

# Application of Biostatistical Models in Public Health under Mpox Virus

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**Abstract.** Since January 1, 2022 last year, many countries outside Africa have begun to have outbreaks of Monkeypox (Mpox) virus. The first case of Mpox transfusion was confirmed on 16 September 2022 Chinese mainland. In order to prevent major public health events, the aim of this study is to predict which populations in China are more susceptible to Mpox virus infection. There are two main research methods used in this paper: literature research method and statistical analysis method. The proportion of male cases in different groups was mainly analyzed separately, and the proportion of the data was determined by a 95% confidence interval. Second, analyze the true proportions of these factors through demographic information. Semen samples and rectal swabs of the type from the confirmed case are then transmitted to determine how Mpox virus is transmitted. Finally, sex-age (proportion hospitalized) was counted. The results of the experiment are: the proportion of male cases is the highest, and the true proportion of male sex and sexual transmission ratio of the influencing factors is the highest. The main types of transmission are: sexual contact, other, and between people. Men in the 18-49 age group and women in the 18-59 age range had the greatest hospitalization rates, respectively. The conclusion is that men who have sex with men, sex actors, HIV-positive patients, women aged 18-59 and men aged 18-49 are the main target groups in China and are susceptible to Mpox virus.

**Keywords:** Monkeypox virus, public health, statistical analysis method.

## 1. Introduction

In recent years, Monkeypox (Mpox) virus has slowly emerged in the public eye and has become an emerging problem. According to a fact sheet from the World Health Organization (WHO), According to the information that is now available, the first case of the viral zoonotic disease mpox was identified in 1970 in a nine-year-old child in the Democratic Republic of the Congo. Since then, it has been primarily found in the rainforests of Central and West Africa.

However, in recent years, it has started to spread to other continents. The Mpox virus sequence is still expanding. According to the Mpox virus database published by the National Center for Bioinformation (CNGB) and the National Genome Sciences Data Center (NGDC). On September 16, 2022, mainland China also reported the discovery of the first imported Mpox case, raising further concern for people. Through consulting some domestic and foreign academic journals, it was reflected that currently most countries have not established disease control measures for Mpox virus and the development of drugs has not made much progress. More advice on Mpox prevention and treatment guidelines. Therefore, in order to prevent the large-scale outbreak of Mpox in China, a biologic statistical model can be established based on some phenomena and data to predict which groups of people are more susceptible to Mpox virus infection in China.

This article Human Mpox:Based on 214 patients and 2,510 contacts during five years of data collecting in Zaire. As a result, human Mpox consists of four consecutive cases, with most primary cases of Mpox (caused by infection from wild animals) failing to cause even a single infection in contacts [1]. Then, this article was published. In order to evaluate the protection provided by previous smallpox vaccination and the potential for virus transmission in unvaccinated communities, as well as to support the discontinuation of smallpox vaccination based on evidence that the virus is less contagious than smallpox, five years of data on Mpox in Zaire are necessary [2].

The Detection of Mpox in Humans in the Western Hemisphere reported that the author took blood and tissue samples from 11 patients and one prairie dog for analysis. The conclusion is that most

patients present with fever, headache, and sweating as in Africa, and that the potential host range of Mpox virus in its early stages often far exceeds that of African species. The opinion is that there has been little or no transmission between these eleven persons, but most of them have been clawed by animals.[3]. A Family Cluster in the Midwest of the United States can learn that of the three family members who had the Mpox virus, two simply experienced a rash disease, and the third required hospitalization for serious encephalitis. The family members with the mildest clinical course had been previously vaccinated against smallpox. The final findings are that screening should be expanded to include Mpox where appropriate, such as the presence of unusual rashes, contact with animals, or recent travel to Africa [4].

Author Nolen Ld noted a surge in MPX infections in the country through a regional surveillance system. There is little information available about how MPX enters the neighborhood and the elements that contribute to transmission within the home. The result reached was that school-age males were both the group most frequently affected overall and the person's most frequently recognized as the first person infected in the household. Using the same plate or cup as the primary case while sleeping in the same room or bed was another risk factor for contracting MPXV in a family. The ingestion or processing of wildlife did not pose a major risk. The mucosa may become infected with the virus during any actions linked to a higher risk of MPXV transmission.[5].

This overview of emerging Mpox outbreaks in West and Central Africa 1970-2017 focuses on the need to improve surveillance capacity, laboratory diagnosis, and infection control measures in countries where Mpox is endemic in order to respond effectively. Gaps in Mpox epidemiology and viral ecology need to be filled, and plans, recommendations and measures for prevention and control of Mpox need to be strengthened. The two Mpox viruses had different epidemiological and clinical characteristics. The epidemiological and clinical characteristics of both Mpox viruses were different. DNA sequence analysis can be used to understand the characteristics of virus strains and populations, so it is necessary to further strengthen the research on the characteristics of genetic differences among different clays [6]. According to the above literature review, it is proved that some phenomena and data can be used to establish a biostatistical model to predict which groups of people are more susceptible to Mpox virus infection in China.

Patients with Mpox associated with this epidemic have had a range of clinical presentations up to this point. Many people in this epidemic don't have the classic Mpox clinical symptoms. Some examples of atypical characteristics that have been mentioned include the presentation of only a few or even just one lesion [7]. According to Dr. M C at UKHSA. The illness is mostly spread by close contact between individuals in connected sexual networks, with the majority of Mpox cases in the UK still occurring in gay, bisexual, and other men who have sex with men (MSM) [8].

There were 336 laboratory-confirmed cases of monkeypox in the UK as of June 8th, 2022. The majority of cases are male and a large fraction are inhabitants of London [9]. As the majority of patients who were spoken with during interviews admitted having intercourse with unknown or impromptu partners. This highlights the importance of determining the incubation period so that public health information and interventions can be properly understood and adjusted. Ea et al. emphasize that in recent times, the situation of partners who have had sex may explain the outbreak of Mpox in many countries, although it is rare for related means such as sexual intercourse to spread between people [10].

## 2. Methods

### 2.1. Data Sources

The relevant data on Mpox virus used in this article are from the Mpox virus section of the official website of the World Health Organization (WHO). The data period is from January 1, 2022 to December 23, 2022. ([https://worldhealthorg.shinyapps.io/mpx\\_global/](https://worldhealthorg.shinyapps.io/mpx_global/)).

## 2.2. Variables

The variables used in this paper include: Indicator selection: Proportion of male cases of sex with men, Proportion of male cases. Demographic information, Transport type, Age-sex (proportion hospitalized).

Finding out whether there is a higher prevalence of the disease among males who have sex with other guys is the first variable in Figure 1. so that they can pay more attention to this group of people. Figure 2 complements the data in Figure 1. The table 1 variable provides information on what people do and don't do, as well as the percentage of people who also have other diseases who have Mpox virus infections. It also completes information on men who have sex with other men. The target population is reduced by using the three factors of the chart to determine which routes of transmission are more prone to disease. The four variables of the chart count the proportion of hospitalizations according to both age and gender, and we can tell who is more likely to be affected by men, women and children.

## 2.3. Method

There are three main research methods used in this paper: quantitative analysis method, literature research method, and statistical analysis method. The characteristics, relationships and sources of Mpox virus infection were analyzed. It mainly takes WHO data as the main data source, and is processed and sorted into chart form, and obtains the results and future development trends of the data. Then, through the research of the collected literature on Mpox virus, we can explore the transmission mode of Mpox virus and the status of patients, and draw their own research topics from it. Finally, based on the analysis and study of statistical data, it is a research method to understand the association between Mpox virus and susceptible populations and the incidence trend of Mpox virus, so as to achieve prediction of the target population.

## 3. Results and discussion

Mpox virus data obtained from the WHO's official website is updated once a week, including variables such as transmission type, age, gender, sexual orientation and so on. To determine more accurately which population is susceptible to Mpox virus. According to today's official statistics, the 95% confidence interval is grey when assessing the proportion of groups who have sex with men first separately, and the proportion of men who have sex. Second, demographic information considers the true proportions of these factors by "yes" or "no." Semen samples and rectal swabs from confirmed cases are then transmitted to determine which specific modes of Mpox virus transmission and which categories to exclude. Finally, the statistics on gender, age, hospitalization ratio are made into charts using EXCEL to present them more intuitively.

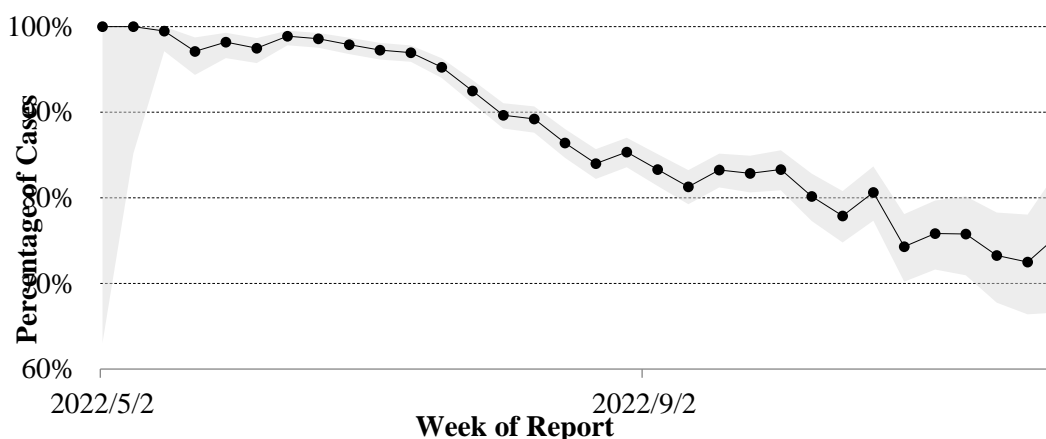
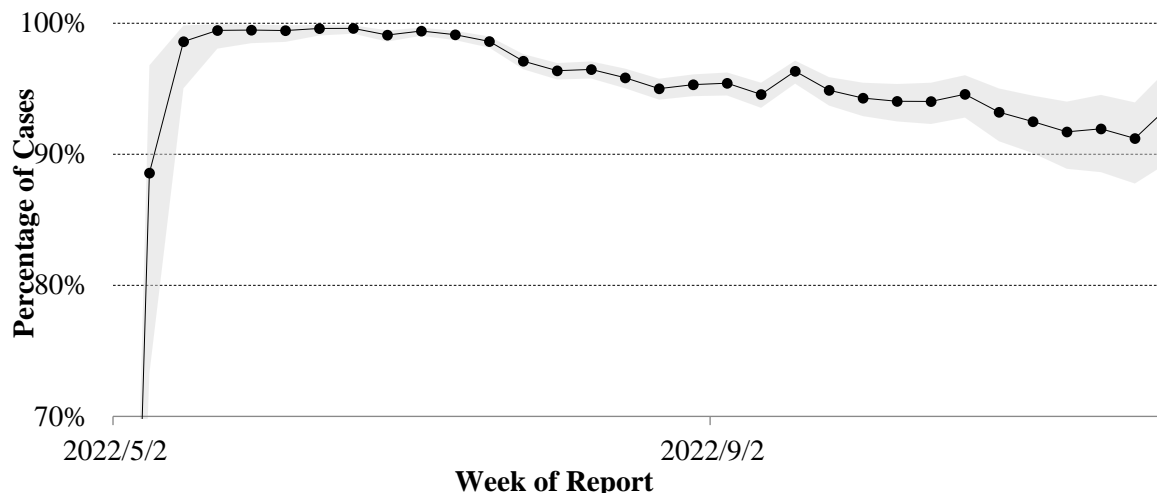


Figure 1. Proportion of cases who are men who have sex with men

From the known data, as figure 1, it can be seen from the chart that from May 2, 2022 to September 2, 2022 and beyond, it can be seen from the table that the proportion of male cases having sex with men has shown a downward trend, but the proportion of male cases still occupies a high position.



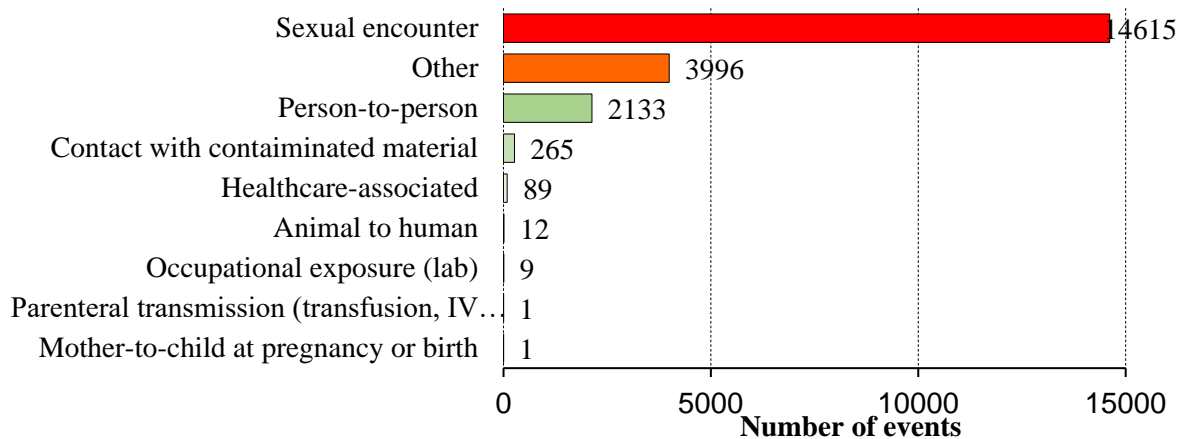
**Figure 2.** Proportion of cases Who are male

From the known data, as figure 2, it can be seen that the proportion of male cases increased particularly rapidly in the period between May 2, 2022 and September 2, 2022, and was very close to 100%. However, in the following years, the proportion of male cases fluctuated and decreased, but it was still as high as more than 90%.

The Table 1 produced from the known data show that men who have sex with men and sexually transmitted the proportion according to the true proportion of these factors shown in the tables. The proportion of HIV-positive is balanced. Health workers, travel history, and hospitalization rates are low. The proportion of cases admitted to intensive care units and deaths is extremely low.

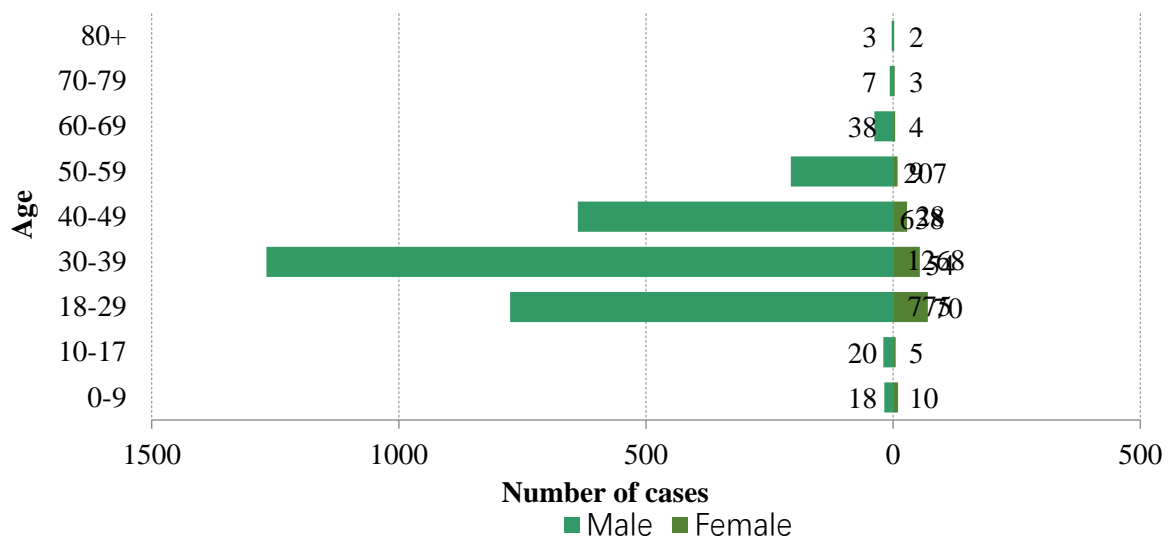
**Table 1.** Demographic information

	Reported values		Unknown or Missing Value
	Yes	No	
Men who have sex with men	25868(84.4%)	4770(15.6%)	49132
HIV-Positive	16486(48.1%)	17794(51.9%)	45490
Health worker	1176(4.3%)	26191(95.7%)	52403
Travel History	2280(14.4%)	13587(85.6%)	63903
Sexual Transmission	14610(69.2%)	6506(30.8%)	58654
Hospitalised	3828(7.3%)	48790(92.7%)	27152
ICU	42(0.3%)	15673(99.7%)	64055
Died	28(0.1%)	52297(99.9%)	27445



**Figure 3.** Mpxv cases by transmission type

As figure 3 shows, the type of transmission information that can be obtained from the chart is: sexual contact, other, the number of events between people accounts for the main part of the transmission. Exposure to contaminated substances, medically relevant, animal-to-human, occupational exposure (laboratory), Mother-to-child transmission occur in a small proportion through parent-to-parent transmission, or during pregnancy or childbirth.



**Figure 4.** Age-sex ratio (hospitalization ratio)

As figure 4 shows, the information that can be obtained from the charts is: women aged 50-59, 40-49, 30-39, and 18-29 years have the highest proportion of hospitalizations. Men have the highest rates of hospitalization between the ages of 40-49, 30-39 and 18-29.

#### 4. Conclusion

After a series of data analysis, the results of these experiments were summarized: it can be predicted that men who have sex with men, sexual actors, HIV-positive patients, women aged 18-59 and men aged 18-49 are the main target groups in China and are susceptible to Mpxv virus. Of course, those small influencing factors cannot be ignored, because there is also an upward trend.

The main target population in China predicted by the experimental results can help the public health department to prevent Mpxv virus in advance. When Mpxv virus is found, the target population

can be detected as soon as possible, and the infected population can be isolated and treated to prevent a large-scale outbreak of Mpox virus.

In view of the existing research results, the advantage of this paper is to analyze the earliest research reports in Africa, and combine the latest content of recent research reports to have a more comprehensive understanding of the causes and transmission and development process of Mpox virus. Through the analysis of recent patient data, it is also better known the severity of symptoms, the source of transmission and the age-to-sex ratio of patients currently infected with Mpox virus.

There are also certain problems in this study, that is, the statistical patient information data is not so sufficient, and there is no genetic information about Mpox virus, and it is impossible to conduct more in-depth analysis of the impact and transmission of Mpox virus.

One suggestion is that the World Health Organization or relevant departments can count more sick people, and conduct more detailed statistics on how Mpox virus is transmitted and the types of work that infect people. It is hoped that in the future, there will be more advanced prediction methods for Mpox virus and other viruses, and vaccines against Mpox virus can be successfully developed as soon as possible.

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