

Analysis of monkeypox prevention and transmission strategies as public health emergencies between 1988 and 2024

Juan Chavez-Perez¹; Raquel Melgarejo-Espinoza²; Victor Sevillano-Vega³; Orlando Iparraguirre-Villanueva⁴
 Universidad Tecnológica del Perú, Perú, u21206063@utp.edu.pe, u21303970@utp.edu.pe,
u21221311@utp.edu.pe, c27399@utp.edu.pe

Abstract– Purpose: *This systematic review of the literature aims to comprehensively analyze available studies on viral diseases, taking into account aspects related to prevention and transmission mechanisms, and providing relevant contributions to their mitigation. The following research questions were posed: 1) What are the main epidemiological manifestations in humans because of MPOX? 2) What risk factors and transmission mechanisms drive the spread of MPOX in vulnerable populations? 3) What prevention strategies have proven effective in controlling MPOX globally? Methods:* *The selection of articles followed the guidelines established by the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) method and took into account highly relevant databases such as Scopus, ScienceDirect, and Web of Science. Subsequently, exclusion and inclusion criteria were applied to 58 scientific articles, all published in English and classified as journal articles. Results:* *The results revealed a high concentration of publications in recent years, with 2024 standing out as the year with the highest number of studies, at 48.28%. The papers were published mainly in the United States (27.59%), Spain (12.07%) and China (12.07%). In terms of methodological approaches, 74.14% of the studies adopted a quantitative approach, followed by a qualitative approach (18.97%) and a mixed approach (6.90%). Conclusion:* *there has been a remarkable increase in scientific production on mpox, which highlights the importance of addressing this issue in future research, reinforcing prevention strategies, strengthening international cooperation and improving health systems to address future outbreaks of the disease.*

Keywords– Monkeypox; public health emergency; transmission; prevention; mpox

I. INTRODUCTION

To date, in the 21st century, the world has witnessed the resurgence of several infectious, potentially viral diseases to become pandemics, causing millions of deaths [1]. Therefore, the World Health Organization (WHO) has shown its concern to counteract the spread of transmitting viruses, which led to the declaration of MPOX as a global health emergency in 2024 due to outbreaks in Africa, Europe and the Americas [2]. The disease was first identified in 1958 in Denmark, where cases of infection in monkeys throughout its epidemiological history were labeled "MPOX", a disease labeled a zoonosis, as it is transmissible to humans, with the first case reported in the Democratic Republic of the Congo in 1970, marking the beginning of its public health relevance [3]. Since then, human globalization in different regions has led to the spread of the disease in countries such as the United States, India, Egypt and Nigeria, where it marked a spike in its impact in 2020,

with reports continuing until 2024 due to increased trade, travel and tourism [4].

MPOX presents sensitive clinical features that may vary depending on the exposure environment, such as geography and epidemiology. Recurring outbreaks have shown that fever is present in most cases, with rates of 86% in Saudi Arabia and 79% in Peru. Skin lesions are the most common symptom, while lymphadenopathy has been reported in certain patient groups at rates of 71% and 54%, respectively, in the countries [5], [6]. In places like Shenzhen, China, local containment of the outbreak has led to moderate control and a reduction in atypical symptoms, highlighting the influence of the geographical context [7]. Importantly, thorough evaluation is important for preventing serious complications such as bacterial infections, proctitis and necrosis caused by skin lesions in documented cases [8].

Diagnosing MPOX in patients is challenging, as its main symptoms are diseases such as chickenpox and measles. However, in recent years, the use of technology, specifically neural networks and the Sparrow search algorithm, has improved the classification of skin lesions and optimized image-based diagnostic models to identify and increase the quality of data with high accuracy [9], [10]. In addition, polymerase chain reaction (PCR) tests have demonstrated high sensitivity and specificity, allowing accurate confirmation of infection [11]. MPOX is transmitted through several routes: close contact with skin lesions, bodily fluids, and contaminated objects. The latter route is particularly relevant in endemic areas of Africa, where the disease primarily affects children through unidentified animal reservoirs [12]. In men who have sex with men (MSM), sexual contact has been identified as the main route of transmission; this route is enhanced in scenarios of human immunodeficiency virus (HIV) coinfection, which increases susceptibility and facilitates the spread of the virus [13]. In addition, contact sports, such as wrestling and rugby, may pose a high risk of transmission due to significant skin-to-skin contact, although no major outbreaks have been reported in these communities [14].

Risk factors associated with MPOX include greater vaccine uptake among men who have sex with men (MSM), especially those with a higher level of education and a history of vaccination, which correlates with a greater willingness to adopt protective behaviors, such as seeking medical help or avoiding sexual contact [15], [16]. Notably, the present

systematic literature review (SLR) was based on a comprehensive analysis of 58 scientific journal articles selected from relevant academic databases in relation to the topics of study.

The exponential growth of monkeypox has prompted the exploration of multiple studies, particularly in situations associated with risky sexual behaviors. For example, [17] identified concurrent sexually transmitted infections (STIs) in 187 patients with MPOX virus via PCR, resulting in the detection of 36 pathogens and a significant prevalence of herpes simplex, gonorrhea and syphilis. In the same vein [18], the study assessed the prevalence of bacterial STIs in patients infected with MPOX and conducted a prospective cohort study involving 538 patients, finding that the disease was significantly associated with HIV. Similarly, in [19], an outbreak of simian clade I virus (MPXV) in the Democratic Republic of the Congo was analyzed via surveillance data and genomic analysis, and 241 suspected cases were identified, with sexual contact accounting for 29% of the cases. These results suggest sexual involvement in its spread. Finally, [20] compared the clinical features of MPOX between people with and without HIV in a retrospective study of 3561 cases, revealing increased hospitalization and mortality in HIV-positive patients, especially those with high-risk sexual practices.

A study by [21] assessed the influence of climatic factors on MPOX transmission in 33 countries between 2022 and 2023 via the use of statistical mixed models to analyze confirmed cases and reported that heat increases daily cases, whereas humidity and wind reduce them. Meanwhile, in [22], researchers investigated how factors such as deforestation and urbanization affect the transmission and zoonotic evolution of MPOX using a mixed-methods approach that combines genomic and epidemiological analyses, revealing that the virus has become better adapted to human-to-human transmission. Similarly, [23] analyzed the ophthalmological complications associated with recent clades of MPOX through a clinical and epidemiological review, highlighting severe ocular manifestations that highlight the need for surveillance and research to optimize treatment and prevention.

In [24], they investigated the public perception of mpox in China via an online survey to collect data from 2135 participants. The results revealed that 62.7% of the respondents expressed concern about the disease, and 68.8% indicated a willingness to receive the vaccine. In addition, [25] analyzed the evolution of mpox in 2022 via a comprehensive review of the literature on its transmissibility and prevention, highlighting the lack of effective methods to control it, despite the use of smallpox-derived vaccines. Similarly, a previous study [26] highlighted the application of machine learning techniques to select conserved virus epitopes via reverse vaccinology and data from 2433 virus sequences, which identified 47 MHC-I epitopes and 10 linear B-cell epitopes as potential candidates for vaccine development.

This review is motivated by the need for a deeper understanding of the evolution of MPOX as a global health emergency in 2024. While there are studies that address clinical manifestations, transmission mechanisms, or prevention strategies separately, this study builds upon that literature by offering a synthesis that simultaneously integrates all three dimensions, highlighting the interrelationships that a fragmented approach fails to reveal. The objective was to provide, through this integrated approach, a solid foundation for future public health interventions and to contribute to the global containment of the disease.

II. METHODOLOGY

The PRISMA method was implemented in this study, following its standard updated in 2020 to optimize the systematization and precision of the analysis [27]. This approach made it possible to clearly and transparently structure the information search and selection stages, using flow charts and rigorously applying the previously established inclusion and exclusion criteria [28]. The application of PRISMA ensured that the systematic review was replicable while facilitating the synthesis of mpox-related studies in 2024, within its global aspect. During the process, priority was given to the identification of relevant clinical features, transmission patterns and prevention strategies, considering the parameters established by the method, and criteria were established to filter, identify and select studies that met the essential requirements previously defined.

A. Purpose And Research Questions

To address the objectives of this systematic review, three research questions were formulated to guide the collection and analysis of the included studies, as shown in Table I.

TABLE I
RESEARCH QUESTIONS

Research Questions	
RQ1	What are the main epidemiological manifestations in humans because of MPOX?
RQ2	What risk factors and transmission mechanisms drive the spread of MPOX in vulnerable populations?
RQ3	What prevention strategies have proven effective in controlling MPOX globally?

B. Inclusion And Exclusion Criteria

For this SLR, we considered the inclusion and exclusion criteria specified in Table II, which allowed us to apply the corresponding filters and then exclude them for each phase of the PRISMA method.

TABLE II
INCLUSION AND EXCLUSION CRITERIA

Inclusion criteria

Publications between 1988 and 2024, to provide a historical and up-to-date perspective on mpox.
Original studies presenting primary data related to mpox characteristics, transmission and prevention strategies essential for analysis.
Papers written in English, ensuring accessibility to a wide range of scientific information of international relevance.
Articles using precise terminology related to mpox, ensuring relevance to the objectives of the review.
Exclusion criteria
Articles prior to 1988, because their content does not fit the time frame of the review.
Secondary sources, such as opinions or reviews, do not provide original data relevant to the focus of the research.
Works in other languages, to avoid complications in interpretation and to maintain linguistic consistency.
Studies whose focus or content deviates from the main topic, as they would not contribute to the specific objectives of the review.

To establish the time frame, a preliminary search was conducted in the databases without any year restrictions. This survey revealed that primary studies on MPOX meeting the required terminology and rigor began to appear in 1988, while scientific output experienced marked growth starting in 2022 and peaked in 2024, coinciding with the declaration of a global health emergency. Consequently, the 1988-2024 interval was established, spanning from the first reports with systematic data to the most recent evidence.

C. Search Strategy

The Scopus, ScienceDirect and Web of Science databases were used to search for and compile scientific studies because of their high level of credibility and stored information on the topic. The first step in the search process was to use the keywords previously defined for the systematic review, which were "monkeypox", "public health emergency", "transmission", "prevention" and "mpox". We subsequently proceeded to generate the search string to obtain the papers published up to 2024 centered on the focus of the study, ensuring temporal relevance.

To ensure reproducibility, Boolean search strings were constructed by combining the key terms with the AND operator, adapting the syntax to each database. Table III presents the complete search expressions and filters applied in Scopus, ScienceDirect, and Web of Science.

TABLE III
BOOLEAN SEARCH STRINGS AND FILTERS BY DATABASE

Database	Boolean search string	Applied filters
Scopus	TITLE-ABS-KEY (monkeypox AND public AND health AND emergency AND	Document type: Article (ar); Language: English; Access: Open Access

	transmission AND prevention)	(all)
ScienceDirect	(monkeypox AND public AND health AND emergency AND transmission AND prevention)	Year: 1988-2024; Article type: Research articles; Access type: Open access & Open archive
Web of Science	TS=(monkeypox AND public AND health AND emergency AND transmission AND prevention)	Document type: Article; Language: English

The results of the process revealed the inclusion of 58 journal articles distributed in the databases considered for the work. Fig. 1 graphically shows the distribution flow of the articles that met the established inclusion and exclusion criteria, showing initial and final values for the Scopus, ScienceDirect and Web of Science databases.

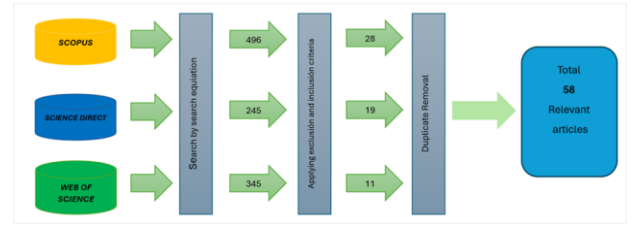


Fig. 1 Distribution of studies per database

The distribution of the journal articles was determined according to the origin of the selected studies. This first step in the process allowed an exhaustive evaluation of the information provided by the studies and the identification of duplicates in the Mendeley software, considering the collections created for storage by each database. The remaining articles were subsequently exported in XML format and imported into Microsoft Excel to perform new filtering, eliminating systematic reviews present and duplicates that remained from the first process since Microsoft Excel allows detailed processing. The screening of titles and abstracts was conducted independently by R. Melgarejo. The review of the full text involved all four authors, organized into two independent pairs: (V. Sevillano, O. Iparraguirre) and (J. Chavez, R. Melgarejo). Discrepancies were resolved through discussion until consensus was reached; when this was not possible, an author from the other pair (V. Sevillano or O. Iparraguirre, as appropriate) acted as an arbitrator. J. Chavez, as the first author, oversaw the overall consistency of the selection process.

The results showed the elimination of 226 duplicate articles, allowing the remaining set of studies to be reorganized in a data matrix considering columns for type of publication, type of document, country of origin and year of publication. This classification facilitated inclusion in the

present systematic review. In addition, an exploratory bibliometric analysis was conducted using VosViewer on the articles ultimately included, with the sole purpose of mapping the predominant conceptual relationships; this analysis did not influence any stage of the selection process.

The decision to include only peer-reviewed primary articles, combined with the rigorous application of inclusion and exclusion criteria and the independent evaluation of the full text by two reviewers, substantially reduced the likelihood of including studies of low methodological quality.

The implementation of PRISMA allowed us to build consistent and transparent processes at each stage, ensuring quality to eliminate and select relevant research that contributed to the topic of study. Fig. 2 shows the distribution of documents at the block level, showing the number of articles collected and discarded by different sequential factors of length and orientation.

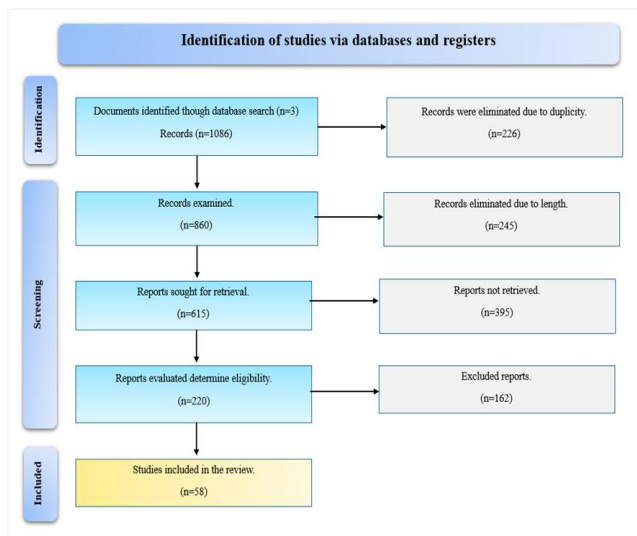


Fig. 2 PRISMA systematic review method

III. RESULTS

The work developed a methodological structure to approach rigorous selection in its phases, ensuring the most appropriate scientific literature. In the first phase, 1086 articles were identified, originating from the Scopus, ScienceDirect and Web of Science databases. This compilation was the result of the exhaustive search carried out with the respective keywords and strings. Table IV presents the number and percentage of articles collected in the initial phase.

TABLE IV
DISTRIBUTION OF ARTICLES IN PHASE 1

Database	Quantity	Percentage (%)
Scopus	496	45.67
ScienceDirect	245	22.56

Web of Science	345	31.77
Total	1086	100%

Scopus accounted for 45.67% of the initial records, suggesting that it will be the source with the largest volume of literature on the subject.

In phase 2, the inclusion and exclusion criteria were used, which led to the identification of 295 documents, as the titles were clearly far from the focus of the study. As a result, the distribution was reduced to 615 research papers that met the criteria for permanence; these results can be visualized in Table V, which shows the detailed representation for each type of database.

TABLE V
DISTRIBUTION OF ARTICLES IN PHASE 2

Database	Quantity	Percentage (%)
Scopus	295	47.97
ScienceDirect	149	24.23
Web of Science	171	27.80
Total	615	100%

During phase 3, the abstracts of the selected papers were reviewed to assess their relevance on the basis of their objective, methodology and outcome. The process resulted in the elimination of 395 records, resulting in the permanence of a new dataset with a total of 220 articles. Table VI provides the individually categorized distribution of the dataset.

TABLE VI
DISTRIBUTION OF ARTICLES IN PHASE 3

Database	Quantity	Percentage (%)
Scopus	140	63.64
ScienceDirect	60	27.27
Web of Science	20	9.09
Total	220	100%

Scopus increased its coverage (63.64%) following the review of abstracts, suggesting greater thematic relevance of its content.

Finally, the last process, "phase 4", included the complete review of the 220 articles selected in phase 3, excluding papers that did not respond to the previously established research questions. This procedure eliminated 162 additional studies, resulting in a final count of 58 journal articles that fully met the quality and relevance criteria. Table VII represents the total number of articles at the level of the three databases, showing their percentage value, which is 100%.

TABLE VII
FINAL DISTRIBUTION OF ARTICLES IN PHASE 4

Database	Quantity	Percentage (%)
Scopus	28	48.28%
ScienceDirect	19	32.76%
Web of Science	11	18.97%
Total	58	100%

Table VII shows the final distribution of the studies classified according to the databases used in the systematic review, indicating the exact number of articles selected from each database after the filtering process.

The distribution of the 58 articles over the years revealed a significant concentration in the most recent periods. The year with the highest production was 2024, accounting for 48.28% of the total number of publications. In second place, 2023 contributed 29.31%, followed by 2022 with 15.52%. In contrast, earlier years, such as 1988, 2001, 2007 and 2019, were minimally represented, with only one article in each, equivalent to 1.72% of the total. As shown in Fig. 3, the year 2024 stands out significantly as the year with the highest amount of relevant research on the topic.

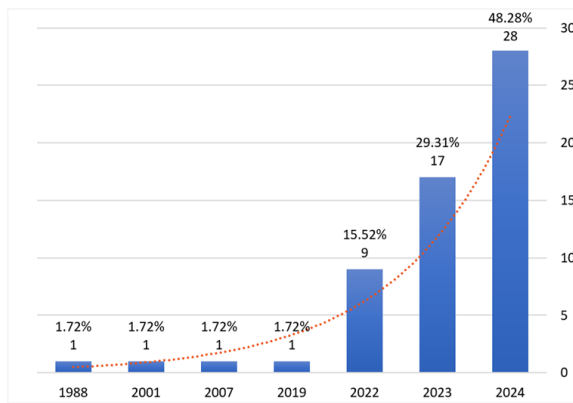


Fig. 3 Scientific literature by year of publication

The analysis of the articles reveals a variation in provenance across databases, with the result that in 1988, 2001 and 2007, a single article was recorded in each of these years, all from Scopus, representing 1.72% per year. In 2019, Web of Science contributed one article, equivalent to 1.72% of the total. In 2022, 3.45% of the articles were from ScienceDirect, 12.07% were from Scopus, and no articles were from Web of Science. In 2023, studies were distributed as follows: 10.34% came from ScienceDirect, 8.62% from Scopus and 10.34% from Web of Science. Finally, in 2024, the articles were distributed between ScienceDirect 18.97%, Scopus 22.41% and Web of Science 6.90%. Fig. 4 visually presents this evolutionary temporal distribution pertaining to the respective databases.

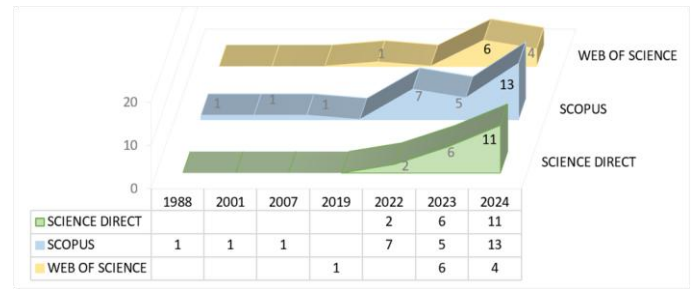


Fig. 4 Number of studies per year and database

According to the data collected, the most prominent studies in the subject matter analyzed come mainly from North America, with the United States being the leader, with 27.59% of the total number of publications. In Europe, Spain and the United Kingdom also make notable contributions, each representing 12.07% and 10.34%, respectively. Similarly, in Asia, China is positioned at 12.07%, highlighting its growing influence in the field of scientific research. Other countries with relevant contributions include Canada, France, Italy and Nigeria, each with 3.45%, whereas nations such as Brazil, Japan, India and Switzerland, among others, contributed more modest percentages at 1.72% each. This geographical distribution reflects the centralization of knowledge in specific regions, such as North America, Europe and Asia, highlighting the hegemony of industrialized countries in the generation of scientific research. Furthermore, it is important to highlight that all the papers were published in English, highlighting its role as the predominant language in global scientific dissemination. This concentration in high-income countries could introduce a representation bias, limiting the applicability of the findings to endemic settings in Africa, where the historical burden of the disease is greater. Fig. 5 illustrates this representation.



Fig. 5 Origin of studies by geographic region

In this systematic review, the documents were classified according to the type of research, highlighting that all the studies corresponded to scientific articles, accounting for 100%. With a total of 58 articles reviewed, this category represents the totality of the bibliography selected for the review. This fact highlights the predominance of scientific articles in the sample, without considering other forms of publication. This distribution highlights the relevance of this type of work in the context of the research.

The methodological analysis of the studies made it possible to identify their distribution according to three approaches. In the quantitative approach, Scopus contributed the highest percentage (37.93%), followed by ScienceDirect (27.59%) and Web of Science (8.62%). On the other hand, in the qualitative approach, Scopus led with 8.62%, whereas Web of Science and ScienceDirect contributed 6.90% and 3.45%, respectively. In the mixed approach, Web of Science accounted for 3.45%, whereas both Scopus and ScienceDirect each had equivalent contributions of 1.72%. The scarcity of qualitative and mixed-methods studies suggests a gap in the exploration of perceptions, cultural barriers, and meanings associated with prevention-aspects that exclusively quantitative approaches fail to capture. Fig. 6 presents this distribution in detail.

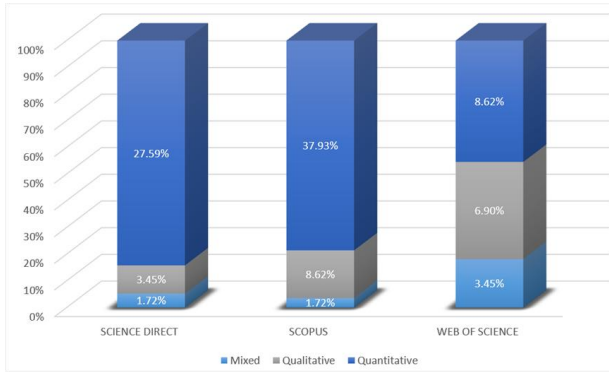


Fig. 6 Scientific studies by methodological approach

In the final phase of the analysis, and as a complementary tool that did not interfere with the systematic selection process, the VosViewer software was used to construct and visualize bibliometric networks. This exploratory analysis does not replace the narrative synthesis conducted in accordance with PRISMA but rather enriches it visually by revealing thematic clusters and connections between key concepts. The terms "mpox" and "monkeypox", directly associated with monkeypox, stood out as the main keywords, showing significant links with concepts such as epidemiology, which analyses the distribution and determinants of the disease; pandemics, which highlights the potential for the global spread of mpox; Ortho poxvirus, the viral genus to which the causative agent of this disease belongs; and digital PCR, an advanced molecular diagnostic technique that improves the accurate detection of the virus.

In addition, terms such as vaccine and prevention underline the relevance of immunization strategies and preventive measures in outbreak control, whereas HIV reflects the association with coinfection in vulnerable populations. COVID-19 appears to be caused by the similarity of symptoms and shared learning between the two diseases in the management of public health emergencies. These thematic connections enrich the understanding of geographic distribution, emergency preparedness and immune responses

to the disease. Fig. 7 clearly illustrates these relationships, strengthening the interpretation of the findings.

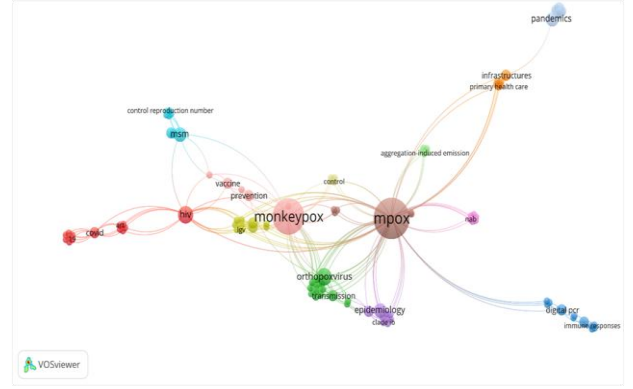


Fig. 7 Bibliometric analysis of the literature using key terms

IV. DISCUSSION

A. RQ1: What are the main epidemiological manifestations in humans because of MPOX?

MPOX has evolved significantly in terms of its spread and clinical manifestations, with important epidemiological implications. Among the most significant features, skin lesions stand out as the most common clinical manifestation; together with sexual exposure, they are the focus of the majority of studies, confirming their central role in the clinical and epidemiological presentation of MPOX. Understanding these manifestations is crucial for designing effective prevention and control strategies.

Several studies support these observations. A study by [17] revealed a high burden of concurrent sexually transmitted infections in 187 patients with MPOX of 36 pathogens, including herpes simplex, gonorrhea and syphilis, revealing the relationship between the virus and risky sexual practices. Likewise, the study by [18], based on a prospective design involving 538 patients, revealed a significant association between MPOX and HIV, particularly among individuals engaging in high-risk sexual practices, underscoring the importance of this epidemiological link. Table VIII presents the main clinical manifestations identified in the studies.

TABLE VIII
EPIDEMIOLOGICAL MANIFESTATIONS OF MPOX

#	Manifestations	Number of studies	References
1	Skin lesions	12	[29], [30], [31], [32], [33], [34], [35], [36], [37], [38], [39], [40]
2	Sexual exposure	9	[41], [42], [43], [44], [45], [46], [47], [48], [49]
3	Geographical distribution	8	[50], [51], [52], [53], [54], [55], [56], [57]
4	Viral load	6	[40], [58], [59], [60], [61], [62]

5	Local transmission	6	[63], [64], [65], [66], [67], [68]
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In addition to skin lesions and sexual exposure, geographical distribution and local transmission are crucial factors in the spread of MPOX. Analysis of the geographical spread of the virus has revealed patterns indicating an increase in cases in certain regions, highlighting the need for coordinated interventions at the global level. On the other hand, local transmission remains a challenge, especially in areas with limited health infrastructure, where conditions to curb spread are less effective. Although findings on viral load are variable, more detailed studies are essential to better understand its impact on the clinical course of the disease and on control strategies.

B. RQ2: What risk factors and transmission mechanisms drive the spread of MPOX in vulnerable populations?

The spread of MPOX is driven by several interrelated factors: sexual transmission, close contact, zoonosis, and socioeconomic factors. High-risk sexual contact has been the primary driver of the spread, underscoring the need to protect vulnerable communities. A previous study [19] analyzed 241 cases in the Republic of the Congo using genomic data and surveillance, and found that 29% were associated with sexual contact, confirming the significance of this route of transmission. Similarly, [20] reported that HIV-positive people, especially those with risky sexual practices, had higher rates of hospitalization and mortality, reinforcing the link between these two conditions.

The spread of the disease is exacerbated by deforestation, urbanization, and climate change, which alter the environment in which transmission occurs. The study [21] analyzed the impact of climatic factors in 33 countries during the 2022-2023 period. Using statistical models, the study concluded that heat increases the number of cases, while humidity and wind reduce it. On the other hand, [22] analyzed zoonotic transmission in urbanization and deforestation incidence factors and reported that the virus remained in the environment, facilitating transmission to humans. On the other hand, [23] highlighted that mass events, by bringing together large concentrations of people, facilitate the transmission of the virus by increasing the opportunities for close contact in crowded spaces. Table IX below outlines the factors and mechanisms that drive mpox transmission.

TABLE IX
RISK FACTORS AND MECHANISMS OF MPOX TRANSMISSION

#	Factors & Mechanisms	Number of studies	References
1	Sexual transmission	12	[29], [31], [34], [35], [40], [41], [45], [47], [48], [62], [68], [69]
2	Close contact	11	[36], [43], [60], [61], [64], [65], [67], [70], [71], [72], [73]

3	Zoonoses	7	[33], [44], [45], [56], [57], [74], [75]
4	Socioeconomic factors	7	[37], [46], [50], [54], [55], [66], [76]
5	Urbanization	5	[30], [32], [56], [59], [75]
6	Mass events	3	[66], [71], [72]

The data in Table IX show that sexual transmission and close contact are the most well-documented factors, while mass gatherings, although relevant, have less empirical support. Notably, socioeconomic aspects, such as poverty and limited access to health services, increase the vulnerability of communities, complicating access to prevention and appropriate treatment of the disease. These data support the importance of a holistic approach to curb the spread of the virus in vulnerable groups.

C. RQ3: What prevention strategies have proven effective in controlling MPOX globally?

The effectiveness of MPOX prevention depends on several strategies; vaccination, surveillance, public education and early diagnosis are several strategies to achieve this goal.

These measures have proven effective in reducing the spread of the virus. A study [24] in China found that 68.8% of participants were willing to get vaccinated, indicating a positive attitude toward immunization. This acceptance is crucial for the implementation of future vaccination campaigns.

On the other hand, vaccines derived from conventional smallpox have proven to be effective at preventing MPOX outbreaks; however, [25] noted that there are still logistical limitations in their availability and distribution. In terms of surveillance, a study conducted in the Democratic Republic of the Congo [19] investigated outbreaks of clade I viruses and reported that contact tracing and early diagnosis were also very important for outbreak containment. Similarly, [21] reported that climatic factors, such as heat, can increase the incidence of cases, but it should also be noted that surveillance strategies need to be adapted to local and environmental conditions.

On the other hand, at the global level, public education is essential for prevention. One study [22] highlighted the importance of informing the public about zoonotic and human routes of transmission, which allows the optimization of control strategies. Table X presents the results of the identification strategies used to combat and control mpox.

TABLE X
EFFECTIVE STRATEGIES TO CONTROL MPOX

#	Strategies	Number of studies	References
1	Vaccination	8	[39], [41], [42], [46], [47], [50], [68], [71]
2	Surveillance	8	[52], [53], [54], [57], [64], [75], [77],

			[78]
3	Education	7	[32], [48], [72], [73], [74], [76], [79]
4	Diagnosis	7	[34], [35], [36], [38], [43], [80], [81]
5	Isolation	6	[49], [59], [60], [65], [82], [83]
6	Control	6	[40], [44], [45], [56], [61], [84]
7	Reinforcement	7	[37], [51], [55], [66], [69], [85], [86]

As shown in Table X, isolation, control and reinforcement are highlighted as key factors in containing the virus. In terms of isolation, the rapid identification of cases facilitates the implementation of measures to prevent transmission between individuals. On the other hand, control strategies, such as contact monitoring and community interventions, are essential for managing outbreaks. In addition, the reinforcement of preventive measures highlights the importance of continuously strengthening surveillance, education and access to diagnosis and treatment, consolidating a comprehensive and effective approach to curb the spread of the disease globally.

V. CONCLUSION

The present SLR study on MPOX as a public health emergency of international concern in 2024 identified the main epidemiological characteristics, transmission mechanisms and prevention strategies associated with this disease. Through the analysis of 58 journal articles selected from academic databases, such as SCOPUS (48.28%), ScienceDirect (32.76%) and Web of Science (18.97%), a comprehensive view of the epidemiological situation of MPOX has been obtained.

The findings indicate that the most common clinical manifestations of MPOX include fever, rash and lymphadenopathy, with transmission particularly prevalent in vulnerable populations, such as those with limited access to health resources. This result underlines the need to adopt prevention strategies, not only according to biological risk but also considering the social and economic conditions of affected populations. However, the fact that most studies have been conducted in North America, Europe, and Asia limits the applicability of these findings to endemic settings in Africa, where the historical burden is greater but available evidence is scarce. Socioeconomic factors emerge as key determinants in the spread of disease, making it imperative to adopt multidimensional approaches in public health policies. Although control interventions, such as vaccination and case isolation, have proven to be essential for mitigating the spread of MPOX, the reviewed studies indicate that the effectiveness of these measures is compromised by several obstacles. Among the most recurrent challenges are the lack of adequate health infrastructure, limited training of health personnel and

insufficient disease-focused education programs in affected regions.

A major limitation identified in this review is the lack of studies assessing the long-term effectiveness of the preventive measures implemented. Although the studies reviewed report favorable short-term results, there is a clear gap in the assessment of the sustained impact of these strategies, particularly in scenarios where outbreaks decrease or vary in geographical extent.

In terms of future research, it is essential to prioritize longitudinal studies to assess the long-term effectiveness of preventive interventions rigorously. It is also essential to strengthen international cooperation, both in terms of monitoring and implementing control strategies adapted to specific contexts. The consolidation of global collaborative frameworks and the strengthening of local health systems will be crucial for a more efficient response to future outbreaks of MPOX and, in general, to health emergencies of a similar nature.

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