

Effectiveness of Educational and Vaccination Interventions in Preventing Monkeypox: Case of Low- and Middle-Income Countries (LMICs)

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Abstract: Preventing the spread of Monkeypox in endemic countries in low-resource settings is important to address the prevalence of this disease and avoid outbreaks in other regions, mostly in the Central African countries and Northern Europe. The concepts covered in this area are educational and vaccination interventions to prevent Monkeypox transmission as a vital public health priority. The aim of this dissertation is to review evidence about the effectiveness of educational and vaccination interventions in low- and-middle-income countries (LMICs) and to examine factors affecting successful implementation of these interventions. A critical review of current literature enabled to evaluate the preventative interventions and factors affecting their implementation to address Monkeypox incidence. The range of evidence included comprised nine studies, eight of which provided evidence from LMICs, while one study was from a high-resource economy, namely the United States. This paper on a high-resource setting was included to assist in establishing factors that have enabled the effective implementation of an intervention in this context to promote public health and suggest ways in which low-income settings could manage implementation challenges. LMICs have differing abilities to handle the factors that affect the successful implementation of intervention efforts. The educational intervention activities increase the ability to identify and address suspected and confirmed Monkeypox cases, while vaccination intervention approaches reduce vulnerability to Monkeypox virus exposure among community members and health care workers. A major finding revealed is that vaccination interventions increased the safety levels among the health care workers infected by Monkeypox virus over a period of four years, with an incidence of 17.4 cases per 10,000 people compared to a range of 0.6-1.8% by year. Corrective and concentrated intervention efforts by the government, health workers, and community members through relaying information and providing follow-up programs is an opportunity to cushion against vulnerability to Monkeypox in low-and-middle-income countries.

Keywords: Monkeypox, low- and-middle-income countries (LMICs), Vaccination Interventions

1. Introduction

1.1 Background Information

1.1.1 Monkeypox Manifestation and Prevalence

This study examines the effectiveness of interventions in preventing Monkeypox in low- and middle-income countries (LMICs). Improved Monkeypox control in countries where it is endemic (e.g., central and west Africa regions) is essential to address increasing disease prevalence and prevent outbreaks in other areas (e.g., Northern Europe) (Reynolds et al., 2019). The first official reported instance of a Monkeypox case among humans was in 1970 in the Democratic Republic of Congo (Kaler et al., 2020). There is rapid growth of cases since 2003 across countries, such as the Democratic Republic of Congo, Ghana, and Nigeria. The recent re-emergence, such as the outbreak in the United Kingdom in 2018 and in Singapore in 2019, has made tackling Monkeypox transmission an important public health priority (Di Gennaro et al., 2022). This dissertation focuses on educational and vaccination intervention to prevent Monkeypox in LMICs.

Before proceeding with describing the growth and spread of the disease across much of the world in recent times, this chapter first summarises the main characteristics of Monkeypox, comprising its definition, causes and sources of infection, treatment, and potential severity of its impacts on those who become infected. Monkeypox is a life-threatening zoonotic infection (i.e., derived from animals) that is triggered by the *Monkeypox virus*. According to the World Health Organization (WHO), Monkeypox death rates in recent years are approximately 3–6%, the highest historical death rate being 11% worldwide (Vogel, 2022). *Monkeypox virus* is classified as an orthopoxvirus and is similar to the *Variola* and *Vaccinia viruses*. Both the *Variola* and *Vaccinia* viruses are causative agents of smallpox (Rao et al., 2022). Recent research has highlighted the serious implications of the increasing rates of Monkeypox, and widespread transmission to countries which were previously not affected by the disease. For instance, the reported cases from non-endemic countries in North America, Europe and Australia have caused alarming public health problems, the issue being connected not to human travels but to direct links with virus outbreaks in endemic regions (Di Gennaro et al., 2022). Evidence suggests that its spread to a region with limited health service capacity, such as the Democratic Republic of Congo, causes the highest death rates. The WHO recorded a total of 67 deaths in this country between 1 January and 1 May 2022 (Tiecco et al., 2022). The recent surge in the appearance of Monkeypox in new countries (e.g., UK) means that it is important to develop and evaluate effective prevention strategies. Therefore, it is important to review the research on prevention strategies, to understand the implementation of these strategies and to identify the most promising approaches.

The re-emergence of Monkeypox virus has meant that health practitioners have paid significant attention to understanding and identifying its key signs and symptoms. Moreover, they are concerned with focusing on the prevention of the virus. The most common indicators of the infection are fever, intense headaches, muscle pain, inflamed lymph nodes, and skin blishes. Other features range from skin lesions (containing yellowish fluid), and concentrated rashes on the face and hands of those infected. What makes these symptoms and signs a vital source of concern is the proportion (3-5%) of deaths among the infected populations (WHO, 2022). Investigation by healthcare practitioners of potential infection involves checking for evidence of skin lesions and asking patients about possible contact with contaminated clothing or other sources of infection. It is crucial to understand the differences between suspected and confirmed cases of the Monkeypox virus. The criteria for a confirmed case are assessed via laboratory experiments after performing real-time polymerase chain reaction (PCR) tests or DNA sequencing (WHO, 2022). Healthcare practitioners initiate prevention strategies based on their awareness of interventions with significant clinical outcomes, notably a reduced spread of the Monkeypox virus.

Understanding how Monkeypox is closely related to smallpox is crucial to recognise its re-emergence and recent transmission across LMICs. Until recently, there were extensive smallpox vaccination programmes, which provided protection against Monkeypox. The WHO discontinued the vaccination programme following a recommendation that the vaccinia virus-based injection had succeeded in eliminating naturally occurring diseases attributed to the spread of smallpox (Kukreja et al., 2022). In the period between 2010 and 2019 that followed cessation of smallpox vaccination, Central African and West Africa clade had a fatality rate of 10.6% and 3.6%, respectively (Bunge et al., 2022). These statistics affirm the need for the re-administration of the smallpox vaccination against Monkeypox in LMICs.

The discontinuation of smallpox vaccination programmes has thus inadvertently left a large proportion of the population unprotected against Monkeypox. Mentioning details of vaccination against Monkeypox is pertinent to distinguishing its effectiveness among the affected populations. It is important to understand effectiveness of smallpox vaccination in preventing the Monkeypox disease. On 4 September 2021, after identifying suspected Monkeypox exposure in Dallas, Texas, USA, the Centers for Disease Prevention and Control recommended the orthopoxvirus vaccine subsequent to infection by the Monkeypox virus attributed to human travel (Rao et al., 2022). These statements are an indication that Monkeypox prevalence is a public health problem to manage.

There has been an ongoing resurgence of Monkeypox outbreak across low- and middle-resource countries. It has caused adverse impacts among the affected population (Reynolds et al., 2019). The renaissance of Monkeypox and its arrival in previously unaffected countries is a major concern for public health practitioners, for whom preparing to combat the virus and developing additional capacity to prevent human transmission are a significant challenge. Moreover, this resurgence has been accompanied by mutations in the disease, which poses an elevated threat of affecting wider populations, especially when coupled with the absence of a specific Monkeypox vaccination (Gong et al., 2022). In addition, the COVID-19 pandemic highlighted the need for significant resources to prevent the transmission of highly infectious disease such as coronavirus and Monkeypox (Rizk et al., 2022). In line with this statement, it is important that public health staff design and deliver intervention strategies that are as effective as possible to address active Monkeypox instances.

Health practitioners deliver interventions on an appropriate scale to prevent the spread of Monkeypox. According to the Centers for Disease Prevention and Control, once a case of Monkeypox has been confirmed, available treatment strategies, such as antivirals and vaccinia immune globulin intravenous (VIGIV) injections, similar to those employed for dealing with other orthopoxviruses, are administered. Hence, addressing Monkeypox requires sustained actions to control its spread, undertake vaccination, and utilise diagnosis until Monkeypox is adequately suppressed (Rizk et al., 2022). The notable aim of this dissertation is to examine effectiveness of interventions to prevent Monkeypox in low-and-middle income countries.

The recent resurgence and spread of Monkeypox in LMICs is an important topic for research. This significance is related both to its highly infectious nature (especially in the context of close contact) and the severity of its symptoms. Disease severity is assessed via the magnitude of the lesion count, higher lesions being correlated with increased complications, such as respiratory issues or ocular infections. This condition is for those patients that are not vaccinated against smallpox (Lum et al., 2022). For the period from mid-December 2021 to 15 June 2022, endemic African countries associated with poverty factors recorded 1365 cases (including suspected cases) and one death (Tambo and Al-Nazawi, 2022). As of December 2022, the predicted number of deaths attributed to human Monkeypox across the USA was five, in Europe three and in Canada six (McAndrew et al., 2022). However, surveillance and detection interventions have failed to mitigate the severity of cases in endemic African countries. Therefore, health practitioners have been unable to identify the possible fatalities attributable to the Monkeypox virus (Tambo and Al-Nazawi, 2022). Some of the main drivers of the disease's emergence and re-emergence in LMICs are poverty and health behaviours - e.g., hygiene, especially sub-Saharan Africa (Tambo and Al-Nazawi, 2022). There is a strong association between lower socio-economic contexts and rates of Monkeypox (Guagliardo et al., 2022).

Hence, this dissertation aims to understand the context for the spread of Monkeypox in endemic countries, especially LMICs.

1.1.2 Defining low- and middle-income countries

Goldstuck (2014) defines low-and-middle income countries as contexts within which healthcare system fails to meet the minimum standards set by the WHO or similar quasi-governmental agencies. LMICs are often characterised by a country's inability to effectively manage disease outbreaks which require a high level of human and financial resources. They typically have high rates of Monkeypox infection whilst at the same time having limited resources and ability address these rates. Van Zyl, et al. (2021) portray LMICs as experiencing both high rates of the disease and low life expectancy, driven by underlying determinants that limit access to public services such as healthcare.

Another way of defining LMICs is in terms of barriers to implementing large-scale initiatives that can impact the management and control of a public health outbreak such as Monkeypox. LMICs are characterised by multiple disease burdens with inadequate human resources in terms of quantity and adequacy of training as well as system governance for mitigating against a disease (Heine, Derman, and Hanekom, 2022). A recent study also argues that public health practitioners in LMICs are expected to utilise prevention approaches designed higher income settings and adapt these for use in their own settings where resource constraints exist (Fell, Hanekom, and Heine, 2022). This dissertation pays particular attention to these characteristics of LMICs and how this is likely to shape the process of implementing prevention strategies for Monkeypox. Thus, this dissertation aims to understand which approaches/strategies are effective within LMICs and the factors which affect this.

1.1.3 Monkeypox in LMICs

Human Monkeypox prevention and treatment in LMICs is essential due to disease re-emergence. It is essential to look for the factors that cause abrupt increases in the spread of the disease in the light of the implemented public health interventions. Major causes of such a rise of Monkeypox in LMICs include poverty and lack of information (Oladoye, 2021). The reported confirmed incidences of Monkeypox for the African countries between January 2022 and 1 June 2022 based on the accumulated suspected and confirmed cases, and deaths in the endemic countries (WHO, 2022a). However, the difference in the magnitude of public health resources for individual countries makes the proportion of confirmed and suspected cases vary. For instance, the Democratic Republic of Congo shows highest incidences due to more pathogenic CB clade Monkeypox virus with an estimated case fatality rate (CFR) of up to 11% (Kmiec & Kirchhoff, 2022). A CB clade refers to the identified samples of viruses associated with causing a severe disease and having a high case-to-fatality ratio among the affected population. Furthermore, the country is reported to experience consistent increases in poverty over time, which is considered as a major driver of Monkeypox transmission (Mandja et al., 2022). Analysing the recent trends in LMICs is important to gauge their effectiveness in managing Monkeypox disease prevalence. The key trend captured is that individual countries that have a distinctive number of suspected and confirmed cases report different death rates. While Nigeria has a significantly high number of suspected cases (66) and confirmed cases (21), its reported death rate is one, whereas the numbers for the Central African Republic are 17, eight and two, respectively. The Republic of Congo has recorded three deaths, corresponding to seven suspected cases and two confirmed cases (see Table 1.1). These differences may be attributed to the nature of public health resources and interventions in individual countries.

Table 1.1 Reported Monkeypox cases between January 2022 and 1 June 2020

Country	Confirmed cases	Suspected cases	Deaths
Cameroon	3	28	2
Central African Republic	8	17	2
Republic of Congo	2	7	3
Democratic Republic of the Congo	10	1 284	58
Liberia	0	4	0
Nigeria	21	66	1
Sierra Leone	0	2	0
Cumulative	44	1 408	66

Source: World Health Organization, 2022b.

With respect to the details displayed in Table 1.1, LMICs are exposed to dominant Monkeypox infections. According to the WHO, dominant infections for Monkeypox are life-threatening conditions, causing skin lesions and complications (WHO, 2022b). Selected public health interventions need to be feasible to implement with limited resources to manage confirmed and suspected cases of Monkeypox. In relation to Monkeypox prevention, evidence-based medicine provides context to report the magnitude to which a set of potential public health interventions, for example communication strategies, influence the ability to establish facts pertaining to an infectious disease to prepare possibility of dealing with its worst-case scenarios (Cloeckaert and Kuchler, 2020). This claim is explained from the perspective of lack of adequate resources in public health intended for preventing the Monkeypox virus. In LMICs, lack of resources limits the ability to control an illness with the potential to cause a major public health crisis. This problem escalates when clinical experts fail to initiate and maximise the use of possible interventions expected to limit disease spread.

Other interventions possible for aiding in preventing Monkeypox in the LMICs are surveillance and reporting. On the one hand, surveillance entails investigating an emerging infection case to determine its sources and to establish optimal clinical treatment. Other aims of surveillance when the method is used to identify transmission are assisting public healthcare practitioners in discerning epidemiology and consequences of an outbreak. On the other hand, reporting during Monkeypox outbreak entails amassing data about the recent exposure, nature of contact, status of smallpox vaccination, presence of symptoms and signs, method of confirmation, description of genomics, and classification of cases in terms of suspected or confirmed incidences (WHO, 2022b). This study focuses on the extent to which interventions could curtail the spread of Monkeypox disease.

1.2 Problem Statement

Could surveillance, educational interventions, or vaccination interventions in LMICs help tackle re-emergence of Monkeypox virus spread? This question is asked in the context of the limited resources often available to implement interventions. Monkeypox is now circulating widely across both LMICs and higher income countries such as the UK. High rates of Monkeypox in LMICs have a particular significance because these settings have far greater challenges in prevention transmission, and in resourcing effective intervention strategies. However, searches for this study identified no previous systematic reviews of the effectiveness of interventions in LMICs to prevent the transmission of Monkeypox. Likewise, there is no review which summarises current evidence on factors affecting effectiveness in the implementation of interventions.

2. Research Question, Aims, and Objectives

2.1 Chapter Overview

This chapter presents a clear and focused question addressed by the current research. Formulating and structuring the central question was based on the PICO framework. This segment follows on from the background information provided in the introduction. Therefore, this chapter outlines the overall purpose of the study and its objectives that will guide the systematic review

on the effectiveness of interventions in LMICs to prevent the transmission of Monkeypox and factors affecting effectiveness and implementation of interventions.

Table 2.1 PICO framework to formulate research question

PICO Elements	Description
P (Patient or Population)	Population suffering from Monkeypox disease
I (Intervention)	Vaccination Educational
C (Comparison)	No intervention
O (Outcome)	Prevent Monkeypox incidence in low- and middle-income countries

2.2 Research Questions

1. Which interventions are effective in preventing Monkeypox in low- and middle-income countries?
2. What are the factors that affect the successful implementation of interventions preventing Monkeypox in low- and middle-income countries?

2.3 Research Aim

The aim of this dissertation is to review evidence on the effectiveness of interventions in low- and middle-income countries. Moreover, the purpose of the dissertation is to examine factors affecting these interventions in low- and middle-income countries. The focus is on educational and vaccinations interventions.

2.4 Study Objectives

1. To examine the factors affecting the implementation of educational interventions in preventing Monkeypox disease in low- and middle-income countries.
2. To examine the factors affecting the implementation of vaccination interventions in preventing Monkeypox in low- and middle-income countries.
3. To explore the factors affecting the effectiveness and implementation of educational interventions that have been delivered in low- and middle-income countries.
4. To study the factors affecting the effectiveness and implementation of vaccination interventions that have been delivered in low- and middle-income countries.
5. To provide recommendations for further effective strategies for facilitating prevention of Monkeypox in low- and middle-income countries.

2.5 Significance of Research Aim in Relation to Monkeypox as a Public Health Problem

The contribution of this study is grounded in intensive examination of public health interventions relevant to preventing Monkeypox incidences within low- and middle-income countries. Awareness of public health interventions for emerging zoonotic makes it essential to look at the factors affecting the effectiveness of prevention interventions, including the reduction in administering smallpox vaccination (Petersen et al., 2019). Another contribution of this dissertation is on reporting confirmed Monkeypox cases within the low-and-middle income countries. Knowledge of Monkeypox cases (confirmed, suspected, and deaths) in non-endemic regions, such as Northern Europe, rather than the endemic countries in Central and West Africa areas is significant. This understanding aids reflection on whether testing has been ineffective in improving the management of recent global outbreaks of the disease due to limited testing capacity (Kozlov, 2022). Limited testing capacity is relevant to the aims and objectives of this dissertation, namely to validate the significance of vaccination and educational interventions. Thus, this attention underscores the requirement for examining the existence of distinctive strategies to cushion against the spread of Monkeypox virus cases.

3. Method

3.1 Chapter Overview

This chapter sets out the systematic review methodology and methods used to answer the study's research questions. The aim of this section is to illustrate how the researcher identified current literature to review through extensive independent research. Therefore, this chapter details the diverse methods used, with comprehensive explanations, which would enable another researcher to reproduce similar results. Furthermore, it provides a rationale for the steps undertaken. The specific detailed information revolves around the main components of the methods, definitions of the search terms, an explanation of the search strategy, eligibility criteria, data extraction, data quality or critical appraisal, and analysis and synthesis.

3.2 Methods

The aims of this study required a critical review of current literature relevant to preventative interventions and factors affecting the effectiveness of implementation of education and vaccination interventions to address the incidence of Monkeypox in LMICs. To achieve this aim, a systematic search was required to answer the research questions, which was grounded in literature in the public health prevention intervention domain. The review process was aligned with the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) statement. According to Tricco et al. (2018), a PRISMA adds value to systematic research and aids in analysing the central questions of a study in a clear manner. In this case, the tool allowed for the evaluation and interpretation of the findings revealed and the inferences drawn, leading to recommendations based on the studies investigating factors affecting the effectiveness of the educational and vaccination interventions, as well as the implementation of these interventions for preventing Monkeypox and its related negative consequences (deaths and widespread outbreaks among uninfected populations). A detailed justification for the use of the systematic review method is also provided.

The value of the systematic review approach for this dissertation can be confirmed from several perspectives. First, systematic reviews provide a means of synthesising the knowledge in a given field and identifying gaps in the current studies, within which future research priorities are identified to address central questions that might not be examined comprehensively if relying on individual studies (Page et al., 2021). This demonstrates the effectiveness of this research method in identifying future research priorities through bridging gaps in the literature. In this way, different types of public health intervention knowledge can be generated, intended for review by users (patients, healthcare providers, and policy makers) (Gough et al., 2019). The PRISMA tool effectively assists toward achieving the researcher's purpose of identifying the effectiveness of educational and vaccination interventions in addressing the outbreak and spread of Monkeypox. Qualities associated with a systematic review are that it reflects up-to-date reporting, including transparent, accurate, and complete accounts of the reasons why the review was undertaken, actions taken (identification and selection of studies), and results (characteristics of the studies and outcomes of meta-analysis) (Moher, 2018). Consistent with these explanations, this dissertation meets the rationale for utilising a systematic review and relying on the PRISMA method. As the main intention of this systematic review process was to indicate the outcomes of Monkeypox prevention strategies among populations in low-resource settings, the selection of different search terms to employ was an important aspect of the approach taken.

3.3 Key Search Terms

Prevention Program: The definition of this concept in the context of the current systematic review was a set of public health care interventions created to optimise and sustain the prevention of Monkeypox occurrences amongst community members (including the public and general practitioners) in LMICs. Monkeypox occurrences have risen to reach a magnitude at which public health entities could be tasked with acquiring and progressing the relevant clinical management approaches, given its potential to become a worrying epidemic (Titanji et al., 2022). This description is a clear sign that different public health interventions are necessary as the minimal efforts to prevent its spread.

Educational Intervention: This term was defined as a collective effort to reduce the prevalence of Monkeypox by promoting preventive measures among health care workers and the general population, with a focus on early detection and response against the resurgence of the virus to become a threat to uninfected individuals (Alshahrani et al., 2022). Based on the outcome

that this literature review intended to report, it was vital for the researcher to identify and analyse interventions that involved preventative measures to complement therapeutic procedures, due to the worrying rise in the incidence of Monkeypox within LMICs.

Vaccination Intervention: This term was used in the context of this study as a self-intention among a sub-population to associate with administering a vaccine as a preventive precautionary measure or following a diagnosis with Monkeypox. According to Wang et al. (2022), efforts to increase vaccination intentions serve to support affected or concerned individuals in receiving a dose of the vaccine after contact with a suspected source of infection. This dissertation focuses on how the widespread use of vaccination interventions could prove effective in preventing Monkeypox.

Overall, it was considered that these search terms and corresponding synonyms was the best available to meet the needs of this study. Such terms and synonyms proved to be viable in enabling the identification and validation of the complexity of educational and vaccination interventions as prevention programs against Monkeypox. Further, these search terms assisted a comprehensive search of the current literature through an all-inclusive, systematic search strategy.

3.4 Search Strategy and Data Sources

3.4.1 Study Selection Process

This study depended on a defined and refined search strategy to retrieve the eligible papers. This technique involved integrating various filters and subject indexing, including “full text”, “in the title”, and “in the abstract” in the chosen databases. Furthermore, since the intention of this search strategy was to trace studies, specifically relevant to Monkeypox prevention using the effective implementation of vaccination and educational interventions, the search terms needed to be refined. This refining aids in the categorisation and prioritisation of areas for exploration (Cooper et al., 2018). For retrieval from the PubMed database, the keyword first applied was “Monkeypox or Monkeypox virus”, which was redefined to “Monkeypox AND interventions.” The term was redefined because it was necessary to show that a systematic search was a suitable method of performing a critical review of the literature. This process was repeated for Google Scholar, Plos One, and the manual searches of studies and reference lists as the most preferred data sources to locate sufficient relevant studies to conduct comprehensive systematic review. These procedures were appropriate and sufficient to enable the researcher to answer the research questions of this dissertation.

In the first phase of the search strategy, the major research question formulated was as follows: “What are the most effective ways of preventing Monkeypox in LMICs?” This central question helped the researcher to identify educational programs as the most effective approach. However, the identification of inadequate studies on educational approaches led to the inclusion of surveillance and vaccination interventions in the search to broaden the scope, as there were fewer educational studies than expected. Surveillance studies were subsequently excluded from the review as a potential extension, since this type of intervention was beyond the scope of this study, namely prevention. Hence, in order to conduct a comprehensive systematic review founded on all-encompassing findings, it was essential to formulate another research question to capture the implementation aspect in Monkeypox prevention.

Structuring another research question was an important procedure and was performed to ensure that the critical review of the literature reflected educational and vaccination interventions and the factors affecting their implementation. The second research question was formulated as follows: “What are the factors that affect the implementation of interventions to prevent Monkeypox in LMICs?” According to Reynolds et al. (2013), the application of appropriate interventions depends on whether those concerned know of the various factors that affect the measures taken, such as logistical constraints and insufficient laboratory experimentation. The focus on implementation aimed to enable an understanding of whether the interventions were implemented as intended, and if there are particular challenges within low-resource settings such as LMICs.

3.4.2 Data Sources

This study employed a search strategy to locate, analyse, and synthesise the current pertinent literature on educational and vaccination interventions and implementations that affect the effectiveness of preventive measures against Monkeypox prevalence in the context of LMICs.

The major online databases utilised for this dissertation were PubMed, Web of Science, Google Scholar, Plos One, and SCOPUS. This search was complemented by a manual search to eliminate research bias and include grey literature. Di Gennaro et al. (2022) stated that it was necessary to include different data sources when performing comprehensive narrative reviews. The paper indicates the limitations on the data pertaining to Monkeypox incidences, a type of knowledge which is vital to the current dissertation. An all-inclusive narrative review was thus used to guide the formulation of viable research questions and terminologies related to prevention and intervention. Furthermore, the current literature proved crucial to identify studies for analysis. The final search for published studies for review was undertaken on August 24th, 2022, to assemble the final resources required for this dissertation. The eligibility criteria process applied, based on the Population, Intervention, Comparison, and Outcomes (PICO) framework, is provided in detail in the next section.

3.5 Eligibility Criteria

The eligibility criteria used for this study were founded on the research questions. The PICO tool and its elements provided the basis for study selection through the inclusion and exclusion of current scientific works linked to the literature review sources. The PICO tool is recommended to identify and review innovative academic articles through a research process that consists of data generation, data analysis, and presentation of findings (Shapovalova, 2022).

Population or Participant: The study populations principally consist of individuals infected with Monkeypox in LMICs. However, a study of a population from a high-resource background is also considered, namely the United States, where public healthcare resources are established for the prevention of Monkeypox outbreaks among the population. The inclusion of this study assisted in identifying and assessing the factors that have made the United States successful in implementing vaccination interventions to both prevent and treat Monkeypox. However, surveillance studies, in which participants did not benefit from the Monkeypox prevention strategies, were excluded. The major rationale was because such interventions do not prevent the spread of Monkeypox. Populations that only benefited from preventive and treatment measures were the most important for analysis in this work.

Interventions: Educational and vaccination approaches for the prevention of Monkeypox were considered as effective interventions in this critical literature review. This selection resulted in the inclusion of studies evaluating clinical and community-based services and vaccine administration to curb Monkeypox. Publications that did not meet these criteria were excluded from this systematic review.

Comparison: This dissertation paid attention to comparisons between intervention and no intervention, rather than comparing educational and vaccination approaches for the prevention of Monkeypox.

Outcome: The outcome of this systematic review was to specify whether educational and vaccination interventions prevent Monkeypox and to assess the extent to which factors affecting the effectiveness of the interventions mentioned hinder disease prevention. A summarized table of the PICO framework is provided below (see Table 3.1).

The usefulness of the PICO format cannot be overstressed. The identification of PICO information allows a researcher to formulate the question that is to be answered in research and to establish the eligibility of studies for inclusion (Brockmeier et al., 2019). Hence, the diversity of interventions for preventing Monkeypox required this dissertation to adopt comprehensive inclusion and exclusion criteria. According to Sim et al. (2014), inclusion and exclusion criteria are basic requirements for applying the PICO instrument and assessing the characteristics of a study to facilitate the completion of the search. For these reasons, the current review used inclusion and exclusion criteria related to several aspects of the population that needed prevention against Monkeypox, the types of educational and vaccination interventions used, and the factors affecting the implementation of these prevention strategies.

Table 3.1 PICO framework to develop the systematic review

PICO Elements	Keywords	Search Terms	Search Strategies
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P (Patient or Population)	Population suffering from Monkeypox disease	Monkeypox Monkeypox virus	Monkeypox Interventions	AND
I (Intervention)	Vaccination Educational	Educational Vaccinations	Monkeypox Vaccination Monkeypox Education	AND AND
C (Comparison)	No intervention			
O (Outcome)	Prevent Monkeypox Reduce Monkeypox prevalence	Effective strategies	Monkeypox effectiveness	AND

3.5.1 Inclusion and Exclusion Criteria

Different factors were considered in creating a comprehensive search strategy for this systematic review. Notably, the inclusion and exclusion criteria allowed the author to identify works pertaining to LMICs but also to the prevalence of Monkeypox in a context with high-level public health resources for handling this disease. Monkeypox outbreaks in endemic regions with low public healthcare resources expose major gaps in handling the dynamics of the disease's viral transmission, owing to inadequate coordination in promoting preparedness efforts (Zumla et al., 2022). This assertion indicates the need to include not only LMICs, but also some notable high-resource contexts to establish in what manner they have succeeded in implementing educational and vaccination interventions. Moreover, it was decided to expand the search to all countries due to the small number of studies found. The researcher chose to examine whether findings from high-income countries could be used to generate adequate understanding of what might be effective in LMICS whilst acknowledging differences in available resources and levels of preparedness.

Furthermore, the researcher included only articles published within the last 20 years. The rationale was to reflect wide-ranging studies, consisting of a deliberated list of sources reflecting the interventions and implementations chosen. Resources reporting findings that revealed prevention programs were included as well. However, excluded articles comprised descriptive review publications and non-human and non-epidemiological studies. Other inclusion criteria for this study were grey literature and explorations of countries that have been able to cushion against overlapping Monkeypox differential diagnoses. The inclusion and exclusion criteria are set out in Table 3.2.

Table 3.2 Summarized inclusion and criteria elements

Inclusion Criteria	Exclusion Criteria
• Year of publication (2002-2022) • Papers written on Monkeypox for low- and middle-income countries • Papers undertaken or written in high-income countries about Monkeypox • Grey literature • Epidemiological study designs (cohort, cross-sectional & RCT) • Latin American countries affected by Monkeypox and have managed to address overlapping differential diagnosis of the disease	• Year of publication prior to 2002, in spite of the first outbreak being reported before 2002. • Descriptive review papers • Non-human studies • Non-epidemiological studies

3.6 Data Extraction

The data extraction process followed the steps outlined in the PRISMA flowchart — identification, screening, eligibility, and inclusion. The table that corresponded to the papers analysed and presented with respect to the study characteristics and significance. Grounded on these aspects, the quality of analysis of a critical systematic review is upheld to ensure transparency, accuracy, and completeness. Thus, this study used a standardised four-stage flow diagram to ensure the quality of the systematic review. These stages each had corresponding elements, such as the data searching of records to identify high-quality sources and the removal of duplicates before screening. The eligibility stage involved locating full-text articles and excluding surveillance-based and non-human studies. The advantage of adhering to these aspects was that they allowed for the analytical procedure to be undertaken in the most consistent manner. A copy of the data extraction tool is attached in the appendices (Appendix A). Components that corresponded to the study characteristics and significance are outlined as follows:

- Author (s)
- Title
- Population/ Setting/ Country
- Design/Method
- Intervention Description
- Outcome Measured
- Results
- Intervention Effectiveness
- Implementation Issues

3.7 Data Quality/Critical Appraisal

The Critical Appraisal Skills Programme (CASP) tool was used to assess the quality of each study. The rationale for using this instrument was to ensure that the researcher could evaluate the methodological quality of the debates and studies synthesised to judge the most appropriate works (Long et al., 2020). The key feature of a CASP tool is to critically appraise literature papers; It enabled this dissertation to have a standardised analysis and reporting of the results from selected nine papers. A copy of the CASP tool is attached (see Appendix B). However, it was modified to suit the context of the critical literature review for the present study. A conventional CASP instrument has standardised questions specifically evaluating the presence of a focused question, method appropriateness, recruitment approach, and outcome measurement. The modified questions for this study needed to establish the significance of clear, focused research questions, primary topic of research, exposure and appropriateness of outcome measurement, and clear definition of the method used. This deviation enabled the researcher to establish how the selected studies answered the research questions for this dissertation.

3.8 Analysis and Synthesis

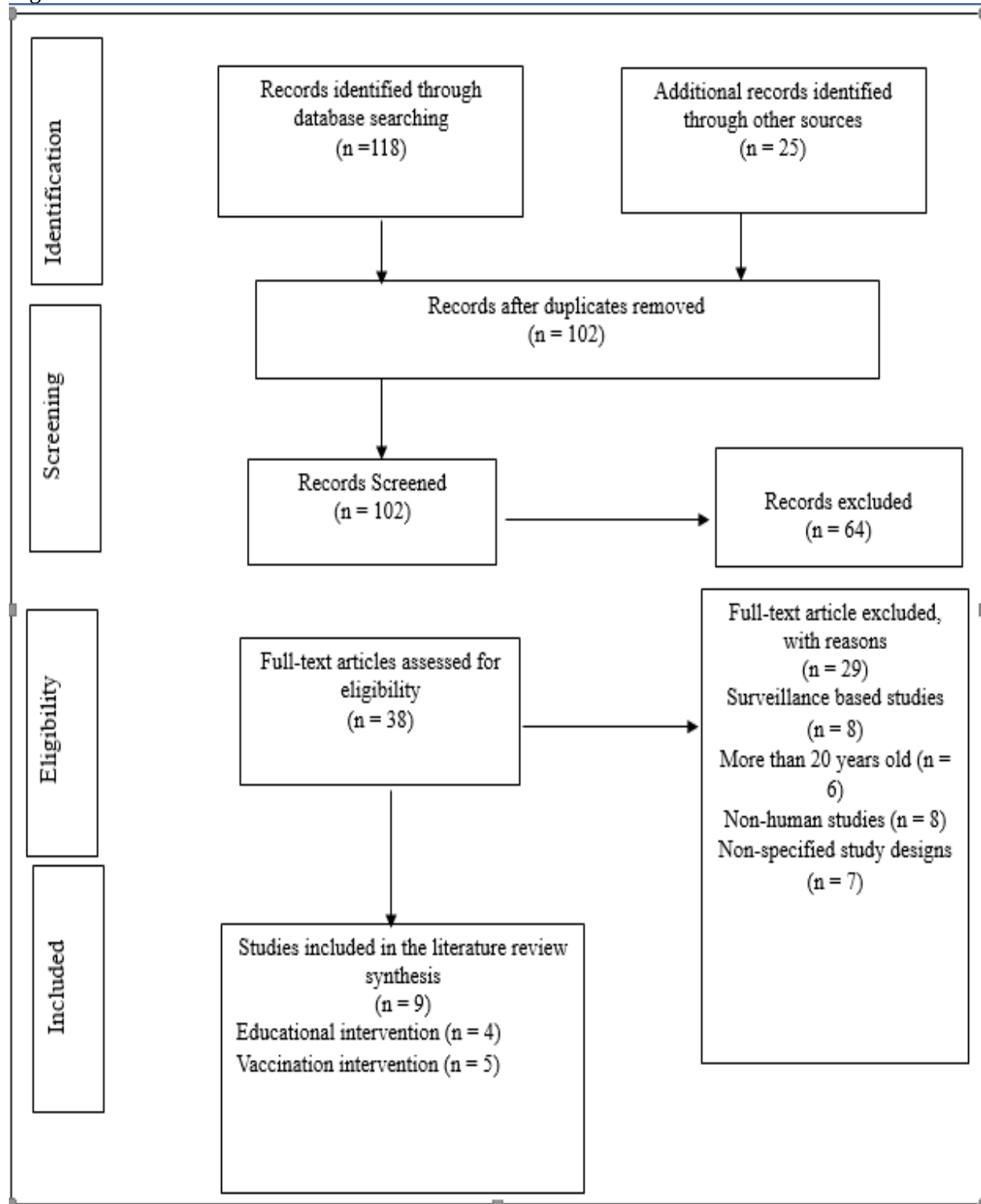
The analysis adopted for the systematic review for this dissertation went beyond a simple descriptive literature review. A narrative synthesis was the most appropriate approach to guarantee collective interpretation of evidence. Narrative synthesis is considered in the PICO question framework elements to group findings based on key questions, interventions, comparisons, and outcomes (Garritty et al., 2021). In line with this clarification, the use of this approach for the current study was appropriate. The analysis entailed summarising and interpreting findings to draw significant conclusions. Narrative synthesis was thus employed to report major findings pertaining to the strategies intended to mitigate the spread and the severity of Monkeypox attributed to the transmission of viral infections. Hence, the narrative synthesis strategy was justified for use in this dissertation. Moreover, it enabled interpretation of the chosen empirical studies on human populations, which facilitated the examination of the factors affecting the effectiveness of educational and vaccination interventions in preventing Monkeypox. Ultimately, the narrative synthesis approach informed clinical outcomes, such as vaccination strategies, as key interventions in mitigating Monkeypox given its outbreak and spread in LMICs.

4. Results

4.1 Overview

This chapter presents the findings from the literature review based on the search strategy detailed in the previous chapter, which generated a range of articles that were aligned to the aim of the study. The first research question adopted to direct this systematic search was, “Which interventions are effective in preventing Monkeypox in low- and-middle-income countries?” In order to answer this research question, the first phase entailed a focus on identifying studies that examined educational programs and interventions, but the small number of educational studies found led to the addition of surveillance-based studies, vaccination interventions, and implementation studies. The basis for including these studies was partly to expand the scope of the review due to the inadequate papers assessing the efficacy of interventions. Moreover, it was crucial to explore implementation issues, since if these interventions were lacking, LMICs would need to adopt some strategies from high-income countries. This approach was vital to understand the implementation challenges in the low-income context. Surveillance studies were excluded from the review because this intervention is a distinct area of exploration, which is different from the prevention interventions. These exclusion and inclusion criteria led to the formulation of the second research question: “What are the factors that affect the implementation of interventions in preventing Monkeypox in low-and-middle-income countries?” The initial literature search involved records identified through the database searches, comprising 118 articles, with an additional 25 articles identified through other sources. Ultimately, a total of nine (9) studies were included in the final list for analysis: four (4) on educational interventions and five (5) on vaccination interventions. The PRISMA flowchart that captures this process is shown in Figure 4.1.

Figure 4.1 PRISMA Flowchart



4.2 Overview of the Selected Studies

A synopsis of the selected studies is based on different dimensions of characteristics and significance to validate their eligibility for analysis. The studies are summarised in table format for individual sources. A corresponding supportive narrative is also provided, entailing a brief explanation of the vaccination and educational approaches and implementation issues to delineate the findings of the studies. The study settings vary depending on the intervention executed for the prevention of Monkeypox. A total of nine studies emerged as the final record to analyse, with eight (8) of them being from LMICs: the Democratic Republic of Congo (2), Congo (1), Indonesia (2), Nigeria (1), Cameroon (1), and Jordan (1). Only a single study was included from a high

resource context, namely the United States. The basis for its addition was to facilitate adequate understanding of implementation issues that low-income contexts could experience because of their inadequate capacity to adopt vaccination and educational strategies.

4.3 Study Characteristics and Significance

Study characteristics and significance are necessary elements to depict the context in which educational interventions are implemented and vaccinations are administered among the target population, such as health care workers and community members. The nine studies revealed the efforts made to address the negative consequences of Monkeypox prevalence. For instance, Karem et al. (2007) stated that smallpox vaccination moderated severe cases of Monkeypox among the vaccinated population compared to unvaccinated individuals, thus demonstrating the efficiency of this strategy in protecting individuals at risk of contracting the illness or those who are already infected. However, the interventions experienced implementation issues due to the concerns about smallpox vaccinations (Petersen et al., 2019). Ross et al. (2011) identified inadequate participation among populations and lack of awareness about Monkeypox risk factors as further implementation issues. Yet, different countries in the low-income context have made noteworthy strides in averting the undesirable effects attributed to the outbreak and prevalence of Monkeypox virus. Finally, the details on the effectiveness of educational and vaccination strategies provide a clear indication that these interventions are worthwhile to help restrict the spread of Monkeypox in LMICs while emphasizing gains made as a result of coping with the implementation issues.

4.3.1 Description and Summary of Vaccination-Based Studies

Vaccination-based studies are examined based on the exposure, expected impact, severity, and management of implementation issues to influence the clinical outcomes of adopting this strategy. An outbreak and route of exposure are major factors that increase the spread of Monkeypox, which contributes to the challenge of implementation vaccination (Karem et al., 2007). Imparted knowledge regarding the magnitude of vaccine acceptance among health care workers eliminates the conspiracy beliefs about mitigating emerging zoonotic viruses (Sallam et al., 2022). For instance, health practitioners would willingly accept and pay for smallpox vaccines while the government actively supports this program (Harapan et al., 2020). However, the capacity to adopt the vaccination strategy among medical staff raises an implementation issue of inadequate provision of subsidies by the government to purchase the required quantity (Harapan et al., 2020). Nonetheless, a rise in safety levels makes the vaccination intervention a feasible program (Petersen et al., 2019). These points denote the complexity of implementing vaccination intervention to make this an effective approach in LMICs.

4.3.1 Description and Summary of Educational-Based Studies

Educational-based studies chosen for this critical literature review are described and summarized from the perspective of how they enable health providers to increase awareness of Monkeypox occurrences and prevent its outbreak. Moreover, the related implementation issues are provided. Ross et al. (2011) ascertain that educational interventions eliminate Monkeypox cases, since film-based educational activities help health care staff to disseminate information to community members. The implementation issue that affects the effectiveness of this strategy is the promotion of high-level participation to familiarise people with Monkeypox risk factors. Similarly, inadequate training on Monkeypox management and curriculum to teach about the disease impedes the containment of the illness. However, educational interventions prompt consistent and organised efforts among health care workers to detect and provide care services to patients (Bass et al., 2013). Moreover, Guagliardo et al. (2020) identify socioeconomic status and education level as vital implementation issues in low-income settings. A solution to this problem is for the government to provide adequate resources to prevent the occurrence of Monkeypox. Medical facilities could benefit from a response routine that aids in reporting and managing potential outbreaks and widespread transmission of the disease (Ogoina et al., 2019). A succinct description and summarised findings of the nine (9) studies is presented in the data extraction table below (Table 4.1).

4.4 Data Extraction

Table 4.2 Data extraction table

#	Author (s)	Title	Population/ Setting/*Country	Design/ Methods	Intervention Description	Outcome Measured	Results	Intervention Effectiveness	Implementation issues
1)	Karem et al. (2007)	Monkeypox-induced immunity and failure of childhood smallpox vaccination to provide complete protection	Health care teams, including clinicians, epidemiologists, microbiologists from the CDC *The United States	Cohort study	Vaccination efforts that are reported in this study encompass vaccine-derived control against Monkeypox	Efficiency of Monkeypox-induced vaccination	Moderate to severe cases of disease were seen in 9 of 19 (47%) young cases (31 years) compared to older cases (3 of 11 [27%]), 10 of 23 (43.5%) unvaccinated cases had moderate to severe Monkeypox compared to 1 of 6 (16.6%) vaccinated cases.	Lab results on individuals who had one year's exposure show that the vaccine-derived strategy was efficient in protecting the population at risk of getting the infection or those already infected	Smallpox dose availability and nature of viral exposure are crucial factors associated with implementation of vaccination and its effect on preventing Monkeypox
2)	Petersen et al. (2019)	Vaccinating against Monkeypox in the Democratic Republic of the Congo	Health care workers with suspected Monkeypox in the health care setting *The Democratic Republic of Congo	Cohort study and survey method	Vaccination intervention has become an effective approach, especially the third-generation	To determine whether the Monkeypox vaccination program is feasible and acceptable among	The proportion of cases of suspected Monkeypox between January 2010 and August 2014 ranged from 0.6 to 1.8%. For the	Over a period of four years (2010-2014), administering the third-generation vaccine (IMVAMUNE)	Smallpox vaccination use among health care workers is limited due to concerns about its adverse events

					vaccine, with a rise in safety levels.	public health staff	699 confirmed cases, the health care workers had a 0.9% rate, and an average of 1.5 health care workers were infected during the observation period, and an incidence of 17.4 cases per 10,000 people	improved the safety profile of populations affected by confirmed and suspected Monkeypox cases	
3)	Roess et al. (2011)	Assessing the effectiveness of a community intervention for Monkeypox prevention in the Congo Basin	Community residents *Congo	Interview and survey methods	Study to ascertain the effectiveness of an educational strategy in eliminating Monkeypox cases	Determining the effectiveness of film-based educational activities for improving knowledge on Monkeypox characteristics	Approximately half of the enumerated population residing in the area under study attended outreach activities (47% for the locations in four towns and three villages over a 47-day period and 64% for the locations in two towns and seven villages over a 43-day period	Implementing film-based educational activities encouraged community members to seek details from health care staff in the case of a suspected outbreak of Monkeypox	Garnering effective participation tends to affect how the population is acquainted with the risk factors for Monkeypox disease

4)	Bass et al. (2013)	Enhancing health care workers' ability to detect and care for patients with Monkeypox in the Democratic Republic of the Congo	Health care workers in the hospital setting *The Democratic Republic of Congo	Survey	Educational intervention comprising training of health care staff regarding Monkeypox curriculum and areas intended to improve performance metrics on patient care	Assessment of results after completing training and Monkeypox curriculum	In the five months prior to the 2011 training, 359 notifications of suspected cases of MPX were made from Tshuapa to the MoH; 24 of these (6.7%) were investigated. During the 12 months after the training, 227 of 608 suspected cases were investigated (37.3%): a significant increase ($p \leq 0.001$)	Educational intervention prompted significant improvement after training sessions that consisted of interactive and organised workshops for a one-month period	Lacking major concern with personal safety and obstacles during the investigation of Monkeypox cases are factors that affect the implementation of vital training among health care workers
5)	Harapan et al. (2020)	Physicians' willingness to be vaccinated with a smallpox vaccine to prevent Monkeypox viral infection: A	Health care setting among general practitioners (GPs) *Indonesia	Cross-sectional study with survey method of data collection	The vaccination approach was described in this study in terms of the degree of readiness to receive a	The measured outcome was willingness to accept the vaccination, which might be a contributing factor to the rise in	Responses from 407 of 510 participants (79.8%) were analysed, of whom 381 (93.6%) were willing to receive vaccination. Based on a non-	Providing a subsidy is essential to enable health care to afford a vaccine to prevent Monkeypox	Government's efforts to provide affordable vaccinations impacts the extent of vaccination coverage, since high prices discourage

		cross-sectional study in Indonesia			dose of smallpox vaccine amongst health care workers	Monkeypox cases	subsidized vaccine, the proportion willing to be vaccinated decreased to 71.9%.		immunisation acceptance
6)	Sallam et al. (2022)	Updated: Knowledge of human Monkeypox and its relation to conspiracy beliefs among students in Jordanian health schools: filling the knowledge gap on emerging zoonotic viruses	Hospital setting among medical and dental students *Jordan	Cross-sectional study with a survey method of data collection	Vaccination strategy that included imparting knowledge about the magnitude of acceptance of the vaccine to eliminate held beliefs (conspiracy theories)	The study involved in gauging the level of vaccine acceptance in light of emerging negative conspiratorial beliefs	From a list of eleven Monkeypox knowledge items, >70% of subjects for the study accurately identified three of them. Only 26.2% of the respondents ($n = 161$) knew that vaccination to prevent Monkeypox is available.	Endorsement of Monkeypox vaccines depended on satisfactory levels of exposure among university medical students to curricula that helped to create awareness of the importance of such vaccines during their medical training	Conspiracy beliefs affected the degree of vaccination acceptance among health care workers due to them developing negative views about the adverse effects of the Monkeypox vaccine
7)	Guagliardo et al. (2020)	Asymptomatic orthopoxvirus circulation	Staff employed at a primate sanctuary and residents in a community	Cross-sectional study with survey method of	An educational strategy was used to create an	The impact of formal education during exposure to	34.4% of the sample (43 individuals) were IgG positive for	Educational intervention about contact with a person	Differences in acquisition of formal education and socioeconomic

		in humans in the wake of a Monkeypox outbreak among chimpanzees in Cameroon	setting *Cameroon	data collection	increase in awareness among community members and health care workers in areas affected by the virus	Monkeypox-associated cases	anti-OPXV antibodies, while among 63 subjects 6.3% (4 people) were IgG positive, and 1.6% (1 person) from Metet village indicated OPXV exposure	suffering from symptoms of confirmed or suspected Monkeypox is effective when the affected population has attained an education level that helps them to identify the degree of prevalence of Monkeypox illness	status impact the rate of Monkeypox prevention in poor settings
8)	Ogoina et al. (2019)	The 2017 human Monkeypox outbreak in Nigeria—Report of outbreak experience and response in the Niger Delta University Teaching	Patients that have been diagnosed and admitted to Niger Delta University Teaching Hospital *Nigeria	Cross-sectional study	An educational strategy was that the staff of the Niger Delta University Teaching Hospital were capable of to addressing the	Determining the outcome attributed to Monkeypox-education and training programs	A rate of 35% (21 cases) indicated as confirmed or probable cases of Monkeypox, including 18 cases confirmed through the laboratory tests. Of the 21 cases of Monkeypox, 38.1% (8) were noted as	Collaborative effort over the period of admission for patients in the medical facility was a crucial factor for increasing the potential to develop a vital routine to aid in	Accepting educational intervention aimed at reducing the incidence of Monkeypox is dependent on the capacity to avail ample resources for infection prevention in to positively impact a

		Hospital, Bayelsa State, Nigeria			potential outbreak of for Monkeypox cases within the health facility		students 47.6% (10) noted as traders while 4.8% (1) was a farmer and health care worker	reporting an outbreak of the illness	decisive and sustainable response to the occurrence of Monkeypox
9)	Harapan et al. (2020)	Acceptance and willingness to pay for a hypothetical vaccine against Monkeypox viral infection among frontline physicians: A cross-sectional study in Indonesia	Hospital setting Registered general practitioners (GPs) *Indonesia	Cross-sectional study with a survey method of data collection	Vaccination intervention is the most important infection control measure used among frontline health care members	This study measured the impact linked to the provision of a vaccine, IMVAMUNE, and the level of reception by health care workers	Among the 407 respondents, 16 (3.9%) indicated willingness to receive the vaccination if the government provides it for free, compared to 356 (87.4%) who indicated willingness to pay for a vaccination, of whom 89.7% were willing to pay only when priced at US \$1.79. However, this percentage decreased to 77.9% when vaccine was priced at \$10.74	Vaccination program is accepted among the medical staff, as indicated by their high levels of willingness and ability to pay for the vaccine	Inadequate provision of vaccination subsidies is an inhibiting factor when it comes to receiving the vaccine against Monkeypox

4.5 Critical Appraisal

This dissertation employed the Critical Appraisal Skills Programme (CASP) tool to categorise the quality of the nine studies included for systematic search. This tool helps guide the synthesis of qualitative and quantitative evidence as a fundamental stage of a literature review. With regard to the quality of the qualitative evidence, and particularly the approach used to assess this aspect, it is necessary to develop appropriate standards to aid in evaluating appropriate criteria (Long, French, & Brooks, 2020). Evidence affirms the appropriateness of the CASP instrument in enabling public health researchers to assess different studies. Long et al. (2020) state that the importance of conducting a thorough exploration rather than reporting only the strengths of studies underlines the applicability of the CASP checklist for appraising studies in the public health domain. A sensitivity analysis eliminates the studies of low quality to favour the synthesis of significant findings. Hence, the choice of the papers assisted in answering the research questions for this dissertation.

Based on the modification of some questions from the CASP tool, this study describes and assesses the quality of the nine research publications to highlight their strengths and limitations. The CASP checklist questions revolve around three broad areas: the validity of results, the nature of the results, and their significance in a societal context. However, in order to provide a good fit for this study, some questions were rearranged to reflect standard aspects of consistency, neutrality, and ethical considerations. This adjustment was attributed to a need to ensure that the quality assessment criteria were suitable for the research questions formulated for this dissertation. These modifications guided the researcher in establishing how the included studies aligned with the two research questions formulated. Answering the CASP questions involves addressing different subcategories encompassing the research aim, methods, recruitment, appropriateness of data collection, researcher-participant relationship, defined findings, and value of the research. The responses are indicated in the form of “yes”, “no” or “can’t tell” (Nadelson & Nadelson, 2014). The modified quality assessment tool used for the critical appraisal in this systematic search is presented in Table 4.3.

Table 4.3. The modified study quality assessment CASP tool

CASP question(s)*	Modified question	Answer
Does the study assess a clear focused question?	1. Does the study use a clear focused research question?	Yes No Can’t tell
Did the authors use an appropriate method to answer the question?	2. Is the method clearly defined?	Yes No Can’t tell
	3. Is the method used to answer the research question appropriate?	Yes No Can’t tell
Were the cases/control or cohort recruited in an appropriate way?	4. Were the populations for the study recruited in an appropriate way?	Yes No Can’t tell
Were the exposure and outcome accurately measured to minimise bias?	5. Was the exposure (monkey pox) and outcome accurately measured to minimise bias?	Yes No Can’t tell
	6. Were the limitations of the study clearly indicated?	Yes No Can’t tell
	7. Was the outcome accurately measured to minimise bias?	Yes No Can’t tell
	8. Were the exposure and outcome clearly defined?	Yes No Can’t tell
Have the authors taken into account the potential	9. Have the authors accounted the potential implementation issues that	Yes No

confounding factors in the design and the analysis?	affect the implementation of interventions?	Can't tell
How precise are the results /estimates of the treatment effect?	10. How precise are the results/ estimates of the treatment effect?	Yes No Can't tell
Do you believe the results?	11. Do you believe the results?	Yes No Can't tell
Do the results of this study fit with other available evidence?	12. Do the results of this study fit with other available evidence?	Yes No Can't tell

Alongside an examination of their strong points, the papers were also assessed in terms of whether they were appropriate to assist the researcher in answering the central questions of the dissertation. This appraisal was conducted from the perspective of the studies' focused research questions, the recruitment procedures they used to sample the population, outcome measurement, and potential confounding factors. All of the nine studies had clear, focused research questions. Kamer et al. (2007) assert that the obvious question to ask is whether smallpox vaccination provides an opportunity to protect against Monkeypox infection. Thus, the study report quality findings that aids in reporting that Monkeypox-induced vaccination is efficient to control against the infection. Roess et al.'s (2011) study was included due to its notable outcome measurement, ascertaining that educational strategies are vital in reducing the prevalence of Monkeypox cases. Furthermore, the quality of Petersen et al.'s (2019) research was established through the robustness of its recruitment process, which used a cohort design to engage health care workers in the investigation. Eventually, the study clearly revealed how the participants were given the IMVAMUNE vaccine to improve their health status. Furthermore, the authors of both education-based and vaccination-based papers were careful to account for confounding factors in their analysis. This consideration allowed them to identify the implementation issues affecting the interventions. Bass et al. (2013) designated a concern with safety levels as a major obstacle to the investigation and reporting of suspected Monkeypox incidences. The quality of Harapan et al.'s (2020) and Sallam et al.'s (2022) studies cannot be overstressed, since these authors provided consistent and reliable findings. Consequently, the use of the CASP tool helped the researcher to assess the quality of the analysed research papers.

5. Discussion and Conclusion

5.1 Chapter Overview

This dissertation aimed to examine how educational and vaccination interventions are effective in preventing Monkeypox and the factors that affect successful implementation of these approaches in LMICs. This chapter analyses, interprets, and compares the findings for the current work and previous research. The discussion is based on two major research questions: "Which interventions are effective in preventing Monkeypox in low- and middle-income countries?" and "What are the factors that affect the successful implementation of interventions preventing Monkeypox in low- and-middle-income countries?" The overall reflection is in the scope of broader public health.

5.2 Discussion

5.2.1 Statement of Findings

Major findings from the results of evaluation of the selected studies assist in proving whether vaccination and educational strategies, if implemented effectively, are effective ways of preventing Monkeypox in LMICs. The reported success of these approaches in the studies reviewed demonstrated that vaccination against human Monkeypox is effective to prevent the spread of the virus. Smallpox (*vaccina*) vaccination is efficient in lessening the severity of a systemic infection rather than averting the adverse effects of systemic orthopoxvirus (Karem et al., 2007). On the one hand, a systemic infection is a mild disease variant, and vaccination is needed to manage the route of exposure. On the other hand,

a systemic orthopoxvirus is a specific virus that impedes immunity. The effectiveness of this vaccination is thus dependent on the extent to which it reduces the severity of the symptoms experienced. The scale to implementation issues influence the outcomes of utilising vaccination strategies in preventing human Monkeypox through administrating smallpox immunisation when the necessary resources are availed. Research examining the nature of attitudes and practices for prioritizing vital knowledge about Monkeypox appears to be a crucial undertaking. Scientists must conduct future studies to investigate the species that correlate with orthopoxvirus to aid in attaining the protective responses on species-specific diagnostics. Viable solutions to counter the effects of Monkeypox should be established in the resource-limited settings. The attitude of physicians is paramount, and behavioural intention is not a reliable determinant to predict actual willingness among health care workers to accept vaccines. The implementation of the vaccination program is accepted amongst medical staff, as evident in their willingness and their ability to pay for their vaccines.

Vaccination prevention efforts are essential to prevent the spread of Monkeypox and the eradication of the disease. Findings from a paper included and analysed in this systematic review, conducted by Petersen et al. (2019), indicate that smallpox vaccine (IMVAMUNE), intended to avert expected Monkeypox infection. The intervention is crucial for diagnosing the suspected cases of the illness. However, one might contemplate whether vaccinating a section of the population who are at risk addresses Monkeypox epidemiology. In the case of Petersen et al. (2019), perceptions and willingness to be vaccinated among the health care workers serve as a means to reduce the risk of occupationally acquired Monkeypox virus infections due to the potential benefits of this intervention. These benefits include coping with uncertainty about disease spread and its eradication subsequent to the progress of vaccine technology to lessen the number of reported cases.

The overall findings reported in Petersen et al.'s (2019) study relate to the effectiveness of the IMVAMUNE vaccine in reducing the proportion of individuals to have been affected by this infection. With the consideration that advanced vaccines have the potential to prevent the spread of Monkeypox virus, the effectiveness of this strategy is ascertained. However, this depends on the extent of acceptance of smallpox vaccination amongst the population that is anticipated to benefit from effective vaccine dosage. Another advantage associated with IMVAMUNE is that it was developed for use amongst individuals thought to have been exposed to increased risk factors, which might contribute to Monkeypox symptoms (including systemic signs, such as fatigue and headache). Therefore, this paper identified the need for a high-quality smallpox vaccination to reduce the risk of Monkeypox infection. The study also highlighted the need to focus on to vaccinating health care workers, as this provides an opportunity to demonstrate the effectiveness of this intervention to prevent infection within an endemic setting.

Several of the selected studies also affirm the value and effectiveness of educational interventions in preventing the spread of Monkeypox in LMICs (Bass et al., 2013; Guagliardo et al, 2020; Ogoina et al., 2019; Roess et al., 2011). Bass et al. (2013) cite community education as effective when health care workers are introduced to a curriculum that increases their focus on improved handling of suspected Monkeypox cases. The major inference made in this research is that education can add value in reducing the prevalence of Monkeypox, as in this case in the Democratic Republic of Congo, but it requires critical support in terms of effective knowledge transfer, which is the most effective way to improve the detection and prevention of human Monkeypox. As argued by Guagliardo et al. (2020), educational level influences the patterns of Monkeypox exposure. Potential educational and socioeconomic status is cited as a major factor that stimulates the degree of reporting of cases of the illness. Even among health care workers, inadequate awareness and attitudes towards consuming animals with a high likelihood contracting Monkeypox reflect the prevalence of Monkeypox.

Ogoina et al. (2019) found that an educational intervention is an effective strategy that helps to coordinate responses and control of suspected Monkeypox cases. Their study denote clear evidence that Monkeypox training programs assist in documenting opinions and actions must be reviewed and case management of post-outbreak cases identified. Moreover, educating health care staff through sensitization is crucial to determine how clinicians benefit from training sessions that provide them with distinctive guidelines as to how to identify and respond to Monkeypox outbreaks. Roess et al. (2013) noted that community participation in areas with inadequate health resources is vital to identify and report outbreaks of zoonotic nature, such as Monkeypox, affecting populations residing in remote areas with inadequate access to health care services. A notable revelation in this work is that programs

affiliated to film-based educational actions are effective in elevating awareness of specific diseases and encouraging people to collaborate with health care workers if a Monkeypox outbreak is suspected.

Findings from these studies support the implementation of community-wide education initiatives to strengthen recognition of clinical Monkeypox infection prevention and epidemiological reporting status. In current and future contexts, educational interventions are considered to be a major factor that can facilitate the development of critical attention to infection control. Enhancing public awareness about a disease is substantially reliant on the capacity to equip populations exposed to Monkeypox with knowledge of that disease. This knowledge is coupled with the ability to detect such exposure and initiate the necessary actions to collectively cope with health emergencies through recognition of existing or potential hazards. The effectiveness of educational interventions cannot be overstressed because they assist health providers to create and increase awareness of Monkeypox and to confirm and report suspected Monkeypox outbreaks (Guagliardo et al., 2020). Safety concerns about a disease are dependent on the level of awareness of its manifestation. The LMICs may experience extensive impediments to the identification and management of Monkeypox depending on the level of formal education among the affected population.

The quality of implementation of interventions will also affect the outcome of Monkeypox prevention initiatives. Harapan et al. (2020a) highlighted that willingness to be vaccinated against Monkeypox among physicians influences the level to which the disease is constrained. Health care workers who receive subsidised vaccines from the government may demonstrate willingness to engage in curbing the illness. The price of the vaccine tends to influence the acceptance of this intervention amongst the general population. Accordingly, the implementation of a program intended to assist in containing the Monkeypox outbreak requires identification of the level of acceptance of the intervention. In the case of Indonesia, physicians' willingness to boost their immunity against Monkeypox is rooted in the degree to which the government is able to take necessary measures to offer partial or full funding of the vaccination.

In another study, Harapan et al. (2020) examine the nature of implementation of Monkeypox control measures in a hospital setting among Indonesian registered general practitioners. The clear conclusion reached by these authors was that clinicians' readiness and behavioural intentions show how they remain actively involved in the prevention of Monkeypox infections. Moreover, in a study that sought to evaluate health care workers' level of acceptance and willingness to purchase a Monkeypox vaccine, Harapan et al. (2020b) determined that a range of factors, including the type of workplace, medical experience, and the monthly income of the general practitioners, affected acceptance of vaccination against Monkeypox. As the government remains a crucial provider of this service, the supposition made in this context is that subsidising the provision of this amenity will extend protection against Monkeypox.

Sallam et al. (2022) examined the quality of implementation from the perspective of beliefs (conspiracy theories developed towards zoonotic diseases). The level of concern shown toward a major public health issue is important in the clinical setting, especially among health care workers. General attitude and knowledge levels towards the prevailing virus infection and the degree of concern about vaccination are determining factors of the expected outcome (infection control). For this reason, Sallam et al. (2022) concluded that human Monkeypox knowledge is closely connected to conspiracy beliefs, in that higher levels of such beliefs hinder the use of this strategy in preventing Monkeypox. Jordanian health care students' unsatisfactory attitudes and practices represent an implementation issue with a negative effect on the acquisition of knowledge about emerging viral infections. A substantial conclusion drawn based on this finding is that the anticipated awareness-raising about infection management is grounded on influencing positive reactions to the intervention measures undertaken amongst the target population, and, in this case, the health care practitioners.

The implementation of educational strategies and vaccination interventions impacts the responses by health practitioners and communities to shape the quality of their adoption, which in turn impacts the prevention of infections. Kareem et al. (2007) pointed out that the existence of differences in clinicians' reactions to vaccine-derived interventions is useful in reflecting the attitudes of physicians towards this approach. Similarly, studies report willingness among physicians and acceptance of vaccinations as key factors through which Monkeypox is controlled in low-income settings (Harapan et al., 2020). For Petersen et al. (2019), the determining factor was concerns about adverse events. Yet, Bass et al. (2013) cited reasons hindering Monkeypox prevention as stemming from inadequate training

and personal safety concerns, when educational interventions are expected to improve investigation of the existing and potential Monkeypox cases. Sallam et al. (2020) found that non-health factors, such as age and gender, were associated with worrying conspiracy beliefs, which affected the effectiveness of efforts to prevent Monkeypox despite the adoption of widespread implementations (extensive knowledge acquisition and dissemination). Ogoina et al. (2019) also cited insufficient routine training as a significant barrier to the reduction of negative consequences of Monkeypox outbreaks. Moreover, Roess et al. (2011) mentioned inadequate participation to obtain and share necessary knowledge amongst different community members infected and affected by Monkeypox as a constraining factor.

These results demonstrate that the research questions for the study have been answered. This systematic search notes vaccination and educational interventions to add value to managing Monkeypox through creating awareness and acceptance of vaccines to prevent the spread of this infection (Harapan et al., 2020). The next significant phase is to relate these major findings to the broader aim of the dissertation, in order to interpret the inferences drawn and explain how educational and vaccination strategies, and factors influencing their implementation, improve public health. The findings are also discussed in the context of a contemporary understanding of factors that affect the effectiveness of these interventions in LMICs.

5.2.2 Interpretation of Findings

Preventing Monkeypox infection requires the adoption of wide-ranging interventions. These approaches extend beyond the clinicians' knowledge and health care practitioners' willingness to encompass the effectiveness of resource utilisation (Harapan et al., 2020). Vaccination intervention is an effective strategy to curb life-threatening zoonotic viruses such as Monkeypox. However, it is also essential to possess knowledge about manifestations of the disease and its causative agents in order to curb its effects (Rao et al., 2022). The execution of vaccination interventions is grounded on health care workers' understanding of how to handle suspected Monkeypox cases (Petersen et al., 2019). Medical experts demonstrate willingness to actively engage in limiting exposure to Monkeypox in endemic regions when they are comfortable that the vaccine administered is suitable. This willingness is based on the extent to which they believe that the nature of infection warrants vaccination and that there is no compulsion to receive the vaccination. This claim is interpreted from the perspective of clinicians' attitudes and beliefs. Consistent with this finding is another study in the context of Saudi Arabia, which indicates that physicians' knowledge and positive attitudes towards getting vaccination against Monkeypox virus are crucial in encouraging vaccination among health care workers in the hospital setting (Alshahrani et al., 2022). Frontline health care workers are prepared to accept vaccination as an intervention when they are satisfied with this approach.

Educational and vaccination interventions are appropriate for the contemporary context within the LMICs that are fighting against the resurgence of Monkeypox. The burden of mitigating Monkeypox outbreaks in endemic countries in the post-smallpox era is connected to the level of knowledge and awareness amongst the general population and the availability of health care experts (Uwishema et al., 2022). The ever-rising risk of exposure to unvaccinated individuals in low- middle resourced contexts is a worrying trend. Protection against Monkeypox through induced immunity (humoral and cellular) requires boosting of vaccination interventions via adequate examination of reported outbreaks (Karem et al., 2007). The recommendation provided for such scenarios is that there must be a strong emphasis on vaccination and cross-border collaborations with global agencies charged with the responsibility to lessen Monkeypox, especially in LMICs. Hence, developing awareness among physicians about the early symptoms and signs linked with Monkeypox promotes timely diagnosis and initiation of treatment measures as actions to prevent the possible escalation of the disease (Ghazanfar, 2022). Thus, developing vaccination as an effective prevention approach is crucial. However, LMICs must not only identify efficient clinical procedures for use in these contexts but also the availability of resources to curb the outbreak of infections, which could impact the health of the general population.

Addressing the widespread re-emergence of Monkeypox in LMICs requires in-depth understanding of the most appropriate approach to apply. Clinical practitioners' awareness of interventions for disease preventing is vital to optimise patient care. Understanding of clinical manifestations, the complications of the disease, predictive factors, severity, and factors that affect the limited prevention and unsatisfactory medical interventions are vital (Reynolds et al., 2017). The impact of administering vaccinations against Monkeypox through the implementation of educational programs and to address factors that affect the efficiency of implementing these approaches. Smallpox vaccination

reduces and stabilises the spread and manifestation of Monkeypox virus to create immunity against orthopoxvirus, which ranges between 10% and 25% for unvaccinated populations (Thakur et al., 2022). Yet, immunisation against Monkeypox encounters anti-vaccination attitudes, which, in turn, hinder acceptance and administration of vaccines (Roberts et al., 2022). Educational programs could be effective in clearing doubts surrounding the use of vaccines to prevent Monkeypox.

Reliance on educational interventions manifests in different ways. Persistent training and collaborative efforts by health care practitioners address the challenges of unpreparedness for the successful repression of Monkeypox outbreaks in endemic countries classified as LMICs (Ogoina et al., 2019). The role of educational interventions in countering zoonotic pandemics among the vulnerable is important in the societal setting. Training health workers in the community is a mechanism to promote awareness and outreach and mitigate more effectively against misinformation in the event of Monkeypox outbreaks (Tambo and Al-Nazawi, 2022). Overall, these findings note that educational and vaccination interventions in LMICs are effective towards curbing the resurgence of Monkeypox when clinical experts can identify and manage factors that affect the effectiveness of these interventions.

5.2.3 Strengths and Limitations of the Review

The findings revealed using the systematic review methodology are characterised by both strengths and limitations. Relying on the clearly defined steps for conducting this systematic review led to notable gains. The process provides an excellent opportunity to follow detailed instructions, to prepare a final report, to adhere to the inclusion and exclusion criteria of peer-reviewed studies, and finally to disseminate the findings in a transparent manner (Owens, 2021). This strength designates that the conclusions drawn reflect a replicable procedure that provides a comprehensive appraisal and review of the literature. One of the aims of this dissertation was to explore factors affecting the effectiveness of educational and vaccination strategies in preventing the re-emergence of Monkeypox in LMICs. Using the systematic methodology allowed the collection of evidence whilst avoiding duplication. The PICO framework helped to establish the inclusion and exclusion criteria. Frandsen et al. (2020) affirm that the PICO model is recommended for carrying out a comprehensive systematic review. Hence, the use of this model in the current dissertation proved vital for revealing major findings on Monkeypox prevention using criterion-based selection.

The use of criterion-based selection in this dissertation led to the identification of relevant evidence regarding the effectiveness of educational and vaccination interventions and factors that hinder the implementation of these approaches. A typical example is Petersen et al.'s (2019) study, which reported the significant gains attributed to the vaccination strategy and circumstances that influence its efficacy in mitigating against the spread of Monkeypox. The criterion-based approach ensured that this dissertation could rely on high-quality studies to perform the analysis. As well as helping the researcher to identify relevant interventions, it also made it possible to explain in detail the possible factors affecting its use in handling zoonotic infection.

A notable advantage of the criterion-based approach is its appropriateness in ensuring logical data collection and analysis. Research using this approach is comprehensive in the acquisition of new knowledge, as it is based on a systematic approach characterised by diligent planning to interpret newly found facts (Garg, 2016). Such criteria, which demonstrate the weight of evidence, are research design, evidence focus, and general quality (Hallinger, 2013). Thus, it is also important to demonstrate an understanding of the use of systematic review methodology. This approach is central when a researcher needs to thoroughly answer research questions using existing studies. Thus, this dissertation benefited in terms of sourcing evidence from various studies to support the study aims and objectives.

Considerations for using a systematic search were also informed by the manner in which the procedure guides the researcher to analyse the existing research. The steps in the PRISMA flow diagram provide a context to organise and evaluate the evidence retrieved, resulting in a potential increase in the accuracy of the review and the efficiency of the entire process (Owens, 2021). This literature review involved a sole researcher. A systematic search aided in reporting reliable findings based on the data collection and analysis used. Another strength of a systematic search is that it offers a natural approach to assessing replicability. According to this concept, a systematic search is reliable when its findings replicate the efforts manifested in the original studies, with respect to the research interests of the original authors of the works reviewed (Jaluli et al., 2022).

The studies used for the critical literature review reported their findings, whether on educational or vaccination interventions, in a consistent manner. The included papers passed the criteria outlined in

the CASP appraisal tool, thus allowing the systematic search to lead to reliable results. In the public health domain, the method promotes the ability to seek details from existing works and encourage the implementation of risk-mitigation actions, such as patient-focused and hospital-based interventions (Geerligs et al., 2018). Relative to the implementation issues captured in the analysed studies, the reliability of their findings was accepted by this dissertation. Educational programs for relaying information facilitate sharing of the knowledge required to respond to potential negative consequences associated with the re-emergence of Monkeypox in LMICs (Bass et al., 2013). Overall, this research methodology is valuable because of its dependability to report conclusive findings on the topic under investigation.

However, the systematic search methodology also has its limitations. One potential shortcoming is selection bias. Dekkers et al. (2019) assert that selection bias is a situation that arises when participants or outcome events are chosen for analysis but results are prejudiced. The concern regarding selection bias in this dissertation pertains to the reliance on the researcher's informed opinion in interpreting the research questions of interest. The expected findings might not be explained subjectively because this approach might prompt bias in the results revealed. The steps taken to locate sources were exhaustive, involving the application of the PRISMA flowchart process for identification, screening, eligibility, and inclusion, but it should be clarified that the researcher was limited in obtaining only the resources that proved to be the most applicable studies to answer the research questions of this study. This limitation called for a change in the approach employed in locating sources. In the first instance, only educational intervention studies were included. However, the small number of such studies in LMICs led to the inclusion of surveillance and vaccination studies, although surveillance studies were later excluded because this strategy does not prevent Monkeypox infection.

5.3 Conclusion

5.3.1 Summary of Key Findings

This dissertation was grounded on two major aims: To examine which interventions are effective in preventing Monkeypox in LMICs and to explore the factors that affect the successful implementation of these interventions. The study incorporated educational and vaccination strategies as the effective ways to restrict the re-emergence of the disease in the low-income contexts. Based on the key findings, the research questions were answered. Communication among community members and health care practitioners is paramount to ensure that supportive clinical care reduces the incidence of Monkeypox. Health providers utilize formal education and film-based educational activities to disseminate information on medical wellbeing to the general public. A key benefit regarding developing consciousness about the effectiveness of educational and vaccination interventions is that it assists both infected and uninfected populations in understanding the factors that affect the successful implementation of this approach. Another notable gain of such strategies to physicians is that they aid them in improving training on health measures to mitigate against the prevalence of Monkeypox in LMICs.

This critical literature review has revealed that the educational interventions in LMICs emphasise community education. These activities are intended to increase the ability to identify and respond to suspected and confirmed Monkeypox cases. Critical support in educational interventions involves stimulating ample awareness about the outbreak of the infection to develop positive responses. Educational interventions help with the sensitisation and clarification of efforts efficient in managing the re-emergence and potential occurrence of Monkeypox virus. Individual's familiarisation with the epidemiology of the disease is vital to help the target population to understand the effectiveness of an educational approach when handling a zoonotic infection. The recent resurgence of Monkeypox in LMICs has potential to increase anxiety and concern, which requires the implementation of educational efforts to create awareness regarding the capacity to minimise its spread. However, inadequate training remains a situation to be resolved, since limited clinical knowledge hinders the effectiveness of this strategy.

Ongoing reliance on vaccination interventions to prevent the resurgence of Monkeypox in LMICs is characterised by benefits and drawbacks. Positive aspects noted are that smallpox vaccination is effective in reducing the systemic severity of Monkeypox and curbing the life-threatening consequences of the infection. This dissertation also reveals that the efficiency in implementing vaccination strategy is dependent on the level of acceptance. Satisfaction and reaction among health care workers stimulate reliance on this initiative. Health care workers report that they are willing to accept smallpox

immunisation when the government provides the necessary support, including funding. Thus, it becomes possible to reduce their vulnerability to exposure to the Monkeypox virus. Nevertheless, insufficient subsidies and inability to initiate species-specific diagnostics are factors that inhibit adequate provision of vaccination among health care workers.

It has been established that educational strategies and vaccination programmes are interconnected in combating existing and re-emerging Monkeypox cases. Both interventions rely on the provision of adequate information and resources within environments where there is a risk of exposure to Monkeypox. Failure to disseminate such details delays the prevention and control of Monkeypox, because the affected population is not familiar with population-based programs that need to be implemented as a roadmap to deal with the risk factors and vulnerability in LMICs.

Educative messages inform society members about the efficient steps necessary to undertake as risk-mitigation strategies to eliminate zoonotic infections. Educational tactics are effective when the education level of the infected population assists them in identifying the prevalence of Monkeypox. Future public health responses need strengthening to aid in reducing the incidence of Monkeypox. Nonetheless, this effort necessitates seeking training in the domains of case management, infection control, and prevention. The acceptance of the educational interventions to reduce the prevalence of Monkeypox is dependent on capacity to provide ample resources for infection prevention to impact positively on adopting a decisive and sustainable response.

5.3.2 Public Health Recommendations

The following suggestions are provided from the perspective of health workers, government, and community members. From the standpoint of health care workers and the implementation of vaccination programs to prevent the resurgence of Monkeypox, an effective assessment plan after exposure to the virus should complement management actions. This should entail notification of the infection outbreak and the risk of possible increase in contact in the community setting. This form of relaying information is an opportunity to initiate follow-up programs. Medical staff are prone to occupational-derived exposure. Therefore, when implementing any possible intervention, the first step should be to protect health care workers, as they are at the frontline line in safeguarding the welfare of populations that are vulnerable to zoonotic infections such as Monkeypox.

Concern about the resurgence of Monkeypox in LMICs remains the foremost reason for promoting specialist training in handling infectious hazards. After the implementation of the initiative to protect health workers, community members could also be acquainted with knowledge to address the disease before it can cause major adverse effects. This approval is deep-rooted in the need for governments to support extensive collaboration. The rise in the number of confirmed and suspected cases and deaths in LMICs calls for the implementation of intensive strategies. Coordination is required to detect outbreaks of the disease and increase awareness of its prevalence. Public health officials must respond efficiently during resurgence and major outbreaks. One limitation is the lack of active support from the government through adequate funding. Hence, educational strategies are crucial to increase people's awareness of the epidemiological characteristics of such outbreaks. Medical experts should concentrate on executing tactics to protect against potential increases in deaths attributed to Monkeypox.

Implementing education programs requires the incorporation of diverse opinions of health care workers. This is important because these public practitioners are at the centre of efforts to control and treat the virus, especially responding through implementing policy actions that the government has adopted for public health. Fear and inadequate incentives, such as insufficient reductions in the price of vaccination, are challenges that can be resolved. Furthermore, governments should demonstrate willingness to encourage health experts to engage in training sessions to understand health measures to curb the infection before high case numbers are reported. Increasing awareness and the availability of funding to motivate health care professionals' determination to assess the prevalence of Monkeypox in contexts with limited resources are also paramount. Intensive community education while taking into account the role of clinical practitioners in LMICs is expected to be a course of action that improves health standards in these contexts.

5.3.3 Implications for Practice

Educational and vaccination interventions are effective in preventing Monkeypox resurgence in LMICs. These measures have the potential to promote and sustain positive results such as reduced suspected and confirmed cases among the infected and uninfected populations. This systematic search

emphasises the significance of immunisation against Monkeypox, educational programs, and understanding the factors that affect the successful implementation of these interventions. The minimal requirement revealed by this dissertation is to encourage the reception of vaccination amongst the general populations or clinical practitioners at high risk of contracting the disease.

Moreover, this study shows that the success of educational and vaccination strategies is dependent on the level of awareness among general public and support by the government. Knowledge of interventions to cushion against the spread of Monkeypox in low-resource contexts necessitates that government and health care practitioners collaborate, where the government provides sufficient resources, such as ample funding, and the medical staff demonstrate willingness to accept the formulated guidelines to reduce Monkeypox exposure and severity.

This study highlights the potential to forge cooperation while executing educational and vaccination programs to prevent Monkeypox in LMICs. The work also contributes to the understanding of the effectiveness of utilising educational interventions through regular and perfected training and collaborative efforts by health care practitioners. These plans aids in addressing the challenges associated with the unpreparedness experienced when coping with an outbreak of an infectious virus. This suggestion is paramount to improve evidence-based decision-making and the implementation of effective measures to curb Monkeypox.

Another implication of the study findings is that they identify ways to optimise supportive treatment. Resource allocation is a key countermeasure in the resurgence of Monkeypox. Hence, this study provides ample details about the implementation of both educational and vaccination strategies. Policy changes in LMICs are essential. The intention is to improve the detection of Monkeypox epidemiological characteristics. Furthermore, this critical review reveal and affirm the significance of responsive measures meant for handling infectious diseases that pose a threat to public health.

5.3.4 Research Recommendations

Further research is needed to explore attitudes and practices in order to prioritise fundamental knowledge about Monkeypox disease. Scientists must conduct future studies to investigate the species associated with orthopoxvirus to aid in attaining protective responses through species-specific diagnostics. Moreover, viable solutions to counter the effects of Monkeypox should be established in resource-limited settings. The attitude of physicians is vital, and behavioural intention is not a reliable determinant to predict actual willingness among health care workers to fully accept vaccination interventions. New works should explore other factors that affect the successful implementation of the vaccination program, as well as implementation issues that influence the scale of positive reception of this strategy amongst medical staff.

This study leaves a literature gap to fill, which is left vacant by limited testing capacity to eradicate the resurgence of Monkeypox in low-income contexts. Scholars in public health addressing the prevalence of this illness should establish factors that affect collaborative efforts to reinforce epidemic response activities within the hospital and community settings. Examining possible epidemiologic limitations that could hinder the eradication of Monkeypox will aid in evaluating the extent to which enhanced testing capacity remains sufficient to respond to species-specific diagnosis to counter the virus. This investigation could reveal whether inadequate Monkeypox suppression is because of insufficient testing capacity as an effective strategy or whether the intrinsic characteristics of the virus, such as genetic determinants, heighten its spread beyond endemic regions.

Public health scholars could develop further literature to explore mechanisms for promoting risk communication and community engagement prevention interventions to handle outbreaks and resurgence of Monkeypox. This dissertation depicts how the association between health providers and community members is important. Evidence-based investigation is needed to identify approaches to strengthen collaboration and commitment to public health prevention, including monitoring, to increase awareness and acceptance of educational and vaccination interventions to build community resilience against zoonotic Monkeypox outbreaks.

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