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Generative AIs in Detecting Mpox Related Misinformation: ChatGPT and Gemini

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Abstract
This study investigates the performance of two generative AI systems, ChatGPT and Gemini, in detecting Mpox-related misinformation. As the Mpox outbreak in recent times led to widespread dissemination of both accurate and false information, particularly on social media platforms, the potential of AI in combating health misinformation has gained attention. Ten commonly circulated pieces of Mpox misinformation were selected through a content analysis of news stories and social media posts. These false claims were presented to ChatGPT and Gemini, and the AI systems were asked to determine whether the information was true or false. Their responses were then cross-checked against fact-checks from authoritative sources like AFP Fact Check and public health databases such as the World Health Organization (WHO) and Centers for Disease Control and Prevention (CDC). The results demonstrated that both ChatGPT and Gemini performed admirably in identifying false information and providing accurate data about Mpox. Their responses aligned closely with information from authoritative sources. The study's findings suggest that these AI tools could be valuable assets in combating the spread of misinformation during disease outbreaks. However, the researchers emphasize that AI systems should not be considered infallible and should be used in conjunction with human expertise and authoritative sources. The study calls for further research to fully realize the potential of AI chatbots in addressing health misinformation.
Keywords: Mpox, Misinformation, AI, ChatGPT, Gemini

Introduction

Mpox, formerly known as monkeypox, is a viral zoonotic disease caused by the Monkeypox virus (MPXV), a member of the Orthopoxvirus genus that has recently gained global attention due to its unprecedented spread outside endemic regions (WHO, 2023). First identified in 1958 in laboratory monkeys, the initial human case was reported in 1970 in the Democratic Republic of Congo (DRC). The virus has two primary clades: Clade I (Central African) and Clade II (West African), with further subdivisions. The global outbreak in 2022 was predominantly caused by Clade IIb, lineage B.1, marking a significant spread to countries without previous MPXV presence. By 2024, Clade I cases were reported beyond the five Central African

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countries where it was historically endemic, potentially due to declining smallpox vaccine immunity and evolving environmental and social factors. The World Health Organization (WHO) declared a public health emergency of international concern following an outbreak that spread to at least 13 additional African nations beyond the DRC, with cases also reported in Europe and Asia on August 14, 2024 (WHO, 2024). The disease typically manifests with symptoms including fever, rash, and swollen lymph nodes, lasting 2-4 weeks (CDC, 2022).

The outbreak sparked widespread concern and led to the rapid dissemination of information, including misinformation, particularly through social media platforms. The spread of misinformation during disease outbreaks can significantly impact public perception of the illness and the implementation of public health measures. While misinformation has always existed, its proliferation has accelerated in recent decades due to the increased use of social media and internet-based information globally. The rapid dissemination of misinformation during disease outbreaks poses a significant threat to public health efforts and societal well-being. Misinformation often exaggerates transmission risks or propagates false claims, leading to stigmatization and impeding public health efforts (Titanji et al., 2022). Misinformation can undermine the credibility of public health organizations, governments, and scientists, as well as hinder the adoption of evidence-based interventions (Gagnon-Dufresne et al., 2023). The Mpox outbreak in recent years exemplified this challenge, with a deluge of misinformation circulating across social media platforms and online communities.

Existing theoretical frameworks suggest that the proliferation of misinformation is a complex phenomenon influenced by various factors, including cognitive biases, lack of scientific literacy, and the amplification effects of social media algorithms (Chou et al., 2018; Tandoc et al., 2022). Moreover, studies have highlighted the role of emotional appeals, conspiracy theories, and the erosion of trust in institutions as drivers of misinformation acceptance (Bridgman et al., 2020; van der Linden et al., 2021).

Addressing this multifaceted challenge requires a comprehensive approach that incorporates insights from various disciplines, including psychology, communication studies, and information science. Proposed solutions range from improving science communication and digital literacy to leveraging the power of social media platforms to combat misinformation through content moderation and algorithmic adjustments (Treen et al., 2020).

One promising avenue for misinformation detection and correction is the utilization of artificial intelligence (AI) systems. Artificial Intelligence (AI) is a complex term. AI can be defined in simple terms as a machine exhibiting behavior that would be considered intelligent if displayed by a human. A more comprehensive definition describes AI as the study of systems that perceive their environments and take actions that affect those environments. However, AI is not confined to a single concept. Efforts to gain a deeper understanding of AI are immediately met with challenges, and paradoxically, as our knowledge grows and uncertainty diminishes, the term "AI" itself remains ambiguous, capable of being employed in various ways depending on the context (Kok et al., 2009). Mitchell (2019) stated that artificial intelligence encompasses any computer-performed task that would typically require human intelligence. However, Miller (2019) argues that defining "AI" is challenging, whether attempting a singular definition or employing a pluralistic approach. The term "Artificial Intelligence" can be understood as referring to the diverse methods by which

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non-human systems can be programmed to learn from experience and emulate the actions of highly intelligent humans. AI has emerged as a potential tool for combating misinformation. Advances in natural language processing and machine learning have led to the development of generative AI models capable of understanding and generating human-like text. Generative AI systems, such as ChatGPT and Gemini, have demonstrated capabilities in various domains, including natural language processing and information analysis (Patil et al., 2024).

Theoretical studies in the field of AI and misinformation have explored the potential of these models to identify false claims, provide accurate information from authoritative sources, and engage in conversational fact-checking (Zhou et al., 2022). However, empirical research evaluating the real-world performance of these AI systems in combating health misinformation is still limited.

This study aims to explore the performance of these generative AI systems in detecting Mpox-related misinformation. It has tried to contribute to this growing body of knowledge by assessing the capabilities of ChatGPT and Gemini in detecting and responding to Mpox-related misinformation. By leveraging these state-of-the-art AI models, the research seeks to gain insights into the potential of AI-driven solutions in addressing the critical challenge of health misinformation during disease outbreaks.

The findings of this study could inform the development of more effective strategies for harnessing the power of AI to counter misinformation, while also highlighting the limitations and ethical considerations that must be addressed. Ultimately, the goal is to contribute to the ongoing efforts to promote evidence-based public health communication, safeguard societal well-being, and foster an informed and resilient global community in the face of future disease outbreaks.

Literature Review

Information Dissemination in Public Health Emergencies

The dissemination of information during disease outbreaks is a complex phenomenon that lies at the intersection of science, technology, and human behavior. On one hand, the rapid and widespread sharing of accurate information is crucial for effective public health response and disease containment efforts (Voeten et al., 2009). Timely access to credible data can guide preventive measures, shape public perceptions, and ultimately improve health outcomes (Hall et al., 2003).

However, the very channels that enable the efficient transmission of authoritative information also facilitate the proliferation of misinformation. Social media platforms, in particular, have emerged as double-edged swords in this regard. While they allow for real-time communication and active public engagement, they also provide fertile ground for the spread of false or misleading information, often outpacing official health communications (Wilson & Wiysonge, 2020).

This dichotomy highlights the inherent tension between the democratization of information and the maintenance of epistemological integrity. The ease with which information can be shared in the digital age has challenged traditional notions of

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expertise and authority, potentially eroding public trust in scientific institutions and evidence-based practices (Gagnon-Dufresne et al., 2023).

The impact of misinformation during disease outbreaks extends far beyond the realm of information itself. It has profound implications for global health, societal well-being, and the pursuit of scientific understanding. As demonstrated by the COVID-19 pandemic, misinformation can obstruct evidence-based solutions, fuel vaccine hesitancy, and undermine public health efforts, ultimately costing lives (Mahmud et al., 2023). Misinformation also contributes to the stigmatization of certain communities, which can hinder disease prevention and treatment efforts within those groups (Titanji et al., 2022). This phenomenon highlights the complex interplay between information, social dynamics, and health outcomes, underscoring the need for a holistic and multidisciplinary approach to addressing misinformation.

Mpox-Related Misinformation

The global outbreak of Mpox brought the disease into the spotlight, leading to a surge of information and, unfortunately, misinformation. This literature review examines the current research on Mpox-related misinformation, its spread, impact, and efforts to combat it. Social media platforms have played a significant role in the dissemination of Mpox-related information and misinformation. Edinger et al. (2023) analyzed Twitter posts during the early stages of the 2022 Mpox outbreak and found that misinformation spread rapidly, often outpacing official health communications. The study identified several common themes in Mpox misinformation, including false claims about transmission routes, severity, and origins of the disease. Similarly, Otu et al. (2022) highlighted the "infodemic" surrounding Mpox, noting that the rapid spread of misinformation on social media platforms posed significant challenges to public health efforts. They emphasized the need for proactive communication strategies from health authorities to counter false narratives.

The spread of Mpox misinformation has had tangible effects on public health efforts and individual behaviors. Cheung et al. (2023) conducted a survey that revealed a correlation between exposure to Mpox misinformation and vaccine hesitancy. Respondents who reported frequent encounters with misinformation on social media were significantly less likely to express willingness to receive the Mpox vaccine. Moreover, Titanji et al. (2022) discussed how misinformation contributed to stigmatization of certain communities, particularly men who have sex with men (MSM). This stigmatization, fueled by inaccurate information about transmission patterns, potentially hindered testing and treatment efforts within these communities.

Studies have uncovered various types of misinformation surrounding Mpox that were widely circulated. Morejón-Llamas and Cristòfol (2023) analyzed fact-checking websites and found several recurring themes in the disseminated misinformation. One category involved inaccurate claims regarding how Mpox is transmitted from person to person. Another centered on conspiracy theories speculating about the origins of the Mpox outbreak without evidence. Misinformation also spread misleading details about the symptoms of Mpox and the severity of the disease. Additionally, unsubstantiated methods for preventing or treating Mpox were promoted as misinformation. Furthermore, false connections were drawn between the Mpox virus and COVID-19 vaccines, creating unfounded links between the two distinct health issues.

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Efficiency of Generative AIs

Generative AI technologies have shown promise in various applications, including the detection of misinformation. Studies have demonstrated the potential of these systems in fields such as science, law, and medicine (Shen et al., 2023; Gilson et al., 2023). However, their performance can vary depending on the complexity of the task and the specific domain of knowledge (Deng & Lin, 2022). Recent research has compared the performance of different AI systems, such as ChatGPT and Google Bard, in various tasks. While some studies have found ChatGPT to outperform other systems in scientific and medical fields, others have shown comparable performance between different AI platforms (Koga, Martin & Dickson, 2023; Lim et al., 2023).

A study at the University of Liverpool's computer science department found that ChatGPT struggled to provide appropriate responses when queried about computer skills (Huang et al., 2023). However, in other domains, ChatGPT has shown promising results. For instance, it performed well in science and legal exams, particularly excelling in essay sections of law exams, although its performance declined in multiple-choice questions and was notably weaker in mathematical problems (Shen et al., 2023).

Research has also revealed that ChatGPT's responses often relate to real-world cases, with the specificity depending on the prompt's formulation (Choi et al., 2023). A comparative study between ChatGPT and ChatGPT Plus in the context of ophthalmology exams demonstrated that ChatGPT Plus frequently outperformed its predecessor. This superior performance was attributed to ChatGPT Plus's ability to transcend the probabilistic limitations of the original ChatGPT. Moreover, the study noted that regenerated responses from both versions generally maintained consistency (Antaki et al., 2023). In a medical evaluation conducted in the United States, ChatGPT demonstrated superior performance compared to GPT-3 and InstructGPT. While these AI platforms didn't achieve perfect accuracy, they successfully answered a significant number of questions. However, their performance notably declined when faced with more complex inquiries (Gilson et al., 2023).

A similar trend was observed in assessments related to neurosurgery and oral surgery. In these evaluations, GPT-4 (also known as ChatGPT Plus) outperformed both GPT-3.5 and Google Bard on comparable queries. Interestingly, while GPT-3.5 didn't surpass ChatGPT Plus, it did show better performance than Google Bard. However, when it came to addressing image-related questions, both ChatGPT and Google Bard exhibited commendable capabilities (Ali et al., 2023).

In recent developments, generative AI systems have shown proficiency in recognizing various types of misinformation. The application of AI in detecting fake news represents an innovative approach in our contemporary world (Patil et al., 2024).

Challenges of Misinformation

At its core, the proliferation of misinformation during disease outbreaks represents a fundamental challenge to our understanding of knowledge and truth. It calls into question the traditional sources of authority and expertise, as well as the mechanisms by which information is validated and disseminated. In this context, the role of artificial intelligence (AI) in combating misinformation takes on a deeper conceptual significance. AI systems like ChatGPT and Gemini represent a convergence

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of human knowledge and machine learning, potentially redefining the very nature of expertise and the locus of knowledge production.

As these systems demonstrate the ability to synthesize and present information in a human-like manner, they raise questions about the relationship between AI and human agency in the pursuit of truth. While AI may offer powerful tools for identifying and countering misinformation, its outputs should not be accepted as absolute truth without critical evaluation and cross-checking against authoritative sources.

The potential use of AI in combating health misinformation also carries significant ethical implications. As these systems become more prevalent and sophisticated, it will be crucial to develop robust ethical frameworks and governance structures to ensure their deployment aligns with principles of transparency, accountability, and respect for human autonomy and dignity.

Issues of bias, privacy, and the potential amplification of misinformation must be carefully considered and addressed. Furthermore, the integration of AI into public health communication strategies should not undermine human agency or diminish personal responsibility for verifying information.

Ultimately, the literature suggests that addressing misinformation during disease outbreaks requires a multifaceted approach that combines technological solutions with human expertise, critical thinking, and a commitment to promoting evidence-based information from authoritative sources. It is a complex challenge that necessitates a nuanced understanding of the interplay between science, technology, and societal dynamics, as well as a willingness to confront the epistemological and ethical questions that arise in the pursuit of truth and knowledge.

Method

Research Design

This study employed a qualitative research approach to investigate the performance of ChatGPT and Gemini in detecting Mpox-related misinformation. The research paradigm was interpretivism, as the study aimed to interpret the responses of the AI systems and compare them with authoritative sources to assess their accuracy.

Population and Sample

The research targets were the generative AI systems ChatGPT and Gemini. The sample consisted of ten commonly circulated pieces of Mpox misinformation identified through a content analysis of news stories and social media posts.

Data Collection Techniques

The ten selected pieces of misinformation were presented to ChatGPT and Gemini, and their responses were recorded. The AI systems were asked to determine whether the information presented was true or false.

Data Analysis Techniques

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The responses from ChatGPT and Gemini were cross-checked with fact-checks from reputable sources such as AFP Fact Check (https://factcheck.afp.com/doc.afp.com.36EN4YM) and FactCheck.org (https://www.factcheck.org/issue/monkeypox/), as well as public health databases from the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC). The accuracy of the AI systems' responses was evaluated by comparing them with the information from these authoritative sources.

Findings and Discussion

Table 1: Responses of Generative AIs Regarding Mpox-Related Misinformation

Misinformation	Response of ChatGPT	Response of Gemini
Mpox is a new disease.	Mpox is not a new disease. It was first discovered in 1958 in monkeys, with the first human case recorded in 1970 in the Democratic Republic of the Congo. While recent outbreaks have raised public awareness, Mpox has been known to medical science for many years	Mpox is not a new disease. It has been known for decades, particularly in Central and West Africa. However, the recent global outbreak has increased awareness of it.
Mpox was created in a lab.	Mpox is a naturally occurring zoonotic disease caused by the Mpox virus, which belongs to the Orthopoxvirus genus. It was first identified in monkeys in 1958 and has been present in various animal species and human populations for decades. There is no evidence to support the claim that it was created in a lab.	While Mpox was first identified in laboratory monkeys, it's a naturally occurring virus and was not created in a lab. It has been circulating in nature for centuries, primarily in Central and West Africa.
One can get mpox from a swimming pool.	Mpox is not transmitted through water. It spreads primarily through direct contact with infected skin lesions, body fluids, respiratory droplets, or contaminated materials. The virus does not survive well in chlorinated water, so the risk of transmission through swimming pools is extremely low.	Mpox is primarily spread through close contact with an infected person, including through respiratory droplets, skin lesions, or contaminated materials. It cannot be transmitted through swimming pools.
Mpox is very dangerous.	While Mpox can cause severe illness, particularly in immunocompromised individuals, children, and pregnant women, it is generally not as deadly as smallpox. The case fatality rate varies from 1% to 10% depending on the strain and the healthcare setting. Most	While Mpox can cause severe illness and even death in some cases, it's generally not as deadly as diseases like COVID-19 or Ebola. Most cases of Mpox resolve on

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	individuals recover with supportive care.	their own without medical treatment.
Mpox is a sexually transmitted disease.	Mpox is not classified as a sexually transmitted infection (STI). However, it can spread through close physical contact, including during sexual activity. It is not limited to sexual transmission; it can also spread through non-sexual close contact, such as touching lesions or contaminated materials.	While Mpox can be transmitted sexually, it's not exclusively a sexually transmitted disease. It can also spread through other means of close contact, such as sharing contaminated items or respiratory droplets.
Mpox is a sexually transmitted disease.	Mpox is not classified as a sexually transmitted infection (STI). However, it can spread through close physical contact, including during sexual activity. It is not limited to sexual transmission; it can also spread through non-sexual close contact, such as touching lesions or contaminated materials.	While mpox can be transmitted sexually, it's not exclusively a sexually transmitted disease. It can also spread through other means of close contact, such as sharing contaminated items or respiratory droplets.
Only bisexual men can get mpox.	Mpox can affect anyone, regardless of sexual orientation, gender, or age. While recent outbreaks have shown higher transmission rates among men who have sex with men (MSM), this is due to social and epidemiological patterns rather than a characteristic of the virus itself. Anyone can contract Mpox through close contact with an infected person.	Mpox can affect anyone, regardless of sexual orientation or gender identity. While the initial outbreak in the United States primarily affected men who have sex with men, this does not mean that only this group is at risk.
Monkeypox can lead to being paralyzed.	Monkeypox, now commonly referred to as Mpox, is a viral disease caused by the monkeypox virus. It primarily presents with symptoms like fever, rash, and swollen lymph nodes. While severe cases can occur, leading to complications such as secondary infections, pneumonia, or encephalitis, paralysis is not a recognized symptom or complication of Mpox. The notion that Mpox can lead to paralysis is not supported by scientific research or clinical data.	While mpox can cause a variety of symptoms, including fever, headache, muscle aches, and a rash, it has not been linked to paralysis.

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Mpox is caused by COVID-19 Vaccine.	Mpox is not caused by the COVID-19 vaccine. Mpox is caused by the monkeypox virus, which is an entirely different virus from SARS-CoV-2, the virus responsible for COVID-19. COVID-19 vaccines are designed to protect against SARS-CoV-2 and have no components or mechanisms that would cause Mpox. There is no evidence or scientific basis to support the claim that any COVID-19 vaccine can cause Mpox.	Mpox is caused by a virus called monkeypox virus, and it is not related to the COVID-19 vaccine. The COVID-19 vaccine protects against the SARS-CoV-2 virus, which causes COVID-19.
Mpox is new COVID-19.	Mpox and COVID-19 are entirely different diseases caused by different viruses. Mpox is caused by the monkeypox virus, which is related to the virus that causes smallpox. COVID-19 is caused by SARS-CoV-2, a coronavirus. These diseases' modes of transmission, symptoms, and impacts are different. While both diseases have prompted public health responses, comparing Mpox to COVID-19 in this manner is misleading and incorrect. Mpox does not spread as easily as COVID-19, and the public health risks and impacts are not comparable in scale or severity.	Mpox and COVID-19 are two distinct viruses. While they can both cause respiratory symptoms, they belong to different families of viruses and have different characteristics.

Source: Researchers (2024)

The study revealed the performance of ChatGPT and Gemini in responding to 10 commonly circulated pieces of misinformation regarding Mpox. Based on the statements of public health databases (e.g., WHO, CDC) and responses of fact-checkers, both platforms showed promising results in terms of detecting misinformation and providing accurate information about Mpox.

The evaluation of ChatGPT and Gemini's performance in detecting Mpox-related misinformation yielded encouraging results. When compared against information from authoritative public health sources like the WHO and CDC, as well as responses from established fact-checkers, both AI platforms demonstrated a high level of accuracy in identifying false information and providing correct data. This outcome aligns with the broader trend of generative AI platforms showing potential across various fields, including physics, law, medicine, and image analysis, where they have been tested with varying degrees of success. In the context of public health, as demonstrated by this study, these AI tools have shown particular promise. This finding is significant, especially considering previous research that highlighted ChatGPT's

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superior performance compared to other conversational AI systems in scientific and medical domains (Koga, Martin and Dickson, 2023; Lim et al., 2023). Notably, the current study's results indicate that Gemini's performance is comparable to ChatGPT's, corroborating findings from other recent studies that have shown similar levels of competence between the two platforms (Boissonneault and Hensen, 2024).

Conclusion

The findings of this study demonstrate the potential of generative AI systems like ChatGPT and Gemini to combat health misinformation during disease outbreaks. Their ability to accurately identify false claims and provide factual information aligns with the growing capabilities of AI in various domains, including science, medicine, and information analysis.

However, it is crucial to acknowledge the limitations of this study. The sample size of ten pieces of misinformation is relatively small, and further research with a larger and more diverse set of misinformation is necessary to fully evaluate the AI systems' performance. Additionally, the study focused specifically on Mpox-related misinformation, and the results may not be generalizable to other health contexts or types of misinformation.

Despite these limitations, the study's findings have important implications for the role of AI in public health communication and misinformation management. The proliferation of misinformation during disease outbreaks can significantly hinder public health efforts, undermine trust in authorities, and contribute to the spread of the disease itself (Gagnon-Dufresne et al., 2023). The ability of AI systems to quickly and accurately identify and counter misinformation could be a valuable asset in responding to these challenges.

However, it is essential to view AI as a complementary tool rather than a replacement for human expertise and traditional fact-checking methods. While ChatGPT and Gemini performed well in this study, their responses may not always be flawless, and they could potentially amplify misinformation if not appropriately calibrated or validated against authoritative sources.

Furthermore, the study highlights the broader conceptual question of the relationship between AI and human knowledge. While AI systems like ChatGPT and Gemini can synthesize and present information in a human-like manner, their knowledge is ultimately derived from the data they are trained on. As such, they may perpetuate biases or limitations present in their training data, and their responses should be critically evaluated rather than accepted as absolute truth.

This study contributes to the growing body of research exploring the potential of generative AI in combating misinformation, particularly in the context of public health. The findings suggest that AI systems like ChatGPT and Gemini can be effective tools in identifying and responding to Mpox-related misinformation, aligning with their demonstrated capabilities in other scientific and medical domains.

However, it is crucial to recognize the limitations of this study and the need for further research to fully understand the practical applications and implications of using

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AI for misinformation management. Future studies should explore larger and more diverse datasets, as well as investigate strategies for integrating AI into public health communication and social media fact-checking initiatives.

Ultimately, the fight against health misinformation requires a multifaceted approach that combines AI technologies with human expertise, critical thinking, and a commitment to promoting evidence-based information from authoritative sources. While AI systems like ChatGPT and Gemini show promise, they should be viewed as tools to augment human efforts rather than as infallible solutions.

As AI continues to advance, it will be essential to critically examine its role in knowledge production, dissemination, and the pursuit of truth, while also remaining vigilant against the potential amplification of biases and misinformation. By adopting a nuanced and responsible approach to AI integration, we can harness its potential while upholding the highest standards of accuracy, integrity, and ethical conduct in public health communication and beyond.

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