International STD Research & Reviews
2(1): 12-20, 2014; Article no. ISRR.2014.002

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Recent Progress and Challenges in Combating the HIV/AIDS Epidemic: A Review

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Authors' contributions

This work was carried out in collaboration between both authors. Author JO conceived the idea. Authors JO and IAOO wrote, read and approved the manuscript.

Mini-review Article

Received 29th October 2013
Accepted 13th January 2014
Published 28th January 2014

ABSTRACT

The human immunodeficiency virus (HIV), the virus that causes the acquired immune deficiency syndrome (AIDS) has for many years devastated lives and still continues to do so in the present day. Reducing the spread of HIV/AIDS is a global concern, one that has been given vast resources, but still remains a major huddle to development to most world economies. The devastation caused by the disease is not only felt by individual families, friends and loved ones, but is also a heavy loss of human capital. Identifying the key factors that affect the spread of the disease ensures that resources and efforts are devoted to addressing those specific issues. Many factors like: irresponsible behavior and life-style, cultural practices, unsanitary medical equipments poverty and illiteracies have been long blamed for the persistence of the disease. However, none of these factors is often solely to blame for the high prevalence of HIV in some communities. Unless elaborate studies can elucidate the complex interaction between these factors and how exactly they influence the HIV dynamics, reducing the spread of the epidemic might remain a challenge for the foreseeable future. This work discusses recent progress and major challenges faced in combating the spread of HIV/AIDS. Further insight into what can be done to reduce its spread and improve the welfare and quality of life of those infected and affected by the epidemic is provided.

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Keywords: HIV/AIDS; disease; prevalence; healthcare; epidemic; transmission.

1. INTRODUCTION

For over a quarter a century the world has battled against the human immunodeficiency virus (HIV)/Acquired immune deficiency syndrome (AIDS) epidemic. HIV is a virus that is causing a lot human loss in the world with more incidences in Sub-Saharan Africa. Infection with the virus results in the progressive deterioration of the immune system leading to immune deficiency. This disease is devastating in various aspects and its impact spans well beyond the patient to friends, relatives and loved ones. The immune system is considered deficient when it can no longer fulfill its role in fighting infections and diseases. AIDS is known to have originated from nonhuman primates in the Sub-Saharan Africa and it is caused by the HIV [1] for insight into the possible origins of HIV and the AIDS pandemic).In humans, the disease is caused by two lent viruses, namely: the human immunodeficiency viruses types 1 and 2 (HIV-1 and HIV-2) – hereafter simply denoted as HIV. Although it is not exactly clear when the transfer of HIV/AIDS to humans first occurred, it is believed to have occurred somewhere in the late $19^{th}$to early 20^{th} Century Greene [2] and Center for Disease Control and Prevention [3]. Further insight into the origins of the AIDS virus can be found in the work of Sharp and Hahn [1].

The HIV disease currently still remains a big problem in particularly third world countries. The differences in prevalence between rich and poor nations can be attributed to various factors namely: welfare structure and social economic differences between nations, illiteracy, cultural differences and lifestyle among others [4]. The term prevalence refers to the proportion of a population that suffers a given condition (or disease). In this paper, theintricate interaction between numerous factors that contribute to the spread of the HIV/AIDS epidemics is discussed. The discussions are based on geographic regions of particularly unique demography and epidemic history. This enables making comparisons with other communities with diversely different prevalence rates for the disease in an effort to identify the key players that aid the persistence of the spread of the disease.

In many poor societies the provision of adequate healthcare still lags behind. The same societies do not have access to proper social service provision, education and jobs remain lacking. These are some of the factors that force the people in such communities to resort to risky lifestyles and sexual practices – thereby contracting the disease. The mode by which the disease is spread is well documented [5,6,7,8]. The rapid population growth in some countries means that the provision of education, healthcare and other very much needed social services remains a challenge [9].The provision of essential social services and basic needs like: clean water, housing, education, healthcare is a challenge not only to the developing countries but also to the developed ones. Here, the details of prevalence in individual countries are not provided but such information is accessible in the internet. It is therefore imperative that the scientific quest for more effective antiretroviral vaccines for HIV should go hand-in-hand with the provision for counseling services in communities.

Many mathematical models for understanding and explaining the dynamics and spread of HIV/AIDS have so far been proposed [10,11]. These models often describe the mode of spread in a given community and how the community dynamics would change given a change in the demography or a change in certain parameters that are considered to be crucial for the disease spread. Such advancements are much welcomed by the global community. The major huddle with it is that it often remains largely theoretical and difficult to implement in practice. The other pitfall is that mathematical modeling does not and cannot

account for all factors that influence the prevalence and incidence rate of the disease. The role of cultural practices by a community (e.g. male and female circumcision, having multiple sexual partners), social economic status, and an individual's literacy level cannot be easily accounted for in mathematical modeling. In some communities around the world it still remains an acceptable practice to remarry the wife of a fellow brother or clans' man – apractice that has no doubt contributed to raising the prevalence of the disease e.g. [12]. This points the need for other approaches to stop the spread of HIV/AIDS alongside scientific research.

2. THE HIV/AIDS EPIDEMIC

2.1 Root Causes of the Problem

The modes of transmission of HIV/AIDS are very well known, namely: through sexual intercourse (female-to-male, male-to-female, male-to-male transmission), parenteral transmission (such as transfusion of infected blood and sharing of needles and other sharp body piercing instruments like those for body decorations in tattoos), transmission from mother to child and some other less known modes of transmission, with the main infection states being the Susceptible, the Exposed and the Infected. Consolidating extensive knowledge on the modes of transmission of the disease does not necessarily make combating the diseases any easier; however, it does contribute to helping healthcare workers in disseminating information to communities on how to protect themselves from HIV/AIDS and also how to care for the already sick.

The devastations caused by HIV infection can be enormous especially for individuals that do not have proper access to antiretroviral drugs – let lacking a sustainable income for a living. Antiretroviral drugs are often in short supply in many communities especially in third world countries. The few available drugs in the market are either overpriced or simply sold by healthcare workers even if they are meant to be provided to patients for free. This element has to do with corruption since a lot of the global funds provided to individual governments and institutions in poor countries end up being misused and unaccounted for by the relevant authorities [13,14]. Children in households whose heads are at the advanced stages of the disease and very sickly are often faced with the inevitable choice of dropping out of school and providing care for their parents or guardians. This robs the children of their right to education forcing them to assist in heavy domestic duties and in some cases taking over the role of being a bread winner in a family.

2.2 Combating HIV/AIDS

Up to date there remains a huge unresolved debate among experts as to whether practices like male circumcision helps reduced the spread of HIV; e.g. Byakika-Tusiime [15] on the transmission of HIV infections led to the conclusion that, circumcision does reduce the transmission of HIV-1 infection. The overall reduction was 58% for circumcised men. His work involved a meta-analysis of three randomized controlled clinical trials and also from cohort and case-control studies. Other similar studies have also lead to conclusions of reduction in transmission of HIV infections [16,17,18]. However, on the contrary, some studies have led to the conclusion that the circumcision of HIV-infected men did not reduce HIV transmission to their female partners for a period of over 24 months and the longer-term effects of the circumcision could not be assessed[19]. This divergence in studies can lead to misinformation to the general public. This difference in opinion about the reality remains a

dangerous issue especially since certain countries have already embraced and openly campaigned for male circumcision in a bid to reduce the spread of the disease. Arguably such illusions coupled with other misinformation of the illiterate can lead to risky sexual practices like having multiple sex partners and unprotected sex. Some men believe their chances of contracting the disease is reduced if they are circumcised. Recently, there has been some evidence that actually being circumcised might only increase ones chances of contracting the disease contrary to what other scientists had earlier on claimed [20].Their findings suggest the need for caution in the use of circumcision as an HIV prevention strategy, particularly in cases where more effective combinations of interventions remain to be fully implemented. It is therefore imperative that the facts be spot on prior to dissemination of information, otherwise, in a bid to help combat the epidemic more lives could be put at risk thereby further compromising the progress already achieved.

Involvement in risky practices like the use of needles and/or other body piercing instruments also increases the spread of HIV/AIDS. Societies with prominent drug use and alcohol abuse are most likely to have high rates of sexually transmitted diseases – particularly in very poor countries. These issues coupled together leads to the question: how are we ever going to get rid of this disease? The answer to this question has not only so far eluded experts, but also led to divided opinions on the best ways of combating the disease. Whatever the differences in opinion, it remains clear that the fight against HIV/AIDS is far from over. Eradication of the virus is not attainable with the current available drugs and now the focus is the management and control of the virus progression in an infected person. Amidst all these challenges and dilemmas on how best to fight this pandemic, much has been achieved in reducing its prevalence in various countries around the world; e.g., a lot of effort has already been put in by various governments and stake holders around the world in a bid to illiteracy and reduce risky cultural practices that put people at risk of contracting HIV. The reduction of poverty through provision of education and other income generating projects to the youth and other high risk groups helps in the fight against the spread of the disease. There is still need for improved funding for scientific research on HIV/AIDS. The provision for affordable vaccines and/or drugs to patients should also be up-scaled especially in the third world counties. This will ensure that not only shall will there be advancements in science with regard to finding more effective vaccines, but also achieve prolonged and improved quality of life for patients.

Here an overview of successful HIV prevention strategies adopted around the world is provided. Most of these strategies are unique to individual countries and the way they are practiced and/or implemented might also vary; in principle these successful strategies share in common features like: good high-level political leadership, effective placement of programs to combat stigma and discrimination, nationwide condom promotion, sexually transmitted infection surveillance and control among individuals of all age groups, identification of low and high risk age groups in each population – this enables authorities to devise measures to combat transmission of the virus from high-risk to low-risk groups, there should be active engagement of civil and cultural society and religious leaders, putting in place age-structured programs designed to change social norms in a population-particular the norms that contribute to the spread of HIV/AIDS, stepping up efforts in open communication on sexual activities, HIV/AIDS and all other sexually transmitted diseases, and steering interventions aimed at connecting all age groups in a population. Additional insight into such preventive strategies on combating the spread of HIV/AIDS can be found in [21,22,23,24]. Having only some of the above preventive strategies in place is insufficient to effectively combat the spread of HIV/AIDS and improve patient care – therefore, the need for an integrated collaborative effort from all sectors and organizations. Such integrated efforts

should include targeted strategies on behavioral change, biomedical and structural interventions as discussed in [25,26].

3. RECENT DEVELOPMENTS, CURRENT CHALLENGES AND DILEMAS

Even though there have been major advances inthe quest to find a HIV vaccine that completely eradicates the virus that causes AIDS in primates like monkeys [27], we are still far away from finding an effective HIV vaccine. The findings from research with primates show that half of the monkeys tested responded to the vaccine, the monkeys were infected with simian immunodeficiency virus [27]. Such a vaccine of course still remains to be extensively tested in humans before any major claims can be made about its effectiveness in combating the disease. It would be an illusion to assume that the discovery of vaccines for HIV/AIDS such as that [27] would spell the end of the pandemic. On the contrary, such a development only pauses more challenges on the affordability of the vaccines – especially by the poor and unprivileged. If and/or when the cure for HIV/AIDS is found, there still remain a lot of issues to address, e.g. the monumental task of how to make the vaccines affordable by the poorest people who are in most cases the ones who suffer most from the HIV epidemic.

The most known achievements in biomedical approaches for HIV prevention are the use of: condoms, clean injection, blood and blood product safety, and prevention of mother-to-child transmission. Recently, antiretroviral drugs to reduce the risk of transmission or reduce the risk of acquisition have proven efficacious [28]. Recently, there has been some interesting insight into the challenges and opportunities that are exist in integrating behavioral and biomedical research in HIV interventions [5]. This work highlights the need for integration of behavioral science to implement prevention at the population level with the goal to reverse the spread of HIV/AIDS. Availability of more funds should enable us see improvements in various aspects in the fight against the disease – see further discussions in Hale et al. [29].

A recent study has elucidated the conflicting inferences resulting from studies using mathematical models for predicting the disease dynamics e.g. [30,31,32]. What is apparent from these studies is that often they deviate from capturing the reality and truth of the disease dynamics and actual challenges faced by the people in specific communities. Additionally, most if not all mathematical models are constructed using assumptions that might match the population structure, its dynamics and the diseases prevalence in certain communities. It still remains a challenge to address social issues like engagement in risky sexual behavior, drug abuse, etc. Some of these are issues that can be best addressed by providing alternative life supporting activities and income generating projects alongside services like education, counseling and the care provision. It is vital that people be guided unto seeking to know their own HIV status and that of their partners. This not only helps them make healthy and informed decisions about their sexual behavior but also enables them to plan for their families and future. Access to counseling services is still not widely available to many people world-wide, let alone the availability of healthcare personnel in many remote regions of the world. It would be naïve of us to assume such challenges take a few years to address, but by careful collaborative planning between the authorities charged with policy making and implementation and healthcare provision. There is need for improved access to education for everybody.

Currently, at least 35 million people are living with the HIV/AIDS epidemic – with the majority of them living in African and in particular central and Sub-Saharan Africa. Today ~2/3 of those living with HIV/AIDS is from Sub-Saharan Africa, this fraction includes ~88% of the

world's HIV positive children. In South Africa for instance estimates of the national prevalence are ~10% (of a total of ~53 million) – with wide variations existing between the prevalence rates of various age groups in the population. Such statistics are not limited to South Africa, but other countries that share similar demographic, cultural and social economic backgrounds, namely: Malawi (~10%), Zimbabwe (~15%), Lesotho (~23%), Botswana (~24%) and Swaziland (~26%) further details on these statistics can be found in: Central Intelligence Agency report [33]. The above statistics is alarming, thereby pointing to the need to upscale efforts to fight against the epidemic. In this fight the world is faced with some unpopular questions, e.g.: Can the world afford to lose the fight against HIV – given the progress achieved within the last few decades? Is enough being done to combat the disease? What are the best strategies for combating the spread of HIV? Is everyone including scientists doing enough in the fight against the epidemic? Providing answers to such questions helps in the bid to lower the global HIV/AIDS prevalence and improve the quality of lives of those infected and/or affected. By 2010, a trend in reduction of the number of people newly infected (incidence) with HIV was reported from 1999 to 2009 [34]. This negative trend in incidence is encouraging and highlights the rewards of the extensive on-going global battle on reducing the spread of the disease. Though such a trend is encouraging, there is no call for celebration, but more vigilance, as any slight lapse in the battle against combating the disease can reverse the trend – a prospect that is very worrying. Dennin et al. [34] also noticed variations in geographic and age-structured prevalence of the epidemic for various regions of the world.

4. CONCLUDING REMARKS

Even though the modes of spread of HIV/AIDS is the same for every community, the specific strategies for combating the spread of the disease should be tailor made bearing in mind various social economic factors and cultural background of that specific community. In essence there is no one size fits all solution or strategy that will globally help reduce the prevalence rates of HIV/AIDS. It is crucial that the world leaders and governments, private sectors and other authorities charged with the dissemination of information on healthcare and counseling services step up their efforts if we are to continue to gain grounds on the fight against AIDS. The prevention of HIV arguably remains one of the biggest challenges in the modern day. Although much has already been achieved in reducing the prevalence of the disease in many countries, the last few years have seen a rise in the prevalence rates of the disease in some countries. It is vital that the key factors that influence the increase in prevalence be identified, thereby, providing clues as to how they can be addressed. It still remains a challenge to prove the benefits of detection and treatment of sexually transmitted diseases in the fight against HIV. Currently, strategies of combating the HIV epidemic still remain an issue of debate even among experts in combating the pandemic. Although much still remains to be achieved, the role of technology in the fight against the HIV/AIDS epidemics cannot be understated. The availability of high-tech scientific research techniques, tools and communication devices such as mobile phone have not only aided the search for more effective antiretroviral vaccines but also fastened the pace at which healthcare services are delivered. It would be a bit naïve to assume that putting all the above discussed solutions to practice would rid the world of HIV/AIDS, however, it is crucial to bear in mind that every single effort invested in the fight against the disease will go a long way in combating the epidemic.

CONSENT

Not applicable.

ETHICAL APPROVAL

Not applicable.

ACKNOWLEDGEMENTS

The workwas self-sponsored, i.e. by the authors.

COMPETING INTERESTS

The authors declare no competing interests.

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Peer-review history:
The peer review history for this paper can be accessed here:
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