengue disease, the focus dimensions of these strategies, the level of their implementation in the health system, the challenges facing the implementation of programs and interventions, and the proposed solutions.
Context	Health systems of the world countries.

Table 2: Search strategy

DATABASE	SEARCH STRATEGY

PUBMED	(("Dengue"[Mesh] OR "Dengue Virus"[Mesh] OR dengue[Title/Abstract] OR "dengue fever"[Title/Abstract] OR "break-bone fever"[Title/Abstract] OR "dengue hemorrhagic fever"[Title/Abstract] OR "dengue hemorrhagic fever"[Title/Abstract] OR "dengue shock syndrome"[Title/Abstract]) AND (("Plan"[Title/Abstract] OR "Program"[Title/Abstract] OR "Intervention"[Title/Abstract] OR "Initiative"[Title/Abstract] OR "Prevention Program"[Title/Abstract] OR "Control Program"[Title/Abstract] OR "Control"[Title/Abstract] OR "Management Program"[Title/Abstract]) OR ("Strategy"[Title/Abstract] OR "Policy"[Title/Abstract] OR "Approach"[Title/Abstract])) AND ("Prevention"[Title/Abstract] OR "Public Health"[MeSH] OR "Control"[Title/Abstract]) AND ("Challenge"[Title/Abstract] OR "Challenges"[Title/Abstract] OR "Barriers"[Title/Abstract] OR "Shortcoming"[Title/Abstract] OR "Obstacle"[Title/Abstract] OR "Difficulties"[Title/Abstract] OR "Limitations"[Title/Abstract])) AND ("2003/01/01"[Date - Publication] : "3000"[Date - Publication]) NOT ("Animals"[Mesh] NOT ("Animals"[Mesh] AND "Humans"[Mesh]))

Table 3: Inclusion and Exclusion criteria

Inclusion criteria	Exclusion criteria
English language	Non-English language
Studies published since 2003	Articles published before 2003 (unless identified as foundational by citation analysis).
Peer-reviewed articles, reviews, and gray literature focusing on dengue management strategies, challenges, and solutions.	Studies that are determined after a full review of the text are outside the scope of the concept and field of our research.
Articles with full-text access.	Not access to full-text
Publication Status: published	Publication status: pre-print

Table 4. Preliminary items of the data extraction form.

Item	Description

Author(s)	
Journal	
Title	
Year of publication	
Country/continent	Country Continent
Type of evidence source	journal articles
Aims/purposes/Arguments/Problem	
Conceptual framework or theory	
Study design	Qualitative Quantitative Mixed
Data collection period / considered period	
Methodological approach	
Thematic data (to guide basic qualitative data analysis)	
Key findings related to the study objective	Types of dengue fever management strategies The focus dimensions of these strategies The level of their implementation in the health system The challenges facing the implementation of programs and interventions The proposed solutions.

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Global Dengue Fever Management in Health Systems: Identifying Strategies, Challenges, and Solutions - A Scoping Review Protocol

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Abstract

Introduction: Dengue fever, the fastest-spreading mosquito-borne viral disease, poses a significant global public health challenge. Over the past two decades, its rapid spread has been driven by urbanization, climate change, and international travel, particularly affecting tropical and subtropical regions. Despite its considerable economic burden, effective antiviral treatments and vaccines remain unavailable. This study aims to bridge gaps in dengue fever management by systematically identifying and analyzing strategies, challenges, and solutions adopted within health systems worldwide.

Methods and Analysis: This scoping review will adopt the methodological framework of Arksey and O'Malley. A comprehensive search will be conducted across databases including PubMed, Scopus, Web of Science, Embase and Cochrane Library, along with gray literature sources and manual reference list searches, covering the period from 2003 to 2024, limited to English-language publications. Search strategies will be developed using controlled vocabulary and key terms associated with various components of dengue fever management. Two independent reviewers will screen titles and abstracts based on predefined inclusion and exclusion criteria, followed by full text screening to determine final eligibility. A descriptive numerical analysis will summarize the characteristics of included studies, while a thematic analysis will provide an overview of the literature, encompassing strategies, challenges and Solutions.

Ethics and Dissemination: This study, approved by the Medical Ethics Committee of Mashhad University of Medical Sciences (IR.MUMS.REC.1403.142), adheres to ethical guidelines for handling publicly available data. All findings will be transparently reported and disseminated through peer-reviewed journals, relevant conferences, and stakeholder engagement.

Keywords: dengue fever, strategies, challenges, solutions.

Strengths and Limitations of this Study:

- This scoping review uses Arksey & O'Malley's framework.
- The search strategy will cover both peer-reviewed and grey literature.
- Two independent reviewers will conduct screening and extraction.
- The review will be limited to English-language publications.
- The quality of evidence will not be assessed (as this is a scoping review).

Introduction

Dengue fever is the fastest-growing mosquito borne disease in the world, and due to its significant disease burden, the World Health Organization (WHO) identified it as one of the top ten global health threats in 2019 [1]. According to WHO reports, the global incidence of dengue has increased rapidly in recent years, with the number of cases more than eightfold over the past two decades. Additionally, reported deaths in 2015 were four times higher than in 2000 [2]. It is projected that the burden of dengue fever will continue to rise due to increased vector density, rapid and unplanned urbanization, population growth, international travel, unsanitary waste disposal, and virus evolution[3,4]. Moreover, due to ongoing climate change, *Aedes* species mosquitoes will likely spread to many new areas. By 2070, an additional 4.7 billion people will be at risk of contracting dengue fever[1]. The spread of dengue fever in countries such as China, India, and Pakistan, as well as the recent emergence of the disease in Tokyo, Japan a city that has not seen a dengue epidemic in over 70 years illustrates the shifts in the geographic distribution and ecology of vectors[5].

The highest incidence of dengue occurs in South Asia, Southeast Asia, and Latin America, with 70% of the disease burden in Asia[6,7]. Approximately 2.8 million cases of dengue were reported in Latin America in 2022, with an incidence rate of 282.64 cases per 100,000 people, and all four dengue virus serotypes were found circulating simultaneously, indicating a high transmission rate[8]. While this disease primarily affects low and middle income countries, globalization and climate change have increased dengue transmission in previously unaffected regions of Asia, Europe, and North America[9].

Unlike malaria, which receded from Southern Europe in the mid 20th century, *Aedes* mosquitoes and potentially dengue fever are expanding into warmer areas of high-income countries, including Australia, the United States, and Southern Europe[10]. While dengue fever's disease burden, mortality, and economic impact are significant, they are not directly comparable to malaria. Nevertheless, coordinated initiatives that fund regionally and globally shared research and control activities, which have been effective in addressing the global malaria burden, could yield similar success in controlling dengue fever[11]. Additionally, adopting effective management models for malaria control and elimination, particularly focusing on quality improvement and participatory processes, could be beneficial in managing dengue fever[12,13].

Dengue is a costly infection, with an estimated global cost of $8.9 billion in 2013 [14]. However, later studies have shown that the global estimates by Shepard et al. did not account for indirect costs, such as lost work or school days and outpatient visits. After including these indirect costs, the global economic impact of productivity loss, mortality, and healthcare utilization in 2013 was estimated at $39.3 billion[15]. The true cost of dengue fever is likely underestimated due to underreporting. For example, it was shown that India had approximately 53 million symptomatic infections in 2016, 282 times the officially reported figures with an estimated cost of $5.7

billion[16]. In Malaysia, the annual household days lost due to dengue fever ranged from 11.2 to 18.7, while symptomatic patients lost an average of 7.2 to 8.8 workdays per infected individual[17]. It is evident that, beyond the morbidity and mortality linked to dengue fever, the disease imposes considerable economic costs and social consequences. Although housing conditions, socioeconomic status, and equity are likely to influence both disease burden and associated costs, these factors remain underrepresented in most current assessments[18].

Currently, treatment for dengue fever is supportive, meaning it is focused on managing clinical symptoms and preventing complications rather than targeting the virus itself. This typically involves fluid replacement, fever and pain management, and close monitoring for signs of severe disease, such as hemorrhage or shock. No antiviral therapies are currently available for dengue infection[19]. Similarly, no vaccine has proven effective or safe for widespread public use against dengue[20]. Without targeted treatments, effective management relies on individuals seeking timely and appropriate care when dengue fever is suspected. While the mortality rate for severe, untreated cases is around 20%, supportive care reduces this to less than 1%[21].

According to the WHO, the requirements for regional dengue management strategies include recognizing dengue as a major health problem in endemic countries, securing long-term political commitment from governments, promoting multi-sectoral collaboration, ensuring sustained national financial support for dengue prevention and control programs, developing national action plans with clear objectives to reduce dengue mortality, creating surveillance systems that include clinical, laboratory, and entomological components, supporting healthcare services to ensure early diagnosis and prompt treatment of dengue cases, enhancing national capacity for sustainable vector control and preventive actions across health and other sectors, and building national capacity for researching vectors, epidemiology, and laboratory diagnostics of infection. Surveillance, early detection, and rapid response to emerging infectious disease outbreaks require responsible policy-making, planning, education, and support by countries and health systems[19].

Recent studies in various countries have identified diverse strategies for managing dengue fever. For example, the study by Shi Hu et al. identified strategies such as source reduction, vector surveillance, community education, legislation, monitoring and control during outbreaks, risk based prevention and intervention, coordinated inter-sectoral collaboration, and the development and adoption of science and technology[22]. The study by Mahmood et al. emphasized environmental management strategies[23]. In contrast, the study by Manafa et al. highlighted public service accountability, effectiveness and efficiency, regulation and rule of law, community participation as stakeholders, and collaboration and partnership[24]. Additionally, Modin et al. demonstrated the effectiveness of integrated vector management, emphasis on disease management, and social mobilization[25].

Countries use various models and strategies for dengue fever management based on their contexts and resources, and they continuously strive to develop and improve their management approaches. Thus, as a comprehensive and inclusive research method, a scoping review provides an opportunity to identify and examine various strategies and the challenges countries face in managing dengue fever. This approach enables researchers to systematically review and analyze existing resources and studies, identify successful management models, and recognize existing knowledge gaps[26].

Objective

This study aims to systematically identify strategies for managing dengue fever within health systems worldwide. It seeks to address the challenges encountered in implementing these strategies and propose actionable solutions to enhance dengue fever management at local, regional, and global levels. By doing so, the study aligns with the World Health Organization's (WHO) global health priorities, particularly its goals of reducing the burden of vector-borne diseases and strengthening health systems to respond effectively to emerging public health threats.

Methods and Analysis

Scoping reviews are a relatively new method for synthesizing evidence based research, particularly in health and other disciplines[27]. There is no single definition of what constitutes a scoping review, but a widely used definition is provided by Arksey and O'Malley, who describe the purpose of a scoping review as rapidly mapping the key concepts underlying a research area, as well as the main sources and types of available evidence[28]. The scoping review framework developed by Arksey and O'Malley in 2005 will be applied to this study. According to this framework, we will follow five stages: 1-identifying the research question, 2-identifying relevant studies, 3-selecting studies, 4-charting the data, and 5-collating, summarizing, and reporting results [28]. We will adhere to the Preferred Reporting Items for Systematic Reviews and Meta Analyses Extension for Scoping Reviews (PRISMA-ScR) guidelines, as outlined by Tricco et al[29,30].

Stage 1: Identifying the Research Question

In scoping reviews, research questions should be broad to encompass the breadth of evidence[28], linking a clear objective to a well defined aim. The research question formulated in this initial stage provides a solid rationale for conducting the study and facilitates decisions on study selection and data extraction in subsequent stages[31]. The research question in this review is based on the Joanna Briggs Institute's PCC (Population-Concept-Context) framework[26]. (Table 1). A comprehensive research question was formulated to guide the search strategy:

"What strategies are used for managing dengue fever within health systems across the world?" This question enables us to capture relevant literature and allows for refining or adding sub questions throughout the study. The sub-questions are as follows:

1. At which levels of the health system are these strategies implemented?

2. How are various aspects of dengue management, prevention, treatment, and control addressed within these strategies?

3. What are the key challenges in implementing these strategies across different countries?

4. What is the appropriate solution to these challenges?

Stage 2: Identifying Relevant Studies

Our approach includes systematically searching peer reviewed studies from reputable electronic scientific databases. We will also explore the gray literature using Google. The literature search strategy will be conducted in two stages:

Stage 1: The research team will develop and execute an initial limited search in the Pubmed database with support from a research librarian specializing in systematic reviews. Titles, abstracts, and index terms will be analyzed. Guided by this preliminary search, a team of health management specialists, epidemiologists, and a librarian will review the search terms to ensure that relevant keywords are captured in the final search.

Stage 2: Based on the findings from Stage 1, the research team will refine the electronic search strategy and search strategies will be specifically developed and adapted for each individual database to ensure optimal retrieval of relevant literature. Searches will be conducted in the following databases: PubMed, Scopus, Web of Science, Embase and Cochrane Library. Literature search strategies will utilize Medical Subject Headings (MeSH) terms and free text words associated with dengue management. Keywords can include dengue fever and its synonyms, strategies and its synonyms, challenges and its synonyms, and solutions and its synonyms A draft of the search strategy is provided in Table 2.

The reference lists of included articles will be examined to capture any potentially missed articles, and the reference lists of related reviews will also be reviewed, with any identified relevant primary studies added manually. Articles published in English from 2003 to 2024 will be included. This timeframe was selected based on our knowledge of the literature, aiming to capture key publications and the first comprehensive guidelines issued by the World Health Organization, the onset of new epidemiological trends, and advancements in dengue fever management strategies. However, foundational studies published before 2003 that are frequently cited or considered influential in the included articles will be manually added to ensure the

comprehensiveness of the study. Following the electronic search, data collection, and data extraction, the search results will be imported into data management software (EndNote), and duplicates will be removed. The selected studies will then be screened according to eligibility criteria. Study Date: The study will begin in early 2025.

Stage 3: Study Selection

Article screening will proceed in two phases. Two independent reviewers (M.S and A.G) will assess article eligibility based on inclusion and exclusion criteria (Table 3) during each screening phase. Any disagreements will be resolved through discussion or consultation with a third reviewer (E.H). Reviewers will screen all titles and abstracts retrieved from the search. The first 50 articles will be screened to determine the level of inter reviewer agreement[29]. The team will also discuss potential protocol adjustments and refine the screening form as necessary. A Cohen's Kappa statistic will be calculated to evaluate inter rater reliability[32]. Upon reaching an 80% agreement, the initial screening phase will commence. Studies deemed relevant will advance to the second phase.

Reviewers will use a structured form to screen the full text articles in the second phase. Similar to the abstract screening phase, five initial articles will be screened to ensure optimal agreement. Any necessary adjustments will be discussed and implemented. The full text screening phase will begin once an 80% agreement is achieved between the two reviewers. Only articles meeting all inclusion criteria will be included, and the reasons for excluding any articles will be documented and reported in the scoping review. Reviewers will meet regularly to discuss any disagreements, consulting with the third reviewer as necessary to reach a consensus. The team will also convene periodically to update the guidelines and screening forms.

Stage 4: Charting Information and Data

Following Pollock et al.'s recommendations[33], the review team will conduct data extraction, analysis, and presentation, with the process documented in accessible digital records aligned with the research question and scoping review objectives. To address the research question, the research team will create a data charting form in Excel with the following features: authors, journal, year of publication, study title, study design, study objective, country studied, and key findings relevant to the review's objective. Additionally, all pertinent evidence related to stakeholder perceptions and experiences will be extracted. This includes both perceived and objective implementation challenges, as well as proposed solutions. Data may be qualitative, quantitative, or mixed in nature and will encompass participant quotations, narrative summaries, explanatory insights, recommendations, themes, and sub-themes.

As a preliminary step, reviewers will independently extract data from the first five articles using the data charting table to confirm that the data extraction approach aligns with the study's objectives. The draft data extraction tool will be refined and revised as necessary throughout the

extraction process[31], with any changes detailed as part of the review methodology. Data extraction will then proceed independently by two review authors. In cases of disagreement, consultation with a third reviewer will be sought to reach a consensus. If data are incomplete or unclear, the original authors will be contacted. If they do not respond or cannot provide the requested information, the data will be considered missing.

Stage 5: Collating, Summarizing, and Reporting Results

The steps in this scoping review are similar to those of a systematic review; however, due to the breadth and diversity of available literature, scoping reviews do not involve a detailed assessment of identified sources[34]. Instead, scoping reviews collate evidence through a descriptive numerical summary and thematic analysis[28]. The first summary, a descriptive numerical analysis, will be conducted by two graduate students to outline the characteristics of included studies, such as the total number of studies, types of study designs, publication years, types of strategies, and the countries where the studies were conducted. Tabular and graphical data presentations may illustrate identified results, supported by a narrative description of the data (Table 4).

The second summary will be a thematic analysis to provide an overview of the scope of the literature[28]. Emerging themes from the review will be organized into a thematic matrix, facilitating easy comparison by theme. For each concept, we will prepare tables and charts. By employing a consistent approach to reporting findings, we will compare across concepts, identify similarities and differences, create a conceptual framework, and highlight gaps. Initial thematic analysis will be conducted by research team leaders and two graduate students, after which the analysis will be shared with the research team and reviewed during an in-person team meeting. In this session, the research team will determine the best approach to present the study's final output and convey the findings of the scoping review. We will also discuss the implications of these findings for future research in dengue fever management.

Review Team

The review team consists of experienced researchers with backgrounds in public health, epidemiology, healthcare management, health policy, and literature review methodologies (scoping and systematic reviews).

Patient and Public Involvement

Patients AND/OR the public were not involved in any stage of this study.

Discussion

This scoping review offers a comprehensive synthesis of global strategies for managing dengue fever, addressing the multifaceted challenges faced by health systems worldwide. By identifying strategies and effective models, the findings of this study have the potential to directly influence key aspects of dengue fever management at various levels of health systems and beyond. Additionally, by identifying existing gaps, it can help guide the direction of future research.

Limitations

This scoping review acknowledges several limitations inherent in its design and methodology and has adopted strategies to address biases and constraints. One of these strategies is the use of a dual-reviewer system for study selection, data extraction, and analysis, which helps reduce individual biases and ensures consistency in applying inclusion and exclusion criteria. Additionally, to bridge historical knowledge with current practices, foundational and frequently cited studies, even those published before 2003, have been manually included in the review.

The study is limited to English-language publications, as translating technical content from other languages into English may lead to inaccuracies or loss of nuance. Furthermore, conducting a multilingual review would require significant resources and time, which is not feasible for this research. However, to address this limitation, summaries or translated abstracts in English, when available, have been considered.

The goal of this review is to provide an overview of the available evidence rather than assess the quality of individual studies. The findings focus more on identifying strategies, challenges, and solutions, and a systematic, transparent methodology has been used to ensure consistency and reproducibility.

Ethics and Dissemination

This scoping review is part of a Ph.D. thesis in healthcare management, it has been approved by the Medical Ethics Committee at Mashhad University of Medical Sciences (IR.MUMS.REC.1403.142).

To facilitate knowledge dissemination, the findings of this scoping review will be published in a peer-reviewed journal, presented at conferences relevant to this research area, and shared with relevant stakeholders.

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Author Contributions

Conceptualization: EH , SST , JM , EMF
Methodology: EMF
Manuscript Drafting: MS , AGH
Critical Revision of the Manuscript: EMF
Supervision and Feedback: EH , EMF
All authors (EH, SST, JM, EMF, MS) read and approved the final version of the manuscript.
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Table 1: PCC framework of our scoping review

PCC element	Definition
Participants	-
Concept	The strategies used in the management of dengue disease, the focus dimensions of these strategies, the level of their implementation in the health system, the challenges facing the implementation of programs and interventions, and the proposed solutions.
Context	Health systems of the world countries.

Table 2: Search strategy

DATABASE	SEARCH STRATEGY
PUBMED	(("Dengue"[Mesh] OR "Dengue Virus"[Mesh] OR dengue[Title/Abstract] OR "dengue fever"[Title/Abstract] OR "break-bone fever"[Title/Abstract] OR "dengue hemorrhagic fever"[Title/Abstract] OR "dengue shock syndrome"[Title/Abstract]) AND (("Plan"[Title/Abstract] OR "Program"[Title/Abstract] OR "Intervention"[Title/Abstract] OR "Initiative"[Title/Abstract] OR "Prevention Program"[Title/Abstract] OR "Control Program"[Title/Abstract] OR "Control"[Title/Abstract] OR "Management Program"[Title/Abstract]) OR ("Strategy"[Title/Abstract] OR "Policy"[Title/Abstract] OR "Approach"[Title/Abstract])) AND ("Prevention"[Title/Abstract] OR "Public Health"[MeSH] OR "Control"[Title/Abstract]) AND ("Challenge"[Title/Abstract] OR "Challenges"[Title/Abstract] OR "Barriers"[Title/Abstract] OR "Shortcoming"[Title/Abstract] OR "Obstacle"[Title/Abstract] OR "Difficulties"[Title/Abstract] OR "Limitations"[Title/Abstract])) Filters: English, from 2003/1/1 - 2024/12/31 Sort by: Most Recent

Table 3: Inclusion and Exclusion criteria

Inclusion criteria	Exclusion criteria
English language	Non-English language
Studies published since 2003	Articles published before 2003 (unless identified as foundational by citation analysis).
Peer-reviewed articles, reviews, and gray literature focusing on dengue management strategies, challenges, and solutions.	Studies that are determined after a full review of the text are outside the scope of the concept and field of our research.
Articles with full-text access.	Not access to full-text
Publication Status: published	Publication status: pre-print

Table 4. Preliminary items of the data extraction form.

Item	Description
Author(s)	
Journal	
Title	
Year of publication	
Country/continent	Country Continent
Endemic or non-endemic dengue in the country	
Type of evidence source	journal articles
Aims/purposes/Arguments/Problem	
Conceptual framework or theory	
Study design	Qualitative Quantitative Mixed
Data collection period / considered period	
Methodological approach	
Thematic data (to guide basic qualitative data analysis)	
Key findings related to the study objective	Types of dengue fever management strategies The focus dimensions of these strategies The level of their implementation in the health system The objective challenges facing the implementation of programs and interventions The perceived challenges facing the implementation of programs and interventions The proposed solutions.