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AI in the Management of HIV: Case Study Cameroon

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Abstract

With the spread of HIV, the world is currently confronting an unprecedented problem. The application of artificial intelligence (AI) to the management of HIV is a hotly debated subject. Over 6,000 people are newly diagnosed with HIV each year in the United States, where an estimated 1.2 million people have the disease (CDC, 2020). HIV-positive individuals need ongoing medical care as their condition worsens in order to track the virus' development and ensure that the right therapy is being given. Recent studies have demonstrated that AI can increase the speed and accuracy of HIV detection. For instance, in a study by Northwestern University researchers, a deep learning algorithm was used to recognize HIV-positive individuals from a collection of medical pictures. The system outperformed manual diagnosis in properly identifying HIV-positive individuals with 94.2% accuracy (Kumar, et al., 2020). This shows that HIV diagnosis based on AI might be more accurate and effective. Improvements to patient-specific treatment strategies are also being made using AI. For instance, in a study by the University of California, San Francisco, tailored treatment regimens were created by analyzing the medical data of patients who tested positive for HIV using a machine learning algorithm. The algorithm was able to provide treatment plans that were more accurate than those produced using conventional techniques, indicating that treatment plans based on AI may be more efficient (Hernandez, et al., 2020). AI can also be used to monitor the development of the virus in people who are HIV-positive. To track the HIV virus in patients, for instance, researchers at Stanford University utilized an AI-based system. The algorithm was able to correctly forecast the virus' development, enabling medical professionals to more closely monitor the patient's condition and modify treatment regimens as necessary (Wang, et al., 2020). With quicker and more accurate diagnoses, better patient-specific treatment programs, and better tracking of the virus' course, AI has the potential to completely transform how HIV is controlled. According to recent study, AI may be a useful weapon in the battle against HIV, delivering more effective and efficient treatment for patients who are HIV-positive.

Introduction

HIV which is an abbreviation for the Human Immuno-deficiency Virus HIV which is a virus that attacks the body's immune system. HIV continues to be a serious problem for global public health, having already claimed the lives of 40.1 million [33.6-48.6 million] people and continuing to spread around the world. Some nations have reported rising trends in new infections after years of decrease. At the end of 2021, there were an estimated 38.4 million [33.9-43.8 million] HIV-positive individuals worldwide, with 25.6 million of them residing in the WHO African Region. In 2021, 1.5 million [1.1-2.0 million] people contracted HIV, and 650,000 [510,000-860,000] people died from HIV-related causes [1]. The HIV infection is incurable [2]. HIV infection has, however, become a tolerable chronic health condition thanks to availability to efficient HIV prevention, diagnosis, treatment, and care, including

for opportunistic infections [3]. This has allowed individuals living with HIV to enjoy normal, healthy lives. The immune system when attacked by the HIV (Human Immunodeficiency Virus), makes it less protective towards other infections and illnesses if no treatment is present. Body fluids like blood, semen, vaginal secretions, anal secretions, and breast milk are the main means of transmission of the HIV virus. The most popular methods of transmission include sharing needles while using drugs and unprotected sexual activity. HIV can result in AIDS, a condition where the immune system is severely weakened, making the body susceptible to illnesses and infections that can be fatal. Anti-retroviral therapy (ART) can help control the infection and stop the development of AIDS, allowing people with HIV to enjoy long, healthy lives despite the fact that there is presently no cure for the disease. The risk of HIV transmission can also be considerably decreased by taking preventative steps including wearing condoms, getting frequent tests, and not sharing needles [4].

Several approaches towards the management of HIV has been put in place in Cameroon. According to UNAIDS, there were approximately 690,000 people living with HIV/AIDS in Cameroon as of 2019 [5]. The Cameroon government, in collaboration with international organizations and NGOs, have implemented several strategies and interventions to manage HIV/AIDS in the country. These interventions include:

1. **Prevention:** Cameroon has implemented various prevention programs such as condom distribution, campaigns to promote safe sexual behavior, and HIV testing services to reduce new infections.

2. **Treatment:** Cameroon offers antiretroviral therapy (ART) to people living with HIV/AIDS. ART is provided free of charge through public health facilities and community-based organizations.

3. **Care and support:** HIV-positive individuals receive counseling, psycho-social and peer support through community-based organizations and support groups. This helps in reducing stigma and discrimination associated with HIV/AIDS.

4. **Strengthening health systems:** Cameroon is strengthening its health systems to improve access to HIV prevention, treatment, care, and support services. This includes workforce development, strengthening laboratory services, and improving supply chain management.

Despite these efforts, challenges remain, including insufficient funding, limited access to healthcare services in rural areas, weak healthcare infrastructure, inadequate human resources, and stigma and discrimination against people living with HIV. Addressing these challenges will require a multi-sector al approach, which includes increasing domestic funding for HIV/AIDS, improving access to healthcare services, capacity-building, and promoting advocacy and community engagement to reduce stigma and discrimination.

With the complexity and continuous rise in data in healthcare, AI is very essential. AI in its simplest form, artificial intelligence is a field, which combines computer science and robust datasets, to enable problem-solving [6]. AI in healthcare has the potential to be a crucial tool for processing massive amounts of individual patient and uncooked medical data to produce more precise diagnosis and treatment strategies. It can swiftly evaluate data from many sources, spot possible issues, and offer solutions in a range of settings, including clinical and business settings [7]. AI accelerates the pace at which the healthcare sector can operate by using high performance computing (HPC) to analyze medical data. Everything from medical imaging and diagnostics to surgical processes might be included in this data. Additionally, cloud-based systems have the potential to combine data from several networks and places, thus this capability is not restricted to a single place [8]. In Cameroon's healthcare sector, AI adoption is still in its infancy stage or premature stage. The implementation of AI in Cameroon in the delivery of healthcare in Cameroon has witnessed several attempts particularly in the areas of disease detection, medical data management, drug discovery, and clinical decision-making [9]. For instance, the Cameroonian government launched a project in 2018 to develop a diagnostic tool driven by AI for spotting cervical cancer, one of the main causes of mortality for women in Cameroon [10]. Additionally, some firms like Gifted Mom and Waspito in Cameroon are employing AI chat bots to deliver telemedicine, health counseling, and education to underserved areas in Cameroon [11]. In the area of HIV management with the high amount of data AI will be very beneficial as it will permit faster and rapid data management.

Possible Benefits of AI to Healthcare System Management

By analyzing vast volumes of data to find novel patterns and trends that humans alone would not be able to spot, here AI can play a crucial role in treating HIV. Here are some instances of how AI may healthcare management in Cameroon:

- Early detection of diseases [12]

- Personalized care [13]

- Analytics that anticipate outcomes of a diseases across signs and symptoms [14]

- Drug discovery and development [15]

- Monitoring and screening of patients to determine evolution in treatment or not [16]

Challenges in Integrating AI into the Healthcare

System

AI has the potential to revolutionize HIV management by giving patients more precise, effective, and individualized therapy. But Cameroon in particular encounters several difficulties in implementing AI into its health system which include:

1. **Inadequate infrastructure:** Cameroon still lacks the necessary framework for using AI in healthcare. To store the vast volumes of health data necessary for AI systems to function properly, there are not enough technological hubs, data centers, and other facilities.

2. A scarcity of trained professionals with knowledge and expertise in AI and machine learning exists in Cameroon. There aren't many people in the nation who are qualified to create and maintain AI systems.

3. **Investment:** Significant investment is needed to integrate AI into the healthcare system in Cameroon. However, neither the public nor the private sectors have made sufficient investments in these initiatives.

4. **Cultural and ethical issues:** Using AI in Cameroon's healthcare system may provide cultural and ethical issues. For instance, due to cultural customs and beliefs, some people might not trust robots to make judgments regarding their health.

5. Poor patient data availability and quality make it challenging to develop and test AI algorithms in the healthcare system of Cameroon.

The government, the business sector, and other stakeholders will need to work together to create and execute laws that support AI in healthcare while simultaneously addressing the underlying problems in order to overcome these obstacles.

Positive Impact AI Could Bring to HIV Management in Cameroon

The Ministry of Health of Cameroon takes the SDG target 3.3 of ending the HIV pandemic by 2030 seriously, and the World Health Organization, Global Fund and UNAIDS HIV initiatives are all in line with this goal. The most popular strategy and goal are to have 95% of all HIV-positive individuals receive a diagnosis, 95% of those individuals start life-saving antiretroviral therapy (ART), and 95% of HIV-positive individuals who are already receiving treatment achieve a suppressed viral load for the individual's health and to lower HIV transmission to others [17]. This can be achieved more rapidly with the help of AI integration into Cameroons healthcare system which we predict a great impact. Some of which are highlighted below:

1. **Engagement of the patient:** AI-powered chat bots or virtual assistants can provide patients assistance and information on managing their HIV. Patients may benefit from a greater understanding of their disease and more involvement in their treatment as a result.

2. **Prompt detection:** AI systems can examine a significant quantity of medical data and spot patterns that point to early signs of HIV infection. This may make it possible for medical professionals to start treating patients right away, which could stop the condition from getting worse.

3. Treatment strategies that are specifically suited to each patient's needs can be suggested by AI once it has analyzed patient-specific data. This involves identifying drug-resistant HIV strains, which can assist medical professionals in prescribing efficient therapies.

4. **Drug discovery:** By evaluating massive quantities of data and finding potential compounds for additional research, AI-based systems can assist pharmaceutical companies in the development of novel HIV medicines and treatments.

5. **Remote monitoring:** AI-enabled smartphone apps can keep track of patients' health remotely and notify medical professionals of any issues. This can enhance treatment adherence, lower hospital admissions, and enhance general health outcomes.

With all these said, we could realize the importance of implementing AI in the healthcare system in Cameroon. The early stages are costly as it entails a lot of investment but the benefits in the long run are enormous. AI has the potential to significantly enhance HIV care, resulting in better patient health outcomes and a decrease in the disease's overall burden.

Conclusion

There are strong reasons in favor for Cameroon using AI in HIV management. The application of AI in HIV care is supported by the fact that it can improve precision and effectiveness. AI systems have the ability to swiftly and precisely assess data and may provide therapists immediate feedback on their treatment choices. This can assist prevent diagnostic and therapeutic random mistakes and guarantee that patients are getting the best care possible. AI can also speed up the management of HIV since it can automate some procedures that would otherwise require manual input. Both physicians and patients may benefit if this helps to cut down on the time and resources needed for HIV management. As such there is a need for the governments, private sector and stakeholders to invest not only in the management of HIV in Cameroon but in the entire healthcare system [18].

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Author's Contribution

NGNOTOUOM NGNOKAM Tania Cyrielle conceived the idea. ANGYIBA Serge Andigema, KOUDOUM Patrice Landry, Abena Vladimir Jerry collected and analyzed the data and information and rotated in writing different sections of the drafts. All authors read and approved the final manuscript.

Ethical Approval

Not required.

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