THE USE OF TECHNOLOGY IN EMERGING DISEASE PREVENTION AND CONTROL IN NIGERIA

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ABSTRACT

In Nigeria, technology has played a crucial role in developing disease prevention and control. With the rise of new illnesses like Ebola, Lassa fever, and COVID-19, technology has become critical in detecting, tracking, and managing the epidemics. Disease surveillance systems are one of the most important ways that technology has been used in Nigeria. The Nigeria Centre for Disease Control (NCDC) has established a real-time countrywide surveillance system to track disease outbreaks. This approach is aided by technology, such as mobile applications, electronic reporting systems, and data analytics tools, which allows for the rapid detection and reaction to outbreaks. Another application of technology has been in contact tracing.During the COVID-19 epidemic, digital contact tracing apps were developed and deployed in Nigeria to assist in identifying and tracking infected persons' possible contacts. These apps monitored movements and conversations using GPS and Bluetooth technology, and alerted users who had been exposed to the infection. The paper highlights the objectives of using technology in the emerging disease prevention and control,factors responsible for emerging or re-emerging diseases, types of emerging diseases, types of technologies in the prevention and control of emerging disease, the role of technology in prevention and control of emerging diseases as well as how technology can be use in the prevention and control of emerging diseases. The paper concluded that technology has the ability to improve healthcare in Nigeria by increasing access to services, enhancing care quality, and allowing for a more coordinated and effective response to health concerns. Based on the conclusion, the paper recommended that governments and other stakeholders should invest greater resources in R&D to speed technological innovation and its application to public health.

Key words: Emerging diseases, Control, Prevention, Technology, Nigeria

Introduction

Emerging diseases are those that have recently been found in a population or that have previously existed but are rapidly expanding in incidence or geographic range. These diseases are frequently caused by infections that have mutated or crossed over from animal populations to humans, or by environmental changes that enhance disease transmission. COVID-19, Ebola, Zika, and Middle East Respiratory Syndrome (MERS) are examples of emerging diseases. These diseases have had substantial global health consequences, causing widespread illness, death, and economic disruption (WHO, 2015; Morens& Fauci, 2013).

Emerging illnesses pose a serious public health risk because they spread quickly and are difficult to manage. They may also be highly contagious or fatal, with few therapeutic options available. Early diagnosis and surveillance, rapid reaction and containment measures, the development of effective therapies and vaccinations, and public education and awareness are all required for the prevention and control of emerging illnesses. Real-time disease surveillance systems, biosensors, genome sequencing, and telemedicine are among the advanced technology being utilized to help prevent and control new diseases (WHO, 2015; Morens, Fauci, 2013).

In recent years, there have been multiple cases of developing diseases in Nigeria. Here are a few examples:

Lassa fever is a hemorrhagic viral illness caused by the Lassa virus. The disease was originally diagnosed in Nigeria in 1969 and has subsequently spread throughout the country. Lassa fever is spread to people through contact with food or household items contaminated with infected rodent urine or excrement.

Ebola virus disease: In 2014, Nigeria experienced its first Ebola outbreak. Contact with infected people's or animals' bodily fluids spreads the virus. Although the outbreak was rapidly managed, it prompted concerns about Nigeria's ability to respond to future outbreaks.

COVID-19: Nigeria was hit by the COVID-19 pandemic in 2020, and the country has since undergone multiple waves of illness. The virus spreads predominantly by respiratory droplets and has had a severe economic and healthcare impact.

Monkeypox is a viral infection that is comparable to smallpox. In 2017, the first cases of monkeypox in Nigeria were recorded. Contact with infected animals or humans is thought to spread the virus.

Yellow fever is a viral disease spread by mosquitos. In recent years, Nigeria has seen yellow fever outbreaks, with the most recent being in 2019. Vaccination can help avoid the condition.

In recent years, Nigeria has seen the emergence of various new diseases, including Lassa fever, Ebola viral disease, COVID-19, monkeypox, and yellow fever. These diseases represent considerable health hazards and necessitate early and effective government and healthcare system responses.

In recent years, the use of technology in emerging disease prevention and control has grown in importance. Technology can aid in the detection and monitoring of developing diseases, as well as in the creation and implementation of preventive measures. One important technology is the use of digital surveillance systems, which can aid in the early detection of epidemics by tracking patterns in symptoms and illness incidence. Many countries, for example, have built digital contact tracking apps in response to the COVID-19 pandemic to identify and notify individuals who may have been exposed to the virus. (World Health Organization, 2019; Nava, Shimabukuro, Chmura, and Luz, 2017).

The use of artificial intelligence (AI) and machine learning (ML) to analyze massive datasets and detect trends that may suggest the advent of a new disease is another technology. This can be especially helpful in finding rare or unusual diseases that healthcare providers may not be aware of. Remote monitoring and telemedicine technology can also be used to remotely monitor and care for patients with developing diseases. This can assist to limit the risk of transmission while also ensuring that patients receive the necessary care. World Health Organization (WHO, 2015; WHO, 2019).

Finally, improvements in genomics and sequencing technologies can aid in the identification of the genetic make-up of new diseases, which can then be utilized to design targeted medicines and vaccinations. Overall, the use of technology in the prevention and management of emerging diseases is crucial to ensuring a prompt and effective response to new disease risks.

Objectives of using Technology in the emerging disease prevention and control

1. Early detection and rapid response: Technology can assist in detecting developing diseases early and facilitating a quick response to prevent or minimize disease spread.
2. Improved surveillance: Technology can improve disease surveillance systems by allowing for real-time data gathering, monitoring, and analysis, which can aid in identifying outbreaks and tracking disease spread.
3. Effective communication and coordination: Technology can help public health officials, healthcare providers, and the general public communicate and coordinate more effectively. Social media channels, for example, can be used to spread information about new diseases and promote public health initiatives.
4. Remote monitoring and care: Technology can allow for remote monitoring of patients with developing diseases, as well as access to care and support while reducing the danger of transmission.
5. Targeted intervention development: Technology can assist in identifying the genetic makeup of new diseases, which can then be used to design targeted medicines and vaccinations.
6. Capacity development: Technology can be utilized to train healthcare personnel, improve laboratory capacity, and improve disease surveillance and response systems.
7. In general, the use of technology in the prevention and control of emerging diseases aims to enhance public health outcomes by enabling early identification, rapid reaction, and effective prevention and control methods. (Koo, Cook, Park, & Sun, 2018; The Rockefeller Foundation, 2016)

Factors responsible for emerging or re-emerging diseases

There are several factors that can contribute to the emergence or re-emergence of infections:

Environmental changes: Changes in the environment, such as deforestation, climate change, and urbanization, can alter the distribution and behavior of organisms that cause disease. For example, deforestation can lead to the spread of diseases from animals to humans, and climate change can affect the range and activity of disease-carrying insects. (WHO, 2015; WHO, 2019; Nava, et.al, 2017).

Increased human mobility: As people travel more frequently and over longer distances, they increase the risk of introducing and spreading infections in new locations.

Microbial adaptation: Microorganisms have the ability to adapt to new environments and evolve to become more virulent or drug-resistant. This can lead to the emergence of new strains of infectious agents that are more difficult to treat.

Changes in healthcare practices: The overuse and misuse of antibiotics, inadequate infection control practices, and inappropriate use of medical devices can all contribute to the emergence and spread of drug-resistant infections. (WHO, 2015; WHO, 2019).

Population growth and density: As populations grow and become more densely populated, the risk of transmission of infectious diseases increases. This is particularly true in urban areas where large numbers of people live in close proximity to each other.

Poverty and inequality: Poverty and social inequality can contribute to the spread of infectious diseases by limiting access to healthcare, sanitation, and clean water.

Zoonotic infections: Zoonotic infections are those that are transmitted from animals to humans. As humans come into closer contact with animals, either through domestication, agriculture or wildlife trade, there is an increased risk of zoonotic infections.

Globalization and trade: Globalization and international trade can facilitate the spread of infectious diseases across borders and continents. This can happen through the movement of people, goods, and animals. (WHO, 2015; WHO, 2019).

Natural disasters: Natural disasters such as floods, earthquakes, and hurricanes can lead to displacement of people, disruption of healthcare services, and contamination of water sources, which can increase the risk of infectious diseases.

Foodborne infections: Improper food handling, processing, and storage can lead to the transmission of foodborne infections. This can be due to contamination with microorganisms such as bacteria, viruses, and parasites.

Immunization gaps: When large numbers of people are not vaccinated against infectious diseases, it can lead to outbreaks and re-emergence of infections that were previously under control.

Emerging technologies: New technologies and scientific advances can create new opportunities for the spread of infectious diseases. For example, advances in genetic engineering can lead to the creation of new strains of microorganisms with enhanced pathogenicity.

Antimicrobial resistance: The overuse and misuse of antibiotics and other antimicrobial agents can lead to the emergence and spread of drug-resistant infections. This can make it more difficult to treat infectious diseases and can lead to longer hospital stays, higher healthcare costs, and increased mortality.

Overall, the emergence and re-emergence of infections is a complex and multifactorial phenomenon. Addressing these factors requires a coordinated effort from multiple sectors, including public health, healthcare, environmental, and social services, to prevent and control the spread of infectious diseases (WHO, 2015; WHO, 2019).

Types of emerging diseases

1. Re-emerging diseases: These are diseases that were previously controlled but have resurfaced in a population. Measles, TB, and cholera are a few examples.

2. Zoonotic diseases: These are diseases spread from animals to people. Many new diseases, including COVID-19, Ebola, and SARS, are zoonotic.

3. Pandemic: A pandemic is a worldwide disease outbreak. Emerging illnesses, if extremely contagious and spread swiftly across international borders, have the potential to produce pandemics.

4. One Health approach: Recognizing the interconnection of human, animal, and environmental health, this strategy strives to prevent and manage new diseases by treating their core causes.

5. Antimicrobial resistance: The increased usage of antibiotics caused by emerging diseases can contribute to the development of antimicrobial resistance. This is a major public health concern since it complicates the treatment of infectious infections.

6. Global Health Security Agenda (GHSA): The GHSA is a collaboration of countries, international organizations, and non-governmental organizations aimed at improving global health security and preventing the spread of new diseases.

7. Contact tracing: The practice of identifying and tracking people who have had contact with someone infected with an emerging disease. It is an important technique for preventing disease spread and is frequently used in conjunction with quarantine procedures. (The Rockefeller Foundation, 2016).

Overall, emerging illnesses are a complicated and constantly changing public health concern that necessitates a comprehensive and coordinated response from governments, international organizations, and the general public. (The Rockefeller Foundation, 2016).

Types of Technologies in the prevention and Control of Emerging Disease

In the prevention and control of developing illnesses, according to Velasco, Aghene, Denecke, Kirchner, Eckmanns, (2014); Oshitani, (2016). various forms of technologies are applied. Here are a couple such examples:

1. Real-time disease surveillance systems: To detect early indicators of a disease outbreak, these systems use complex algorithms to analyze health data from diverse sources such as social media, news broadcasts, and healthcare facilities.

2. Biosensors: These are small devices that detect biological indicators linked to specific diseases, allowing for faster diagnosis and treatment.

3. Genome sequencing: Researchers may use this technology to quickly read the genome of a virus or bacteria, allowing them to develop effective therapies and vaccinations.

4. Telemedicine: Telemedicine technology enables healthcare experts to diagnose and treat patients remotely, lowering the risk of disease transmission and increasing access to healthcare services.

Wearable technology, such as smartwatches and fitness trackers, can monitor vital signs, detect early warning signs of sickness, and notify people to potential health concerns.

6. Mobile apps: Mobile apps can provide up-to-date information on new diseases, assist individuals in tracking their symptoms, and allow public health officials to broadcast information about outbreaks and preventative measures fast.

7. Machine learning and artificial intelligence (AI): These technologies can analyze enormous amounts of health data to detect patterns and trends, forecast disease outbreaks, and build effective disease control measures.

Robotics: Robots can be employed to clean public spaces, carry medical supplies and samples, and do duties that require little human interaction.

Drones: Drones can be used to deliver medical supplies and samples to remote places, minimizing disease transmission risk and enhancing access to healthcare services.

10. Virtual reality: In a controlled environment, virtual reality technology can be used to model epidemics and evaluate response methods.

11. Blockchain technology: Blockchain technology can be used to securely store and distribute health data, protecting patient privacy and lowering the risk of data breaches.

12. 3D printing: During an emergency, 3D printing technology can be used to quickly generate medical equipment and supplies like as face shields and respirator pieces.

13. Nanotechnology: Nanoparticles can be utilized to administer targeted therapies and vaccines, increasing efficacy while decreasing negative effects.

14. Internet of Things (IoT): By tracking the movement of people and things and giving real-time data on disease outbreaks, IoT technology can be utilized to monitor and manage the spread of illnesses.

These are only a handful of the many different forms of technology utilized in the prevention and management of developing illnesses. As technology advances, we should expect to see new and inventive solutions to the issues of developing diseases emerge.

The Role of Technology in Prevention and Control of Emerging Diseases

In numerous ways, technology plays an important role in the prevention and control of new diseases:

Early detection and surveillance: Technology such as real-time disease monitoring systems, biosensors, and mobile apps can aid in the early detection of developing diseases, allowing public health officials to respond promptly to contain epidemics before they spread.

Advanced analytics and machine learning algorithms can be used to evaluate enormous amounts of data in order to find patterns and trends, predict disease outbreaks, and design effective control tactics. (WHO, 2015; WHO, 2016).

Vaccine and drug development: Advances in technology have increased the speed and efficiency with which vaccine and medication development can be completed. DNA sequencing, CRISPR-Cas9 gene editing, and synthetic biology are examples of advanced technologies that have dramatically sped the creation of new vaccines and medicines.

Telemedicine and distant care: Telemedicine technology can assist healthcare professionals in providing care and treatment to patients in remote places, minimizing disease transmission risk and enhancing access to healthcare services. (WHO, 2015; WHO, 2016).

Public education and awareness can be achieved through the use of social media, websites, and mobile apps to communicate information about developing diseases, how to prevent them, and what to do if infected. This can assist boost public awareness and prevent illness spread. (WHO, 2015; WHO, 2016).

Overall, technology plays an important role in the prevention and control of emerging diseases, and it will continue to do so in the future as we face new and growing health concerns.

How Can Technology Improve Healthcare in Nigeria

In various areas, technology has the potential to greatly enhance healthcare in Nigeria:

Telemedicine and Remote Monitoring: Technology can be utilized to provide telemedicine and remote monitoring services, which can help people in distant or underserved areas gain access to healthcare. This can assist to alleviate the strain on healthcare facilities while also improving patient outcomes. (Velasco, et.al, 2014; Oshitani, 2016).

Electronic Health Records (EHRs): Using technology, electronic health records (EHRs) can be created, allowing healthcare providers to conveniently access and share patient information. This can help to improve care quality, prevent medical errors, and assure care continuity.

Medical Education and Training: Medical education and training for healthcare personnel can be provided through technology. This can help to increase healthcare providers' skills and knowledge, as well as the quality of care. (Milinovich, Williams, Clements, Hu, 2014; Vignier, Bouchaud, 2018; Oshitani, 2016).

Disease Surveillance and Outbreak Response: Technology can be utilized to improve disease surveillance systems and respond quickly to disease outbreaks. This can help to limit disease spread and lessen the impact of outbreaks on public health (Milinovich, et.al., 2014; Vignier, Bouchaud, 2018; Oshitani, 2016).

Mobile Health (mHealth): Technology can be utilized to create mobile health (mHealth) applications that can be used to increase patient access to healthcare services and deliver health information. This can aid in the improvement of health outcomes and the promotion of preventative health habits (Milinovich, et.al., 2014; Vignier, Bouchaud, 2018; Oshitani, 2016).

Technology can be used to create health information systems that allow healthcare providers to monitor and track health outcomes and trends. This can assist in informing healthcare policies as well as improving healthcare planning and resource allocation. . (Mugo, & Moodley, 2019).

Overall, technology has the potential to dramatically improve healthcare in Nigeria by increasing access to services, enhancing treatment quality, and allowing for a more coordinated and effective response to health concerns.

Conclusion

Emerging disease prevention and control rely heavily on technology. Digital surveillance systems, artificial intelligence and machine learning, remote monitoring and telemedicine, genomics and sequencing technologies, and other technological advancements can aid in the identification, detection, and monitoring of emerging diseases, as well as the development and implementation of preventive measures.

Early diagnosis and prompt reaction, improved surveillance, effective communication and coordination, remote monitoring and care, development of focused therapies, and capacity building are some of the goals of employing technology in emerging disease prevention and control. Technology has had a tremendous impact on the prevention of new diseases, allowing for early identification, rapid reaction, and effective prevention and control methods, resulting in better public health outcomes.

Technology has the ability to improve healthcare in Nigeria by increasing access to services, enhancing care quality, and allowing for a more coordinated and effective response to health

concerns. Overall, technology is an important tool in combating emerging diseases and improving healthcare outcomes, and continuous investment and innovation in this field is critical for global public health.

Recommendation

Following are some recommendations based on the role of technology in developing disease prevention and control, as well as its potential to improve healthcare outcomes:

Increased research and development investment: Governments and other stakeholders should invest greater resources in R&D to speed technological innovation and its application to public health.

Collaboration and partnerships should be strengthened: The public and commercial sectors, healthcare providers, and other stakeholders should work together to find and implement new solutions that can improve emerging disease prevention and control, as well as healthcare outcomes.

Focus on capacity building: Healthcare professionals and other employees should be trained in the use of technology and other digital tools to ensure they have the skills and knowledge to deploy and use them successfully in their work.

Increased public awareness and education: Governments, healthcare providers, and other stakeholders should raise public understanding of the relevance of technology in developing disease prevention and control, as well as healthcare delivery.

legislation and ethical considerations: Governments and other stakeholders should enact legislation and ethical guidelines to ensure responsible technology development and deployment in emerging disease prevention and control, as well as healthcare.

Continuous evaluation and improvement: The effectiveness of technology in emerging disease prevention and control, as well as healthcare outcomes, should be examined on a continuous basis, with an emphasis on improvement and resolving any potential obstacles or issues that may occur.

By putting these ideas into action, we may further exploit technology's potential to improve public health outcomes and promote global health security.

Conflicts of interest

The authors have no conflicts of interest to declare.

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