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Healthcare Professionals' Knowledge and Gaps in Under- standing Mpox and its Management

A Descriptive Literature Review

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<p>Mpox, uusiutuvana zoonoottisena sairautena, aiheuttaa merkittäviä kansanterveydelisiä haasteita sen tartuntapotentialin ja kliinisten oireiden vakavuuden vuoksi. Näiden haasteiden tehokas ratkaiseminen edellyttää, että terveydenhuollon ammattilaisilla on tarkkaa tietoa mpoxin kliinisistä piirteistä, tartuntateistä ja hoitovaihtoehdoista.</p> <p>Tämän tutkimuksen tavoitteena oli antaa yleiskuva terveydenhuollon ammattilaisten nykyisestä tiedosta mpoxista, tunnistaa tiedonpuutteet, jotka voivat estää tehokkaan epidemian ehkäisyn. Tutkimus keskittyi CINAHL- ja Medline-tietokannoista saatuihin alkuperäistutkimuksiin, ja 16 artikkelia valittiin kuvailevaan kirjallisuuskatsaukseen täysimittaisen tekstien arvioinnin ja tietojen laadun varmistamisen jälkeen.</p> <p>Menetelmien osalta vuosina 2020–2024 julkaistuja tutkimuksia tarkasteltiin kuvailevassa kirjallisuuskatsauksessa, jossa analysoitiin terveydenhuollon ammattilaisten tietämystä, näkemyksiä ja käytäntöjä, jotka liittyvät mpoxiin.</p> <p>Tutkimus osoittaa, että vaikka yleinen tieto mpoxista on olemassa, merkittäviä puutteita esiintyy erityisesti sen oireiden, tartuntateiden ja hoitoprotokollien ymmärtämisessä. Erityisesti hengitystie-eritteiden välityksellä tapahtuvan tartunnan ja antibiootien roolin ympärillä olevat harhaluulot korostavat näitä tiedonpuutteita. Lisäksi asenteet rokotusta kohtaan osoittavat merkittävää epäröintiä, sillä suhteellisen harvat terveydenhuollon ammattilaiset ilmoittavat valmiutensa vastaanottaa mpox-rokote.</p> <p>Tämän katsauksen tulokset viittaavat merkittävään tarpeeseen erikoistuneille koulutus- ja tietoisuusaloitteille terveydenhuollon ammattilaisten valmiuksien parantamiseksi tulevien tartuntatautien hallintaan. Tutkimus korostaa ennakoivan koulutuksen tärkeyttä julkisen terveydenhuollon vastausten vahvistamisen kulmakivenä.</p> <p><i>Tämän tutkielman alkuperä on tarkistettu Turnitin-ohjelmalla, ja tuloksena on hyväksyttävä 2 prosentin plagiointiprosentti.</i></p>	
Avainsanat	terveydenhuollon ammattilaiset, ymmärrys, mpox ja sen hoito

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<p>As a re-emerging zoonotic disease, mpox poses substantial public health challenges due to its transmission potential and the severity of clinical symptoms. Addressing these challenges effectively requires that healthcare professionals possess accurate knowledge of mpox's clinical features, transmission routes, and treatment options.</p> <p>This study sought to provide an overview of healthcare professionals' existing knowledge of mpox, with the objective of identifying knowledge deficiencies that may impede effective outbreak preparedness. Focused on primary research obtained from the CINAHL and Medline databases, 16 articles were selected for the descriptive literature review after evaluating full-texts and ensuring data quality.</p> <p>As for methods, studies published between 2020 and 2024 were examined through a descriptive literature review, analyzing healthcare providers' knowledge, perspectives, and practices related to mpox.</p> <p>The study reveals that, while general awareness of mpox is present, critical deficiencies persist, particularly in the comprehension of its symptoms, transmission pathways, and treatment protocols. Notable misconceptions around respiratory droplet transmission and the role of antibiotics further highlight these knowledge gaps. Additionally, attitudes toward vaccination display notable hesitancy, with relatively few healthcare professionals indicating readiness to receive an mpox vaccine.</p> <p>The results of this review suggest a significant need for specialized education and awareness initiatives to improve healthcare professionals' preparedness for managing future infectious disease scenarios. This study calls attention to proactive training as a cornerstone for bolstering public health responses.</p> <p><i>The origin of this thesis has been checked by Turnitin program resulting in an acceptable percentage of 2%.</i></p>	
Keywords	healthcare professionals (HCPs), understanding, mpox and its management

Table of contents

1	Introduction	1
2	Background	2
2.1	Mpox as a Disease	2
2.1.1	Epidemiology	2
2.1.2	Clinical Presentation	3
2.2	Mpox Management	4
2.2.1	Vaccines	4
2.2.2	Antiviral Drugs	5
2.2.3	Symptomatic and Supportive Care	8
2.3	Healthcare Professionals (HCPs) and their Understanding of Mpox	8
2.4	Gaps in Understanding of Mpox and its Management	9
3	Purpose, Aims, and Research Questions	10
4	Methodology and Methods	10
4.1	Data Collection Method	10
4.2	Data Search and Selection	12
4.3	Data Analysis Method	16
5	Results	16
5.1	HCPs' Present Knowledge of Mpox and its Management	18
5.1.1	Average Knowledge and Understanding	18
5.1.2	Favourable Attitudes on Prevention and Response	19
5.1.3	Significant Concern on Information and Communication	20
5.1.4	Low Management Perceptions and Confidence	20
5.2	Gaps In HCPs' Present Knowledge of Mpox and its Management	21
5.2.1	Lack of Guidelines and Research Knowledge	21
5.2.2	Low Health Perceptions	21
5.2.3	Vaccination Hesitancy	21
5.2.4	Misinformation on Treatment	22
5.2.5	Deficient Knowledge on Transmission	22
6	Discussion	23
6.1	Characteristics of the Data	23
6.2	Discussion of Results	24

6.3	Ethics and Validity	25
6.4	Limitations	26
6.5	Utilization of Results and Recommendations	27
7	Conclusion	29
	References	31
	Appendices	
	Table 1. Inductive Content Analysis Example	
	Table 2. Units of Analysis Based on the List of Selected Articles	
	Table 3. Summary of Included Articles	
	Table 4. Selected Articles' Publication Channel Check	

1 Introduction

With individuals diagnosed of mpox, usually the more visible signs and symptoms include spread or focal genital rash, hyperthermia, chills, lymphadenopathy, cephalgia, myalgia, arthralgia, fatigue, and respiratory symptoms like pharyngitis, cough, and nasal congestion. Skin lesions are mainly focal to the face in up to 95% of cases in the rash phase of the disease. While signs and symptoms usually clear up on their own, worse cases may lead to complications like skin infections, pneumonia, neurological symptoms, eye disorders, proctitis, and dysuria, having a mortality rate reaching up to 10%. The interventions typically focus on supportive care, however, medications like antivirals for example tecovirimat, cidofovir, and brincidofovir may be given to severe or immunocompromised patients. The latest outbreak was addressed with two available antiviral medications, namely ACAM2000 and MVA-BN, demanding a thorough opinion of the pros and cons of vaccination. In addition to this, smallpox medications are at least 85% effective in preventing mpox. (Masood et al. 2023: 2-3.)

Mpox displays a characteristic progression. The incubation period varies from three to 34 days, lasting to a mean length of 13 days. In the prodromal stage, usually lasting roughly one to four days, is presented by having a set of symptoms such as fever, headache, fatigue, and lymphadenopathy. In the eruptive phase which extends from 14 to 28 days, skin lesions appear in distinct stages: initially showing as macules, developing to papules, then vesicles, and finally developing to pustules. (Greener 2023: 28.) It is necessary to emphasize that, for the greater number of individuals infected with mpox, supportive care together with strategizing pain management are generally satisfactory for relief of symptoms and recovery (Meyer, Guillaume and Adalja 2023: 173).

Anticipating the possibility for a new global mpox outbreak, the role of healthcare professionals (HCPs) and healthcare students — who will be integral to future responses — is integral to the realization of treatment and prevention efforts. Their participation is vital for the efficient application of strategies with the goal of controlling the spread of the virus and overseeing patient care. (Masood et al. 2023: 3.) For initiating effective preventive measures and putting transmission to a minimum, efforts on an extensive awareness of the virus's characteristics is important (Tanashat et al. 2024: 2). Ironically, a major obstacle in abating the global reoccurrence of mpox has been the limited information on infection in the healthcare sector. To promptly deal with an outbreak, it

is emphasized that healthcare practitioners and students are fully aware of the clinical presentation, preventive strategies, therapeutic interventions, and available vaccines for mpox. (Aljahdali, Albeshri, Allqmani, Alhindi and Elashmoony 2023: 7.)

To conclude, the significant strategies for greatly improving healthcare systems' preparedness and level of capability to respond, which are crucial for strengthening public health protection and optimizing the management of outbreaks are – addressing systematically existing knowledge gaps and fostering a proactive approach to disease prevention and control (Rony, Sharmi, Akter, Parvin and Alamgir 2023: 10). In enhancing awareness and understanding on mpox, which can influence the incidence of and managing outbreaks, promising studies should turn their focus on determining how effective specialized educational programs are. Moreover, qualitative studies could form insightful points of view into the problems and various factors that affect mpox prevention and response capabilities, thus providing more information to the advancement of comprehensive public health approaches. (Aljahdali et al. 2023: 8.)

2 Background

2.1 Mpox as a Disease

As a reappearing zoonotic ailment brought about by the monkeypox virus, which is a double-stranded DNA virus – Mpox, formerly known as monkeypox, belongs to the Orthopoxvirus genus in the Poxviridae family (Huang et al. 2022: 6). This disease was initially identified in 1958 on an outbreak among monkeys in Denmark connected to polio vaccine research (Parker and Buller 2013: 3). Mpox was first seen as a human pathogen in 1970 after being traced to a patient in the Democratic Republic of Congo (WHO 2023).

2.1.1 Epidemiology

In some Central and West African areas starting from the 1970s, the mpox virus has been existent (WHO 2023). Through primary reservoirs particularly rodents and non-human primates, the virus often is passed on from animals to humans (Di Giulio and Eckburg 2004: 264). Transmission among humans may occur via respiratory droplets, direct contact with bodily fluids or lesion material, and indirect exposure to contaminated items like clothes or bedding that have come into contact with lesions (CDC 2024).

2.1.2 Clinical Presentation

When contracting mpox, a set of symptoms like fever, headache, fatigue, and lymphadenopathy follows a duration of 7–17-day (possibly 5–21 days) long incubation (CDC 2024). After the fever has subsided, a facial rash usually emerges, developing through macular, papular, vesicular, and pustular stages (McCollum and Damon 2014: 261). A distinct feature of mpox not seen in smallpox, the former clinically resembles the latter but presents milder symptoms, including lymphadenopathy (Damon 2011: 55). Some of the complications from mpox are secondary bacterial infections, pneumonitis, encephalitis, and keratitis (Huang et al. 2022: 5). Refer to Table 1 for a list of symptoms.

Table 1. Table of Mpox Symptoms.

Symptom	Timing / Progression incubation period: (<i>duration before symptoms begin to show</i>) *7–17 days (can be 5–21 days)	Comparison with Smallpox
Fever (<i>elevated body temperature</i>)	initial symptom	present in both mpox and smallpox
Headache (<i>persistent pain in the head area</i>)	early symptom	
Fatigue (<i>general tiredness and lack of energy</i>)		
Lymphadenopathy (<i>swelling of lymph nodes</i>)		unique to mpox, not present in smallpox
Rash (<i>skin eruptions, progressing through specific stage</i>)	appears as fever declines	present in both, with similar progression
Rash stages (<i>rash progresses through macular, papular, vesicular, and pustular phases</i>)	follows fever; primarily appears on the face	similar stages in both diseases
Secondary infections (<i>bacterial infections that may follow primary symptoms</i>)	potential complication	not specified for smallpox
Pneumonitis (<i>inflammation of the lung tissue</i>)		
Encephalitis (<i>inflammation of the brain, potentially serious</i>)		
Keratitis (<i>inflammation of the cornea, can lead to eye complications</i>)		

2.2 Mpox Management

A combination of preventive strategies, vaccination, and antiviral therapies is required to manage mpox effectively. Having been proved that current smallpox vaccines and antiviral medications are effective against mpox are due to the resemblance of genetic makeup between mpox and smallpox (Huang et al. 2022: 8, 12). Refer to Tables 2 and 3 respectively for a comprehensive list of vaccines and antiviral drugs.

2.2.1 Vaccines

The smallpox vaccine extends a level of cross-protection against mpox due to the similar genetic and immunological properties between the viruses. Considering this cross-protection within orthopoxviruses has included smallpox vaccination as a recommended therapy in response to the mpox outbreak. The World Health Organization (WHO) particularly advises the utilization of the smallpox vaccine for individuals at high risk of exposure, like healthcare workers and laboratory personnel. (Huang et al. 2022: 11; WHO 2023.)

ACAM2000, a second-generation live attenuated vaccinia vaccine, received approval in the United States for the prevention of smallpox in August 2007. It is effective in both animal studies and clinical trials. However, it is not recommended for individuals with compromised immune systems, including those living with HIV, pregnant women, and individuals with skin disorders like eczema considering that its ability to replicate can lead to serious adverse effects, such as progressive vaccinia, eczema vaccinatum, and myopericarditis. (Huang et al. 2022: 8.)

JYNNEOS is approved for the prevention of both smallpox and mpox, referred to as IMVANEX in the European Union and IMAMUNE in Canada, and is a third-generation non-replicating vaccine. It currently stands as the sole FDA-approved vaccine for mpox and is advised for pre-exposure vaccination in those at risk of occupational exposure to orthopoxviruses because of its high level of immunogenicity, safety, and effectiveness in both animal models and clinical trials. (Huang et al. 2022: 11.)

When compared to ACAM2000, LC16m8 – a live, replicating, attenuated smallpox vaccine – is considered a safer choice for immunocompromised individuals because it has displayed persistent protection from mpox in studies concerning non-human primates. Japanese regulatory authorities expanded the vaccine's indications to encompass protection against mpox in August 2022. (Huang et al. 2022: 12.)

2.2.2 Antiviral Drugs

Tecovirimat, also known as TPOXX commonly, has performed significant antiviral properties both in animal studies and laboratory settings and was approved by the FDA for smallpox treatment in 2018. Moreover, as a small-molecule inhibitor that blocks the virus' ability to exit affected cells and promptly limits spread to the system because it targets the VP37 protein, it has an important part in the production of enveloped virus particles. Similarly, it is currently accessible for treating mpox through an expanded access Investigational New Drug (EA-IND) protocol because it has gone through several phase 3 clinical trials showing that it is well-tolerated and safe for use. (Huang et al. 2022: 7–8.)

Cidofovir is another prodrug that has been allowed for treatment of cytomegalovirus (CMV) retinitis in patients with AIDS and has performed effectiveness against orthopoxviruses in animal studies since 1996. While clinical data concerning its use for mpox is somewhat scarce, its inhibiting action on viral DNA polymerase blocking viral replication made it to be considered widely as effective and is recommended by the Centers for Disease Control and Prevention (CDC) for managing orthopoxvirus infections, including mpox. (Huang et al. 2022: 10.)

Brincidofovir, a lipid-conjugated variant form of cidofovir, has shown antiviral characteristics on double-stranded DNA viruses, including poxviruses in animal studies. The FDA allowed its use for the public, treating human smallpox in both adults and children in 2021. Recent research has shown that brincidofovir may result to major risks, for patients with mpox such as liver toxicity, although it achieved better intracellular concentrations of the active drug, improved oral bioavailability, and enhanced efficacy against adenoviruses compared to cidofovir. (Huang et al. 2022: 10.)

Table 2. Table of Mpox Vaccines.

Vaccine	Type	Approval Status	Indications	Efficacy	Safety Concerns	Target Population
<i>ACAM2000</i>	Second generation live attenuated vaccinia vaccine	approved in the USA (August 2007)	prevention of smallpox	effective in animal studies and clinical trials	potential for severe side effects, including progressive vaccinia, eczema vaccinatum, and myopericarditis	not recommended for immunocompromised individuals, pregnant women, and those with skin conditions like eczema
<i>JYNNEOS</i>	Third-generation non-replicating vaccine	approved for both smallpox and mpox	prevention of smallpox and mpox	good immunogenicity, safety, and efficacy in trials	minimal safety concerns noted in studies	recommended for pre-exposure vaccination of individuals at high risk of occupational exposure to orthopoxviruses
<i>LC16m8</i>	Live replicating attenuated third-generation vaccine	licensed in Japan	protection against smallpox and mpox	long-lasting protection against mpox in non-human primate models	considered safer for immunocompromised individuals compared to ACAM2000	expanded indications for mpox protection approved in August 2022

Table 3. Table of Antiviral Drugs.

Antiviral Drug	Mechanism of Action	FDA Approval	Indications	Efficacy	Safety Profile
<i>Tecovirimat (TPOXX)</i>	Small-molecule inhibitor targeting VP37 protein	Approved for smallpox (2018)	Treatment of smallpox and mpox	Significant antiviral activity in laboratory and animal studies; shown to be safe and well-tolerated in phase 3 trials	Generally well tolerated
<i>Cidofovir</i>	Inhibits viral DNA polymerase to block replication	Approved for CMV retinitis (1996)	Treatment of cytomegalovirus and orthopoxvirus infections	Effective against orthopoxviruses in animal studies; limited clinical data for mpox	Considered effective but requires monitoring for adverse effects
<i>Brincidofovir</i>	Lipid-conjugated cidofovir; acts on double-stranded DNA viruses	Approved for smallpox (2021)	Treatment of smallpox and mpox	Demonstrates antiviral activity against poxviruses in animal studies	Potential risks, including liver toxicity, especially in mpox patients

2.2.3 Symptomatic and Supportive Care

Treating with analgesics and antipyretics are some of the combination treatments in tending to the pain and discomfort from skin lesions, and fever. Cleaning skin lesions regularly and properly with sufficient hydration may help in reducing the occurrence of secondary bacterial infections, complemented with consistent vital signs and symptoms monitoring may allow for prompt management of potential complications. (CDC 2024.) For better patient outcomes, prompt identification and intervention are needed. Healthcare providers should thoroughly check for possible complications, including secondary bacterial infections, pneumonitis, encephalitis, and keratitis. (Huang et al. 2022: 5.)

2.3 Healthcare Professionals (HCPs) and their Understanding of Mpox

The healthcare field comprises a wide array of professionals with doctors, physician assistants, pharmacists, social workers, dietitians, as well as physical and occupational therapists, medical technologists along with registered nurses and nurse practitioners, at its core (Institute of Medicine 2009: 118). Recommending "mpox" as the more acceptable designation following massive requests from numerous individuals, professional organizations, and nations concerning the racial and stigmatizing implications of the term monkeypox, the World Health Organization (WHO) introduced a change in the terminology for monkeypox, with the term "monkeypox" to be gradually discontinued over the following year of November 2022. Considering the formal recognition of mpox as the main and may only be a "reference" to monkeypox took place in 2023, making it the standard terminology for clinical and health statistical data. The original name will be kept only as a historical reference in the International Classification of Diseases (ICD) coding. (WHO 2022).

Having identified the key roles of healthcare professionals (HCPs) in patient care, achieving timely and effective interventions can only be met when the current level of mpox knowledge among physicians and nurses are evaluated. While ultimately aiming for improved preparedness and response strategies that are in line with World Health Organization (WHO) recommendations, this evaluation can positively affect enhanced knowledge thru implementation of targeted trainings. What is needed for effective control of an outbreak is a sound and well-rounded awareness for the risks of both acquiring and transmitting the virus mainly among HCPs, and the clear understanding of

managing mpox and the confidence in diagnosing it. (Sallam et al. 2022:9.) Firm implementation of public health measures, such as improving HCP's ability to accurately diagnose cases early and give effective medical care as highlighted by the WHO to control transmission despite issues with the availability of vaccines and treatments for mpox can ensure the goal of preventing the virus from spreading further (Malaeb et al. 2023: 2).

2.4 Gaps in Understanding of Mpox and its Management

Healthcare professionals (HCPs) are essential because health systems are reliant on specialized service coverage being provided, thus the state of these workers being available, accessible, acceptable, and of high quality should be secured (WHO 2024). A study by Masood et al. (2023: 6) indicates that participants with only moderate knowledge about mpox prevention generally have an inadequate understanding of the disease's signs and symptoms, with correct answer rates ranging from 49.1% to 68.4%. Similarly, HCPs in Jordan also exhibit insufficient knowledge about mpox (Sallam et al. 2022: 12). Considering that there is a small sample size and possible selection bias in the findings of Jairoun et al. (2022: 1070), caution is advised in its interpretation since there is still a notable low level of knowledge on mpox among participants, specifically on epidemiology, symptoms, and treatments. Furthermore, a similar development between the results of Rony et al. (2023: 8) and the survey by Miraglia Del Giudice, Della Polla, Folcarelli, Napoli and Angelillo (2023: 6) has shown the necessity for improved training and awareness because of the global need for education among nurses.

A major concern that can degrade effective mpox treatment, together with assumed notions about the ineffectiveness of smallpox vaccines along with antiviral agents, and the lack of awareness on potential use of preventive and therapeutic measures are rampant. It is important to recognize that although smallpox vaccines were not specifically developed for mpox, they offer some degree of cross-protection due to the similarity between the viruses. Similarly, treating mpox even in severe cases with antiviral agents are just as important as utilizing smallpox vaccines. Therefore, confronting these misconceptions and making certain that accurate information is provided on effectiveness of these measures are critical. (Eze et al. 2024: 12.)

The key terms used were healthcare professionals (HCPs), understanding, and mpox and its management.

3 Purpose, Aims, and Research Questions

The purpose of this study is to provide an overview of the current healthcare professionals' (HCPs') understanding of mpox and its management.

This study aims to identify the gaps in healthcare professionals' understanding of mpox and its management to help prepare the healthcare field in a resurgence.

The study questions are:

1. What is known about mpox and its management among healthcare professionals?
2. What are the gaps in the present knowledge on mpox and its management among healthcare professionals?

4 Methodology and Methods

4.1 Data Collection Method

A typical process for a literature review sometimes starts with a formal search to identify relevant resources and the selection of materials to include. It is followed by synthesis of these sources which may come in textual, tabular, or graphical formats, and lastly evaluating their significance (Grant and Booth 2009: 97). This study followed a descriptive approach within the framework of a scoping review. Scoping reviews, like systematic reviews, follow an organized process. They aim to survey existing research and offer direction for future studies, with the main goal of identifying and mapping available evidence. (Munn, Peters, Stern, Tufanaru, McArthur and Aromataris 2018: 3-4.)

While Arksey and O'Malley (2005) define scoping reviews as a method to swiftly outline foundational concepts, assess available evidence, examine the range and nature of research activities, evaluate the need for a full systematic review, and identify gaps in the

literature for further exploration, the researchers have aligned this study with the purpose of a descriptive review – to uncover what has already been achieved, facilitating the integration of knowledge, the extension of previous studies, summarizing findings, preventing repetitive efforts, and identifying any overlooked areas or gaps (Grant and Booth 2009: 95). The main goal is to offer readers a thorough foundation for grasping existing knowledge while underscoring the importance of recent research (Cronin, Ryan and Coughlan 2008: 38).

The literature review process (Table 4) involves choosing a topic, conducting a literature search, collecting and thoroughly examining relevant materials, composing the review, and compiling references. (Cronin et al. 2008: 38).

Table 4. Literature Review Process (Cronin et al. 2008: 39).

The literature review process:
<ul style="list-style-type: none"> • Selecting a Review Topic • Searching the Literature • Gathering and Analyzing • Writing the Review • Compiling References

In this review, the topic is healthcare professionals' (HCPs') understanding on mpox and its management and the gaps in this knowledge. Clarifying the exact area of interest and understanding its importance helped sharpen the topic, enabling a more precise formulation of the review question (Hendry and Farley 1998: 46). Although a narrative or traditional review differs from a systematic review, its principles and format were useful in shaping this review's approach. This conventional method employs an inductive process, where the researchers examined past resources — such as databases, journals, abstracts, and articles — to compile a list of relevant materials. (Timmins and McCabe 2005: 42.)

4.2 Data Search and Selection

The framework being applied in this review was PICO, namely “Population, Phenomena of Interest, and Context” in which the specific participant groups of interest are outlined as "Population" and their primary experiences or events being studied are described in "Phenomena of Interest", while the key enablers or conditions and background factors encompassing the study are identified in the "Context" (Hosseini, Jahanshahloo, Akbarzadeh, Zarei and Vaez-Gharamaleki 2024: 3). This configuration mainly provides an overview of how healthcare professionals (HCPs) interact and process the information known on mpox revealing valuable points on their perspectives and identifying inadequacies in some knowledge areas. Table 5 illustrates the use of the PICO framework in developing the review’s search strategy. The search terms used are healthcare professionals (HCPs), understanding, and mpox and its management. These terms were used to formulate the search strategies.

Table 5. PICO Framework.

P	Population	Healthcare professionals (HCPs)
I	Interest	Understanding of mpox and its management
Co	Context	Healthcare field

Currently, most literature searches are carried out using computers and digital databases. These electronic resources offered broad access to information and allowed for quicker and more efficient retrieval than traditional manual methods. (Younger, 2004: 45). For this review, the search was confined to primary studies sourced from electronic databases, specifically CINAHL and Medline. The researchers have followed the proper channels in obtaining the information accessible only to students or staff affiliated, as most universities generally keep subscriptions to a wide array of databases. (Cronin et al. 2008: 40.) Keeping tabs and documenting keywords used in searching for information and taking into account the search strategies being used, is an integral initiative in conducting a literature search since this action is useful in describing the whole process of literature search as presented in Table 6 (Timmins and McCabe 2005: 42).

Table 6. Database Search Results.

Database / Limiters	Search phrase	Total number of hits / citations*	Papers / records included based on title*	Papers / records included based on abstract*	Papers / records included based on full-text*
CINAHL (25.9.2024) 2019-2024, English, Peer-reviewed	<i>("healthcare AND (professional* OR worker*)" OR nurs*) AND ("level of knowledge" OR "perception") AND "isolation protocol" AND (mpox OR monkeypox)</i>	165	8	1	1
Medline (25.9.2024) 2019-2024, English, Peer-reviewed	<i>("healthcare AND (professional* OR worker*)" OR nurs*) AND (understanding OR awareness) AND ("isolation protocol") AND mpox</i>	685	42	19	17
Total:		850	50	20	18

In this review, only primary sources were used. Two researchers conducted the search, retrieval, and screening of articles. Initially, articles deemed relevant were identified from reliable databases and screened based on titles and abstracts. Secondly, articles with potential were scrutinized to determine the inclusion or exclusion of the source as outlined in Table 7.

Table 7. The Inclusion and Exclusion Criteria.

Inclusion	Exclusion
Primary scientific studies	Non-primary studies like review articles
Articles published from 2019 to 2024	Studies published before the period September 2019
Articles written in English language	Studies published in languages other than English
Peer-reviewed articles	Non-peer-reviewed studies
Focused on HCPs' understanding of mpox and its management	Not focused on HCPs' understanding of mpox and its management
Identify underlying factors contributing to gaps in HCPs' understanding of mpox and its management	Do not identify underlying factors contributing to gaps in HCPs' understanding of mpox and its management

The scientific articles being primary studies written in English were prioritized and selected. In addition to this, publication should be between 2020 - 2024. Moreover, selected articles should be peer-reviewed with a focus on understanding of mpox and its management among healthcare professionals (HCPs). Finally, studies investigating the factors contributing to gaps in their knowledge of mpox and its management were included.

The primary database for the search was CINAHL, with an additional search performed in Medline which had the major number of articles. Using the inclusion and exclusion criteria, articles were chosen based on their titles, abstracts, and finally, a full-text review. The database search results displayed in the Prisma Flow Diagram (Figure 1) show a total of 815 articles screened after having removed 35 duplicates and excluding 768 articles not focused on the study, excluded HCPs and/or nurses as participants and generally focused on public awareness, and lastly having selected 47 articles by title. After reviewing the abstracts, 29 of which were not primary studies, thus 18 articles were chosen. Following full-text evaluation, data quality checks, and removal of 2 inaccessible full-texts, 16 articles were ultimately included in this descriptive literature review.

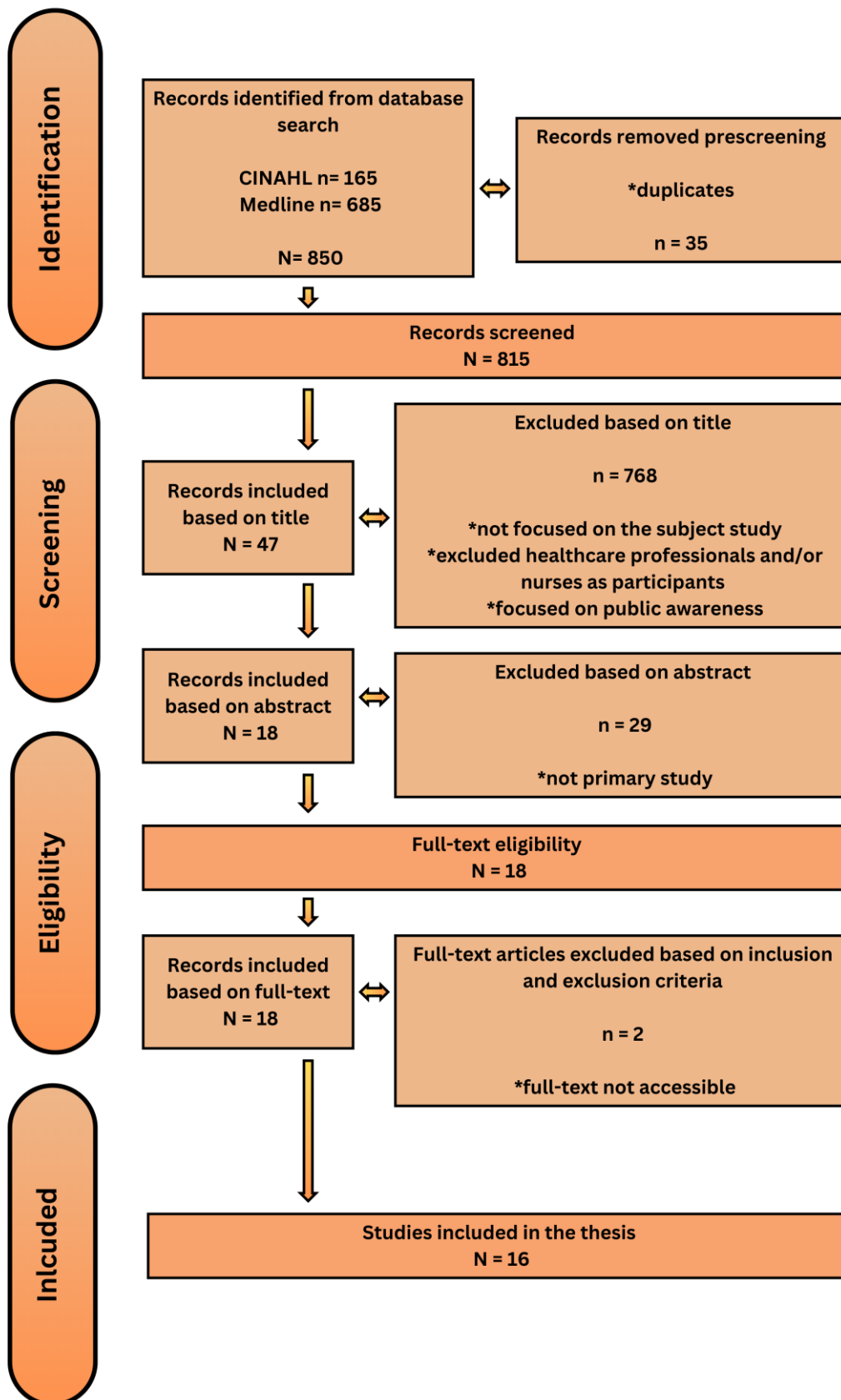


Figure 1. Modified PRISMA Flow Diagram (PRISMA 2020).

4.3 Data Analysis Method

In addressing study questions, researchers apply abstraction to break down complex details and reorganize data through concepts, categories, or themes (Kyngäs, Mikkonen and Kääriäinen 2019: 14). The approach used by the review involved key phases such as preparation, organization, and reporting as in inductive content analysis. It is also commonly used in qualitative research. (Elo and Kyngäs 2008: 109).

Initially, the chosen literature was analyzed to understand the relevant findings. Subsequently, the main points were identified from these sources that particularly addressed the research questions. The initial coding was done to arrange data within a broad conceptual framework. (Vears and Gillam 2022: 117.) To achieve this, relevant content related to the research questions was highlighted, enabling the identification and labeling of sections based on their main categories. Each piece of content was closely examined to understand its subject matter before looking for overarching categories. During the second coding phase, all data were analyzed thoroughly while preserving their original ideas and results (Elo and Kyngäs, 2008: 111).

The study questions were the basis throughout the process. Basically, the gathered data was sorted into relevant smaller segments, with these open cues categorized depending on similar ideas to form subgroups. These data were arranged to have further subcategories, and the similar cues were further sorted and grouped into generic categories. This configuration was then aggregated progressing to broader, main categories that answered the study questions. New insights emerged with each additional analysis. The identified concepts and categories (subcategories, generic, and main) formed the basis for reporting the findings. Each category was reexamined to ensure accuracy, with both authors contributing to the coding process. (Elo and Kyngäs 2008: 111). Refer to Appendix Table 1 for an example of inductive content analysis. Refer to Appendix Table 2 for an analysis of units from selected articles.

5 Results

In this descriptive literature review, data were analysed following content analysis principles. Two researchers thoroughly reviewed each article, highlighting and tabulating relevant results, organized into subcategories, and subsequently analysed to develop 9 distinct generic categories. The generic categories were: 1. Average knowledge and

understanding; 2. Favorable attitudes on prevention and response; 3. Significant concern on information and communication; 4. Low management perceptions and confidence; 5. Lack of guidelines and research knowledge; 6. Low health perceptions; 7. Vaccination hesitancy; 8. Misinformation on treatment; 9. Deficient knowledge on transmission. To visually link the generic categories with the subcategories, color coding was applied as part of the process.

The 16 articles conducted between 2020 and 2024 employed cross-sectional surveys or online questionnaires (15 articles) and a qualitative study employing empirical phenomenological methods. They were conducted mainly in Syria, Ethiopia, China, Italy, Egypt, Bangladesh, Saudi Arabia, Nigeria, Nepal, and Indonesia (see Appendix Table 3). The findings identified 23 subcategories and 9 generic categories that provide an overview of the healthcare professionals' (HCPs') present understanding of mpox and its management and the deficits to this present knowledge.

The first table of inductive content analysis addressed the question, "What is known about mpox and its management among HCPs?" The results are illustrated in Figure 2.

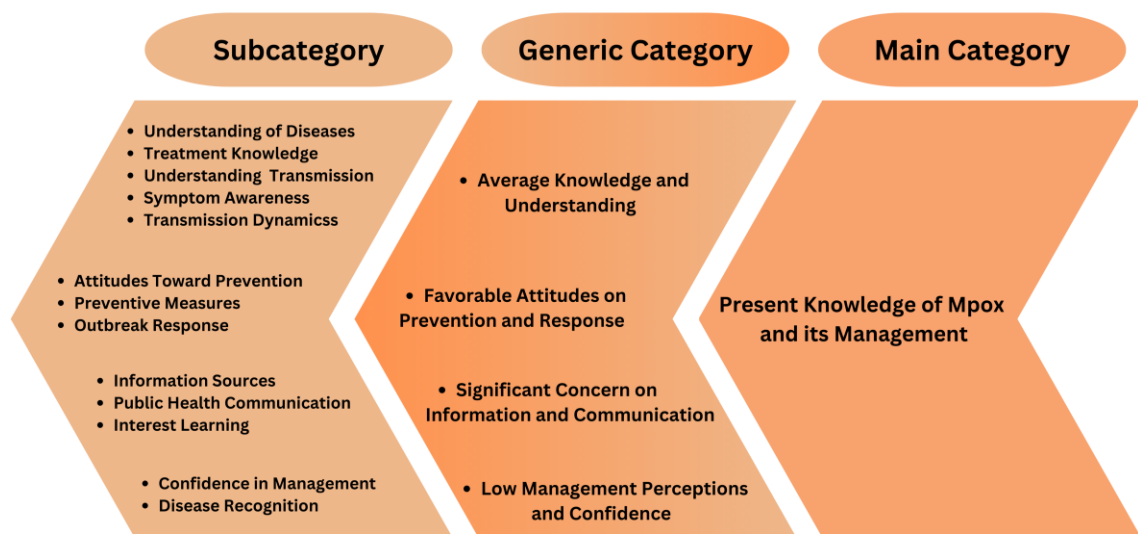


Figure 2. HCPs' Present Knowledge of Mpox and its Management

For the second research question, "What are the gaps in the present knowledge on mpox and its management among HCPs?", the findings are presented in Figure 3.

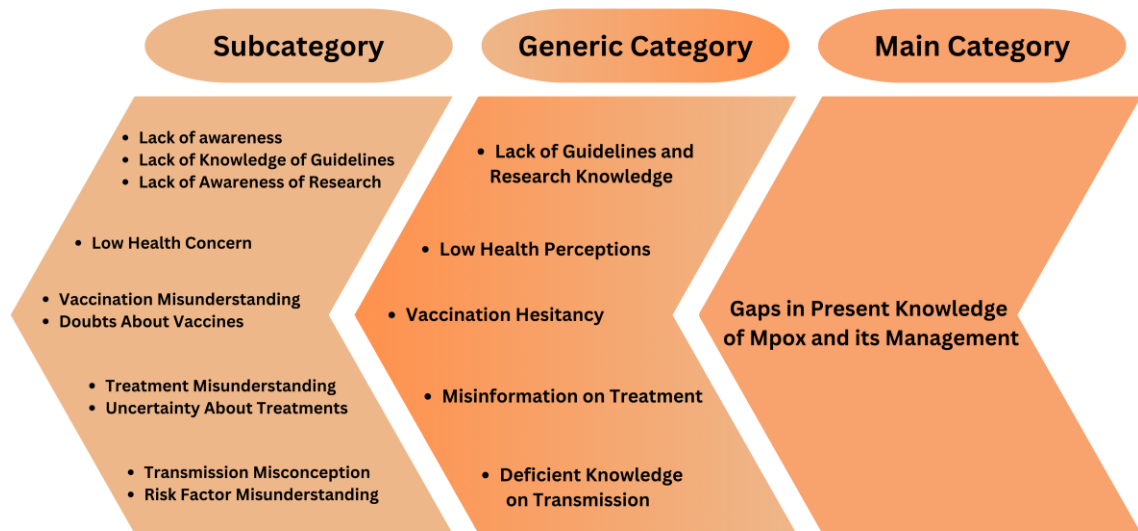


Figure 3. Gaps in HCPs' Present Knowledge of Mpox and its Management

5.1 HCPs' Present Knowledge of Mpox and its Management

5.1.1 Average Knowledge and Understanding

A recurring mention of established knowledge on mpox and an understanding of its management were found in 5 articles – Harapan et al. 2020; Swed et al. 2023b; Temsah et al. 2022; Zhang et al. 2024; Zhou and Zhang 2023. According to the first study, 13.8% (average knowledge score of 13.84) had encountered information during their studies. Just over half (51.3%, n = 3012) were previously familiar with mpox, yet only a small proportion — 11.7% — correctly identified its natural host and incubation period. Although 58.9% could recognize mpox symptoms, only 28% believed its signs resembled those of smallpox. (Swed et al. 2023b: 6.) On the second study, understanding on incubation period, transmission routes and transmission prevention measures was assessed. Seven questions covering the incubation period (choices included 1–3 days, 5–21 days, or 60 days or more) were used to measure participants' knowledge and majority of respondents particularly physicians and nurses selected the correct range, 80% and 84% respectively. For the assessment results on knowledge about what can prevent monkeypox transmission, such as washing hands (physicians 89%, nurse 86%), wearing masks (physicians 78%, nurses 77%), and wearing of gloves (physicians 83%, nurses 76%) were revealed. Similarly, results on knowledge of transmission

routes such as sexual activity (physicians 55%, nurses 40%), respiratory droplets (physicians 62%, nurses 60%), or maternal (physicians 55%, nurse 48%) were also presented. (Zhou and Zhang 2023: 2915-2916.)

Almost half of the respondents recognized animal-to-human transmission for the third study concerning healthcare providers' (HCPs') understanding of mpox's transmission modes. Among the respondents, a substantial 64.8% identified that direct skin contact could facilitate human-to-human spread, 67.6% understood that mpox is not transmitted through the air, only 53.7% acknowledged droplet transmission as a valid means of spread, 94.4% accurately noted that food does not transmit mpox, and 96% incorrectly assumed other possible routes. (Temsah et al. 2022: 6.) Across some aspects according to the third study, participants overall had a precise understanding of mpox, such as more than 85% were aware of similarities in both mpox and smallpox in terms of signs and symptoms and 97.6% generally know that mpox is brought about by a virus. When it came to mpox treatment, 23.1% claimed antibiotics were used. (Harapan et al. 2020: 72.) In treatment and care of human mpox, healthcare providers utilize antibiotics in this last study, due to lack of antiviral treatment, prompting early discharge due to patient frustration. (Zhang et al. 2024: 117.)

5.1.2 Favourable Attitudes on Prevention and Response

In a cross-sectional study by Rony et al. (2023: 4) that focused on knowledge and attitude regarding human monkeypox virus among nurses, and after having determined different variables, 93.12% among 975 participants exhibited favorable attitudes on prevention of mpox transmission. The results of nurses' and other professionals' assessments of attitudes towards mpox in this study revealed that a less than half at 35.8% held a positive perspective on mpox, while the remaining majority 64.2% had a negative outlook (Yeshiwas et al. 2024: 5). Respondents revealed a 62%-positive-attitude rate towards human monkeypox and as a response of those with a favorable attitude towards mpox and its management, a show of higher confidence in managing the illness was observed among healthcare workers (Aynalem et al. 2024: 1160,1169). A lower rate of participation to mpox management such as vaccination coverage among healthcare workers due to some variables when compared to other studies with the same focus. (Scarinci et al. 2023: 2,7).

5.1.3 Significant Concern on Information and Communication

Information on mpox sources and interaction channels was found in five articles – Alhasan et al. 2023; Amer et al. 2024; Awoyomi et al. 2023; Miraglia del Giudice et al. 2023; Swed et al. 2023a. Remarkable gaps persist in their knowledge regarding mpox transmission and prevention, despite the fact that HCPs generally exhibited a firm understanding of mpox and its management. Noteworthy is that 43 (5.2%) professionals reported they had never heard of mpox, which is concerning given their essential role in diagnosing and managing infectious diseases (Awoyomi et al. 2023: 16-17). Among the primary sources of mpox information, participants cited social media (58.1%), the World Health Organization (WHO) and Centers for Disease Control and Prevention (CDC) websites (31.1%), and other online resources (30.2%) (Swed et al. 2023a: 4). Moreover, majority of healthcare professionals (HCPs) at 68.3% who were surveyed were dependent on global health websites, such as those of the WHO and CDC, for retrieval of information on mpox (Alhasan et al. 2023: 6). Furthermore, over two-thirds (76.6%) in one study were interested in having more information about mpox, and nearly two-thirds (64.6%) in another study prompted a desire to learn more opportunities about the disease (Amer et al. 2024: 4; Miraglia del Giudice et al. 2023: 4).

5.1.4 Low Management Perceptions and Confidence

An existing low level on perception and confidence on management of mpox was found in 2 articles – Amer et al. 2024; Yeshiwas et al. 2023. The majority of respondents at 83.7% pointed out mpox as a zoonotic viral infection, although a closely lesser group at 76% correctly identified that its origins is bacterial (Amer et al. 2024: 3). The study highlighted that more confidence in diagnosing and managing mpox as opposed to that of their match having a negative perspective was displayed by healthcare professionals (HCPs) with a positive outlook. With attitudes toward mpox, favorable views were expressed by just 35.8%, leaving a significant majority of 64.2% having a negative stance. (Yeshiwas et al. 2023: 5.)

5.2 Gaps In HCPs' Present Knowledge of Mpox and its Management

5.2.1 Lack of Guidelines and Research Knowledge

In addition to the 58.4% that could not distinguish symptoms between that of mpox or smallpox, a little more than half (55%) of respondents also lacked sufficient data including unfamiliarity with the virus (Swed et al. 2023a: 8). Evidently, HCPs' understanding of the virus's epidemiology and clinical characteristics was not evaluated this may be due to limited knowledge about mpox and low perception of risk (Scarinci et al. 2023: 8). It was revealed that 6% of HCPs in Nepal were unaware of mpox before the survey. Just 10.2% had covered the topic during their medical training. (Das et al. 2023: 5.)

5.2.2 Low Health Perceptions

An article - Swed et al. 2023a - highlighted the gap on the health perceptions on mpox of healthcare professionals on mpox. The results were accordant to a study from Saudi Arabia, where majority of the participants (48.7%) displayed little to no anxiety about a future mpox outbreak, and minority (25.3%) of participants showed significant concern. Roughly 9% of respondents thought mpox could cause an epidemic and considerably risk human health akin to COVID-19, while 51.6% were otherwise unconcerned. (Swed et al. 2023a: 8.)

5.2.3 Vaccination Hesitancy

Uncertainties and hesitations on vaccination were spoken about in 3 articles – Amer et al. 2023; Hong et al. 2023; Swed et al. 2023a. More than half of the respondents (54.5%) displayed support on mpox vaccination, while only almost a thirds (27.1%) expressed strong belief on the present accessibility for mpox immunization and were mentioned in 2 of the 3 articles (Swed et al. 2023a: 8; Amer et al. 2023: 3.) Under the "vaccine acceptance" group were respondents expressing either strong or moderate willingness to receive the vaccine, while those who were part of the "vaccine hesitancy" group were moderately or strongly unwilling. In another study, apprehensions were expressed regarding the safety of mpox vaccines by 68.90% of respondents while a close 67.15% of participants similarly voiced concerns about their efficacy. (Hong et al. 2023: 10.)

5.2.4 Misinformation on Treatment

Misinformation on therapy for mpox were found in 2 articles – Aynalem et al. 2024; Swed et al. 2023a. Several questions, such as: “Is mpox prevalent in the Middle East?”; “Is it common in Western and Central Africa?”; “Is there a global epidemic of human mpox?”; “Is mpox caused by a virus or another type of pathogen?”; “Is there a risk of transmission between individuals?” were presented to participants. Questions on whether human mpox could be treated with antibiotics, if diarrhea is a symptom of the infection, whether pustules develop during the illness, the presence of a skin rash, whether mpox shares symptoms with smallpox, and the availability of a vaccine for its prevention were also given to the respondents. Each question had “yes”, “no”, or “I do not know” as answers. More than half of the respondents (58.4%) of respondents felt the symptoms were close and comparable when it comes to the similarity of symptoms between mpox and smallpox while some of them (23.3%) claimed antibiotics could be used for treatment. (Swed et al. 2023a: 5.) When it comes to the selection of the correct treatment options for mpox, several HCPs were unsure. While 38% identified the need for antiviral medications in treating human mpox, just 47.5% accurately identified paracetamol as a treatment option for symptomatic patients. Additionally, 40% mistakenly believed that antibiotics were necessary for managing mpox cases. (Aynalem et al. 2024: 1165.)

5.2.5 Deficient Knowledge on Transmission

In 3 articles, misconceptions on transmission were spoken about– Alhasan et al. 2023; Temsah, et al. 2022; Zhou and Zhang 2023. Healthcare professionals (HCPs) possess a particular outlook on the topic of transmission of mpox compared to public perception. About transmission, almost half (49.9%) identified correctly that it can happen from animals to humans. A majority of respondents (64.8%) recognized mpox can be spread via skin contact in humans, while less than half of the total respondents (40.7%) were aware of the potential for sexual transmission. Additionally, a little more than half (53.7%) acknowledged droplet transmission as a possible route, while much more (67.6%) had understood that mpox is not airborne. Majority of HCPs (96%) mistakenly claimed other forms of routes might exist in addition to those (94.4%) who were aware that mpox is not spread through food. (Temsah et al. 2022: 6; Zhou and Zhang 2023: 2918.) Deficits in knowledge were noted: in sexual transmission of mpox, only 57% responded correctly, while on the absence of transmission through respiratory droplets,

only 47% of participants gave correct answers. Similarly, among physicians in Italy as well as Indonesia, Kuwait, Jordan, and the Czech Republic insufficient understanding of mpox transmission was observed. (Alhasan et al. 2023: 11.)

6 Discussion

6.1 Characteristics of the Data

The review covered 16 primary studies (Appendix Table 3) which were conducted between 2020 and 2024, with 15 having quantitative cross-sectional design (Alhasan et al. 2023; Amer et al. 2024; Aynalem et al. 2024; Awoyomi et al. 2023; Das et al. 2023; Harapan et al. 2020; Hong et al. 2022; Miraglia del Giudice et al. 2023; Rony et al. 2023; Scarinci et al. 2023; Swed et al. 2023a; Swed et al. 2023b; Temsah et al. 2022; Yeshiwas et al. 2024; Zhou and Zhang 2023) and 1 study (Zhang et al. 2024) following a qualitative, phenomenological approach. Additionally, the said lone study combined quantitative and qualitative elements.

Mostly survey-based, majority (14 studies) used in the review were online surveys, 1 study conducted phone interviews, and 1 study utilized in-person questionnaires. Ranging from a qualitative study with 42 participants to a large-scale quantitative study involving 5,874 healthcare personnel, numbers of respondents varied significantly. Consisting of healthcare professionals such as physicians, nurses, pharmacists, medical students, and public health stakeholders making the count among all studies to over 18,000. The data included countries with respective multiple studies: China, n = 3 (Hong et al. 2022; Zhang et al. 2024; Zhou and Zhang 2023); Ethiopia, n = 2 (Aynalem et al. 2024; Yeshiwas et al. 2024); Italy, n = 2 (Scarinci et al. 2023; Miraglia del Giudice et al. 2023); Syria, n = 2 (Swed et al. 2023a; Swed et al. 2023b); and Saudi Arabia, n = 2 (Alhasan et al. 2023; Temsah et al. 2022). To examine healthcare professionals' (HCPs') knowledge of mpox and identify key deficiencies, this study analysed cross-sectional surveys and qualitative phenomenological methods. Through this analysis, 23 subcategories and 9 generic categories were mapped out, offering a detailed overview of the current understanding of mpox among HCPs (see Appendix Table 3 for an outline of the methodologies, participant types, and key outcomes).

6.2 Discussion of Results

Being moderately knowledgeable on mpox, there are still considerable discrepancies among healthcare professionals' (HCPs') knowledge of mpox. While half of the respondents (51.3%) have general information on mpox, only a small portion (11.7%) could properly point out its host and duration of incubation. Among those (58.9%) who recognized the symptoms, just 28% could categorize them to those of smallpox. (Swed et al. 2023b: 6.) Proper diagnosis of mpox may be affected due to a lack of understanding of its clinical features. Underlining the urgency for clearer communication on mpox epidemiology, confusion on mpox transmission may also heighten these knowledge deficits. Transmitting mpox by respiratory droplets was acknowledged by slightly more than half (53.7%) of the respondents, while via skin contact was pointed out by majority (64.8%) of them. Additionally, despite the large number (94.4%) of participants' understanding that mpox is not foodborne, most of them (96%) incorrectly believed in other transmission routes. (Temsah et al. 2022: 6.)

When it comes to prevention, a large number of respondents (93.12%) held positive views towards preventive measures, and just 35.8% claimed a favorable outlook on mpox itself. (Rony et al. 2023: 4; Yeshiwas et al. 2024: 5). Along with the European Centre for Disease Prevention and Control's (ECDC's) advice to those whose risks are high, still a small portion (23%) of healthcare professionals were willing to be vaccinated, which may have been brought about by confusion on vaccination according to a study by Scarinci et al (2023: 2), while similar concerns of efficacy relating to hesitation on being vaccinated on another study by Hong et al. (2023: 10) showed effectiveness was a major concern for 67.15% of respondents.

This angle on mpox management gives a view of obstacles encountered by HCPs that prevent effective management despite the existence of basic knowledge. Although a small part of the participants (10.2%) received some proper education on the virus, more than half (58.4%) were not able to differentiate mpox symptoms from those of smallpox (Das et al. 2023: 5). On the urgency for trainings to be improved and more comprehensive, an inadequate focus on medical programs for mpox could result to the opposite. Moreover, confidence among HCPs appears to be divided related to their outlook towards mpox. In diagnosing and treating the disease, better confidence levels were shown by those with positive views on mpox while 64.2% of participants saw the

infection on a negative note (Yeshiwas et al. 2024: 5). Further indicating misconceptions on the origin of mpox whether bacterial or viral, in addition to treatment issues, less than half (40%) of HCPs mistakenly claimed antibiotics were suited for managing mpox. Additionally, having just 38% of the group properly recognizing the need for antivirals goes to show that the majority of the respondents have a lack of knowledge on the therapies. (Aynalem et al. 2024: 1165.) As conclusion, these results highlight that there are notable gaps in HCPs' basic understanding of mpox, particularly on transmission, distinguishing symptoms, and treatment protocols.

6.3 Ethics and Validity

As pillars of the research process, reliability, honesty, respect, and accountability were observed throughout this study as stated in the in the European Code of Conduct for Research Integrity. (Finnish National Board on Research Integrity 2023: 11-12). Maintaining clarity, equality, and an unbiased execution, review, and reporting stages, ensuring honesty in every step of the work, the team assured of the design's quality, in addition to methodology, analysis, and resource management. Realization of the the idea was upheld with accountability as colleagues have shown respect with others, the environment, and cultural heritage. All throughout the process, the team has put emphasis on prioritization of standards on ethics and conduct, strictly observing integrity, meticulousness and accuracy.

With the screening of data meticulously following tested methods, evidences for the study were made sure to obtain reliable scientific material. Works as referenced, as well as studies and authors, were properly credited in the list of references, and no particular permission were needed on the planning phase. A thorough presentation of the procedures and outcomes was possible after a complete and transparent reporting of data. Reliable databases endorsed by the Metropolia University of Applied Sciences library were the main sources for the studies utilized and excluded in this research, based on certain provided criteria. The search process was critically reviewed and conferred upon. Publications of all articles were classified Level 1 using the JUFO (julkaisufoorumi.fi). Such categorization expedites the evaluation of quality in scientific publishing, encompassing scientific journals, book series, conferences, and publishers of books. In line with this, the team has used OpenAI's ChatGPT-4o, Grammarly (free version), Turnitin, and Google to organize and refine the work process such as to finalize

the language, translation of most words, and format of citations. As authors of the thesis, the team is responsible for all the content.

While ethical guidelines were observed from early stages to implementation and reporting, the team adopted the principles of a scoping review with concerns on limited substantial literature, on the notion that this approach would lay the groundwork for another future comprehensive synthesis. Initially, providing an analytical framework and thematic structure together with a descriptive numerical summary to summarize the existing literature, without the intent for synthesis (Arksey and O'Malley 2005: 27). While the number of articles was limited, the amount of information available becoming evidently substantial than anticipated, gradually developed. Additionally, when previous information about the phenomenon is fragmented, an option is to perform the inductive approach. With connection to discussing the analysis process, the term 'category' was used, as it is commonly employed in literature. (Elo and Kyngäs 2008: 108.) This eventually shifted the scoping review to a descriptive one, a shift that was both logical and beneficial. With ample data, the researchers continued with inductive content analysis to systematically examine the findings and uncover patterns (Grant and Booth 2009: 94). An inductive data approach progresses from specific observations to broader conclusions where individual instances are examined and then integrated to form a general statement or overarching understanding. Ultimately, transitioning to a descriptive literature review enabled the researchers to synthesize insights into a thorough summary of the literature, emphasizing important findings and implications for future research and practice. (Elo and Kyngäs 2008: 109.)

6.4 Limitations

Affecting depth and applicability of the results due to a wide array of limitations, the reviewed studies on healthcare professionals' understanding of mpox are shown in Appendix Table 3. Such limits encountered were with cross-sectional approach, evident in studies by Swed et al. (2023a), Yeshiwas et al. (2024), and Miraglia del Giudice et al. (2023) though efficient, decreased the ability to identify causation and gives only a glimpse rather than long-term patterns. Another widespread obstacle were related to sampling, observed in studies by Swed et al. (2023b), Awoyomi et al. (2023), and Temsah et al. (2022), particularly done online with surveys, can possibly be affected by factors such as stability of internet connection, and location-based or selection biases. In

like manner, convenience sampling limited broader applicability, as results were obtained from specific, localized settings, like those single-region studies by Das et al. (2023) and Aynalem et al. (2024) conducted in Nepal and Ethiopia, respectively.

Different studies depended on self-reported information like studies by Amer et al. (2024), Hong et al. (2022), and Harapan et al. (2020). Respondents may not totally provide substantial information or may opt for responses which are socially accepted. Similarly, small size sampling influencing reliability of findings due to decreasing possibility of covering a larger scope, were encountered by studies in Saudi Arabia by Alhasan et al. (2023) and in China by Zhang et al. (2024), having only 199 and 42 respondents respectively.

Respondents' potential to express opinions fully and researchers' opportunities to assess non-verbal cues, were some of the particular problems encountered potentially affecting reliability, when semi-structured questionnaires and interviews via phone were employed in the qualitative studies done by Rony et al. (2023) in Bangladesh and Zhang et al. (2024), respectively.

Possibly discounting knowledge differences with healthcare workers, Aynalem et al. (2024) noted that their study did not dwell on differentiating healthcare roles. Similarly, having affected the quality of reactions, Alhasan et al. (2023) also observed survey fatigue among respondents, especially post-pandemic. Moreover, studies of Scarinci et al. (2023) in Italy and Zhou and Zhang (2023) in China, wherein data were gathered from specific hospitals or cities, regional limitations centered on distinct aspects or institutions were seen.

6.5 Utilization of Results and Recommendations

Substantial knowledge gaps exist, as reviewed articles disclose a fair level of knowledge of mpox in healthcare professionals (HCPs). Some awareness of the disease were claimed by more than half of the participants, with a modest number of participants having true understanding on important aspects of mpox like the natural host and period of incubation (Swed et al. 2023b). Evidently, misconceptions were common with numerous participants mistakenly thinking antibiotic treatment was needed, despite the fact mpox was largely recognized as a viral infection (Harapan et al. 2020). As for the part of respiratory droplets play on mpox transmission, understanding of routes

varied, as skin contact was acknowledged by most (Temsah et al. 2022). Among the respondents, 58.4% were unable to differentiate symptoms of smallpox and mpox, and 55% had no fundamental knowledge on the virus (Swed et al. 2023a). Low recognized risk was associated with restrictions on mpox's clinical and epidemiological characteristics (Scarinci et al. 2023). As a reflection of these gaps, 51.6% among the HCPs from Saudi Arabia were not concerned of mpox (Swed et al. 2023a).

A recurrent theme was misinterpretations on transmission across the studies. Knowledge on respiratory droplets were limited, even though sexual contact as a route for transmission was properly recognized by 46.5% and majority at 62.7% of participants pointed lesions as virulent (Alhasan et al. 2023; Temsah et al. 2022). These inconsistencies on understanding were mirrored in Italy and Indonesia, among others. In the aspect of prevention, only a minority of HCPs were eager to have the mpox vaccine, in spite of strict endorsements for at-risk professionals (Scarinci et al. 2023). Notable vaccine hesitancy persisted, although most articles showed an affirming stance on measures towards the matter. The hesitation together with knowledge gaps underlines the necessity for focused educational measures. Similarly, the reviewed studies revealed different views among respondents. Among the group, less than half (47.5%) identified paracetamol as a sufficient treatment for symptoms, although 40% of them wrongfully considered antibiotics are as necessary, revealing a mixed response among confidence of treatment choices (Aynalem et al. 2024). Even though 54.5% backed vaccination efforts, just 27.1% claimed it was accessible along with more than two-thirds conveyed concerns on its safety and effectiveness (Hong et al. 2022).

The value of effective communication channels as media for improving awareness was highlighted in this study. It was seen in numerous studies that HCPs has a firm interest in finding alternatives to improve awareness on mpox (Amer et al. 2024; Miraglia del Giudice et al. 2023). Moreover, most of them turned to social media and reliable outlets such as WHO and CDC for relevant data (Swed et al. 2023a). Consequently, increased confidence in diagnosis and treatment is paralleled with positive attitudes toward the disease showing its impact on clinical practice (Yeshiwas et al. 2024).

The urgent need for training programs for HCPs at a fundamental level was revealed to be a major concern. When these trainings are merged within preparatory and ongoing professional education, and with the goal to deepen knowledge on mpox and target learning on clinical symptoms, transmission routes, and treatment strategies, HCPs

can better handle occurring contagious infections with competence and confidence. Moreover, as crucial as relaying concise data about mpox to distribute correct updates, public health institutions and organizations should improve channels of communication and leverage various platforms — social media, professional networks, and official health websites included. Furthermore, increasing HCPs' participation in matters of immunization and its importance may deal with issues of hesitancy among HCPs and can create more favorable venues for vaccination initiatives, such as campaigns that advocate on safety and efficacy of the mpox vaccine and its pivotal role for the welfare of those in the frontlines in healthcare. Consequently, the creation of a reliable monitoring and tracking system for mpox cases is of utmost priority, as it provides basis for effective management strategies among HCPs. Potentially, these steps when realized, may enhance patient outcomes and boost public health campaigns by largely influencing HCPs' readiness to face mpox and other contagious diseases.

7 Conclusion

Emphasizing on fundamental knowledge of HCPs' on mpox, together with focal areas that need improvement, some of the results this study underlined are:

- *Fair Knowledge but Substantial Gaps:* Even though HCPs may have moderate knowledge on mpox, notable gaps exist, specifically on areas as treatment guidelines, symptom comparison, and transmission routes. For example, only less than one-thirds of the group can tell symptoms of mpox from smallpox, which may lead to inaccurate diagnosis (Swed et al. 2023b). Similarly, a little more than half of the respondents knew respiratory droplets as a potential route (Temsah et al. 2022).
- *Prevention Attitudes vs. Vaccination Hesitancy:* A large number of HCPs stay hesitant on vaccination inspite of general favorable attitudes shown towards aspects as isolation, contact tracing, and preventive practices. Particularly, focusing around safety and efficacy, eagerness to be vaccinated was displayed by just 23% of surveyed respondents (Scarinci et al. 2023). Consequently, this deficiency may affect proper control measures in an outbreak, with only 27% claiming mpox vaccination is currently existent (Swed et al. 2023a).

- *Education and Specialized Training:* Emphasizing the need for focused programs which highlight epidemiological and clinical distinctions to allow HCPs to become more competent and confident in facing outbreaks, nonetheless, almost 12% only of the participants had proper training however (Das et al. 2023). These results mirror the necessity for measures focusing on mpox's natural host, incubation periods, and symptom differentiation.
- *Dependence on Informal Information Outlets:* The study prompts the role of healthcare institutions to give structured and accessible resources, revealing a significant demand for reliable, evidenced-based educational channels. A large number of HCPs rely on WHO and CDC websites, in particular, for relevant data on mpox, with other external sources like social media becoming main channels for updates in over half of the participants (Swed et al. 2023a).
- *Confidence Inconsistencies based on Attitudes:* Addressing these attitude-driven confidence gaps could enhance both the accuracy and effectiveness of HCPs' response to mpox cases. Additionally, better confidence levels seem to directly correlate with positive attitudes on mpox among HCPs. The value of addressing negative perceptions on mpox through education and awareness is emphasized and evident among respondents having amenable outlooks of mpox (Yeshiwas et al. 2024).

Structured programs specialized to fill knowledge gaps, decrease vaccine hesitancy, and provide effective distribution of relevant information on mpox was highlighted by the study as an urgent need. Moreover, HCPs' potential to manage mpox and other emerging diseases can be improved by fortifying education resources, together with efforts to increase confidence, eventually reinforcing public health preparedness and response effectiveness.

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Table 1. Inductive Content Analysis Example

	Meaning Unit	Reduction / Coding	Subcategory	Generic Category	Main Category	
1	54.5% of participants accepted vaccination against Mpox	Acceptance of vaccination	Vaccination acceptance	Knowledge and attitude	Current knowledge on Mpox	
	58.1% of participants reported social media as their primary source of information	Source of information	Information source			
	35.7% of participants had prior COVID-19 infection, 18.1% were concerned about Mpox, and 82.3% desired more knowledge about it	Desire for more knowledge	Knowledge demand	Awareness level		
	55% of participants were unaware of the Mpox virus	Lack of awareness	Knowledge gaps			
	27.1% believed Mpox immunization is available	Immunization belief	Immunization knowledge	Knowledge misconceptions		
	23.3% thought antibiotics might treat Mpox	Misunderstanding of treatment	Knowledge misconception			
	58.4% of participants thought Mpox symptoms were similar to smallpox	Symptom similarity perception	Symptom understanding	Disease knowledge		
	25.4% of females and 34.8% of participants aged 21–30 had good knowledge of Mpox	Level of knowledge	Knowledge distribution			
	23.8% believed Mpox is expected in Arabic countries	Geographic knowledge gap	Geographic knowledge			
	82.3% obtained information from the internet or media	Information sources	Media and internet as source	Knowledge sources		
	55% of participants were unaware of Mpox virus	Lack of awareness	Knowledge gap	Awareness level		Gaps in knowledge on Mpox
	Only 27.1% believed Mpox immunization was available	Low belief in immunization availability	Immunization knowledge gap	Knowledge misconceptions		
	23.3% thought antibiotics could treat Mpox	Misconception about treatment	Treatment knowledge gap			
	45.9% were not concerned about a global pandemic	Low concern about pandemic	Pandemic understanding gap	Risk perception		
35.3% of respondents didn't know if a global epidemic of Mpox was present	Uncertainty about global epidemic	Epidemiology knowledge gap				

	12.1% of participants with anxiety had good knowledge of Mpox	Limited knowledge among anxious participants	Knowledge distribution gap	Disease knowledge	
	43.5% were uncertain about the severity of Mpox compared to smallpox	Uncertainty of disease severity	Severity perception gap		
	7.7% of clinicians with more than 5 years of experience showed adequate knowledge of Mpox	Low knowledge among experienced clinicians	Experience-based knowledge gap		
	Participants worried about Mpox causing a similar epidemic to COVID-19 had greater knowledge	Uneven distribution of knowledge	Knowledge inequality		
	Participants who disagreed that HCWs should adhere more to infection control measures had lower knowledge levels	Inadequate adherence to control measures linked to poor knowledge	Infection control knowledge gap	Control measures knowledge	
2	620 HCWs participated, with a response rate of 96.9%; majority Orthodox Christians, male (69.7%), and over 5 years of experience (63.9%).	Demographic characteristics	Sociodemographic characteristics	HCPs' Characteristics	Current knowledge on Mpox
	31.5% of HCWs reported high confidence in diagnosing/managing mpox; 26.8% medium; 41.8% low.	Confidence levels	Confidence in diagnosing and managing mpox	HCPs' Confidence	
	Positive attitude, age 30-35, professional category, and visiting WHO/CDC websites linked to higher confidence levels in diagnosing/managing mpox.	Factors influencing confidence	Confidence influencing factors	Factors Affecting Confidence	
	58.2% believe mpox is prevented by handwashing; 52.9% incorrectly believe antibiotics can treat mpox; 36.9% aware of environmental transmission.	Knowledge gaps	Misunderstanding of mpox prevention and treatment	HCPs' Knowledge	Gaps in knowledge on Mpox
	35.8% had a positive attitude towards mpox; 64.2% had a negative attitude; higher among physicians (42.3%) compared to nurses (33.9%).	Attitudes towards mpox	Attitude towards mpox	HCPs' Attitudes	
	24.7% had received PHEM training; low confidence associated with being female, having <5 years of experience, negative attitudes, and not visiting reliable information sources.	Training and knowledge gaps	Lack of training and reliable information sources	Training and Knowledge Gaps	

Table 2. Units of Analysis Based on the List of Selected Articles

Main Category:	Present Knowledge of Mpox and its Management				Gaps in Present Knowledge of Mpox and its Management				
Generic Category:	Average Knowledge and Understanding	Favorable Attitudes on Prevention and Response	Significant Concern on Information and Communication	Low Management Perceptions and Confidence	Lack of Guidelines and Research Knowledge	Low Health Perceptions	Vaccination Hesitancy	Misinformation on Treatment	Deficient Knowledge on Transmission
Sub categories:	<ul style="list-style-type: none"> >Understanding of Disease >Treatment Knowledge >Understanding Transmission >Symptom Awareness >Transmission Dynamics 	<ul style="list-style-type: none"> >Attitudes Toward Prevention >Preventive Measures >Outbreak Response 	<ul style="list-style-type: none"> >Information Sources >Public Health Communication >Interest in Learning 	<ul style="list-style-type: none"> >Confidence in Management >Disease Recognition 	<ul style="list-style-type: none"> >Lack of Awareness >Lack of Knowledge of Guidelines >Lack of Awareness of Research 	<ul style="list-style-type: none"> >Low Health Concern 	<ul style="list-style-type: none"> >Vaccination Misunderstanding >Doubts About Vaccines 	<ul style="list-style-type: none"> >Treatment Misunderstanding >Uncertainty About Treatments 	<ul style="list-style-type: none"> >Transmission Misconception >Risk Factor Misunderstanding
Units / Cues (Selected Articles)	3,4,10,11,12	2,5,7,9	1,6,8,13,14	2,6	1,5,15	1	1,6,16	1,9	3,12,14

Table 3. Summary of Included Articles

Author/s, Year, Country	Topic / Title	Methodology	Participants	Main Outcomes	Limitations
1 Swed et al. 2023a, Syria	A multinational cross-sectional study on the awareness and concerns of healthcare providers toward monkeypox and the promotion of the monkeypox vaccination	Quantitative study: Online cross-sectional design (conducted from August 2, 2022, to December 28, 2022)	n = 3,856 participants (physicians, nurses, pharmacists, and undergraduate medical students from Arabic countries)	Around 82% of respondents sought more information about mpox, while 54.5% were open to vaccination, with the highest willingness (42.4%) among those aged 21-30. Only 45% had sufficient knowledge of the virus. Those who never contracted COVID-19 were more concerned about it than mpox, and COVID-19 survivors were 0.63 times less worried about mpox. Social media (58.1%), WHO/CDC websites (31.1%), and the Internet (30.2%) were key information sources. Anxiety was high: 61.7% worried about infection, 54.6% feared a national lockdown, and 45.9% were concerned about a global pandemic.	The study's cross-sectional design limits establishing causality, and the use of convenience and snowball sampling may have introduced bias, making the sample less representative of HCPs in Arabic countries. Online surveys might exclude individuals without internet access or digital literacy, while self-reported data could introduce response bias. The findings may not be generalizable to HCPs outside Arabic regions or non-healthcare populations. The survey's format may have restricted the depth of responses, and technical issues likely contributed to underrepresentation of older adults.
2 Yeshiwas et al. 2024, Ethiopia	Assessing healthcare workers' confidence level in diagnosing and managing emerging infectious virus of human mpox in hospitals in Amhara Region, Northwest Ethiopia: multicentre	Quantitative study: Institution-based cross-sectional study (October 1 - December 30, 2022)	n = 640 healthcare workers	Among HCPs, 31.5% had high confidence in diagnosing and managing Mpox, 26.8% medium, and 41.8% low. Higher confidence was linked to visiting relevant websites (AOR=1.59), being a physician (AOR=1.9), aged 30–35 (AOR=1.64), receiving epidemic management training (AOR=2.8), and having a positive attitude (AOR=1.72). Additionally, 41.7% of HCPs had limited knowledge of Mpox, and 35.8% had a positive attitude.	Social desirability bias may have influenced some respondents, especially physicians, to provide overly positive but inaccurate responses. Recall bias could also affect the accuracy of answers regarding behaviors like handwashing frequency. Despite a relatively large sample size, findings may be specific to the Amhara Region and not generalizable to other areas or countries.

		institution-based cross-sectional study				
3	Zhou and Zhang 2023, China	Awareness, Attitude, and Knowledge Among the Healthcare Workers in China at the Onset of the Oversea Monkeypox Outbreak	Quantitative study: Online cross-sectional design	Nurses: n= 1793 Physicians: n = 395 Total: n = 2188	Awareness of the Mpox outbreak was high (physicians 93%, nurses 88%), though less than a third had prior knowledge. Over half believed Mpox could spread to China, with more than 30% feeling personally at risk. Most agreed that immediate action was needed for vaccines and therapies. More than half actively sought information, and most expected hospitals to organize seminars. Knowledge of transmission and prevention was generally strong, with the majority recognizing handwashing, mask-wearing, and glove use as key preventive measures.	The study's focus on a single city in central China limits the generalizability of its findings. Non-probabilistic sampling may impact representativeness, and some participants might have hastily answered questions, with only 11 responses excluded for being completed in under 60 seconds. There is also a risk of bias from online searching. Conducted early in the outbreak with closed-ended questions, the survey offered limited depth and primarily captured initial awareness, perceived risk, attitudes, and knowledge, which could have changed as the outbreak progressed.
4	Zhang et al. 2024, China	Efforts made, challenges faced, and recommendations provided by stakeholders involved in mpox prevention and control in China: a qualitative study	Qualitative study Approach: Empirical phenomenological approach	n = 42 participants (n =15 community-based organization (CBO) workers, n = 14 Centers for Disease Control and Prevention (CDC) staff, and n = 13 HCPs)	Efforts to manage the mpox epidemic involved CDCs conducting health education and investigations, HCPs focusing on diagnosis and care, and CBOs providing counseling and referrals. Challenges included financial burdens from hospital quarantine, dissatisfaction due to a lack of antiviral treatments, reluctance to seek help due to identity concerns, and mental health issues among patients and stakeholders.	The study has several sampling limitations, as participants were recruited through purposive sampling, which may not adequately capture perspectives from all cities impacted by the mpox epidemic. Additionally, the exclusion of mpox patients, whose experiences were drawn from a separate article, is noteworthy. Factors such as work experience, education, and job titles may also have influenced the findings. Interviews were conducted over the phone, which restricted the ability to observe non-verbal cues. Furthermore, since the interviews occurred in August 2023, the results may not accurately represent the

						changing strategies and circumstances of the ongoing pandemic.
5	Scarinci et al. 2023, Italy	Evaluation of Smallpox Vaccination Coverage and Attitude towards Monkeypox Vaccination among Healthcare Workers in an Italian University Hospital	Quantitative study: Online cross-sectional design survey.	n = 336 healthcare workers (HCWs) from the Azienda Ospedaliero-Universitaria Pisana (AOUP)	The study achieved a response rate of 60.71% among HCPs who provided the requested data. In terms of vaccination coverage, 38.7% of respondents reported having received the smallpox vaccine, which accounts for 23.5% of the total HCPs in the relevant wards. When including those born before 1979, the coverage increased to 41.7%. Only 23% of HCWs expressed a willingness to receive the Mpxv vaccine, with laboratory technicians showing the lowest willingness, while the Proctological Surgery ward had the highest. The median age of vaccinated HCWs was 54 years, in contrast to 37 years for those who were unvaccinated.	The study's conclusions are constrained by its focus on a single hospital in Italy, limiting the applicability of the findings. A response rate of only 60.71% among HCPs who completed the self-declaration suggests that there may be gaps in knowledge about Mpxv and a lack of perceived risk. Moreover, the study did not assess the level of knowledge HCPs had regarding the Mpxv virus, which could lead to biases like "non-response" and "information bias." The perceptions of risk among those who chose not to get vaccinated were not examined either. Additionally, the research covered only a few wards, which may not accurately reflect the entire hospital or other healthcare facilities.
6	Amer et al. 2024, Egypt	Grasping knowledge, attitude, and perception towards monkeypox among healthcare workers and medical students: an Egyptian cross-sectional study	Quantitative study: Cross-sectional study using a questionnaire distributed via Google form.	n = 1,034 (646 HCPs and 388 medical students)	The study found that 55.3% of participants had adequate knowledge of Mpxv (Mpxv), while 44.5% held favorable attitudes toward it, and 39.8% had positive perceptions. Adequate knowledge was notably associated with participants over 40, married individuals, and doctors. Positive attitudes were more common among males, urban dwellers, and nurses. Additionally, positive perceptions were higher among married participants, doctors, and those in pharmacy or laboratory roles.	The cross-sectional design lacks a temporal link between exposure and outcome. Potential non-response bias and discrepancies in characteristics between respondents and non-respondents due to the use of online questionnaires. Measures to mitigate biases included prior sample size calculation, survey tool testing, distribution through various social media platforms, and extending the data collection period.
7	Rony, Sharmi, Akter,	Knowledge and Attitude	Quantitative study: Cross-sectional study	n = 1047 participants (regis-	The study revealed that 57.97% of participants had good knowledge of Mpxv, with female nurses outpacing male nurses.	Convenient sampling may introduce bias, limiting the representativeness of all Bangladeshi nurses and affecting the

	Parvin, and Alamgir 2023, Bangladesh	Regarding Human Monkeypox Virus Infection among Nurses: A Cross-Sectional Study	using semi-structured and self-administered questionnaires distributed via Google Forms	tered nurses licensed by the Bangladesh Nursing Council)	Younger nurses (23-28 years) and those with higher education (bachelor's or Ph.D.) also demonstrated better knowledge. A significant 93.12% had a positive attitude towards Mpox, especially among female nurses and those in private or tertiary hospitals. A strong positive correlation existed between good knowledge and positive attitudes ($r = 0.76, p < 0.001$), while poor knowledge was moderately correlated with negative attitudes ($r = 0.53, p < 0.001$).	generalizability of the findings. Self-reported data can lead to recall and social desirability biases, impacting the accuracy of knowledge and attitudes reported. The cross-sectional design provides only a snapshot of participants' knowledge and attitudes at one point in time. Additionally, using English for the survey may have caused comprehension issues for some participants, potentially influencing their responses.
8	Miraglia del Giudice, Della Polla, Folcarelli, Napoli, Angelillo, and The Collaborative Working Group 2023 Italy	Knowledge and attitudes of health care workers about monkeypox virus infection in Southern Italy	Quantitative Methods: Cross-sectional survey conducted between July 28 and October 14, 2022, at four randomly selected hospitals in the Campania region, Southern Italy.	n = 421 HCPs (nurses/midwives, physicians/dentists, and other HCPs)	HCPs had limited knowledge of monkeypox (mpox), scoring an average of 3.4 out of 13. Less than two-thirds could define the disease, and responses on transmission mechanisms varied widely. Few recognized HCPs and elderly or frail individuals as risk groups. Higher knowledge levels were associated with fewer years of experience and reliance on scientific journals for information. Perceived severity was moderate, averaging 6.3; women, knowledgeable HCPs, and those seeking more information were more likely to view mpox as severe. Most HCPs did not change their behavior due to fears of contracting the virus. Key information sources included mass media, the Internet, and scientific journals.	The cross-sectional design limits the ability to determine causal relationships. The study was conducted in hospitals from only one region, which may limit the generalizability of the findings to other regions or countries. The use of a self-administered questionnaire may introduce social desirability bias, although anonymity was maintained to mitigate this risk.
9	Aynalem et al. 2024 Ethiopia	Knowledge, Attitude and Associated Factors of Monkeypox Infection Among	Quantitative Methods: Institution-based cross-sectional study	n = 200 HCPs (medical doctors, nurses, midwives, and other allied	About 38.5% of healthcare professionals had good knowledge of Mpox, and 62% held a positive attitude toward its prevention. Better knowledge was associated with higher education (master's degree or	The study's small sample size and single-center focus limit its applicability to all Ethiopian HCPs. While self-reported questionnaires may introduce bias, anonymity might lessen this impact. The research also did not compare knowledge

		Healthcare Workers in Injibara General Hospital, Northwest Ethiopia	using a structured self-administered questionnaire. Descriptive statistics and multivariable logistic regression analyses were computed.	health professionals)	above), COVID-19 vaccination, and access to information. Positive attitudes were linked to being 30 years or older and having access to relevant information.	and attitudes among different HCPs types, and the cross-sectional design presents additional limitations. Future qualitative studies are needed for a deeper understanding of HCPs' knowledge and attitudes about mpox in Ethiopia.
10	Harapan et al. 2020 Indonesia	Knowledge of human monkeypox viral infection among general practitioners: a cross-sectional study in Indonesia	Quantitative Method: Cross-sectional online survey	n = 432 general practitioners (GPs)	Only 9.0% of general practitioners (GPs) exhibited strong knowledge of mpox at an 80% threshold, while 36.5% achieved a 70% threshold. GPs who attended universities in Java demonstrated superior knowledge compared to their peers from Sumatra or other regions. Additionally, younger GPs (30 years or younger) displayed greater knowledge than older practitioners, and those employed in community health centers outperformed those working in private clinics. The primary source of information for most GPs (73.6%) was online media.	The study recorded a completion rate of 85.7%, which is higher than that of comparable studies, but it still leaves room for potential bias. The online survey format may have resulted in geographical bias due to differing levels of internet access in various areas. Furthermore, participants may have searched for answers despite being asked to rely solely on their existing knowledge. The overall low knowledge among general practitioners may be attributed to limited exposure to actual cases of mpox in Indonesia. Additionally, the differences in medical school curricula across the country could have impacted the knowledge levels of GPs.
11	Swed et al. 2023b Syria	Knowledge of mpox and its determinants among the healthcare personnel in Arabic regions: A multi-	Quantitative study: Cross-sectional online survey (conducted from June 6 to June 25, 2022)	n = 5874 HCPs (Medical Students: n = 3975, General Practitioners (GPs): n = 981,	The research highlighted a significant lack of awareness about monkeypox (mpox) among Arabic medical students and healthcare practitioners. Just 13.8% had encountered information about mpox during their studies, leading to an average knowledge score of 13.84, with a median	The design of this cross-sectional study restricts the ability to determine causal relationships between various factors and knowledge of monkeypox (mpox). Moreover, the generalizability of the findings may be compromised due to an uneven distribution among nationality sub-groups, which could misrepresent

		country cross-sectional study		Resident Doctors: n = 559, Specialist Doctors: n = 359)	of 15 out of 34. While over half of the participants (51.3%) were familiar with the term mpox, only 11.7% accurately identified its natural host and incubation period. Furthermore, 58.9% recognized the associated signs and symptoms. Notably, specialist doctors exhibited a greater understanding of mpox than their peers in other medical fields.	knowledge levels in countries with fewer participants. The results are not relevant for older individuals or those without internet access, as these groups were excluded from the study. Despite efforts to reduce bias, issues such as random responses and multiple automated submissions may still persist.
12	Temsah et al. 2022 Saudi Arabia	Monkeypox Disease (MPOX) Perceptions among Healthcare Workers versus General Population during the First Month of the WHO Alert: Cross-Sectional Survey in Saudi Arabia	Quantitative study: Cross-sectional online survey	n = 1130 participants (physicians, pharmacists, researchers, and medical professionals) n = 1546 participants from the general public	A notable 61.3% of the public and 74.2% of HCPs expressed a desire for more information on monkeypox (mpox). Both groups exhibited average knowledge levels; however, university-educated individuals and those more concerned about MPOX scored higher in knowledge assessments. In contrast, HCPs showed significant gaps, particularly regarding vaccination, with only 57% aware that MPOX symptoms can resemble early COVID-19 symptoms. Female HCPs and those with a strong self-assessment of their mpox awareness had higher knowledge scores, as did those in secondary and tertiary facilities. While the public primarily relied on social media (66.1%) for information, HCPs preferred official health sources (60%).	The observational design of the study restricts the establishment of causal relationships. Utilizing convenience sampling raises the potential for selection bias. Since it assesses knowledge, responses may be influenced by recall bias. Additionally, the analysis of subgroups related to recent travel and social activities was limited. Consequently, the results may not be applicable to populations beyond Saudi Arabia.
13	Awoyomi et al. 2023 Nigeria	Mpox in Nigeria: Perceptions and knowledge of the disease among critical stakeholders—	Quantitative study: A web-based cross-sectional survey (conducted between July 24,	HCPs: n = 832, academics: n = 306, tertiary students: n = 462 Total: n = 1,544 respondents	Around 60.5% of respondents demonstrated adequate knowledge of mpox, while only 28.9% held positive perceptions of the disease. Key factors influencing knowledge included age, education, occupation, and region, with higher perceptions linked to tertiary education and	The study's cross-sectional design didn't capture knowledge changes over time, and the non-randomized sampling may have introduced bias. Additionally, the online format could have excluded certain groups, and the self-reported data may be prone to manipulation.

		Global public health consequences	2022, and August 12, 2022)		residency in North-west Nigeria. Most participants understood that mpox spreads through broken skin and bodily fluids, though less than 60% were aware of transmission via respiratory droplets, contaminated items, or infected animal meat. The majority knew prevention involved avoiding contact with animals and regular handwashing, but only 35.1% were aware of available vaccines. Social media and traditional media were the primary sources of information.	
14	Alhasan et al. 2023 Saudi Arabia	Mpox Perceptions and Vaccine Advocacy among the Healthcare Workers of Solid Organ Transplant Centers: A Multicenter, Cross-Sectional Survey in Saudi Arabia	Quantitative study: Cross-sectional electronic survey (from 15 August to 5 September 2022)	n = 199 participants (solid organ transplant healthcare workers in Saudi Arabia)	Most participants were aware of the 2022 Mpox outbreak but were more focused on COVID-19. While many believed lab workers and frontline HCWs should get the vaccine, fewer than 60% felt all HCWs needed it. Knowledge gaps were evident, particularly about animal-to-human transmission, with an average knowledge score of 20.35/32. Precautionary isolation knowledge was strong, but vaccine knowledge was low. Concerns about Mpox included the risk of a pandemic and related restrictions, though 65.8% remained more worried about COVID-19. Information sources included MOH websites, WHO, CDC, social media, and journals.	The study did not consider HCWs' travel to Mpox-endemic regions. The cross-sectional survey faced challenges like sampling issues and recall bias, along with potential low response rates due to post-COVID-19 survey fatigue.
15	Das et al. 2023 Nepal	Socio-demographic determinants of the knowledge and attitude of Nepalese healthcare	Quantitative study: A cross-sectional study using a structured and validated questionnaire.	n = 217 participants (doctors, laboratory professionals, epidemiologists, pharmacists,	The average knowledge score was 13, with 60.4% of respondents showing strong knowledge about mpox. While 51.7% had a positive attitude towards the disease, socio-demographic factors like age, gender, and profession did not signif-	The study, conducted at a single center, may not fully represent all HCPs in Nepal. Using convenience sampling instead of probabilistic sampling introduces bias and affects the generalizability of the findings. While the sample size was adequate, it might not fully

		workers toward human monkeypox: a cross-sectional study	(conducted in person at Tribhuvan University Teaching Hospital in October 2022)	and others: including optometrists, audiologists, biomedical technicians, and imaging technologist)	ificantly impact knowledge levels. However, those who had studied mpox during their medical education were more likely to have a positive attitude. Many HCPs had not learned about mpox during their studies, and some only became aware of it through the survey.	capture the perspectives of HCPs nationwide. Additionally, the study lacked multivariable analysis to explore the relationships between various factors and knowledge or attitudes. Conducting the survey six months after the outbreak may have influenced respondents' knowledge and attitudes compared to earlier data.
16	Hong et al. 2022 China	The willingness of Chinese healthcare workers to receive monkeypox vaccine and its independent predictors: A cross-sectional survey	Quantitative study: Online cross-sectional survey using a self-report questionnaire	n = 1032 participants (doctors and nurses from various departments)	Among Chinese HCPs, 90.12% were willing to receive the mpox vaccine, with a hesitancy rate of 9.88%. Key factors affecting willingness included being aged 30-40 years, working in secondary hospitals, viewing vaccination as necessary for controlling mpox, and being willing to pay for or recommend the vaccine. Most respondents got information from media, government agencies, friends, and books. Concerns about side effects, effectiveness, and safety were common among participants.	Its cross-sectional design makes it hard to establish causality, and self-reported data may introduce bias. Focusing on only three regions in China—Shanghai, Anhui, and Zhejiang—limits the findings' applicability. Excluding participants with cognitive impairments and considering few variables may affect representation. The lack of longitudinal data means changes in attitudes can't be tracked. Although the sample size is sufficient, a larger, more diverse group could yield stronger results. Additionally, a 93.82% response rate raises concerns about bias. These limitations suggest a need for further, more comprehensive research.

Table 4. Selected Articles' Publication Channel Check

Author/s, Year, Country		Topic / Title	Publication channel check (JUFO) / Publisher
1	Swed et al. 2023a Syria	A multinational cross-sectional study on the awareness and concerns of healthcare providers toward monkeypox and the promotion of the monkeypox vaccination	Level 1 Frontiers Media S.A. Frontiers in Public Health
2	Yeshiwas et al. 2024 Ethiopia	Assessing healthcare workers' confidence level in diagnosing and managing emerging infectious virus of human mpox in hospitals in Amhara Region, Northwest Ethiopia: multicentre institution-based cross-sectional study	Level 1 BMJ Publishing Group BMJ Open
3	Heng-Cui Zhou and Zhi-Jiang Zhang 2023 China	Awareness, Attitude, and Knowledge Among the Healthcare Workers in China at the Onset of the Overseas Monkeypox Outbreak	Level 1 Springer Nature Journal of General Internal Medicine
4	Zhang et al. 2024 China	Efforts made, challenges faced, and recommendations provided by stakeholders involved in mpox prevention and control in China: a qualitative study	Level 1 Academic Press Public Health
5	Scarinci et al. 2023 Italy	Evaluation of Smallpox Vaccination Coverage and Attitude towards Monkeypox Vaccination among Healthcare Workers in an Italian University Hospital	Level 1 Vaccines - MDPI
6	Amer et al. 2024 Egypt	Grasping knowledge, attitude, and perception towards monkeypox among healthcare workers and medical students: an Egyptian cross-sectional study	Level 1 Frontiers Media S.A. Frontiers in Cellular and Infection Microbiology
7	Rony, Sharmi, Akter, Parvin, and Alamgir 2023 Bangladesh	Knowledge and Attitude Regarding Human Monkeypox Virus Infection among Nurses: A Cross-Sectional Study	Level 1 SAGE Open Nursing
8	Miraglia del Giudice, Della Polla, Folcarelli, Napoli, Angelillo, and The Collaborative Working Group 2023 Italy	Knowledge and attitudes of health care workers about monkeypox virus infection in Southern Italy	Level 1 Frontiers Media S.A. Frontiers in Public Health
9	Aynalem et al. 2024 Ethiopia	Knowledge, Attitude and Associated Factors of Monkeypox Infection Among Healthcare Workers in Injibara General Hospital, Northwest Ethiopia	Level 1 Dove Medical Press Journal of Multidisciplinary Healthcare

10	Harapan et al. 2020 Indonesia	Knowledge of human monkeypox viral infection among general practitioners: a cross-sectional study in Indonesia	Level 1 Taylor & Francis Pathogens and Global Health
11	Swed et al. 2023b Syria	Knowledge of mpox and its determinants among the healthcare personnel in Arabic regions: A multi-country cross-sectional study	Level 1 Elsevier - New Microbes and New Infections
12	Temsah et al. 2022 Saudi arabia	Monkeypox Disease (MPOX) Perceptions among Healthcare Workers versus General Population during the First Month of the WHO Alert: Cross-Sectional Survey in Saudi Arabia	Level 1 Vaccines - MDPI
13	Awoyomi et al. 2023 Nigeria	Mpox in Nigeria: Perceptions and knowledge of the disease among critical stakeholders— Global public health consequences	Level 1 PLoS ONE Public Library of Science (PLoS)
14	Alhasan et al. 2023 Saudi Arabia	Mpox Perceptions and Vaccine Advocacy among the Healthcare Workers of Solid Organ Transplant Centers: A Multicenter, Cross-Sectional Survey in Saudi Arabia	Level 1 Healthcare - MDPI
15	Das et al. 2023 Nepal	Socio-demographic determinants of the knowledge and attitude of Nepalese healthcare workers toward human monkeypox: a cross-sectional study	Level 1 Frontiers Media S.A. Frontiers in Public Health
16	Hong et al. 2022 China	The willingness of Chinese healthcare workers to receive monkeypox vaccine and its independent predictors: A cross-sectional survey	Level 1 John Wiley & Sons Journal of Medical Virology