



RESEARCH ARTICLE

# Impact of the 2022 Mpox Outbreak on Future Public Health Initiatives in Ohio

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## ABSTRACT

The 2019 coronavirus disease (COVID-19) created a global public health emergency costing the lives of millions, but the advent of COVID-19 vaccination allowed our society to contain infection and morbidity. As global health began to slowly recover in 2022, the emergence of mpox (monkeypox) in the Western world led to fear that global health would soon be under threat by another viral infection. Mpox is known as a viral zoonosis, or a virus transmitted from animals to humans, which presents with symptoms similar to those of smallpox. Mpox and smallpox belong to the orthopoxvirus genus in the Poxviridae family, however, mpox is less clinically severe than smallpox, the latter being fully eradicated. Transmission occurs when an individual has direct contact with an infected rash, bodily fluids, respiratory droplets, or via fomites. From July 2022 to May 2023, the World Health Organization (WHO) declared the mpox outbreak as a Public Health Emergency of International Concern (PHEIC). Therefore, the establishment of treatment guidelines and medication has been widely distributed which include vaccinations based on smallpox and supportive treatments. Most importantly, there are apparent health care disparities in vaccine distribution and treatment which disadvantage Black and Latinx populations, in addition to LGBTQIA+ youth. This review characterizes the human mpox infection and analyzes the impact of mpox in the state of Ohio, with a special focus on tackling the disparities that are disproportionately affecting certain groups.

**Keywords:** Mpox; Sexual and gender minorities; Vulnerable populations; Socioeconomic disparities in health, World Health Organization

## INTRODUCTION

Public health officials in Ohio are concerned about the threat level of the recent mpox (monkeypox) outbreak, especially as the world continues to overcome the 2019 Coronavirus pandemic. Initially, mpox was discovered in a colony of monkeys in 1958, while the first human case of the virus occurred in 1970.<sup>1</sup> The spread of mpox is not a foreign concept in the US; in fact, it was disseminated across several states, including Ohio, in 2003. In July 2003, the CDC reported a total of 87 cases of mpox. It is important to note that the transmission routes and affected populations of the 2003 outbreak differed in comparison to the 2022 outbreak.<sup>2</sup> In 2003, mpox was spread through contact with an infected animal, and there was no proven infection through sexual contact.<sup>2</sup> This out-

break led to an influx of research studies focused on the characterization of mpox virus to identify clinical markers and led to potential treatment and prevention education.

The mpox virus is part of the genus orthopoxviruses, which also include cowpox, horsepox, camelpox, and variola (smallpox) viruses.<sup>3,4</sup> Although the mpox virus is similar to the smallpox virus, which was eradicated in 1980, both genetically and in its clinical presentation, mpox has lower rates of contact transmission and mortality rate than smallpox.<sup>3</sup> The 2 ways mpox is transmitted are through animal-to-human transmission and from human-to-human transmission through direct contact, indirect contact, respiratory droplets, and vertical transmission.<sup>3</sup> The mpox virus is a double-stranded DNA virus; it is clinically present in 2 types:





clade I and clade II.<sup>1,5</sup> The recent 2022 outbreak shows infections are from clade IIb, which is a milder form of the virus with a fatality rate of around 1%; this form of the virus exhibits flu-like symptoms in most patients including fever, headache, muscle aches, chills, and fatigue. Patients with clade IIb also present with rashes, bumps, and blisters on their hands, chest, face, and genital areas. The incubation period is 3 to 17 days, in which the patient suffers no symptoms. The symptoms are likely to last anywhere from 2 to 4 weeks.<sup>6</sup> Patients who are immunocompromised, pregnant, or breastfeeding, have a history of eczema, or are under the age of 1 year are at higher risk for serious and possibly fatal complications.<sup>1</sup> Mpox can spread through direct physical contact with infected rashes or sores, prolonged exposure to respiratory droplets or oral fluids from an infected individual, or infected fomites. Patients remain classified as infectious from the inception of their rash until all their scabs heal.<sup>6</sup> Definitive diagnosis of mpox is made through viral DNA taken from the crusts of vesicles or ulcers.<sup>5</sup> Currently, there are no treatments specifically for mpox patients. However, there are numerous drugs used to treat smallpox that may be advised for use in certain mpox patients, for both prevention and treatment methods.<sup>7</sup> In the ongoing 2022 outbreak in Ohio, men who have sex with men (MSM) have been disproportionately affected at high rates.<sup>5,8</sup> It should be noted that the 2022 mpox outbreak shows unique features of interest in the disease's contagion, spread, progression, and clinical presentation.<sup>3</sup>

### Transmission, Prevention, and Treatment

At the time of writing, there are no FDA-approved treatments specifically developed for the mpox virus infection, however, there are multiple preventive measures that an individual can take depending upon the transmission route. Any individual who has been in close personal contact with an infected individual is at risk of developing mpox. Individuals who may be at higher risk of infection include health care personnel, veterinarians, and those living with an infected individual.<sup>7</sup> Additionally, there is a risk of vertical transmission occurring when a fetus is exposed to the virus through their infected mother during pregnancy or via close contact after birth.<sup>3,8-10</sup>

It is important to avoid direct skin-to-skin contact with individuals who exhibit a rash that may be from mpox. This rash may present on the genitals, hands, feet, chest, or mouth areas.<sup>3,8</sup> In the 2022 outbreak, cases have uniquely exhibited rashes beginning in the genital or perianal areas. The rash may or may not spread to other parts of the body.<sup>5</sup> The Centers for Disease Control (CDC) also advises individuals to avoid contact with materials that have been used by someone with mpox, which could transmit the infection through indirect contact or respiratory droplets from sneezing or coughing.<sup>3,8</sup> Similar to lessons learned from the COVID-19 pandemic, it is important for individuals to continue to wash and apply sanitizer to their hands to prevent all types of transmission.<sup>8</sup> In addition to these preventive measures, vaccination may be an

option to lower the spread of the virus, especially in high-risk individuals.

Historically, the smallpox vaccine has been administered to prevent mpox infection due to the similarities between the 2 viruses.<sup>11</sup> The improvement of clinical symptoms and prevention of mpox has been seen with the usage of the following smallpox vaccines: JYNNEOSTM and ACAM200®.<sup>12</sup> JYNNEOSTM is a live-attenuated, nonreplicating orthopoxvirus vaccine that was licensed in 2019 by the US Food and Drug Administration (FDA). It is currently the primary vaccine utilized for the prevention of smallpox and mpox.<sup>13</sup> ACAM200® is used primarily for active immunization for smallpox for patients with a high risk of infection; ACAM200® was licensed by the FDA in 2007 as a replacement for a previous orthopoxvirus vaccine (Dryvax®) which was removed from circulation.<sup>14</sup> Usage of the vaccines is dependent on the patient and their previous health profiles. Importantly, vaccinia immune globulin (VIG) can be administered to patients suffering from adverse reactions to orthopoxvirus vaccinations.<sup>15</sup>

Measures taken to prevent disease can be categorized into either pre-exposure prophylaxis or post-exposure prophylaxis. In accordance with normal protocol, any person in contact with orthopoxviruses such as laboratory personnel or health care providers should be vaccinated as per the Advisory Committee and Immunization Practices (ACIP).<sup>16</sup> The prevalence and contact with orthopoxviruses or orthopoxvirus-infected patients is variable; consequently, vaccination recommendation is on a case-to-case basis. In contrast, post-exposure prophylaxis is far more complex as mpox transmission requires sustained exposure with an infected patient. The CDC has published a detailed guidance protocol to calculate the risk of exposure and to organize a vaccination schedule. As per the CDC, the first vaccination dose should be given within 4 days of first exposure to prevent infectivity. Additionally, there is a window period of 14 days in which a patient can be inoculated to reduce the severity of symptoms of mpox.<sup>17</sup>

Not only are there preventive measures taken to reduce the chances of mpox transmission, but there are also several options relating to the treatment of infection as well. Vaccinia immune globulin was created in the 1960s to alleviate side effects of smallpox vaccination such as eczema vaccinatum and progressive vaccinia. Supportive care is most effective to treat patients with mild to moderate illness.<sup>15</sup> Furthermore, the common medical treatment these patients require is due to associated symptoms relating to the gastrointestinal system in which patients are given oral rehydration through IV to minimize water loss.<sup>18</sup> Antivirals may be indicated for patients with severe illness; more specifically, Tecovirimat is the most common antiviral prescribed to treat smallpox. The mechanism of action of this antiviral works to stop the spread of the virus inside the host.<sup>19,20</sup>

The treatment and prevention of mpox is consistent in accordance with national health organizations such as the CDC and WHO. The University of Toledo Medical Center published an Infection Con-



trol Precautions protocol on September 6, 2022, in which mpox was designated as both Class A (Airborne) and Class C (Contact) precaution for medical professionals in an inpatient setting.

Class A precaution was maintained until mpox diagnosis was confirmed, and smallpox diagnosis was ruled out. Table 1 shows an abbreviated version of the protocol for Class A.<sup>21</sup>

Class C precaution was maintained until lesions were crusted over. Table 2 shows an abbreviated version of protocol for Class C.<sup>21</sup>

**Disparities**

In the recent global outbreak, the majority of cases are found to affect men who have sex with men (MSM) and younger people under the age of 35 years.<sup>8,22</sup> There is much hesitation and concern about the increased stigma and discrimination that may arise by labeling this outbreak as primarily found in MSM. However, the concern of misinformation reaching those that are at higher risk may be more harmful than withholding information concerning the realities of whom this 2022 outbreak is primarily affecting.<sup>8</sup> A recent modeling study exhibits the possible impact that personal decisions and public health interventions related to reducing one-time sexual partnerships, which account for approximately 50% of the mpox virus daily transmissions, have in the potential to delay the spread of the virus. The same model estimates that a 40% reduction in one-time partnerships may yield a 31% decrease in the number of infected patients.<sup>23</sup> Therefore, increasing aware-

ness of risks and symptoms of mpox among both health professionals and individuals within these social groups through methods such as advocacy and education may alter contact patterns.<sup>8</sup>

Other possible factors contributing to high infectivity in certain populations include mutations which could lead to higher transmission rates, coupled with the declining rate of individuals who have received the smallpox vaccine.<sup>3,8,24</sup> Additionally, socioeconomic factors such as the wealth of a nation influence both disease emergence and impact, when comparing low-income and high-income countries.<sup>25</sup> As the world grapples with 2 major public health issues back to back, factors such as the disease testing capacity of a nation, as well as the currently enforced COVID-19 related restrictions, or lack of, have a direct impact on the spread of mpox.<sup>26</sup>

The topic of racial disparities plays a significant role in the study of the recent 2022 mpox outbreak and is of importance looking toward the future of the mpox virus in the Western world. At the time of writing in February 2023, there are currently 30 123 cases of mpox reported in the US and 85 536 global cases reported by the CDC.<sup>27</sup> A major issue in targeting racial disparities is the lack of sufficient data assessing the demographics in the early stages of the US mpox outbreak.<sup>22</sup> In September 2022, less than 50% of the total cases provided by the CDC had information regarding race or ethnicity.<sup>22,27</sup> As of February 2023, this number has risen to 93.3%, exhibiting significant improvement and providing useful insight on potential racial disparities within the US.<sup>27</sup> Further-

**Table 1. Class A Protocol (abbreviated)**

Room	Use of a private airborne infection isolation room (AIIR) with usage of negative pressure ventilation. In case of lack of AIIR, contact Infection Prevention immediately
Notification	Airborne Precaution sign on door of room
Monitoring of AIIR	If the room is not functioning properly in accordance with negative pressure, keep the door closed and contact the facilities management department immediately. Inspect the negative pressure room daily by using the airborne isolation room daily monitor checklist
Respiratory protection	All personnel entering the room must wear either a controlled air purifying respirator (CAPR) or the National Institute for Occupational Safety and Health (NIOSH)-approved N-95 respirator
Personal protective equipment (PPE)	All personnel entering room must wear gown and gloves when required.
Transport and procedures	Patients must remain in the AIIR unless they require essential diagnostic or therapeutic procedures which must be scheduled for the last shift of the day. When the patient is out of the room, they must wear a surgical mask.
Patient equipment	Use a disposable thermometer
Cleaning	Routine cleaning must be completed by staff wearing the proper respiratory protection (as outlined above). If a patient is being discharged, the door must be closed for a minimum of 30 minutes before personnel can enter without respiratory protection.
Visitors	Limit visitors and offer surgical masks to all visitors. Proper handwashing must be followed when entering and exiting the room.



Table 2. Class C Protocol (abbreviated)

Room	Use a private room, the door does not need to be closed. If a private room is unavailable, the patient should be placed in a room with a patient with the same microorganism and resistance pattern, with no additional microorganisms.
Notifications	Place Contact Precautions sign on the door of the room
Personal protective equipment (PPE)	All personnel entering the room must wear a gown and gloves, the gown and gloves must be discarded after usage.
Patient equipment	Disposable thermometers, blood pressure cuffs, and stethoscopes must be used and kept in the room with the patient. No patient care equipment can be shared with another patient without proper disinfectant.
Transport and procedures	Patients must remain in the room unless they require essential diagnostic or therapeutic procedures which must be scheduled for the last shift of the day. When transport is needed, the infected or colonized areas of the patient's body must be covered. Before transport, all personnel must engage in hand hygiene and dispose of all contaminated PPE; personnel should wear clean PPE to handle the patient during transport.
Cleaning	Reusable instruments should be cleaned with appropriate, hospital-approved disinfectant wipes before being used on another patient or exiting the room. Cleaning must be completed with a gown and gloves.
Visitors	Visitors should wear a gown and gloves when they participate in patient care. Proper handwashing must be followed when entering and exiting the room.

more, the states that were initially reporting this demographic information, such as New York, California, and Georgia, were more likely to represent racially diverse populations.<sup>22</sup> As we learned from the early stages of the COVID-19 pandemic, a lack of sufficient comprehensive data on race and ethnicity early on may lead to a misunderstanding of the disease disproportionately affecting certain racial groups more than others. This could have a direct impact on resource allocation and lead to an inequitable distribution of resources such as vaccinations to communities and people most affected. Looking at the cases in late August 2022 in Georgia, 79% of mpox cases were reported in Black residents, while only 45% of those patients received the JYNNEOS™ vaccine. Without data considering how certain racial groups may be disproportionately affected, poor vaccine distribution may result in worse outcomes for these patients most impacted by the virus.<sup>22</sup> Data from the CDC show that Black and Latinx patients comprise the majority of cases since July 2022. Additionally, the rate of Black patients affected has shown an overall decrease over time, while the rates of Latinx patients have increased.<sup>27</sup> An emphasis on educating physicians, patients, and staff on collecting data with standardized inclusive race and ethnicity reporting over the entire US will highlight communities disproportionately affected.<sup>22</sup>

In the context of disparities, it is also important to consider where this virus may be spreading with high transmission rates that also may be disproportionately affecting a specific racial group. One such place is prisons across the Western world, such as in Europe

and the US, with the highest incarceration rate in the world.<sup>28,29</sup> Factors such as overcrowding, exchange of clothing and personal items, and poor health care awareness result in prison systems at large contributing to the spread of mpox. In European prisons, there is a significant presence of individuals from mpox endemic countries.<sup>28</sup> Furthermore, compared to the general population, incarceration is higher among sexual and gender minority (SGM) persons.<sup>29</sup> This includes transgender individuals who are at high risk for both incarceration and victimization.<sup>28,29</sup> In the US, Black individuals make up 37.7% of the incarcerated population. Within the population of incarcerated sexual minority men, 27% are Black gay or bisexual, and 34% are MSM.<sup>29</sup> Black MSM are at much greater risk than White MSM for HIV/AIDS infection, yet they are less likely to identify as gay or disclose their sexual identity compared to White MSM.<sup>29</sup> Phenomenons such as race-conscious medical distrust may also negatively impact Black SGM individuals, which could lead to hesitance to seek timely treatment.<sup>29,30</sup> Placing more attention on institutions such as prisons where mpox may spread at high rates can aid in lowering transmission rates of the disease while targeting medical disparities.

In the state of Ohio, where the University of Toledo College of Medicine and Life Sciences is located, the first case of mpox was reported in June 2022. According to the Ohio Department of Health, the process of reporting an mpox diagnosis involves 2 steps. First, all health care providers or any individuals with knowledge of a person diagnosed with mpox must report to the



health district in the area in which the patient resides by the end of the next business day. From there, the health district must report confirmed or suspected infections to the Ohio Department of Health. Since the first diagnosis of mpox in Ohio, there have been 393 total cases reported as of February 28, 2023. Of these cases, the percentage of Black patients accounts for 43.8%, which is the most predominant race afflicted with the mpox virus in Ohio. Lucas County accounts for 15 cases which is far fewer than reported in the county of Cuyahoga in which 156 patients have been recorded.<sup>31</sup> The Toledo-Lucas County Health Department published an mpox information pamphlet on July 26, 2022, which included transmission, symptoms, and a concrete description of what mpox is to ease the fears of the public. Importantly, the health department provided additional information such as a recovery timeline which states that illness resolves within 2 to 4 weeks without specific treatment for mild to moderate cases.<sup>32</sup>

Within the state of Ohio, racial and socioeconomic disparities contribute to the phenomenon of Cuyahoga County's large number of cases. This is illustrated as approximately 61% of the cases within Cuyahoga County are found within the city of Cleveland, a city which has a population of 60% African American residents. In fact, many of those being diagnosed with mpox in this county are Black and from underrepresented backgrounds. Many of these cases consist of people coinfecting with HIV. To address this, public health officials in Cuyahoga County are prioritizing equity in their vaccine distribution by focusing their attention on reaching underserved and less affluent community members.<sup>33</sup>

It has been evident that a limited vaccine and resource supply has hindered Cuyahoga County citizens from being vaccinated in comparison to other parts of Ohio, such as Columbus, where mpox rates are lower.<sup>33,34</sup> For example, nearly 2000 more vaccinations have occurred in Franklin County, which includes the city of Columbus, than in Cuyahoga County, despite Cuyahoga County having the overwhelming majority of the mpox cases in Ohio. In Columbus, the demographics within the gay community show a larger White and affluent population, where responses to vaccine rollout programs may be completely different than in a city like Cleveland, where more vaccine education and outreach must be done to reach gay Black men who are primarily affected.<sup>34</sup> In an analysis performed by Kaiser Family Foundation, it was found that, nationwide, mpox case rates are over 5 times greater among Black individuals than White individuals. Other populations particularly vulnerable also include Latinx people and Native Hawaiian and Other Pacific Islanders (NHOPI).<sup>35</sup> In addition, medically uninsured people should be of particular focus as vaccine outreach initiatives ensue. In the state of Ohio, 15% of the African American population and 30% of the Hispanic population are uninsured.<sup>36</sup> These minority populations already face barriers to health care education, but the inability for access to health will lead to negative lifestyle choices and health care through generations.

Such disparities found within the state of Ohio illustrate the complexities involved in vaccine distribution and addressing stigma within the LGBTQIA+ population embedded within certain racial groups. Currently, plans to distribute vaccines in Cuyahoga County aim to target health care settings, and community-based entertainment venues such as gay bars.<sup>33</sup> To further improve accessibility, the Cleveland Department of Public Health has scheduled several vaccine clinics that do not require appointments or preregistration.<sup>33</sup>

Numerous actions and methods exist to help target disparities in the identification and treatment of mpox. First, similar strategies utilized during the COVID-19 pandemic should be leveraged such as isolation procedures when sick, contact tracing, and the use of personal protective equipment (PPE) such as face masks.<sup>28</sup> Since the COVID-19 pandemic, many countries have increased their breadth of molecular testing, trained health care personnel, genomic surveillance, quality of health care interventions, and have enhanced both sanitary infrastructure and evidence-based guidelines.<sup>25</sup> All of this has aided in the prevention of the spread of the mpox virus. Prioritizing data integration and collaboration between fields including public health, medicine, and scientific research will continue to aid in tackling misinformation and promoting efficient risk communication.<sup>25</sup> In addition, boosting the number of immunization campaigns may help lower spread of the virus in at-risk populations.<sup>8</sup> Increasing funding in public health and epidemiology sectors, as well as improving electronic reporting technologies, will aid in data transparency and collaboration.<sup>22</sup>

With the tools and data readily available, our collective responsibility is to protect the most vulnerable populations, who have historically suffered from structural inequities, from these reemerging outbreaks. We have seen the damaging effects of racial and socioeconomic disparities in the contexts of the HIV/AIDS epidemic and the COVID-19 pandemic. Furthermore, to prevent future outbreaks from spreading globally, greater attention must be placed on epidemiology and health care in the non-Western world where diseases may first develop. The initial neglect that the Western world exhibited toward mpox as it increasingly developed in Africa was eerily similar to the neglect exhibited when outbreaks such as Ebola and COVID-19 were developing in the non-Western world.<sup>24</sup> Increasing advocacy, resources, public health planning, research funding, attention, and support for the scientific community will help countries have a response system readily available when future outbreaks arise. It is of utmost importance that we employ the lessons learned from past public health emergencies to continuously inform decisions regarding both mpox and future outbreaks to come.

It remains as crucial as ever for health care professionals, public health officials, and Ohioans to remain informed on disparities affecting our state and nation. The mpox virus has been significantly unexplored in terms of long-term health consequences that may negatively and disproportionately affect certain racial





groups.<sup>37</sup> Increasing advocacy and education across vulnerable communities through public health initiatives will help avoid misinformation or confusion in the long term. As citizens and public health officials continue to collaborate to lessen medical disparities, Ohio will remain a strong example to states across the nation to limit the spread of mpox and future infectious diseases.

### PUBLIC HEALTH IMPLICATIONS

The rise of mpox infections in 2022 was unexpected for public health officials and health care personnel who were still recovering from the COVID-19 pandemic. Mpox is an orthopoxvirus that is less clinically severe than smallpox and was first discovered in the 1950s. Originating first in Western and Central Africa, mpox has recently spread to non-endemic countries including the US in 2022, although this is not the first instance of mpox spread into the Western world.<sup>2</sup> Mpox is spread from either animal to humans or humans to humans. Human-to-human transmission occurs when an individual has direct contact with an infected individual via bodily or respiratory fluids, rash, or fomites. Unfortunately, there is no approved treatment specified for mpox virus, but organizations such as the CDC quickly deployed public health guidelines to demonstrate preventive methods and treatments based upon smallpox.<sup>7</sup> Prevention guidelines for healthy adults, immunocompromised, and adolescents were established to reduce the risk of disease or complications because of the unique characteristics of the 2022 outbreak.<sup>5,38</sup> Most importantly, people with a high risk of illness were given smallpox vaccines which included: JYNNEOS™ and ACAM200®.<sup>8</sup> In the 2022 outbreak, the majority of cases affected MSM and adults under the age of 35 years. Although there is no one definitive reason why, possible explanations lie in the complex sexual network and patterns within this population that make it easier for the virus to spread quickly. Employing all resources available to eliminate stigma and discrimination toward the MSM community is an absolutely necessary action to limit the spread of the virus. Transmission is likely to increase if individuals within the MSM community feel alienated or ashamed to discuss this disease with their health care providers. There remains a dire need for comprehensive demographic mpox disease data as there are numerous racial and socioeconomic factors at play. The lack of sufficient data to characterize the disease's impact has allowed for gaps in public health efforts causing insufficient prevention, education, and lack of vaccination in Latinx and Black communities. The damaging effect of racial and socioeconomic health care disparities is clear in the transmission of mpox in prisons, institutions that contain a strikingly higher number of sexual and gender minority persons. Poor health care awareness has been a key factor in the spread of mpox. To create long-term change and build a proper system to manage mpox outbreaks, it is necessary for public health initiatives to focus on providing strict guidelines that encompass practices common to the COVID-19 pandemic such as isolation, contact tracing, and the use of PPE. In the current digital age, the process of data integration and validation between health care workers such as family medicine practitioners, public health

experts, and research scientists needs to be established to promote efficient communication regarding misinformation, public health initiatives, and preventive methodology.

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