Proceedings of the International Conference on Industrial Engineering and Operations Management

Publisher: IEOM Society International, USA DOI: 10.46254/AF6.20250179
Published: April 8, 2025

A Conceptualized Framework for Management of Monkey Pox

Peter Maitireni, **Vusumuzi Ncube**, **Thando Sibanda**
Yangekile Dube, and **Sibusisiwe Dube**
Department of Informatics and Analytics
National University of Science and Technology
Bulawayo, Zimbabwe
pmaitireni@gmail.com, vusncnube@gmail.com
thandocatherinesibanda@gmail.com, yange.dube@gmail.com
sibusisiwe.dube@nust.ac.zw

Sinokubekezela P. Dube
School of Engineering
The University of Zambia
Lusaka, Zambia
2023008623@student.unza.zm

Abstract

This systematic literature review presents the integration of the Internet of Things (IoT) in managing monkeypox, emphasizing the necessity of a conceptual framework to enhance disease surveillance, optimize resource allocation, and enable timely interventions. Real-time monitoring, predictive analytics, and automated alert systems can significantly strengthen outbreak response strategies. However, despite the growing use of IoT in healthcare, a crucial gap exists in the availability of dedicated conceptual frameworks tailored specifically for managing monkeypox and similar infectious diseases. Existing research primarily focusses on general IoT applications in healthcare and lacks a conceptual framework for guiding the intended users on what IoT technologies to choose from for the purpose of addressing the unique challenges of managing monkeypox during outbreaks. A conceptual framework is essential for an informed implementation of IoT for disease control and management. Using the Preferred Reporting Items for Systematic reviews and Meta-Analysis (PRISMA) model, 597 articles were reviewed, with 24 selected articles included in the systematic literature review. The findings highlight an increased usage of wearable devices, mobile applications, and cloud-based systems in disease management. The research findings also demonstrate IoT's transformative role in real-time data collection, patient monitoring, and community engagement. However, challenges such as geographic disparities, data privacy issues, and inconsistent technological adoption persist. This study underscores the pressing need for a structured IoT-based framework to bridge this gap in literature, for ensuring equitable and effective management of monkeypox and other infectious diseases through interdisciplinary collaboration, predictive modeling, and proactive public health strategies.

Keywords
Monkeypox, Internet of Things (IoT), Disease Management, Infectious Diseases, Real-Time Monitoring

© IEOM Society International

1. Introduction

The emergence and re-emergence of Monkeypox, a zoonotic viral disease caused by the Monkeypox virus, have highlighted the need for efficient disease management frameworks (Pal and Kirubel 2022). Traditional disease surveillance and management strategies have often proven inadequate in curbing the spread of infectious diseases due to delayed reporting, limited real-time data processing, and inefficient response mechanisms (Karama et al. 2023). With advancements in digital healthcare technologies, the Internet of Things (IoT) presents a promising approach for real-time monitoring, early detection, and effective management of Monkeypox outbreaks (Hasan and Saeed 2022). However, existing literature lacks a comprehensive conceptual framework that integrates IoT for the efficient management of Monkeypox, leaving a critical gap in research and practical implementation. (Wagan et al. 2022). Several studies have explored the role of IoT in healthcare, focusing on infectious disease control, wearable health monitoring, and smart epidemic response systems (Abdulmalek et al. 2022; Lederman et al. 2021). While these studies provide valuable insights, they often lack specificity regarding Monkeypox and its unique epidemiological characteristics. Furthermore, most available frameworks prioritize general epidemic management without considering the specific transmission patterns, symptomatology, and containment challenges posed by Monkeypox (Harapan et al. 2022) This lack of a dedicated IoT-enabled framework for Monkeypox management limits the ability of healthcare practitioners and policymakers to develop targeted strategies for outbreak prevention and control. (Pal and Kirubel 2022).

Additionally, the persistence of Monkeypox outbreaks, particularly in endemic regions, underscores the necessity of a well-structured, technology-driven approach. Existing public health strategies rely heavily on manual contact tracing, laboratory-based diagnostics, and conventional reporting systems, which are often slow and prone to inaccuracies (Harapan et al. 2022) The integration of IoT into a conceptual framework for Monkeypox management could enhance disease tracking, automate data collection, and facilitate real-time decision-making, thereby mitigating the impact of outbreaks more effectively. Given these gaps, it is imperative to develop a conceptual framework that leverages IoT capabilities for the management of Monkeypox. Such a framework should encompass real-time monitoring, predictive analytics, automated alert systems, and remote patient management to ensure timely interventions (Šajnović et al. 2024). This study aims to address the shortcomings in existing literature by proposing a structured, IoT-driven model for Monkeypox management, thereby contributing to the broader discourse on digital health solutions for emerging infectious diseases (Mehrdad et al. 2021).

1.1 Research Questions

1. What IoT technologies are mostly used in the management of infectious diseases?
2. How are IoT technologies applied in the management of infectious diseases?
3. What are the expected outcomes from implementing IoT based systems in managing diseases?
4. How does technology impact the management of infectious disease?
5. What are the challenges of using IoTs in disease management?

2. Literature Review

The management of emerging infectious diseases such as monkeypox has revealed critical deficiencies in traditional healthcare frameworks, highlighting the need for innovative solutions (Pal and Kirubel 2022). Recent advances in digital health technologies, particularly the Internet of Things (IoT), offer promising opportunities to address these shortcomings through real-time monitoring, predictive analytics, and automated responses (Kumar et al. 2025). IoT has been widely recognized for its transformative role in healthcare systems, particularly in managing infectious diseases. Key areas of application include surveillance were wearable devices, sensor networks, and mobile health applications have enabled real-time data collection and disease tracking (Pal et al. 2022). It can be used in prevention were mobile applications and IoT platforms have proven effective in promoting health education and vaccination campaigns (Pal and Kirubel 2022). The other area is in treatment were remote patient monitoring and telemedicine tools enhance patient engagement and reduce readmission rates.

2.1. Research Design

This systematic literature review will follow established guidelines, including the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework. The review aims to synthesize current knowledge regarding the application of IoT technologies in the management of monkey pox, focusing on surveillance, prevention, treatment, and community engagement)

© IEOM Society International

2.2. Search Strategy

Table 1. Research Protocol

Protocol Element	Translation In Research
Digital Libraries	**PubMed** **IEEE Xplore** **ScienceDirect** **Google Scholar** **SpringerLink**
Time Interval	**Publication Date**: Articles published in the last 5 years (2020-2025).
Inclusion Criteria	**Language**: English language publications. **Type of Study**: Peer-reviewed articles, conference papers, and systematic reviews focusing on IoT applications in public health, infectious disease management, or specifically monkey pox. **Relevance**: Studies that discuss IoT technologies related to disease surveillance, prevention, treatment, or community health engagement.
Exclusion	**Outdated Studies**: Articles published before 2019. **Non-English Publications**: Studies not published in English. **Irrelevant Focus**: Articles not directly related to IoT applications in health management or those that focus solely on monkey pox without discussing IoT. **Unreviewed Content**: Non-peer-reviewed articles, opinion pieces, and editorials.

2.3 Search Query

The search will utilize specific keywords and phrases to ensure comprehensive coverage. The search queries will include: ("Internet of Things" OR IoT) AND ("infectious disease management" OR "public health" OR "healthcare technology" OR "disease prevention" OR "surveillance")

The search yielded 597 papers, including 11 duplicates found through cross-referencing. In the screening phase of the 597 papers, titles and abstracts were reviewed to filter out irrelevant ones, resulting in 95 relevant papers based on the inclusion and exclusion criteria outlined in Table 1. During the assessment of full-text articles for eligibility, more papers that did not align with the research objective (specifically, an IoT-based conceptual framework for managing Monkeypox) were excluded. As a result, 24 papers were selected for qualitative and quantitative analysis.

2.4. Screening Process

The search yielded 597 papers, including 11 duplicates found through cross-referencing. In the screening phase of the 597 papers, titles and abstracts were reviewed to filter out irrelevant ones, resulting in 95 relevant papers based on the inclusion and exclusion criteria outlined in Table 1. During the assessment of full-text articles for eligibility, more papers that did not align with the research objective (specifically, an IoT-based conceptual framework for managing Monkeypox) were excluded. As a result, 24 papers were selected for qualitative and quantitative analysis as shown in figure 1.

© IEOM Society International

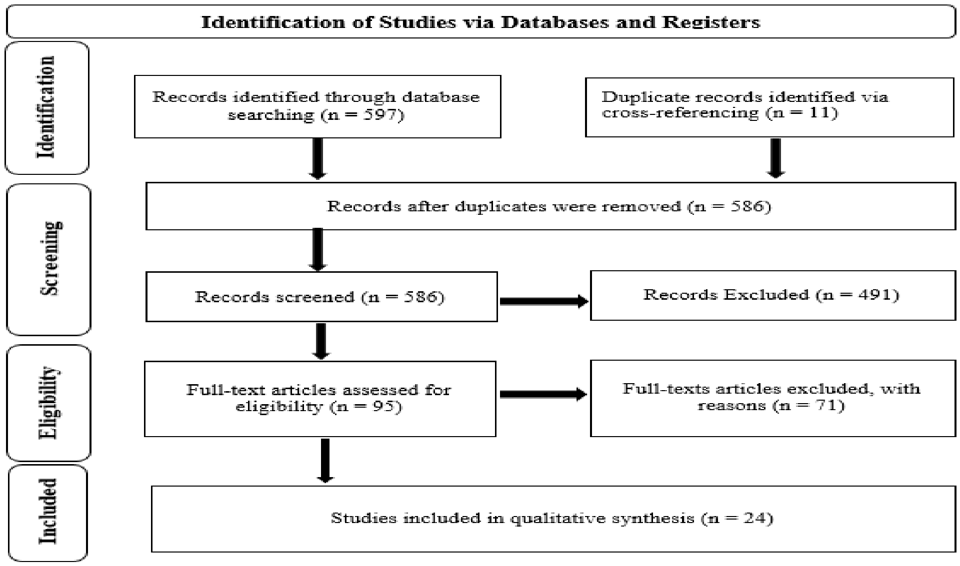

Figure1. Screening Process

3. Data Collection

Table 2. Data Extraction and Data Synthesis

ID	Author(s)	Title	Technology Type	Application Area	Key Outcomes	Impact on Management	Limitations
1	(Channa et al., 2021)	The Rise of Wearable Devices during the COVID-19 Pandemic	Surveillance	Real-time data collection	Early outbreak detection and response	Limited to urban areas	
2	(Krishna Kotha, 2023)	Analyzing the Role of Health Apps in Promoting Healthy Lifestyle and Preventive Care	Mobile apps	Prevention	Increased participation in health programs	Awareness and education	Small sample size
3	(Liu & Wang, 2025)	Advanced applications in chronic disease monitoring using IoT mobile sensing device	Sensor networks	Treatment	Reduced readmission rates	Better monitoring	Geographic limitations
4	(Ejiyi et al., 2023)	The internet of medical things in healthcare management: a review	Health monitoring devices	Surveillance	Significant decrease in infection rates	Enhanced monitoring capabilities	Focused on a single disease
5	(Dettori et al., 2023)	Use of digital technologies in public health: a narrative review	Mobile health apps	Prevention	Effective IoT strategies for health education	Better public health outcomes	Quality of studies reviewed
6	(Bakari & Thandekkattu, 2024)	A Framework for IoT Data Collection and Fusion in Infectious Diseases Surveillance	IoT platforms	Surveillance	Improved data accuracy and timeliness	Faster response to threats	Needs more longitudinal studies
7	(Tóth, 2024)	Innovative IT solutions in health and sport - the importance of wearable devices and Internet of Things	Wearable technology	Prevention	Increased awareness of disease transmission	Enhanced community engagement	Small geographic focus
8	(Praveen et al., 2023)	Real Time Health Monitoring System Using IoT	Wearable health monitors	Treatment	Enhanced patient adherence to medication	Improved patient outcomes	Limited to elderly demographic

9	(Irshad et al., 2023)	Towards enhancing security of IoT-Enabled healthcare system	Cloud-based IoT systems	Surveillance	Streamlined data sharing processes	Efficient outbreak response	Needs wider implementation studies
10	(Chaudhary et al., 2025)	Interdisciplinary Approach to Monkeypox Prevention	Mobile health	Prevention	Increased vaccination rates	Improved public health strategy	Short study duration
11	(Auwal, 2023)	IoT Integration in Telemedicine: Investigating the Role of Internet of Things Devices	Telehealth platforms	Treatment	Identified best practices for IoT implementation	Integration of technology in healthcare	Focus on specific diseases
12	(Philip et al., 2021)	Internet of Things for In-Home Health Monitoring Systems	Smart sensors	Surveillance	Improved public health responses	Real-time data access	Limited demographic diversity
13	(Surya et al., 2024)	A Disaster Management Framework Using IoT	Wearable devices	Treatment	Improved chronic disease monitoring	Enhanced patient engagement	Limited to chronic conditions
14	(Janet Aderonke Olaboye et al., 2024)	Innovations in real-time infectious disease surveillance using AI and mobile data	Mobile applications	Surveillance	More accurate tracking of disease outbreaks	Better allocation of health resources	Data privacy concerns
15	(Peter, 2024)	The Impact of Vaccination Campaigns on Public Health	IoT platforms	Prevention	Increased vaccine coverage	Improved public health outcomes	Focused on urban populations
16	(Bhardwaj et al., 2022)	IoT-Based Smart Health Monitoring System for COVID-19	monitoring devices	Treatment	symptom tracking	Better response outbreaks	Limited demographic focus
17	(Shobana, 2024)	Community Health Engagement through IoT	Community apps	Prevention	Community involvement in health issues	Improved health literacy	Short-term study
18	(Syed et al., 2021)	Future of e-Learning in Medical Education in a Developing country	E-learning platforms	Education	Enhanced learning outcomes	Increased public health education	Limited reach in remote areas
19	(Ezeamii et al., 2024)	Revolutionizing Healthcare: How Telemedicine Is Improving Patient Outcomes	Telehealth systems	Treatment	Improved access to healthcare	Greater healthcare accessibility	Dependence on internet connectivity
20	(Hickey et al., 2021)	Smart Devices and Wearable Technologies to Detect and Monitor Mental Health Conditions and Stress:	Wearable devices	Treatment	Increased awareness of mental health conditions	Improved mental health intervention	Limited to specific demographics
21	(Iqubal et al., 2023)	Real time health care big data analytics model for improved QoS in cardiac disease prediction with IoT devices	Cloud analytics	Surveillance	Faster identification of disease patterns	Enhanced strategic decision-making	Needs more case studies
22	(Sharma et al., 2021)	A Disaster Management Framework Using IoT-Based Interconnected Devices	Smart sensors	Emergency response	Improved response times during outbreaks	Better crisis management	Geographic limitations
23	(Obianyo et al., 2024)	The future of wearable health technology: From monitoring to preventive healthcare	Wearable technology	Prevention	Promoted healthier lifestyle choices	Improved public health outcomes	Focus on lifestyle diseases
24	(Jude, 2025)	A Disaster Management Framework Using IoT-Based Interconnected Devices	Blockchain IoT systems	Data management	Increased data security in health records	Enhanced trust in public health data	Complex implementation

© IEOM Society International

4. Results

The findings from the SLR answer the five research questions asked in section 1.1 relating to IoT technologies used in the management of diseases, their application areas, the outcomes, the impact on the management of diseases and the challenges of using IoT systems in disease management.

4.1. Technology types

Several IoT technology types exist that are used in infectious disease management and these predominant categories include wearable devices, mobile applications, and IoT platforms, each playing a distinct role in addressing public health challenges, which are all depicted in Figure 2.

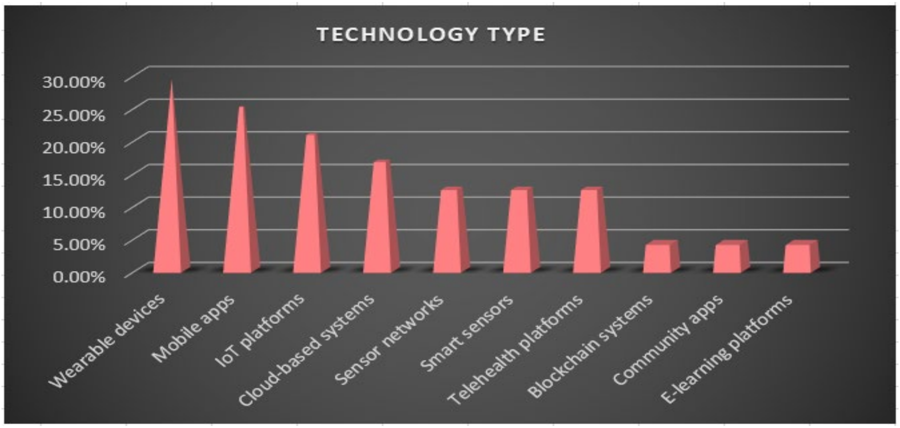

Figure 2. Types Of IoT Technologies Used In Management Of Infectious Diseases

Wearable Devices: Comprising 29.2% of the studies reviewed, wearable devices are increasingly recognized for their ability to collect real-time health data. These technologies facilitate continuous monitoring of vital signs and other health indicators, empowering individuals to take a proactive approach to their health management. The success of these devices in enhancing patient adherence to treatment regimens and improving health outcomes underscores their importance in chronic disease management and preventive health strategies.

Mobile Applications: Accounting for 25.0% of the studies, mobile applications serve as critical tools for community engagement and health education. These apps have been instrumental in increasing public awareness of health issues and encouraging participation in health programs. The versatility of mobile applications allows them to cater to various health needs, making them accessible and user-friendly. Their role in facilitating data sharing and communication between healthcare providers and patients further enhances their impact on public health management.

IoT Platforms and Sensor Networks: The emergence of IoT platforms and sensor networks reflects a broader trend toward interconnected health systems. These technologies enable the aggregation and analysis of data from multiple sources, providing healthcare professionals with comprehensive insights into population health trends. While less represented in the studies (as seen in the categories that combine various IoT applications), their potential for improving surveillance and outbreak response capabilities is significant. The ability to integrate data from various health monitoring devices into centralized platforms can facilitate more efficient public health responses.

Cloud-Based Systems and Analytics: Cloud-based systems are increasingly being utilized for data management and analysis, enabling healthcare providers to leverage large datasets for strategic decision-making. The use of cloud analytics has shown promise in identifying disease patterns and streamlining data-sharing processes, which are crucial for timely public health interventions. However, the variability in implementation and the need for further studies highlight the ongoing challenges in optimizing these technologies.

© IEOM Society International

4.2 Application Areas

The application areas of IoT technologies in public health reveal a multifaceted approach to addressing various health challenges. The predominant categories identified include surveillance, prevention, treatment, and education, each playing a crucial role in enhancing public health outcomes as shown in figure 3.

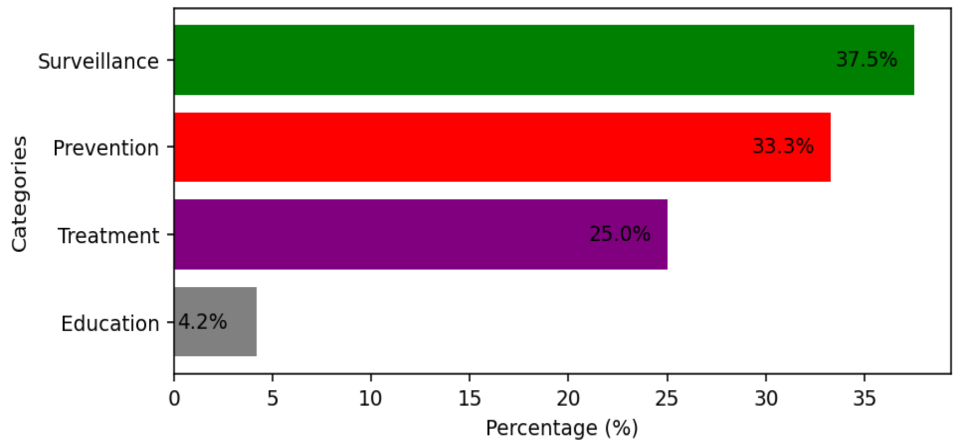

Figure 3. Application Area in Infectious Disease Management

Surveillance (7.5%): Surveillance emerged as the leading application area, highlighting the critical need for real-time data collection and monitoring in public health. IoT technologies enable health authorities to track disease outbreaks, monitor infection rates, and gather data on population health trends. The ability to analyze this data in real time allows for timely interventions and more effective outbreak response strategies. This proactive approach is vital for managing infectious diseases and preventing their spread.

Prevention (33.3%): The focus on prevention reflects a significant shift toward proactive health management. IoT applications in this area are designed to enhance public awareness, encourage healthier behaviors, and facilitate community engagement in health initiatives. Mobile health apps and wearable devices, for instance, empower individuals to monitor their health metrics, access health education resources, and participate in preventive health programs. This emphasis on prevention is essential for reducing the burden of chronic diseases and improving overall population health.

Treatment (25.0%): Treatment-related applications of IoT technologies highlight their role in enhancing patient care and improving health outcomes. These technologies facilitate remote monitoring of patients, adherence to treatment regimens, and timely interventions based on health data. Studies indicate that IoT devices can lead to reduced readmission rates and improved management of chronic conditions. The integration of telehealth platforms further expands access to care, particularly for individuals in remote or underserved areas.

Education (4.2%): Although the focus on education is less pronounced compared to other application areas, it remains a vital component of public health strategies. E-learning platforms and mobile applications are used to disseminate health information and promote health literacy among the public. By enhancing knowledge about health issues and preventive measures, these educational tools play a crucial role in empowering individuals to take charge of their health.

4.3. Outcomes

The implementation of IoT technologies in public health has yielded a range of significant outcomes, reflecting their transformative potential in enhancing health management and outcomes. The primary outcomes identified across the studies include improvements in data accuracy, monitoring capabilities, patient engagement, and health education.
The outcomes associated with the application of IoT technologies in public health underscore their potential to fundamentally transform health management practices as shown in figure 4.

© IEOM Society International

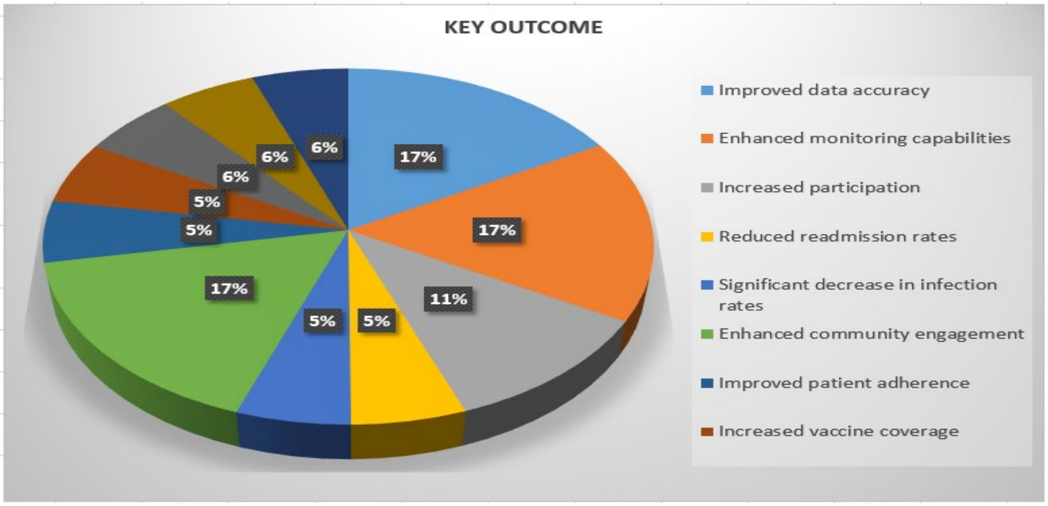

Figure 4. Key Outcomes of the research

Improvements in data accuracy, monitoring capabilities, and patient engagement highlight the effectiveness of these technologies in enhancing individual and community health outcomes. Furthermore, the role of IoT in fostering greater community involvement and health education is critical for building a proactive and informed public health landscape. As the field continues to evolve, it is essential for future research to further investigate these outcomes and explore how IoT technologies can be optimized for diverse populations and settings. Understanding the nuances of these outcomes will inform the development of more effective public health strategies that leverage the full potential of IoT innovations, ultimately leading to improved health and well-being for all communities

Enhanced Data Accuracy: One of the most notable outcomes is the improvement in data accuracy facilitated by IoT technologies. Real-time data collection from various sources, such as wearable devices and mobile applications, allows for more precise tracking of health metrics and disease patterns. This enhanced accuracy supports public health authorities in making informed decisions, leading to timely interventions and more effective outbreak response strategies.

Improved Monitoring Capabilities: IoT technologies have significantly improved the monitoring capabilities of healthcare providers. For instance, remote health monitoring enables continuous observation of patients' vital signs and health behaviors, leading to better management of chronic conditions. The ability to access real-time data fosters proactive care and enhances the overall quality of patient management, ultimately contributing to better health outcomes.

Increased Patient Engagement: The integration of IoT devices and applications has been associated with increased patient engagement in their own health management. Wearable devices and mobile health apps empower individuals to track their health metrics, access personalized health information, and participate in health programs. This heightened engagement not only promotes healthier lifestyle choices but also improves adherence to treatment regimens, which is crucial for managing chronic diseases.

Enhanced Community Engagement: IoT technologies have also played a pivotal role in enhancing community involvement in public health initiatives. By facilitating communication and information sharing, these technologies encourage participation in health education programs and community health campaigns. This increased community engagement is essential for fostering a culture of health awareness and preventive care, ultimately contributing to better population health outcomes.

Improved Health Education: The use of IoT in health education, although less emphasized, has proven to be effective in disseminating health information and promoting health literacy. E-learning platforms and mobile applications provide accessible resources that educate individuals about health risks, preventive measures, and available healthcare services. By enhancing knowledge and awareness, these educational initiatives empower individuals to make informed health decisions.

4.4. Impact On Management

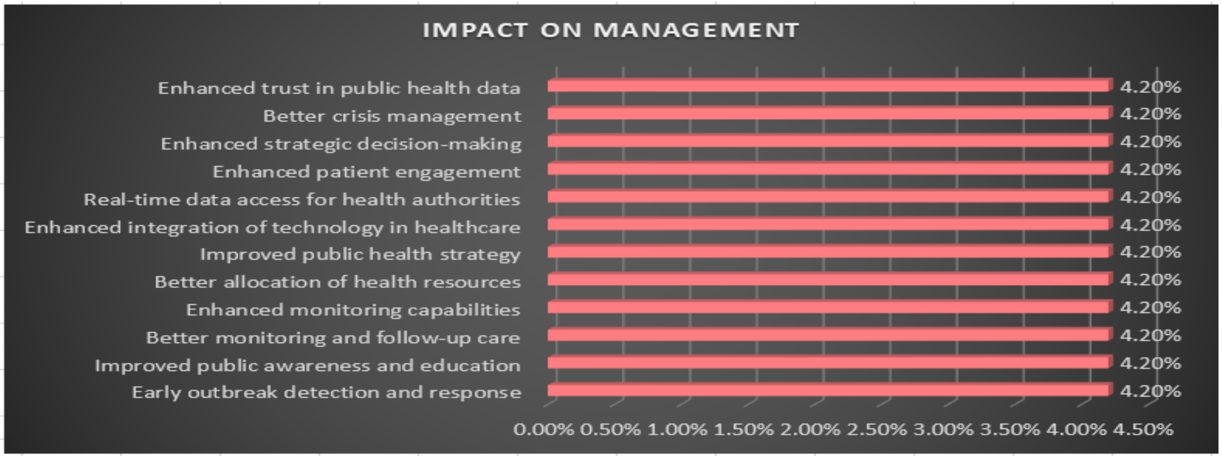

Figure 5. Impact On Management Of Public Health Systems

The integration of IoT technologies into public health management, particularly in the context of infectious diseases such as Monkeypox, has demonstrated significant potential to enhance health systems effectiveness. The findings, as shown in figure 5 indicate several impacts on infectious management:

Data-Driven Decision Making: The ability to collect and analyse real time data through IoT devices empowers health authorities make informed decisions quickly. Enhanced surveillance capabilities allow for timely identification of outbreaks and a more strategic approach to managing health responses, ultimately leading to improved public health outcomes.

Resource Optimization: IoT technologies facilitate better allocation and management of resources by providing insights into disease patterns and community needs. This ensures that medical supplies, vaccines, and personnel are deployed where they are most needed, enhancing the efficiency and effectiveness of public health interventions.

Improved Patient Management: The use of remote monitoring tools and wearable devices has transformed patient care, particularly for those with infectious diseases. By enabling continuous tracking of health metrics, healthcare providers can respond swiftly to changes in patient conditions, reducing hospitalization rates and improving treatment adherence.

Increasing Community Engagement: IoT applications have fostered greater public involvement in health initiatives. By providing individuals with tools to monitor their health and access information, these technologies encourage active participation in disease prevention and management efforts, contributing to a healthier community.

Enhanced Public Health Responses: The integration of IoT into public health strategies has streamlined communication and coordination amongst stakeholders. This improved collaboration enhances the efficiency of health responses, ensuring a more unified approach to managing outbreaks and health emergencies.

4.5. Limitations

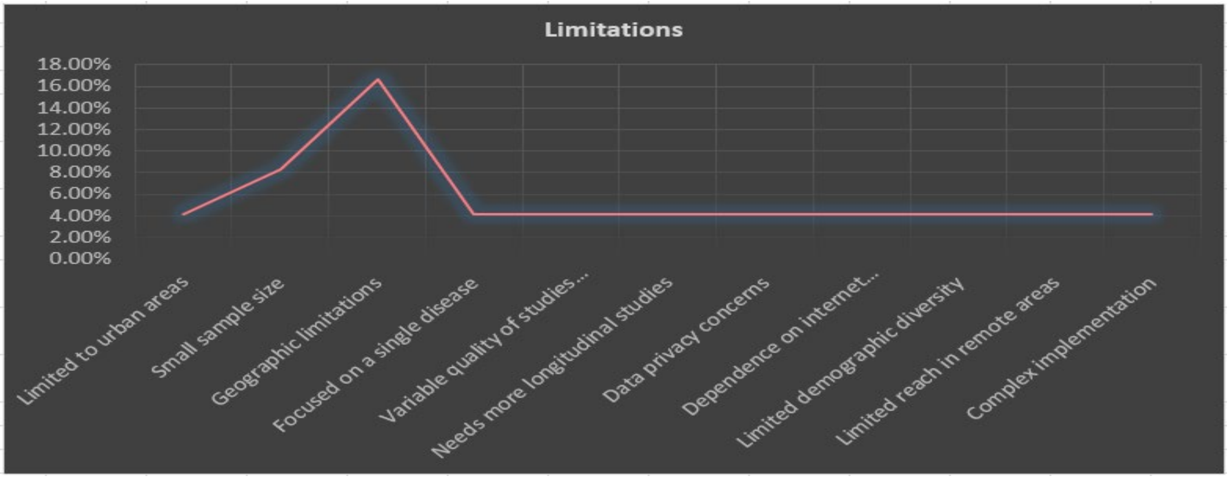

Figure 6. Limitations of Using IoT Technologies

While the integration of IoT technologies in public health management offers significant advantages, several limitations must be acknowledged to ensure effective implementation and utilization; as outlined in figure 6.

Geographic and Demographic Limitations: Many studies indicate that IoT applications are often concentrated in urban areas, leading to disparities in access and effectiveness in rural or underserved regions. This uneven distribution can hinder equitable health outcomes, as populations in remote areas may not benefit from the same level of monitoring and intervention.

Data Privacy and Security Concerns: The collection and transmission of sensitive health data raise significant privacy and security issues. Public apprehension regarding data breaches and misuse of personal health information can undermine trust in IoT solutions, affecting community engagement and participation in health initiatives.

Variability in Technology Adoption:
The effectiveness of IoT applications can vary based on the technological infrastructure and health literacy of different populations. Disparities in access to smartphones, the internet, and digital health resources can limit the reach and impact of IoT initiatives, particularly among vulnerable populations.

Quality of Data and Analysis: The reliability of data collected through IoT devices is contingent upon the quality of the technology and the accuracy of the algorithms used for data analysis. Poor-quality data can lead to misinterpretations and ineffective public health responses, underscoring the need for robust validation processes.

Complex Implementation and Integration Challenges: Integrating IoT technologies into existing health systems can be complex and resource-intensive. Challenges related to interoperability, training for healthcare providers, and the need for continuous maintenance and updates can impede the smooth adoption of these technologies.

Short Study Durations: Many studies have limited timeframes, making it difficult to assess the long-term impacts and sustainability of IoT applications in public health. Longitudinal studies are necessary to understand how these technologies perform over time and their lasting effects on health outcomes.

5. Discussion

The Internet of Things (IoT) has revolutionized healthcare, particularly in managing infectious diseases like monkeypox. By enabling real-time monitoring, data collection, predictive analytics, and automated alerts, IoT enhances disease surveillance, treatment, and prevention. This framework, as illustrated in figure 7 provides guidance on integrating IoT technologies for effective infectious disease management. IoT technologies play a crucial role in disease surveillance, prevention, patient management, treatment, and data security. Wearable health devices and smart sensors track vital signs and environmental factors, while geo-location systems aid in contact tracing. Mobile health applications provide self-diagnosis tools and vaccination tracking, complemented by AI-powered predictive modeling to forecast outbreak patterns. Telemedicine and biosensors support remote patient monitoring, while connected medical devices optimize resource allocation and treatment effectiveness. Data security remains a priority, with block-chain ensuring data integrity and encryption safeguarding communication. Compliance with regulations such as General Data Protection Regulation (GDPR) and Health Insurance Portability and Accountability Act (HIPAA) standards ensures privacy and ethical considerations. For IoT to be effectively integrated, healthcare needs must first be assessed to identify suitable technologies.

Infrastructure development, stakeholder collaboration, and pilot testing are essential before full-scale implementation. Training healthcare professionals and communities in IoT use is crucial, followed by continuous monitoring and improvements using AI-driven insights. In summary, while the potential of IoT technologies in public health management is substantial, several limitations pose challenges to their effective implementation and widespread adoption. Addressing geographic disparities, enhancing data privacy protections, ensuring equitable access, and improving the quality of data and technology are critical for maximizing the benefits of IoT in public health. Moreover, the complexities of integrating these technologies into existing health systems and the need for robust longitudinal research must be prioritized to ensure sustainable and effective health management solutions. By acknowledging and addressing these limitations, public health initiatives can better leverage IoT technologies to improve health outcomes for diverse populations.

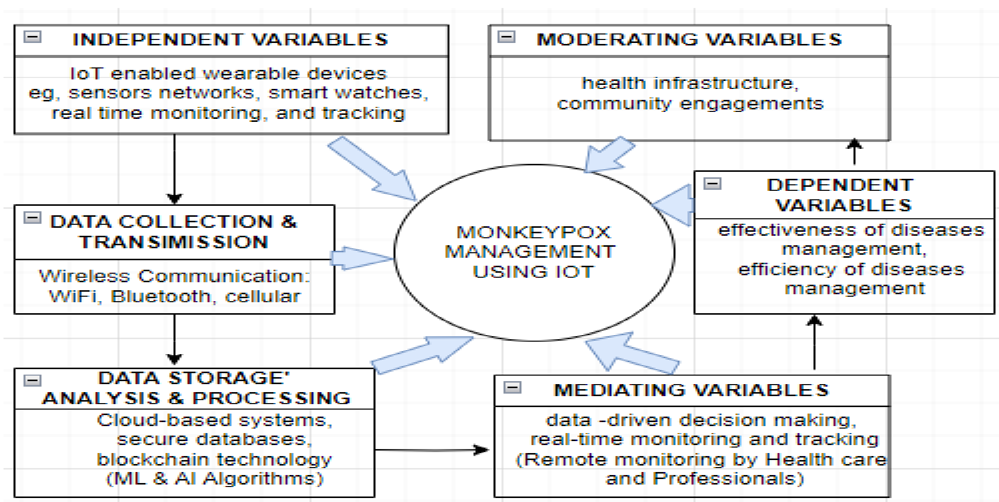

Figure 7. Conceptual Framework using IoT Technologies

6. Conclusion

This research observes that the management of Monkeypox remains a critical public health challenge, exacerbated by inefficient surveillance systems and delayed responses. The integration of IoT technology presents a viable solution to address these shortcomings by enabling early detection, real-time disease tracking and monitoring as well as automated response mechanisms. Despite the demonstrated potential of IoT in healthcare, existing research lacks a dedicated framework tailored specifically to Monkeypox management and the management of other infectious diseases. This study has reviewed relevant literature, highlighting key gaps and challenges in the current disease management landscape. Developing a conceptual framework that incorporates IoT for Monkeypox management is essential for enhancing disease surveillance, optimizing resource allocation, and facilitating timely interventions. By leveraging real-time monitoring, predictive analytics, and automated alert systems, such a framework can significantly improve outbreak response strategies.

However, for successful implementation, challenges related to data privacy, infrastructure, and policy integration must be addressed. Future research should focus on testing and refining IoT-driven frameworks through pilot studies and cross-sector collaborations. Additionally, ensuring accessibility and scalability in resource-limited settings will be crucial for the widespread adoption of this approach. Ultimately, an IoT-enabled Monkeypox management conceptual framework has provided the key IoT-based technologies that have a potential to revolutionize and inform public health care stakeholders of the key technologies for consideration in disease control strategies, mitigating outbreak risks and improving overall public health preparedness.

References

Auwal, A.M. 'IoT Integration in Telemedicine: Investigating the Role of Internet of Things Devices in Facilitating Remote Patient Monitoring and Data Transmission', *International Internal Medicine Journal*, 1(5), pp. 1–13. Available at: https://doi.org/10.33140/iimj.01.05.03, 2023.

Bakari, K. and Thandekkattu, S.G. *A Framework for IoT Data Collection and Fusion in Infectious Diseases Surveillance*. Available at: https://doi.org/10.4018/979-8-3693-5498-8.ch009, 2024.

Bhardwaj, V. and Gaur, A.M. 'IoT-Based Smart Health Monitoring System for COVID-19', *SN Computer Science*, 3(2), pp. 1–11. Available at: https://doi.org/10.1007/s42979-022-01015-1, 2022.

Channa, A. *et al.* 'The rise of wearable devices during the COVID-19 pandemic: A systematic review', *Sensors*, 21(17), pp. 1–22. Available at: https://doi.org/10.3390/s21175787, 2021.

Chaudhary, V. *et al.* 'Interdisciplinary Approach to Monkeypox Prevention: Integrating Nanobiosensors, Nanovaccines, Artificial Intelligence, Visual Arts, and Social Sciences', *Small Structures*, 2400647. Available at: https://doi.org/10.1002/sstr.202400647, 2025.

Dettori, M. *et al.* 'Use of digital technologies in public health: a narrative review', *Acta Biomedica*, 94. Available at: https://doi.org/10.23750/abm.v94iS3.14589, 2023.

Ejiyi, C. *et al.* 'The internet of medical things in healthcare management: a review', *Journal of Digital Health*, 2(1), pp. 30–62. Available at: https://doi.org/10.55976/jdh.22023116330-62, 2023.

Ezeamii, V.C. *et al.* 'Revolutionizing Healthcare: How Telemedicine Is Improving Patient Outcomes and Expanding Access to Care', *Cureus*, 16(7), pp. 1–10. Available at: https://doi.org/10.7759/cureus.63881, 2024

Harapan, H. *et al.* 'Monkeypox: A Comprehensive Review', *Viruses*, 14(10), pp. 1–24. Available at: https://doi.org/10.3390/v14102155, 2022.

Hasan, S. and Saeed, S. 'Monkeypox Disease: An Emerging Public Health Concern in the Shadow of COVID-19 Pandemic: An Update', *Tropical Medicine and Infectious Disease*, 7(10). Available at: https://doi.org/10.3390/tropicalmed7100283, 2022.

Hickey, B.A. *et al.* 'Smart devices and wearable technologies to detect and monitor mental health conditions and stress: A systematic review', *Sensors*, 21(10), pp. 1–17. Available at: https://doi.org/10.3390/s21103461, 2021.

Iqubal, S. *et al.* 'Real time health care big data analytics model for improved QoS in cardiac disease prediction with IoT devices', (April). Available at: https://doi.org/10.1007/s12553-023-00747-1, 2023.

Irshad, R.R. *et al.* 'Towards enhancing security of IoT-Enabled healthcare system', *Heliyon*, 9(11). Available at: https://doi.org/10.1016/j.heliyon.2023.e22336, 2023.

Janet, A.O. *et al.* 'Innovations in real-time infectious disease surveillance using AI and mobile data', *International Medical Science Research Journal*, 4(6), pp. 647–667. Available at: https://doi.org/10.51594/imsrj.v4i6.1190, 2024.

Jude, T. 'Leveraging Blockchain Technology for Secure Health Insurance Portals', (November 2024), (2025).

Krishna, H. 'Analyzing the Role of Health Apps in Promoting Healthy Lifestyle and Preventive Care', *International Journal of Science and Research (IJSR)*, 12(11), pp. 903–910. Available at: https://doi.org/10.21275/sr231111061822, 2023.

Lederman, R. and Vo. T.H. 'The role of the Internet of Things in Healthcare in supporting clinicians and patients: A narrative review', *Health Policy and Technology*, 10(3), p. 100552. Available at: https://doi.org/10.1016/j.hlpt.2021.100552, 2021.

Liu, Y. and Wang, B. 'Advanced applications in chronic disease monitoring using IoT mobile sensing device data, machine learning algorithms and frame theory: a systematic review', *Frontiers in Public Health*, 13. Available at: https://doi.org/10.3389/fpubh.2025.1510456, 2025.

Mehrdad, S. and Atashzar, S.F. 'Perspective: Wearable Internet of Medical Things for Remote Tracking of Symptoms, Prediction of Health Anomalies, Implementation of Preventative Measures, and Control of Virus Spread During the Era of COVID-19', *Frontiers in Robotics and AI*, 8(April), pp. 1–12. Available at: https://doi.org/10.3389/frobt.2021.610653, 2021.

© IEOM Society International

Obianyo, C.M. *et al.* 'The future of wearable health technology: From monitoring to preventive healthcare the future of wearable health technology: From monitoring to preventive healthcare', (September). Available at: https://doi.org/10.30574/wjbphs.2024.20.1.0709, 2024.

Pal, M.and Paulos, G.K.'Emergence of Monkeypox Raises a Serious Challenge to Public Health', *American Journal of Microbiological Research*, 10(2), pp. 55–58. Available at: https://doi.org/10.12691/ajmr-10-2-2, (2022).

Peter, J. 'The Impact of Vaccination Campaigns on Public Health a Comprehensive Analysis Abstract', pp. 1–2. Available at: https://doi.org/10.36648/1791-809X.18.6.1148, 2024.

Philip, N.Y. *et al.* 'Internet of Things for In-Home Health Monitoring Systems: Current Advances, Challenges and Future Directions', 2021.

Praveen, B.M. *et al.* 'Real Time Health Monitoring System Using IoT', *2023 IEEE Renewable Energy and Sustainable E-Mobility Conference, RESEM 2023* [Preprint], (April). Available at: https://doi.org/10.1109/RESEM57584.2023.10236214, 2023.

Šajnović, U. *et al.* 'Internet of Things and Big Data Analytics in Preventive Healthcare: A Synthetic Review', *Electronics (Switzerland)*, 13(18). Available at: https://doi.org/10.3390/electronics13183642, 2024.

Sanusi Karama, R., Akinola, A. and Kama, J. 'Re-emergence of human monkeypox 2022: its ecology and public health significance-short review article', *International Journal Of Community Medicine And Public Health*, 10(4), pp. 1609–1615. Available at: https://doi.org/10.18203/2394-6040.ijcmph20230951, 2023.

Sharma, K. *et al.* 'A Disaster Management Framework Using Internet of Things-Based Interconnected Devices', 2021. Available at: https://doi.org/10.1155/2021/9916440, 2021.

Shobana, N. 'Community Involvement and Engagement (CIE): A Pathway to Equitable and Effective Healthcare', *Batticaloa Medical Journal*, 18, pp. 57–60. Available at: https://doi.org/10.4038/bmj.v18i2.56, 2024.

Surya, S., Gudimetla, M. and Venkata, N. 'AI-Driven Data Engineering for Real-Time Public Health Surveillance and Early Outbreak Detection', (December). Available at: https://doi.org/10.18034/ei.v11i2.732, 2024.

Syed, S. *et al.* 'Future of e-Learning in Medical Education—Perception, Readiness, and Challenges in a Developing Country', *Frontiers in Education*, 6(March), pp. 1–8. Available at: https://doi.org/10.3389/feduc.2021.598309, 2021.

Tóth, K. 'Innovative IT solutions in health and sport - the importance of wearable devices, Internet of Things, artificial intelligence and Big Data', 15(39), pp. 87–114. Available at: https://doi.org/10.19055/ams.2024.11/29/5, 2024.

Wagan, S.A. *et al.* 'Internet of medical things and trending converged technologies: A comprehensive review on real-time applications', *Journal of King Saud University - Computer and Information Sciences*, 34(10), pp. 9228–9251. Available at: https://doi.org/10.1016/j.jksuci.2022.09.005, 2022.

Biographies

Peter Maitireni has an ND in Electronics Communication, a BSc Honors in Telecommunications Engineering, and is currently pursuing a Master's in Information Systems. He works as a Technician at the National University of Science and Technology, Zimbabwe.

Vusumuzi Ncube has ND in Technical Vocational Education, HND Microwave techniques and Radar Systems, BSc Honors in Telecommunications Engineering, currently studying a Master's in Information Systems with NUST. He is a member of Zimbabwe Institute of Engineers. He is an Engineering Instructor at the National University of Science and Technology Zimbabwe

Yangekile Dube has certification in Cisco certified Network Associate, BSc in Information Systems, currently studying Masters in Information Systems, published a paper Online enquiry and bill payments management systems for a local authority with academia.edu.

Thando Sibanda has BSc in Information Systems from the Midlands State University in Gweru, Zimbabwe. She currently studying a Masters in Information Systems at the National university of Science and Technology, in Bulawayo, Zimbabwe. She has worked as an assistant Accountant at Laymack investment in Bulawayo, Zimbabwe.

Sibusisiwe Dube has a PhD in Information Systems from the University of Cape Town in South Africa. She also holds a Master of Science degree in Computer Science from the National University of Science and Technology in Zimbabwe. Sibusisiwe also holds a Bachelor of Science honours degree in Information Systems obtained from the

© IEOM Society International

Midlands State University in Zimbabwe. Sibusisiwe is currently teaching at the National University of Science and Technology. She has published several peer-reviewed publications. She coordinates the post graduate program in the department of Informatics and Analytics. She has examined two PhD student dissertations and is currently supervising three PhD students and several Masters students.

Sinokubekezela Princess Dube is currently studying for a Master of Science Degree in Construction Management in the faculty of Engineering at the University of Zambia in Lusaka Zambia. She holds a bachelor of science degree in Property management from the National University of Science and Technology in Zimbabwe. Sinokubekezela has is an upcoming researcher who has a number of publications accessible via Google scholar. She has a research passion that has seen her attend and present her work at international conferences.

© IEOM Society International