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The Current State of HIV Treatment and Research in Africa

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Tremendous progress has been made in providing highly effective treatment to HIV-infected persons in Africa. Not only will this treatment dramatically prolong the lives of treated persons, it will also decrease new infections among uninfected sexual partners and nearly eliminate mother to child HIV transmission. Unprecedented global resources have been mobilized to realize these accomplishments, and a new paradigm for mass intervention in a public health crisis has been established, although its sustainability is uncertain. Importantly, Africa has become the epicenter of research progress with the potential to benefit research participants, create essential infrastructure for clinical research, and train African scientists to become world leaders in HIV-related investigations. This essay will provide an overview of the history, current epidemiology, successes in treatment, and the challenges of HIV infection on the continent.

HIV in Africa: A Brief History

Molecular studies demonstrate that the human immunodeficiency virus (HIV) evolved from the simian immunodeficiency virus (SIV), which infects chimpanzees and gorillas. Estimates suggest that HIV evolved into its current strain in approximately 1920, and the first known human infections were retrospectively identified in samples obtained from patients in Kinshasa in 1960. Infections remained relatively uncommon in Africa until the 1970's when there were persons who had opportunistic infections commonly associated with AIDS identified in Kinshasa. Fueled by the forces of poverty, urbanization, poor access to health care services, conflict, a lack of women's empowerment, a lack of male circumcision in certain regions, and co-existing sexually transmitted diseases, HIV infections exploded in the 1980s, initially in East Africa and then in Southern Africa. By 1993, it was estimated 9,000,000 of the world's 14,000,000 HIV-infected persons lived in sub-Saharan Africa. During the 1990s, Southern Africa, especially South Africa, Swaziland and Botswana were devastated by increasing numbers of HIV-infected persons, with HIV infection rates surpassing 30% in some antenatal care clinics. In 2000, the World AIDS Conference was held in Durban South Africa, and the contrast between the burgeoning HIV epidemic in the global South and the hopeful era of combination antiretroviral treatment in the North shocked the scientific world into long-overdue action.

Current Epidemiology of HIV Infection in Africa

Worldwide there are an estimated 36,700,000 HIV-infected persons, and approximately 25,600,000 live in Africa. The current epidemiology of HIV infection in Africa demonstrates significant regional differences; Eastern and Southern Africa is home to 19,400,000 HIV-infected persons, Western and Central Africa 6,100,000, and North Africa and the Middle East 230,000. Across the continent women and girls are disproportionately infected more than men and boys². Heterosexual sex and perinatal transmission account for the vast majority of new infections in Africa, although it has been estimated that 5-10% of new infections among African men are the result of having sex with other men. Importantly, in recent years the numbers of new infections, the numbers of deaths due to AIDS, and the numbers of perinatally infected children have been falling across each of these regions on the continent. From among the multiple factors that contribute to these successes, the availability and scale-up of antiretroviral treatment in Africa is a major component.

History of Antiretroviral Treatment in Africa

By the late 1990's antiretroviral treatment was available to wealthy HIV-infected persons in Africa, but the cost of \$10,000-12,000/year restricted access tremendously. International attention became focused on the disparity in care between the global North and South, and in January 2002 The Global Fund to Fight AIDS, Tuberculosis and Malaria was established. President Bush followed this effort by calling for establishment of the President's Emergency Plan for AIDS Relief (PEPFAR) in January 2003. Both of these programs mobilized substantial resources to provide antiretroviral treatment to low-income countries most profoundly impacted by HIV infection. A key parallel event was the Doha Declaration, issued in November 2001, which allowed countries to respond to a public health crisis by manufacturing generic medications at a much lower cost. In addition, the Clinton Foundation advocated strongly for competitive pricing, and over time, the pharmaceutical industry responded by licensing generic manufacturers to produce their products, and both efforts dramatically reduced the costs of treatment to approximately \$100/year.

Current Status of Antiretroviral Treatment in Africa

The current WHO recommendations suggest that all HIV-infected persons should receive antiretroviral treatment. Globally it is estimated that 19,500,000 HIV-infected persons were receiving antiretroviral treatment by the end of 2016, representing 53% of the total HIV-infected population². In Africa it is estimated that 13,800,000 HIV-infected persons are receiving antiretroviral treatment. There are regional differences in treatment, ranging from 60% of those in East and Southern Africa to 35% in West and Central Africa to 24% in Northern Africa and the Middle East. Importantly, successful antiretroviral treatment can suppress HIV levels to below the limits of detection in a high percentage of persons⁴, resulting in restoration of a nearly normal lifespan and decreasing dramatically their risk of HIV transmission to non-infected partners⁵. Suppression of HIV below the limit of detection does not imply a cure, and medications must be supplied and taken diligently or HIV will return in the bloodstream. As a result of these treatment successes, WHO has set ambitious goals to move toward elimination of new HIV infections by 2025 known as "90-90-90"; 90% of HIV-infected persons should know their status, 90% should be on antiretroviral treatment, and 90% of those on treatment should be fully suppressed.

Notable Successes

Prior to 2001, it was unthinkable that such a massive international intervention could be mobilized. It represents an unparalleled alignment of political will to address the challenges of required resources, evolution of international law to enable generic manufacturing, supply chain management, training of health care personnel, and development of critical infrastructure. Hopefully this new paradigm can set a precedent, and its successes can inspire global cooperation to address future public health crises.

The building of capacity through these efforts merits additional description. Through efforts in the North and through South-South support, there has been a far-reaching campaign on the continent to train health care workers in all aspects of HIV prevention and treatment. These trainings cover a huge diversity of topics from condom use to testing to management of antiretroviral treatment to addressing HIV-related complications such as opportunistic infections and cancers. There has been an incredible investment in the laboratory infrastructure needed to properly diagnose and monitor HIV-infected persons, accompanied by the training of laboratory personnel. Many laboratories are now meeting the quality control standards set by the North, representing a tremendous resource for all health care on the continent. Increasingly generic antiretroviral medications are being manufactured in Africa for Africans, an important effort to ensure future sustainability.

Research on HIV and its complications in Africa is now at the cutting edge of science. Research generated in Africa by African scientists is essential because the continent is at the epicenter of the epidemic. Research should benefit those who participate either by directly providing better health, or creating knowledge that can lead others to better health. It is critically important to test interventions in African populations to be aware of the potential for differing drug metabolism and/or medication-related toxicities. The training of African scientists to perform robust, regionally relevant research has been undertaken with international assistance, and African scientists are among the world leaders. The opportunity to perform and publish such research has aided the careers of African academics and propelled them into leadership roles within their universities. Laboratories for research on the continent have become increasingly sophisticated such that most complex assays can be performed in African laboratories without leaving the continent.

Remaining Challenges

Unfortunately, great damage has been done in sub-Saharan Africa; more than 25,000,000 persons have died of AIDS, and over 12,000,000 children have been orphaned. AIDS is now the leading cause of death for African adolescents, and the impact of these losses will be felt for generations. Despite the advances in infrastructure and training described above, overall African health care systems are terribly resourced and vulnerable to instability. Health care may be delivered in separate siloes and is prone to inefficiencies; for example, antiretroviral therapy may be delivered in one clinic, family planning in a completely different clinic, and tuberculosis treatment in a third clinic. In association with HIV infection and antiretroviral treatment, non-communicable diseases such as cardiovascular complications, chronic kidney disease and liver disease are emerging in Africa, and will require treatment in the future.

Substantial challenges also exist for women and their lack of empowerment over their sexuality and fertility. Young impoverished girls and women are vulnerable to transactional sex, where they receive gifts for sex, especially from older men. As a sexually transmitted disease, HIV remains highly stigmatized, leading to late diagnosis, late initiation of treatment and secrecy

regarding the disease. The recent emergence of legal actions against men who have sex with men and the denial of health care to this population in some African countries enhances the likelihood that HIV infection will increase in this population, and endangers public health. Furthermore, many of these men also have sex with women, creating a transmission link between these populations. Finally, there are questions about the sustainability of international aid efforts in the context of emerging isolationism and nationalism among some donor countries.

Summary

Tremendous progress has been made in Africa to address the HIV epidemic. Improvements in health care infrastructure and provider training have bolstered treatment and prevention efforts with assistance from the North. Much of the current research on HIV treatment has been performed in Africa, with benefits to research participants and African scientists.

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