

## Global Trends in Mass Gathering Events: A Bibliometric Analysis (1984-2023)

Kitlesel Toplanma Etkinliklerinde Küresel Eğilimler: Bibliyometrik Bir Analiz (1984-2023)

Ahmet Doğan KUDAY<sup>1</sup>, Kerem KINIK<sup>2</sup>, Cüneyt ÇALIŞKAN<sup>3</sup>, Nihal DAĞ<sup>4</sup>

### ABSTRACT

Mass gatherings are events where a significant number of individuals congregate in a specific location for a common purpose, such as cultural festivals, sports events, religious gatherings, political rallies, and concerts. While studies on mass gathering events have garnered global attention, there has been a lack of published bibliometric research on this subject. To address this gap, this study aims to examine the bibliometric analysis and visualization of the current literature on mass gathering events. In this study, articles were compiled by conducting a search with the keyword "mass gathering" in the Web of Science database, without implementing any exclusion criteria. Performance evaluation, science mapping, and network mapping techniques were employed for bibliometric analysis, utilizing the Bibliometrix software. From 1984 to 2023, a total of 1.342 articles were documented across 571 unique sources, accumulating 30.006 citations and averaging 14.26 citations per publication. Significantly, Memish ZA is the most cited author with 3.234 citations, the journal Prehospital and Disaster Medicine is the most cited source with 1.454 citations, and the USA is the most cited country with 873 articles. The trend topic analysis highlighted keywords such as "meta analysis", "covid-19", "preventive measures" and "spread". Research on mass gathering events has been experiencing significant growth in recent years. The findings elucidates the dynamic field of mass gathering events, providing a comprehensive overview of existing research and potential future directions.

**Keywords:** Analysis, Bibliometric, Mass gathering, Public health

### ÖZ

Kitlesel toplanmalar, kültürel festivaller, spor etkinlikleri, dini toplantılar, siyasi mitingler ve konserler gibi önemli sayıda bireyin ortak bir amaç için belirli bir yerde bir araya geldiği etkinliklerdir. Kitlesel toplanma etkinlikleri üzerine yapılan çalışmalar dünya çapında ilgi görürken, bu konuda yayınlanmış bibliyometrik araştırma eksikliği bulunmaktadır. Bu boşluğu gidermek için, bu çalışma kitlesel toplanma etkinliklerine ilişkin mevcut literatürün bibliyometrik analizini ve görselleştirilmesini amaçlamıştır. Bu çalışmada, Web of Science veri tabanında "mass gathering" anahtar kelimesi ile arama yapılarak, herhangi bir dışlama kriteri uygulanmadan makaleler derlenmiştir. Bibliyometrik analiz için Bibliometrix yazılımı kullanılarak performans değerlendirme, bilim haritalama ve ağ haritalama teknikleri kullanılmıştır. 1984'ten 2023'e kadar 571 farklı kaynaktan toplam 1.342 makale belgelenmiş, 30.006 atıf toplanmış ve yayın başına ortalama 14.26 atıf alınmıştır. Memish ZA'nın 3.234 atıfıyla en çok atıf alan yazar, Prehospital and Disaster Medicine dergisinin 1.454 atıfıyla en çok atıf alan kaynak ve ABD'nin 873 makaleyle en çok atıf alan ülke olması dikkat çekicidir. Trend konu analizinde "meta analiz", "covid-19", "önleyici tedbirler" ve "yayımla" gibi anahtar kelimeler öne çıkmıştır. Kitlesel toplanma etkinlikleri üzerine yapılan araştırmalar son yıllarda önemli bir büyüme kaydetmektedir. Bulgular, mevcut araştırmalara ve gelecekteki potansiyel yönelimlere kapsamlı bir genel bakış sunarak kitlesel toplanma etkinliklerinin dinamik alanını aydınlatmaktadır.

**Anahtar Kelimeler:** Analiz, Bibliyometrik, Görselleştirme, Halk sağlığı, Kitlesel toplanma

<sup>1</sup>MSc, PhD, Ahmet Doğan Kuday, Bezmialem Vakıf Üniversitesi, Sağlık Hizmetleri Meslek Yüksekokulu, Tıbbi Hizmetler ve Teknikler Bölümü, İlk ve Acil Yardım Programı, [dogankuday@gmail.com](mailto:dogankuday@gmail.com), ORCID: 0000-0001-8361-5526

<sup>2</sup>MD, PhD, Kerem Kinik, Sağlık Bilimleri Üniversitesi, Hamidiye Sağlık Bilimleri Fakültesi, Acil Yardım ve Afet Yönetimi Bölümü, [kerem.kinik@sbu.edu.tr](mailto:kerem.kinik@sbu.edu.tr), ORCID: 0000-0002-6913-5312

<sup>3</sup>MSc, MEds, PhD, Cüneyt Çalışkan, Sağlık Bilimleri Üniversitesi, Hamidiye Sağlık Bilimleri Fakültesi, Acil Yardım ve Afet Yönetimi Bölümü, [cuneyt.caliskan@sbu.edu.tr](mailto:cuneyt.caliskan@sbu.edu.tr), ORCID: 0000-0003-0232-1118

<sup>4</sup>MSc, PhD, Nihal Dağ, Sağlık Bilimleri Üniversitesi, Hamidiye Sağlık Bilimleri Fakültesi, Acil Yardım ve Afet Yönetimi Bölümü, [nihal.dag@sbu.edu.tr](mailto:nihal.dag@sbu.edu.tr), ORCID: 0000-0001-6043-1855

## INTRODUCTION

Mass gatherings (MGs) are events where a significant number of individuals gather in a specific location for a common purpose, such as cultural festivals, sports events, religious gatherings, political rallies, and concerts. These events are characterised by the fact that they often involve more than 1,000 participants.<sup>1</sup> MGs are characterized by their ability to bring different communities together, fostering unity, celebration, and the promotion of cultural exchange. These events can encompass a broad spectrum of topics, from human behaviour to natural disasters. MGs often lead to the rapid spread of infectious diseases due to high-density interactions among attendees, as seen in events like the Kumbh Mela, which attracts over 50 million participants.<sup>2</sup> Historical outbreaks, such as cholera and influenza during large gatherings, underscore the need for robust health surveillance and emergency preparedness.<sup>3</sup> As per the definition provided by the World Health Organization (WHO), MGs are characterized by gatherings of people, whether pre-planned or spontaneous, that reach or surpass the capacity outlined in the community's emergency plans.<sup>4</sup>

The examination of MGs is of great importance for understanding social dynamics and the necessity of being prepared for such events. Various aspects of MGs, including their causes, consequences, effects, and intervention strategies, have been studied from a wide range of disciplines, spanning from social sciences to natural sciences.<sup>5</sup> Researchers have conducted extensive studies to contribute to a better understanding of this phenomenon.<sup>6</sup> For instance, it has been emphasized that MGs significantly influence decision-making processes and that psychological contagion can affect management responses during such events. Moreover, it has been noted that emotional states and interpersonal relationships play a critical role in shaping administrative actions.<sup>7</sup> It has been emphasized that Mass Gathering Medicine is a specialized field that focuses on planning for medical needs during large

events. It has also been noted that this field encompasses a unique approach to organizing healthcare resources, ensuring that communities are equipped to handle potential emergencies.<sup>8</sup> It has been shown that MG events can increase the workload for emergency medical services and rescue personnel, particularly during evening and night hours.<sup>9</sup> It has been highlighted that a systematic review identified essential metrics for assessing health service demands at MGs. It has also been noted that standardizing these metrics can enhance planning and intervention strategies, ultimately improving safety and health outcomes during such events.<sup>10</sup>

The field of mass-gathering medicine has evolved, emphasizing the need for evidence-based approaches to planning and managing these events.<sup>11</sup> The multidisciplinary nature of MG research has been recognized as crucial for understanding and addressing the complex challenges associated with these events.<sup>12</sup> However, to gain a more comprehensive understanding of MG events, it is crucial to adopt a broader perspective that takes into account the impact of global trends and considers a wider range of strategic contexts and systemic challenges.

Comprehensive research methods such as meta-analysis and systematic literature reviews can provide in-depth information about studies related to MG events. However, these methods can be time-consuming. In contrast, bibliometric research covers a broader range of studies and offers a more extensive dataset. Bibliometric analysis is a method for examining and evaluating the academic literature in a field. Bibliometric analysis can encompass both quantitative and qualitative approaches. This method helps identify which articles are cited more frequently, which authors are more influential, and which topics generate greater interest. Bibliometric analysis includes science mapping, which involves the evaluation of performance metrics related to publications and citations, as well as the

examination of co-authorship, co-citations, bibliographic links, and shared keywords.<sup>13</sup> Additionally, bibliometric data can be visualized using software like VOSviewer, Bibliometrix, and CiteSpace.<sup>14</sup>

In the field of bibliometric analysis, data obtained from established databases serve the purpose of depicting the distribution of contributions in a specific field, identifying key focal points, and forecasting future trends.<sup>15</sup> Bibliometric analysis was initially introduced by Alan Pritchard in 1989.<sup>16</sup> Since its inception, it has gained increased attention, largely attributed to advancements in evidence-based science and the widespread accessibility of computers and the internet.<sup>17</sup> Furthermore, significant progress has been made in the development of scientific databases seamlessly integrated with bibliometric software packages such as Web of Science, Scopus, and PubMed.<sup>18</sup> The increasing prevalence of bibliometric research and analysis conducted by numerous researchers on topics within their areas of expertise has led to the growing popularity of bibliometric studies and contributed to a richer body of bibliometric research in the literature. In the study by İri and Ünal (2024), which evaluates the status of scientific studies on bibliometric analysis in the international

literature, it has been reported that bibliometric analysis research has started to become widespread globally since 1990.<sup>19</sup>

While studies on MG events have garnered global attention, there has been a lack of published bibliometric research on this subject. To address this gap, we conducted a bibliometric analysis of documents published on this topic using the Web of Science database. We identified prominent trends and gaps in MG research by analyzing the distribution of the most cited studies, leading authors, and key publications in this field. By conducting a comprehensive bibliometric analysis, we aim to shed light on the underlying patterns, trends, and key contributors in this field. The widespread impact of MG events on public health, safety, and social dynamics underscores the necessity of this investigation. Moreover, this study offers unique insights into the interconnectedness of research efforts, facilitating better planning and management strategies for future MGs. Our findings are expected to not only enrich the existing literature but also serve as a foundational reference for policymakers, researchers, and practitioners, promoting further interdisciplinary collaboration in this critical area.

## MATERIAL AND METHODS

### Study design

This study is a descriptive bibliometric analysis. The reporting was conducted in accordance with the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) checklist, which is specifically designed for descriptive studies. The questions of this research are:

- (1) How has the annual scientific production and average citation per year evolved for MG studies?
- (2) Who are the most influential authors and countries in the field of MG studies?
- (3) What are the most cited publications and journals related to MG studies?
- (4) What do the network maps of source co-citations, article co-citations, and keyword co-occurrences reveal?
- (5) What are the most frequently used keywords in MG studies, and current trending topics?

### Data Collection

The literature review was conducted on November 10, 2023. In our study, we utilized one of the most comprehensive and widely used databases for bibliometric analysis and literature review, the Web of Science (WoS) database.<sup>20</sup> Using the keyword "mass gathering" in the WoS database, a total of 1.342 articles were identified. No restrictions were applied through options such as publication year, document types, WoS index and languages, and all 1.342 articles were included in the study (Figure 1).

### Data Analysis

The Bibliometrix package version 4.1 in R was used to conduct bibliometric analysis. The analysis of the included articles in our study was performed in three distinct sections. In the first section, the fundamental structure of articles in the field of MG was examined. In the second section, authors, journals, articles, and countries were analyzed, while

the third section focused on author-generated keywords.<sup>21</sup> To identify the most productive authors, journals, and countries, as well as to explore trends in the field, performance analysis was employed.<sup>22</sup> Science mapping methods were utilized to examine relationships among research components, and network mapping and visualization techniques enriched the evaluation of bibliometric analyses.<sup>23</sup>

In this study, the impact of authors was evaluated based on their h-index, g-index, and m-index values. An author's h-index represents the maximum number of publications (NP) for which they have received at least the same number of citations. This index assesses the consistency of citations and emphasizes the quality of citations rather than quantity. The g-index is calculated to measure the impact of an author's most widely read articles, while the m-index facilitates comparisons between scientists with different academic careers. The m-index is calculated by dividing the author's h-index by the number of years they have been academically active.<sup>24,25</sup>

### Ethical Considerations

Since the descriptive analysis of the articles was conducted using a software program, ethical committee approval was not required.

### Limitations

The study had some limitations, mainly due to its reliance on the Web of Science, which excluded publications from other databases like Embase, PubMed, and Scopus. Additionally, the search, based on article titles, abstracts, and keywords, might not fully capture the entire scope of the field. Future research should consider using multiple databases concurrently and employing specialized bibliometric software such as CiteSpace and SciMAT to enhance the analysis.

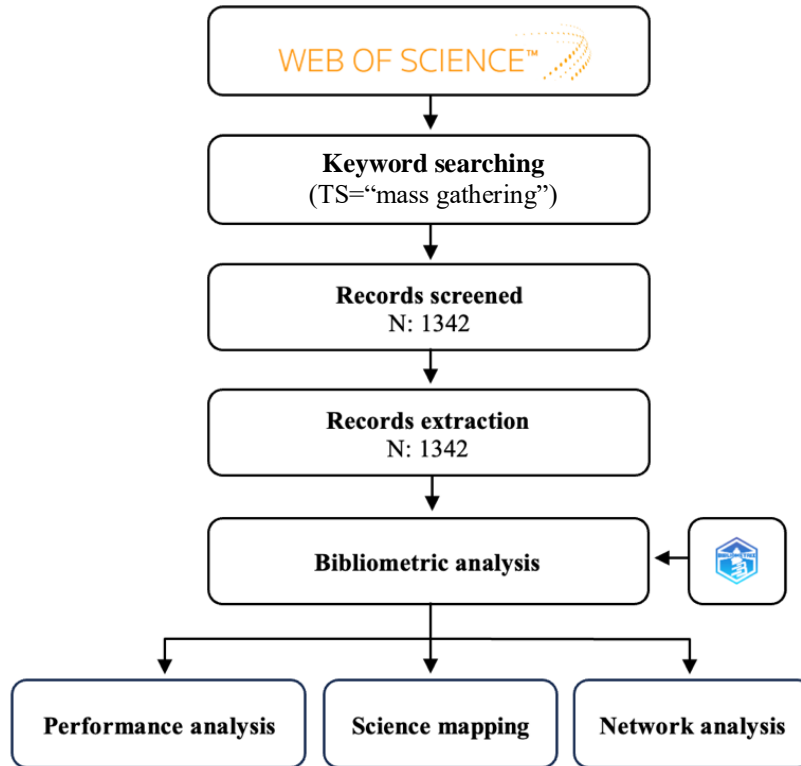


Figure 1. Flow Diagram

## RESULTS AND DISCUSSION

### Fundamental Structural Analysis

#### Main information

Between 1984 and November 2023, a total of 1.342 articles related to MG were published in 571 journals. The annual growth rate of the articles was 12.7%. The average citation per article was 14.26. The articles collectively utilized 30.006 references. These articles featured 5.473 authors, with 99 authors having single-authored articles and a total of 112 articles being authored by a single individual. The average number of co-authors per article was 5.61. A total of 2.596 author keywords were employed.

#### Annual scientific production and citation per year

The annual number of scientific publications and the average number of citations in the field of MG research between 1984 and 2023 are shown in Figure 2. Although there were some fluctuations from 1984 to 2023, there is a general increasing trend. In 1984, only one article was published,

while this number reached 149 in 2022. The highest number of articles, 192, was published in 2021. The high number of articles produced between 2018 and 2021 stands out compared to other years.

In this research, the coefficient of determination ( $R^2$ ), trend line, and equation representing the annual number of scientific articles produced have been placed on the graph (Figure 2). The reliability coefficient is 0.8964, and despite fluctuations in the number of articles produced over the years, the trend line represents the data very effectively. When examining the average annual citation numbers, it is evident that articles published in 2020 received more attention compared to articles published in other years, with an annual average citation number of 4.84.

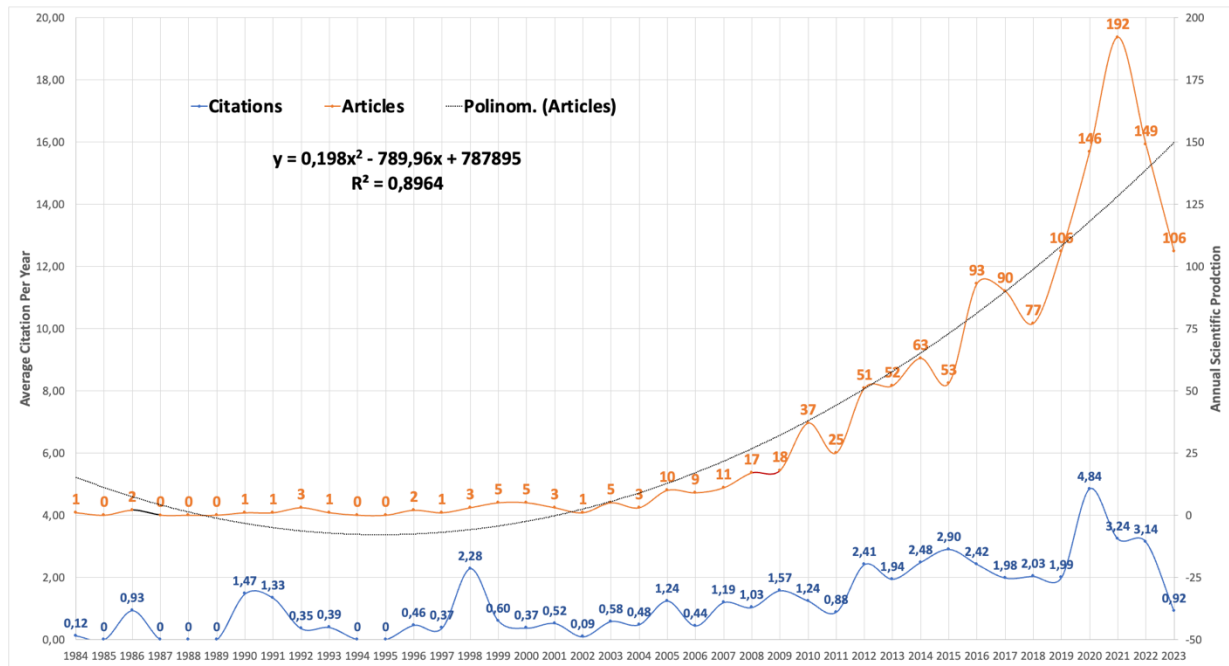


Figure 2. Annual Scientific Production and Citation Per Year

## Analysis of Authors, Sources, Documents, and Country

### Countries of the corresponding authors

The distribution of publications in MGs research field among the top 5 contributing countries reveals significant insights into global research collaboration and output. The top five countries in MGs research field based on the corresponding authors' contributions are the USA, Saudi Arabia, Australia, the United Kingdom, and India. The USA leads with 205 total country publications (TCP), 163 single-country publications (SCP), and 42 multiple-country publications (MCP), resulting in an MCP-Ratio of 0.205. Saudi Arabia follows with 171 TCP, 75 SCP, and 96 MCP, demonstrating a high level of international collaboration with an MCP-Ratio of 0.561. Australia has 138 TCP, 92 SCP, and 46 MCP, reflecting a balanced approach with an MCP-Ratio of 0.333. The United Kingdom, with 98 TCP, 47 SCP, and 51 MCP, shows a strong international collaboration tendency, indicated by an MCP-Ratio of 0.520. Lastly, India, with 79 TCP, 59 SCP, and 20 MCP, has an MCP-Ratio of 0.253, showing a more domestic-focused research output with some international partnerships.

## Author impact

In the field of MG research, the statistics of the top 5 most influential authors based on their h-index values have been evaluated. Total publication count (NP), total citations (TC), h-index, and g-index have been analyzed. Memish ZA stands out as the most influential author with an h-index of 32, a g-index of 54, an m-index of 1.684, 3224 total citations, and 93 publications. Gautret P follows with an h-index of 19, a g-index of 35, an m-index of 1.357, 1239 total citations, and 42 publications. Al-Tawfiq JA has an h-index of 18, a g-index of 32, an m-index of 1.5, 1079 total citations, and 33 publications. Zumla A also has an h-index of 18, a g-index of 33, an m-index of 1.5, 1424 total citations, and 33 publications. Yezli S demonstrates significant impact with an h-index of 17, a g-index of 29, an m-index of 1.7, 935 total citations, and 49 publications

## Production over time of authors

Figure 3 displays the articles published by the authors during the specified period. When examining the length of the publication line, it's apparent that the author with the longest publication history in the MG field is Memish ZA (2005-2023). Memish ZA has been publishing for 19 years and is still actively

contributing to publications. Following him are Arbon P (2005-2020), Rashid H (2008-2023), and Booy R (2008-2022). When looking at the authors' productivity over time,

it can be observed that out of the top 15 authors, nine began publishing in 2011 or earlier.

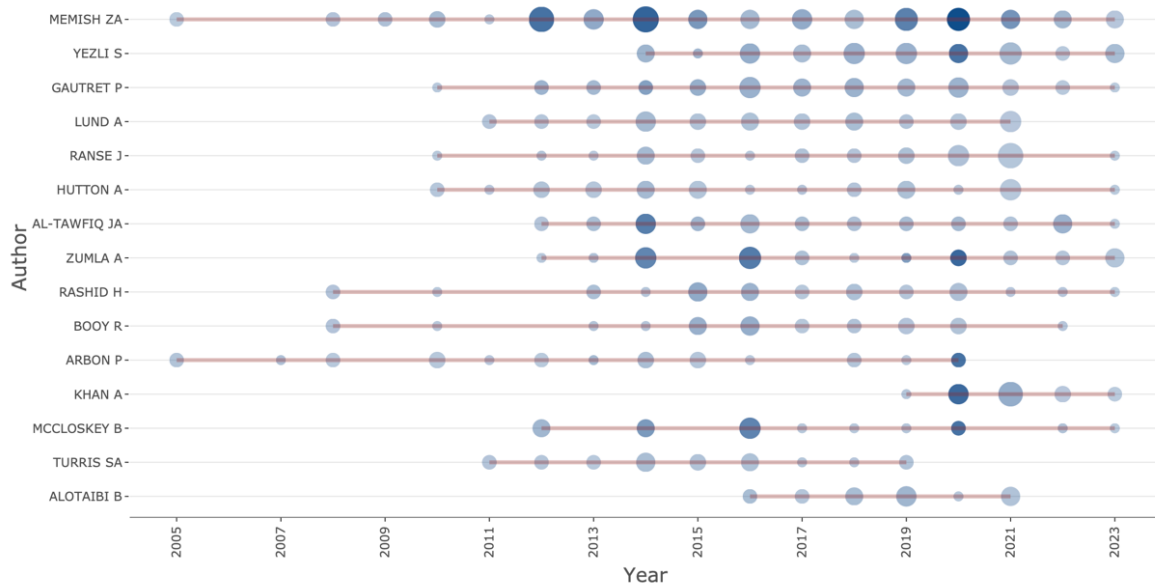


Figure 3. Production Over Time of Authors

### Local impact of sources

The local impact of sources is illustrated by the top 15 journals, which together publish 41.30% (442 out of 1070) of the total articles in the field. Among these, the top five journals are particularly notable. "Prehospital and Disaster Medicine" has the highest number of publications (129), with a total citation count of 1,454 and an h-index of 20, indicating a strong impact since its start in 2005. "Travel Medicine and Infectious Disease" stands out with the highest h-index of 22 and an impressive citations-per-paper ratio of 24.56 from 55 publications since 2009. The "International Journal of Infectious Diseases," which began publishing in 2014, has rapidly gained prominence with 35 publications, 990 citations, and an h-index of 18. The "Journal of Travel Medicine" has 30 publications, 534 total citations, and a citations-per-paper ratio of 17.80, starting in 2010. Lastly, "Disaster Medicine and Public Health Preparedness," with 29 publications, 152 total citations, and a citations-per-paper ratio of 5.24, rounds out the top five, having started in 2008.

### Co-citation network of sources

The co-citation network of references in journals publishing papers on the MG topic reveals distinct clusters of scholarly influence. This network analysis identifies three main clusters, represented by red, blue, and green circles, each circle signifying a journal. The green cluster, the largest with 34 journals, includes "Lancet" as the most co-cited journal, indicating its significant influence. The red cluster comprises 10 journals but lacks a single dominant journal in terms of co-citations. In contrast, the blue cluster, with six journals, is dominated by "Prehospital and Disaster Medicine," suggesting its central role within this specific subset of the co-citation network (Figure 4-A).

### Most locally cited document

Citation analysis was conducted to identify the most cited articles in the field of MG and to determine the connections among these articles. Citation analysis is commonly used to explore the intellectual structure and developmental dynamics underlying a research area.<sup>21</sup> The top 5 publications in the field of MG, ranked in descending order by the number of local citations (LC), have been

evaluated. LC indicates how many times an article has been cited by the 1342 articles in the WoS dataset, while global citation indicates how many times a publication has been cited in the WoS database.

The top five most locally cited documents in MGs research field highlight significant academic contributions. Abubakar I's 2012 publication in "Lancet Infectious Diseases" has 115 local citations (LC) with an LC/year ratio of 10.455, 181 global citations (GC) with a GC/year ratio of 16.455, and a local/global citation ratio of 63.54%. Memish ZA's 2014 publication in "Lancet" has 110 LC, an LC/year ratio of 12.222, 215 GC, a GC/year ratio of 23.889, and a local/global citation ratio of 51.16%. Arbon P's 2007 paper in "Prehospital and Disaster Medicine" has 101 LC, an LC/year ratio of 6.313, 105 GC, a GC/year ratio of 6.563, and an impressive local/global citation ratio of 96.19%. Another work by Memish ZA in 2012 in "Lancet Infectious Diseases" has 87 LC, an LC/year ratio of 7.909, 122 GC, a GC/year ratio of 11.091, and a local/global citation ratio of 71.31%. Finally, Memish ZA's 2019 publication in "Lancet" has 80 LC, an LC/year ratio of 20.000, 147 GC, a GC/year ratio of 36.750, and a local/global citation ratio of 54.42%.

### Co-citation network of articles

The co-citation network of articles in the MG research field reveals significant patterns of scholarly interaction through the analysis of common citations among the top 50 articles. This network is divided into three clusters, represented by green, blue, and red circles, with each circle indicating an article and the lines between them showing relationships. The blue cluster, containing 19 articles, is the largest and includes the highly cited works of Memish ZA from 2014 and 2015. The red cluster, comprising 16 articles, features

prominent articles by Abubakar I from 2012 and Ahmed QA from 2006. The green cluster, with 15 articles, highlights the influential publications of Milsten A from 2014 and Arbon P from 2001. This co-citation network illustrates the interconnectedness and key contributors within the MG research domain (Figure 4-B).

### Scientific production of countries

When examining the distribution of studies related to MG by country, it is observed that the highest number of articles, 873 in total, has been published in the USA. Following the USA, Saudi Arabia (n=735), Australia (n=513), the United Kingdom (n=484), Canada (n=261), India (n=229), Japan (n=200), China (165), Iran (n=131), France (n=122), and Spain (n=109) have also made significant contributions to the literature in this field. Other countries with fewer than 100 articles include Italy (n=96), Germany (n=89), Switzerland (n=86), and Belgium (n=70).

### Keyword Analysis of Authors

#### Word cloud

Keywords, as determined by authors to describe their articles, play a significant role in identifying current topics and themes in the MG research field.<sup>26</sup> A word cloud was created using bibliometrix to visually represent the frequency of these keywords, showcasing the most prominent concepts. In a word cloud, the larger the keywords appear, the more frequently they were used in the dataset.<sup>27</sup> The analysis reveals the top five most frequently used keywords: "mass gatherings" (122 occurrences), "surveillance" (78 occurrences), "transmission" (60 occurrences), "hajj" (58 occurrences), and "impact" (58 occurrences). This visual representation helps in easily identifying interconnected topics and analyzing trending words related to these topics over the years.



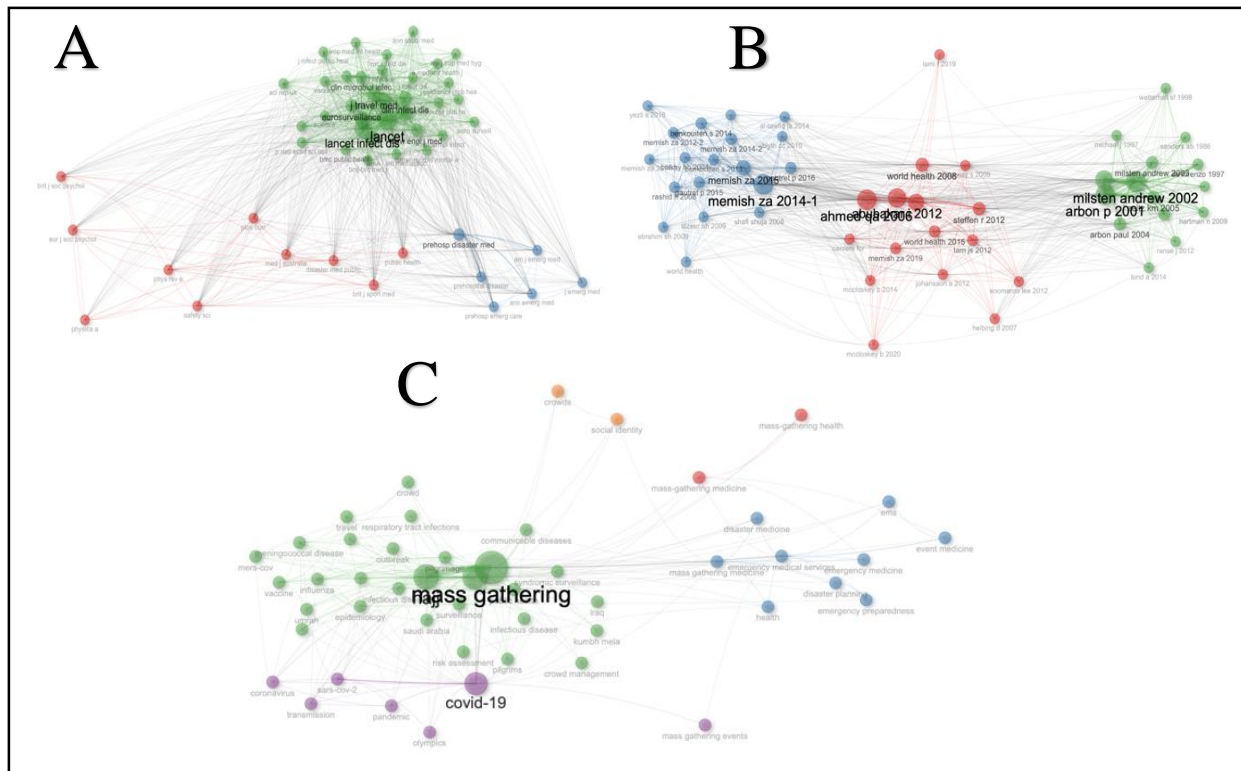


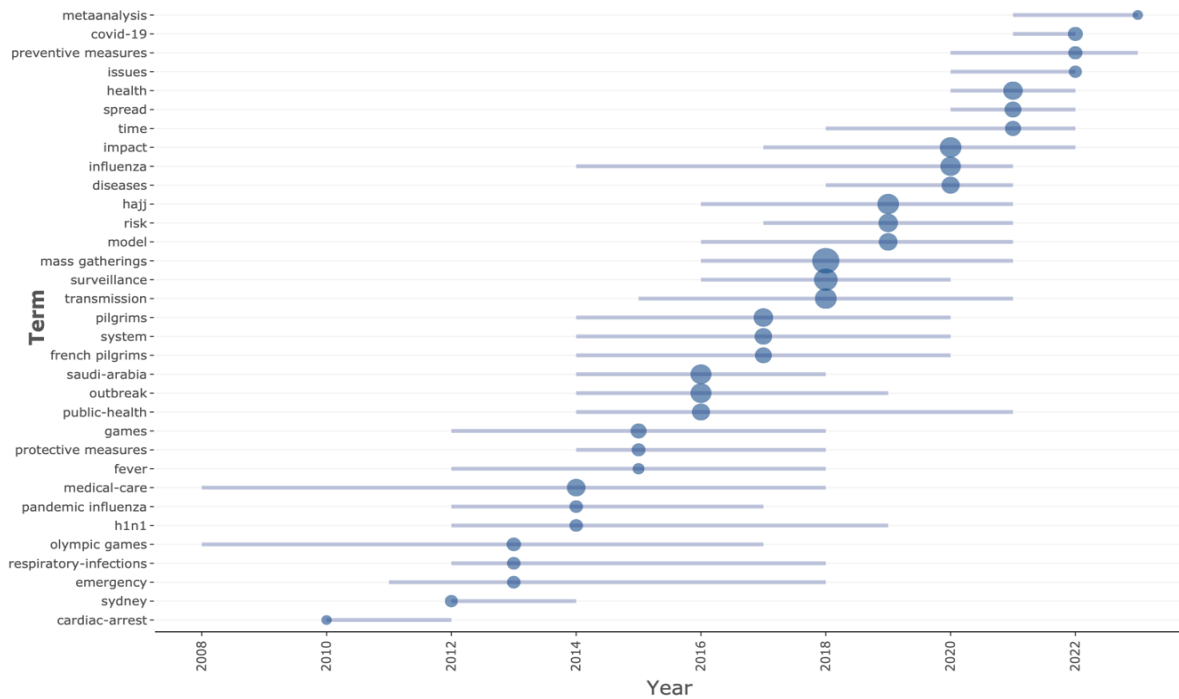
Figure 4. Co-citation Network of Sources, Articles and Co-occurrence Network of Keywords

### Trend topics

The graph in Figure 5 depicts the evolution of author-defined keywords' popularity over the years, visualizing the top three keywords used at least five times each year. Between 2008-2014, keywords such as "olympic games," "h1n1," "respiratory-infections," "pandemic influenza," and "medical care" were used more frequently in studies related to MGs. Nowadays, keywords such as "metaanalysis," "covid-19," "preventive measures," "spread," "time," and "health" have gained more prominence. When looking at the sizes of the circles, in 2016, the most frequently used keywords were "saudi-arabia" and "outbreak," in 2017, "pilgrims," and in 2018, "mass gatherings" and "surveillance" were the most popular.

### Co-occurrence network of keywords

The co-occurrence network of author-generated keywords for articles on MGs highlights the relationships between the most frequently used terms. This analysis, focusing on the top 30 keywords, reveals five clusters: green, blue, purple, red, and orange. In the green cluster, "mass gathering" and "hajj" are the dominant keywords, indicating their central importance in the research field. In the purple cluster, "covid-19" is the most prominent keyword, reflecting the significant impact of the pandemic on research topics. The sizes of the circles in the network diagram illustrate these distinctions, with no single dominant keywords emerging in the blue, orange, and red clusters. This network helps in understanding the interconnectedness and focal points of current research themes in the field of MG (Figure 4-C).



**Figure 5. Trend Topics**

Bibliometric studies have gained particular attention, especially in the field of public health and disaster medicine, and various publications on the subject have been present in the literature.<sup>28-31</sup> It is frequently emphasized that MG is a growing and evolving field, particularly in the discipline of disaster medicine. However, upon reviewing the literature, the absence of a bibliometric study specifically related to MG has been noted. Therefore, this study aimed to fill this gap in the literature.

Our investigation reveals a significant increase in articles related to MG published in the Web of Science (WoS) database. Given the escalating burden of MG, it is believed that the relevance of this topic persists, capturing the interest of researchers. The findings of the current study can provide insights into the content, challenges, and trending topics in MG for various disciplines, including emergency medicine, public health, and disaster medicine.

Prehospital and Disaster Medicine, the official publication of the World Association for Disaster and Emergency Medicine, has been identified as the most impactful journal by publishing 9.6% of all articles related to MG. The fact that this journal is indexed in

widely recognized scientific databases and supported by professional organizations may play a significant role in its preference among researchers.

When publications related to MG are evaluated in terms of citations, it is determined that the most impactful study is the one titled "Global perspectives for prevention of infectious diseases associated with mass gatherings," published by Abubakar I and colleagues in *Lancet* in 2012. This research evaluated the infectious disease risks linked to MG, summarized approaches for risk reduction, and highlighted key challenges encountered by organizers and participants.<sup>32</sup> The second most impactful study is the one published by Memish ZA and colleagues in 2014 in *The Lancet*, titled "Hajj: infectious disease surveillance and control." This study emphasized that there is a large number of pilgrims from around the world, religious festivals have the potential to spread infectious diseases, and this situation poses a threat to global health security. The experience of Saudi Arabia in providing health services during the Hajj process is detailed in the study.<sup>33</sup> The third most impactful study is authored by Arbon P and was published in 2007 in the *Prehospital and*

Disaster Medicine under the title "Mass-Gathering Medicine: A Review of the Evidence and Future Directions for Research." In this study, the literature on MG medicine published in Prehospital and Disaster Medicine has been reviewed, reporting an increased understanding of the effects of MG on health and strategies that can contribute positively to the effective delivery of healthcare services during such events.<sup>11</sup>

When examining the word cloud and trending topics, it is observed that "mass

gatherings," "surveillance," "transmission," "hajj," and "impact" are the most frequently used keywords. Additionally, keywords such as "meta-analysis," "COVID-19," "preventive measures," "spread," "time," and "health" have become more prominent trends. In light of the results of previous studies and the events that have occurred, it is observed that the research topics have changed over time. In this context, it is observed that future studies will focus on the management and impact of MG, infectious diseases and preventive measures, and surveillance and monitoring.

## CONCLUSIONS AND RECOMMENDATIONS

This bibliometric analysis provides a comprehensive overview of the research landscape surrounding MG from 1984 to 2023, highlighting significant trends, influential contributors, and emerging topics. Within the scope of the study, 1342 articles were examined and it was seen that the number of articles on MG increased from year to year. Therefore, it is thought that the subject of MG has attracted the attention of researchers. The increase in publications, particularly between 2018 and 2021, underscores the growing recognition of MG events' public health implications, especially in light of global phenomena such as the COVID-19 pandemic.

The findings indicate that developed countries, such as the USA and the United Kingdom, have made significant contributions to the field of MG research. This suggests that MG research is a multidisciplinary area reflecting both local and international collaboration. However, the data also reveal a notable lack of robust international cooperation. Therefore, we advocate for the promotion of international partnerships and collaboration within this field.

The identified influential authors and highly cited publications reveal critical touchpoints in MG literature. For instance, the studies by Abubakar I and Memish ZA are pivotal in shaping the understanding of infectious disease risks associated with MG events. This insight emphasizes the

importance of continued research in this area, particularly as public gatherings continue to evolve in complexity and scale.

The keyword analysis illustrates shifting research trends, indicating a transition from traditional topics, such as the Hajj, to contemporary concerns like COVID-19 and preventive measures. The co-occurrence networks of keywords further emphasize the interconnectedness of various research themes, suggesting a rich potential for interdisciplinary collaboration.

To effectively manage health risks associated with MGs, it is essential to enhance interdisciplinary collaboration among researchers from public health, sociology, emergency medicine, and event management, fostering comprehensive frameworks and innovative approaches. Standardization of metrics is crucial for improving the reliability of research findings, enabling better comparisons and planning strategies through universally accepted guidelines. Future research should prioritize emerging topics identified in this study, such as the impact of infectious diseases on MG, the efficacy of surveillance systems, and the psychological aspects of crowd behavior. Investigating these areas can provide deeper insights into the complexities of managing health risks at large gatherings. Policymakers are encouraged to leverage insights from MG research to refine public health strategies, thereby improving safety and health outcomes during large events. Finally, developing specialized

training programs for healthcare professionals and event organizers will enhance preparedness and response strategies, effectively addressing potential public health crises.

In conclusion, this bibliometric analysis not only fills a significant gap in the existing

literature but also lays the groundwork for future inquiries into MG. The evolving nature of public gatherings and their associated risks necessitates ongoing research and collaboration to ensure effective management strategies and safeguard public health.

## REFERENCES

1. Llorente Nieto, P, González-Alcaide, G, and Ramos, J.M. (2017). "Mass gatherings: a systematic review of the literature on large events". *Emergencias*, 29 (4), 257-265.
2. Sharma, A, Gupta, B, Petersen, E, Lee, S.S, and Zumla, A. (2023). "Enhancing preparedness for reducing transmission and globalisation of Antimicrobial Resistance at the Ardh Kumbh Mela 2025, the world's largest recurring religious mass gathering". *International Journal of Infectious Diseases*, 137, 79-81. <https://doi.org/10.1016/j.ijid.2023.10.014>
3. Shafi, S, Azhar, E, Al-Abri, S, Sharma, A, Merali, N, Al-Tawfiq, J.A, El-Kafrawy, S.A, Zumla, A, and Lee, S.S. (2022). "Infectious diseases threats at the Arba'een - a neglected but one of the largest annually recurring mass gathering religious events". *International Journal of Infectious Diseases*, 123, 210-211. <https://doi.org/10.1016/j.ijid.2022.09.010>
4. Koçak, H. and Tuncay, İ. (2021). "Evaluation of trauma cases in different types of mass gathering events". *Ulusal Travma ve Acil Cerrahi Dergisi*, 28 (6), 781-789. <https://doi.org/10.14744/tjtes.2021.17971>
5. Koçak, H, Çalışkan, C, Sönmezler, M.Ş, Eliuz, K. and Küçükdemir, F. (2018). "Analysis of medical responses in mass gatherings: The commemoration ceremonies for the 100th anniversary of the Battle of Gallipoli". *Prehospital and Disaster Medicine*, 33 (3), 288-292. <https://doi.org/10.1017/S1049023X18000353>
6. Ceyhan, M.A and Demir, G.G. (2020). "Health care services in shopping centers: a routine Mass-Gathering event". *Prehospital and Disaster Medicine*, 35 (6), 669-675. <https://doi.org/10.1017/S1049023X2000120X>
7. Həcəməva, Z. (2024). "Socio-psychological analysis of the influence of the mass phenomenon on administrative decision-making". *Azərbaycan Respublikasının Təhsil İnstitutunun Elmi əsərləri*, 91 (3), 159-167. [https://doi.org/10.69682/azrt.2024.91\(3\).159-167](https://doi.org/10.69682/azrt.2024.91(3).159-167)
8. Garbin, S, Brady, W, and Griffith, D. (2024). "An Introduction to Mass Gathering Medicine". In W.J. Brady, M.R. Sochor, P.E. Pepe, J.C. Maino II, and K.S. Dyer (Eds.), *Mass Gathering Medicine: A Guide to the Medical Management of Large Events* (1-5). Cambridge: Cambridge University Press.
9. Koski, A, Pappinen, J, Kouvonen, A, and Nordquist, H. (2022). "Preparedness for mass gatherings: rescue and emergency medical services' workloads during mass gathering events". *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine*, 30 (1), 15. <https://doi.org/10.1186/s13049-022-01003-7>
10. Çalışkan, C, Kудay, A.D, Özcan, T, Dağ, N, and Kınık, K. (2024). "Quantitative Metrics in Mass-Gathering Studies: A Comprehensive Systematic Review". *Prehospital and Disaster Medicine*, 39 (2), 195-205. <https://doi.org/10.1017/S1049023X2400027X>
11. Arbon, P. (2007). "Mass-Gathering Medicine: A Review of the Evidence and Future Directions for Research". *Prehospital and Disaster Medicine*, 22 (2), 131-135. <https://doi.org/10.1017/S1049023X00004507>
12. Janaki, V. (2021). "Multidisciplinary Research in the Social Sciences: Breaking new grounds". *Mind and Society*, 10 (03-04), 134-138. <https://doi.org/10.56011/mind-mri-103-420226>
13. Yalcinkaya, T. and Yucel, S.C. (2023). "Mobile learning in nursing education: A bibliometric analysis and visualization". *Nurse Education in Practice*, 71, 103714. <https://doi.org/10.1016/j.nepr.2023.103714>
14. Mukherjee, D, Lim, W.M, Kumar, S. and Donthu, N. (2022). "Guidelines for advancing theory and practice through bibliometric research". *Journal of Business Research*, 148, 101-115. <https://doi.org/10.1016/j.jbusres.2022.04.042>
15. Moral-Muñoz, J.A, Herrera-Viedma, E, Santisteban-Espejo, A. and Cobo, M.J. (2020). "Software tools for conducting bibliometric analysis in science: An up-to-date review". *El Profesional De La Información*, 29 (1). <https://doi.org/10.3145/epi.2020.ene.03>
16. Onchonga, D. and Abdalla, M. (2023). "Integrating social determinants of health in medical education: a bibliometric analysis study". *Public Health*, 224, 203-208. <https://doi.org/10.1016/j.puhe.2023.09.005>
17. Aria, M. and Cuccurullo, C. (2017). "Bibliometrix : An R-tool for comprehensive science mapping analysis". *Journal of Informetrics*, 11 (4), 959-975. <https://doi.org/10.1016/j.joi.2017.08.007>
18. Falagas, M.E, Pitsouni, E.I, Malietzis, G.A. and Pappas, G. (2007). "Comparison of PubMed, Scopus, Web of Science, and Google Scholar: strengths and weaknesses". *The FASEB Journal*, 22 (2), 338-342. <https://doi.org/10.1096/fj.07-9492lsf>
19. İri, R, and Ünal, E. (2024). "Bibliometric Analysis Bibliometric Analysis of Research (1980-2023)". *Ahi Evran Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, 10 (2), 386-403. <https://doi.org/10.31592/aeusbed.1446738>
20. Leydesdorff, L. (2011). "World Shares of Publications of the USA, EU-27, and China Compared and Predicted using the New Interface of the Web-of-Science versus Scopus". *arXiv (Cornell University)*. <https://doi.org/10.48550/arxiv.1110.1802>
21. Can, D. (2023). "A bibliometric analysis of publications on gunshot wounds, 1980-2022". *Ulusal Travma ve Acil Cerrahi Dergisi*, 29 (10), 1138-1149. <https://doi.org/10.14744/tjtes.2023.44257>
22. Donthu, N, Kumar, S, Mukherjee, D, Pandey, N. and Lim, W.M. (2021). "How to conduct a bibliometric analysis: An overview and guidelines". *Journal of Business Research*, 133, 285-296. <https://doi.org/10.1016/j.jbusres.2021.04.070>
23. Baker, H.K, Kumar, S. and Pandey, N. (2021). "Forty years of the Journal of Futures Markets: A bibliometric overview". *Journal of Futures Markets*, 41 (7), 1027-1054. <https://doi.org/10.1002/fut.22211>
24. Kurutkan, M.N. and Orhan, F. (2018). "Kalite Prensiplerinin Görsel Haritalama Tekniğine Göre Bibliyometrik Analizi". Ankara: Sage Yayınevi.

25. Can, D. (2022). "Cardiopulmonary resuscitation: A bibliometric analysis". *Journal of Social and Analytical Health*, 2 (3), 339-351. <https://doi.org/10.5281/zenodo.7389449>
26. Zheng, X, Le, Y, Chan, A.P, Hu, Y. and Li, Y. (2016). "Review of the application of social network analysis (SNA) in construction project management research". *International Journal of Project Management*, 34 (7), 1214-1225. <https://doi.org/10.1016/j.ijproman.2016.06.005>
27. Orimoloye, I.R. and Ololade, O.O. (2020). "Potential implications of gold-mining activities on some environmental components: A global assessment (1990 to 2018)". *Journal of King Saud University - Science*, 32 (4), 2432-2438. <https://doi.org/10.1016/j.jksus.2020.03.033>
28. Rana, I.A. (2020). "Disaster and climate change resilience: A bibliometric analysis". *International Journal of Disaster Risk Reduction*, 50, 101839. <https://doi.org/10.1016/j.ijdrr.2020.101839>
29. Sweileh, W.M. (2019). "A bibliometric analysis of health-related literature on natural disasters from 1900 to 2017". *Health Research Policy and Systems*, 17 (1). <https://doi.org/10.1186/s12961-019-0418-1>
30. Zhou, L, Zhang, P, Zhang, Z, Fan, L, Tang, S, Hu, K, Xiao, N. and Li, S. (2018). "A Bibliometric Profile of Disaster Medicine Research from 2008 to 2017: A Scientometric Analysis". *Disaster Medicine and Public Health Preparedness*, 13 (02), 165-172. <https://doi.org/10.1017/dmp.2018.11>
31. Hao, X, Liu, Y, Li, X. and Zheng, J. (2019). "Visualizing the history and Perspectives of Disaster Medicine: A Bibliometric analysis". *Disaster Medicine and Public Health Preparedness*, 13 (5-6), 966-973. <https://doi.org/10.1017/dmp.2019.31>
32. Abubakar, I, Gautret, P, Brunette, G.W, Blumberg, L, Johnson, D, Pomerol, G, Memish, Z.A, Barbeschi, M. and Khan, A.S. (2012). "Global perspectives for prevention of infectious diseases associated with mass gatherings". *The Lancet Infectious Diseases*, 12 (1), 66-74. [https://doi.org/10.1016/s1473-3099\(11\)70246-8](https://doi.org/10.1016/s1473-3099(11)70246-8)
33. Memish, Z.A, Zumla, A, Alhakeem, R.F, Assiri, A, Turkestani, A, Harby, K.D.A, Alyemni, M, Dhafar, K, Gautret, P, Barbeschi, M, McCloskey, B, Heymann, D, Rabeeah, A.A.A. and Al-Tawfiq, J.A. (2014). "Hajj: infectious disease surveillance and control". *The Lancet*, 383 (9934), 2073-2082. [https://doi.org/10.1016/s0140-6736\(14\)60381-0](https://doi.org/10.1016/s0140-6736(14)60381-0)