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Envisioning “The End of AIDS”: Challenges and Prospects

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Abstract

The decline in the number of new HIV infections over the past decade has created a unique opportunity for the global community to harness the prevailing impetus to envision “The End of AIDS”. Unprecedented international political commitment, resource mobilisation, and civil society engagement have combined to effectively implement AIDS programmes and services using evidence-based technologies and approaches. Complacency, however, could rapidly reverse this trend. Further, new HIV infections continue to occur at unacceptably high levels in many areas, including among key populations characterised by their marginalisation and vulnerability in society. However, experiences in some countries and mathematical models demonstrate that combinations of available interventions can reduce HIV incidence to a level that it no longer represents a public health threat. Ending AIDS will not be an easy task; it will require much more than political commitment or biomedical tools. A more detailed understanding of HIV transmission at a local level needs to be combined with renewed effort to address ongoing HIV transmission. Concerted action at local level needs to learn from past failures, build on local and global successes in implementing effective interventions to scale. Effective implementation requires reinvigorated effort to address law reform, gender inequalities, gender-based violence, stigma and discrimination, and strengthen health systems and programmes. Simultaneously, scientific innovation, including research for an effective HIV vaccine and cure, must be bolstered. Now more than ever, the global AIDS response cannot afford to lose its momentum. With greater global effort and implementation, “The End of AIDS” is within our grasp.

I. HISTORICAL PROGRESS AND MILESTONES IN THE AIDS RESPONSE

Since the first reported cases of AIDS in 1981¹, more than 70 million people have been infected with HIV. Initially, only men who have sex with men (MSM) and people who inject drugs (PWID) were thought to be affected. However, reports soon emerged that the disease was also occurring in haemophiliacs², heterosexual Haitian immigrants in the USA³ and was also being transmitted from mother to child perinatally⁴. It quickly became apparent that the world was facing a new epidemic. By the time that the first HIV antibody test became

commercially available in 1985, AIDS had already been reported from every region of the world.

Public demonstrations and protests highlighted not only the plight of AIDS patients, the need for AIDS research and affordable treatment⁵, but also advocated for LGBT (lesbian, gay, bisexual, and transgender) rights, women's and children's rights, and the direct involvement of HIV positive people in the HIV response. In 1986, the World Health Organisation established the Global Program on AIDS under the leadership of Johnathan Mann who passionately promoted human rights in the AIDS response. In 1987, the first antiretroviral drug, azidothymidine (AZT), was approved by the US FDA for treating AIDS. In 1996, the Joint United Nations Programme on HIV/AIDS (UNAIDS) was created to guide, strengthen and support worldwide efforts against the HIV epidemic. In that year, combination antiretroviral therapy (ART) with three drugs was shown to be more effective than single drug treatment⁶. Life-saving ART was, however, unaffordable and inaccessible to most people needing it at the time.

In 2000, community organisations, trade unions, activist groups, scientists and health care workers united at the 13th International AIDS Conference in Durban, South Africa, to demand the end to the injustice of global inequity in access to AIDS treatment. Drastic reductions in drug prices coupled with the creation of the Global Fund to fight AIDS, TB and Malaria (GFATM) in 2002 and the President's Emergency Plan for AIDS Relief (PEPFAR) in 2004 made AIDS treatment a reality in developing countries. By the end of 2012 an estimated 9.7 million people in low- and middle-income countries were receiving ART⁷.

In parallel, evidence of successful HIV prevention grew, such as the "100% Condom Use" programme in Thailand⁸, harm reduction programmes among PWID in Australia⁹ and the "zero-grazing" campaign in Uganda¹⁰. The discoveries that AZT¹¹ and nevirapine¹² prevented mother-to-child transmission of HIV were rapidly followed by policy and implementation globally to increase HIV testing and provide antiretroviral prophylaxis to pregnant women. The first HIV rapid, point-of-care test in 2002 eased the bottleneck into prevention and treatment scale-up programmes. In 2005, voluntary medical male circumcision (VMMC) was proven to reduce HIV acquisition in men¹³. About 3.2 million adult African men have had VMMC for HIV prevention by the end of 2012⁷.

Since 2010, the HIV prevention landscape has been transformed. There have been more positive HIV prevention trial outcomes in the last three years than the first 29 years of the HIV epidemic¹⁴. These recent trials have demonstrated the effectiveness of antiretrovirals in HIV prevention. An antiretroviral-containing vaginal gel, used before and after sex, reduced the risk of HIV infection by 39% and genital herpes by 51% in women¹⁵. Oral antiretrovirals, for daily pre-exposure prophylaxis (PrEP), reduced the risk of HIV in HIV negative partners in discordant couples¹⁶, MSM¹⁷, at-risk men and women¹⁸, and PWID^{19, 20} by between 44% and 75%. High adherence has been shown to be essential for the effectiveness of PrEP^{21, 22}. Treatment with combination antiretrovirals with sufficiently high levels of adherence to suppress viral load in HIV infected individuals reduced the transmission of HIV to their sexual partners by 96%²³.

I. DESPITE RECENT PROGRESS, HIV PERSISTS IN HIGH RISK KEY POPULATIONS

In contrast to the growing HIV epidemic of the 1980s and 1990s, the last decade has experienced a decline in new HIV infections. Estimates from UNAIDS suggest a 33% drop in the number of new HIV infections from 3.4 million in 2001 to 2.3 million in 2012⁷. Transmission of HIV from mother to child decreased by 52%⁷ over the last decade up to 2012, during which an estimated 260,000 (range: 230 000 – 320 000) children became

newly infected globally. In 2012, an estimated 63% (range: 57–70%) of HIV-positive pregnant women received antiretroviral prophylaxis or treatment⁷. In some parts of the world, mother-to-child transmission of HIV has been virtually eliminated²⁴.

Despite these encouraging trends, HIV remains a substantial global health challenge with an estimated 35.3 million people living with HIV in 2012⁷. In most countries, even those with a declining overall prevalence, HIV continues to spread in key populations, such as young women, especially in Africa, sex workers, MSM, transgender individuals and PWID, where the risk of HIV is highest.

Sub-Saharan Africa accounts for just over 70% of all HIV infections, with young women having as much as 8-fold²⁵ higher HIV prevalence and acquiring HIV 5-7 years earlier than their male counterparts^{26,27}. Several factors contribute to this vulnerability; for example, intimate partner violence has been shown to increase risk for acquiring HIV²⁸. Female sex workers are globally at particularly high risk, with HIV prevalence rates up to 13.5 times higher than those in other women²⁹. In Latin American countries, MSM are up to 33 times more likely to be HIV positive than men in the general population³⁰. In the USA, where the number of HIV infections has remained stable for more than a decade, 63% of all new HIV infections occurring in 2010 were among MSM, who comprise only 4% of the total US male population³¹. Further, in 2009, transgender individuals were estimated to have twice the rates of new HIV infection than men and women in the general US population³². In a meta-analysis of 11,066 transgender women, the worldwide HIV prevalence was 19.1% (95% CI 17.4-20.7)³³. PWID are similarly disproportionately affected by HIV, particularly in eastern Europe and central Asia where more than 80% of all HIV infections in these regions are related to drug use³⁴.

Over the last few years the nature of the HIV epidemic has been changing steadily in many countries, reaching the current situation where ongoing transmission in key populations is now most important but proving to be refractory to current HIV prevention efforts³⁵. HIV prevention for these groups requires a different approach, as they are often hard-to-reach, marginalised, disempowered and stigmatised. The epidemiology of HIV in these key populations is generally poorly understood with many not being acknowledged at country level. Continued success against HIV demands active identification, characterisation and prioritisation of these key populations within each country³⁶. The business-as-usual approach, such as ABC programmes (**A**bstinence, **B**e faithful, **C**ondoms), has little chance of success in reducing the risk of HIV in these groups. A new vision, with reassessment of the priorities and targets, is essential at this stage.

II. CHOOSING A NEW VISION FOR THE GLOBAL AIDS RESPONSE

Now is the time to delineate a new vision for the AIDS response. As the 2015 deadline for achieving the MDG targets draws near, it is opportune to consider options for the post-MDG era. The current vision comprises at least three overarching approaches; the UNAIDS vision of “Zero New Infections, Zero AIDS-related Deaths and Zero Discrimination”, PEPFAR’s “AIDS-free generation”, and the United Nation’s Millennium Development Goals (MDGs). Each of these has served as a rallying point in the global AIDS response, but there is a need to build on these concepts for a new bold post-MDG vision as an integral part of the post-2015 development agenda that is aspirational while encompassing the combination of past successes and future challenges – a vision for “The End of AIDS”.

Now is not the time for complacency. A static or declining level of effort against AIDS may see a reversal in the epidemic trajectory and the unravelling of the recent gains in the global AIDS response. Disturbingly, several countries with stable or declining HIV epidemics are

showing trends of increasing risky sexual behaviours among at-risk groups over the past 5 years^{7, 37}. Uganda for example, successfully reversed its HIV epidemic in the 1990s but is now experiencing a worrying resurgence, with the annual number of new HIV infections dropping from 183,300 in 1991 to 93,800 cases in 2001 before rising again to reach 155,300 in 2011³⁸. In the USA, concern about AIDS has been declining among young MSM, who are continuing to engage in high risk sexual behaviour³⁸. Complacent young MSM who reported reduced HIV/AIDS concern in this 6-city survey, engaged twice as often (OR: 2.06; 95% CI, 1.51-2.81) in unprotected anal intercourse with an HIV-positive or HIV-unknown-status male partner³⁸. Of concern, political leaders are claiming premature victory against HIV and lowering efforts against the epidemic in some countries where the epidemic is showing a declining trend. The parallels with tuberculosis, where complacency rejuvenated a waning epidemic, are striking. The declining global tuberculosis epidemic in the 1980s, was followed by decreased spending and closure of several programmes on this disease³⁹, compromising several country-level responses leading to the recent resurgence in this epidemic, which reached an estimated 8.7 million new cases and 1.4 million deaths in 2011⁴⁰.

Now is the time to build on past successes. The successes achieved to date were made possible firstly by active global, national and local-level political commitment. Secondly, this commitment translated to in-country resource mobilisation specifically for AIDS, with domestic AIDS spending in low- and middle-income countries estimated to have reached US\$ 9.9 billion in 2012⁷. For example, Brazil, Russia, India, China and South Africa (BRICS) increased their domestic AIDS spending by more than 122% between 2006 and 2011⁴¹. Thirdly, the financial assistance needed by low-income countries has been addressed by an important feature of the AIDS response, namely global solidarity. The GFATM and PEPFAR are exemplars of global solidarity, where high-income countries, who themselves have concentrated HIV epidemics, have provided substantial financial resources for the international AIDS response. Fourthly, a substantial portion of these resources have been devoted to implementing multi-sectoral evidence-based programmes, drawing upon local and international guidelines and new scientific evidence as it becomes available. Notwithstanding, there are several examples of inappropriate programming with resources wasted on ineffective interventions. Fifthly, a hallmark of the decision-making process of the AIDS response is the active engagement and involvement of civil society, especially people living with HIV. An unprecedented opportunity exists now to harness this momentum to reinvigorate the AIDS response and reach “The End of AIDS”.

III. THE END OF AIDS

“The End of AIDS” is an aspirational vision for 2030. The epidemiological concepts of *elimination* (reduction to zero of the incidence of infection in a defined geographical area as a result of deliberate measures to prevent transmission)⁴² and *eradication* (permanent reduction to zero of the worldwide incidence of infection)⁴² refer to specific endpoints in global efforts to control an infectious disease. These concepts are not readily applicable to the HIV epidemic at this time as there are millions currently living with HIV and no cure is currently available. The concept of “The End of AIDS” refers to *epidemic control* (reduction of disease incidence, prevalence, morbidity or mortality to a locally acceptable level as a result of deliberate intervention measures)⁴², which can be mathematically defined as the point at which the reproductive rate of infection (R_0) is below 1. The R_0 is the average number of secondary cases that arise from a single new case of infection in wholly susceptible population and is a measure of the propensity for an epidemic to spread. To reach R_0 , a progressive decline in HIV incidence and AIDS-related mortality, will be required in the defined geographical area (for example, a local, district or country level) and the “locally acceptable level” is a point where HIV no longer represents a public health threat and is no longer ranked among the leading causes of a country’s disease burden. This will be no simple feat as it depends on creating a confluence of enabling conditions, including political

commitment, resource allocation, social mobilisation, legislative changes, reducing stigma and social inequities, strengthening of health systems, treatment provision and effective prevention programmes, particularly for key populations.

“The End of AIDS” is more than an epidemiological concept. It goes well beyond preventing and treating HIV to encompass initiatives that strengthen commitment among policy makers, community leaders and civil society, legal reforms aimed at reducing stigma and discrimination, gender inequality, gender-based violence and other social determinants of the HIV epidemic, while fostering human rights, especially the right to health as a central tenet of the AIDS response.

In light of the heterogeneity of the HIV epidemic globally, the pace at which “The End of AIDS” can be realised will vary across countries depending on their HIV disease burden⁴³. The following 5 components provide an approach for a country to assess its progress on the path to “The End of AIDS”:

1. A nationally co-ordinated comprehensive response:

Such a response includes a national policy/plan, stipulated goals/targets, appropriate resource allocation, mechanisms for inter-sectoral coordination, and high level political support. Comprehensiveness refers to the scope of the response and its alignment with the country’s needs, including initiatives to address the underlying drivers of the HIV epidemic, such as gender inequality, stigma and discrimination, human rights violations, legal barriers and lack of access to prevention and care. Progress in all aspects of the AIDS response, especially the social determinants and drivers of HIV transmission, needs to be measured and monitored against pre-set targets.

2. Detailed knowledge of the local HIV epidemiology:

Few countries currently host generalised and uniformly widespread HIV epidemics. In most countries the HIV epidemic is concentrated in key populations, and/or in certain area where HIV prevalence is much higher in the general population than it is elsewhere in the country, referred to as hotspots. In these settings, overall country level estimates showing stable or declining epidemics may be misleading as they may camouflage groups or hotspots where the epidemic is continuing to grow unabated. Epidemiological studies need to be conducted to identify such hotspots and to understand the risk factors and underlying drivers in the key populations where the epidemic continues to spread. Once key populations and hotspots are identified, targeted HIV prevention interventions need to be customised to address those groups. Focused effort with adequate resources aimed at these groups may be required. HIV trends in the key populations need to be monitored. Progress can be measured by the rate at which new hotspots emerge and by declines in HIV incidence in each hotspot or key population identified.

3. Elimination of new HIV infections in children:

Available technologies and strategies have reduced mother-to-child transmission of HIV to the point where a global plan has been developed for the elimination of new HIV infections among children²⁴. Almost 90% of all new HIV infections in infants occur in 22 priority countries. Regardless, every country needs to monitor new infections in children, measure the success of pre-natal screening for ART provision, and implement interventions to reduce breastfeeding transmission. In addition, annual targets to achieve the elimination of new HIV infections in children need to be set and monitored.

4. High level of viral suppression through ART scale-up:

Treatment provision is a key component of any country’s AIDS strategy. Not only is ART life-saving, but it also has the potential to prevent HIV transmission. Hence, the scale-up of treatment provision to all eligible patients, as well as access and affordability of antiretroviral drugs, is a high priority. Initiating eligible patients on ART is key but

maintaining patients on treatment in the long-term is just as important. Retention in care is important for the achievement of viral suppression, which in turn is a strong predictor of the risk of HIV transmission. Reliable estimates of the total number of HIV infected individuals and the proportion eligible for ART is an important first step in this regard. Annual targets of the proportion of eligible patients on ART and their retention in care need to be set and monitored. However, the proportion of the population with suppressed virus, which has been shown to be an important predictor of HIV transmission and mortality⁴⁴, is the most valuable single indicator of progress in ART provision. Measuring this indicator requires data on viral load in HIV infected individuals representing patients who are on ART as well as those awaiting ART initiation and those defaulting on ART adherence.

5. Diminishing HIV incidence through combination prevention:

A single HIV prevention intervention is unlikely to be able to alter the epidemic trajectory on its own as HIV epidemics in communities are complex and comprise a mosaic of different risk factors and different routes of transmission. Hence, a mix of behavioural, biomedical and structural HIV prevention actions is likely to be needed to alter the course of the HIV epidemic in different regions and populations. Proven prevention strategies can be directed at individual behaviour (such as condom use or HIV counselling and testing), at biological effects in individuals (such as ART for viral suppression), at small targeted groups (such as decriminalisation of sex work or needle exchange), at large groups within the population (such as circumcision for men or conditional cash transfers for school-going youth), and at entire populations (such as “zero grazing” norms). To maximise impact, appropriate combinations of these interventions need to be identified for each target population with their meaningful involvement. The combination of HIV prevention interventions needed may vary depending on cultural context, the population targeted and the stage of the epidemic. The goal of effective combination prevention is to reduce the HIV incidence. Each country will need to define its target incidence level and monitor progress by measuring HIV incidence at regular intervals.

The five components above go beyond HIV prevention and treatment to include programmes focused on key populations and hotspots, initiatives addressing the underlying social, economic and legal barriers as well as high-level commitments by political leaders, policy makers, resource allocators and civil society. While “the End of AIDS” is a long-term vision, these components provide a practical approach to assessing progress, with epidemic control being a key milestone for each country on this path.

IV. IS “THE END OF AIDS” ACHIEVABLE?

Historically, highly effective vaccines and / or cures have been central to infectious disease control. While continued investment in the science and innovation required to achieve an effective vaccine and cure remains a very high priority, neither of these technologies are available for HIV yet. However, several effective prevention technologies are readily available and if implemented to scale could put “The End of AIDS” within reach. For example, the scale-up of antiretroviral prophylaxis, and more recently, ART for HIV positive pregnant women has made the elimination of new HIV infections among children feasible, even in the absence of a vaccine or cure, as heralded by the UNAIDS Global Plan Towards the Elimination of New HIV Infections among Children²⁴. This is an ambitious goal and progress towards the elimination of new infections among children in the 22 high priority countries has been variable. Countries like Botswana, Ethiopia, Ghana, Malawi, Namibia, South Africa, and Zambia have made substantial progress, reducing MTCT by over 50% between 2009 and 2012. However, MTCT rates have not declined as rapidly in countries like Angola, Chad, Côte d’Ivoire, Democratic Republic of the Congo, Lesotho, and Nigeria²⁴. In these countries, preventing HIV transmission during the breastfeeding period is an

increasingly important component of MTCT. Initiation of lifelong ART during pregnancy (Option B+) is now being used in several countries to address this challenge. With greater commitment, resources and strengthening of PMTCT services for option B+ in high priority countries, elimination of new HIV infections in children can be achieved.

Coverage of effective services for PWID in many parts of the world remains inadequate³⁶. People with drug dependence problems are stigmatised and have to deal with a range of contextual realities, including human rights abuses, abusive police practices, and widespread use of arrest, detention and incarceration. Mathematical models suggest that a comprehensive package of interventions including opioid substitution, needle exchange, and ART provision can achieve substantial reductions in HIV incidence in PWID⁴⁵. The HIV epidemic can be prevented, stabilised and even reversed in PWID through comprehensive harm reduction programmes as demonstrated in Australia⁹ and in several other countries⁴⁶. Legal and policy reform have been key to these achievements and the recent demonstration of the effectiveness of antiretroviral PrEP in PWID²⁰ provides an additional prevention strategy to reduce new infections in this group.

Sexual transmission predominates in the global HIV epidemic. A number of strategies has been proven to prevent sexual transmission of HIV⁴⁷. Furthermore, evidence of the impact of these strategies on the epidemic trajectory at community level has been accumulating steadily following implementation to scale. For example, scale-up of ART in a rural African community between 2003 and 2011 reduced the risk of HIV acquisition by 38%⁴⁸, while increasing life expectancy by 11.3 years⁴⁹. Further, scale-up of VMMC from 12% in 2007 to 53% in 2010 in one South African community has led to a 19% reduction in HIV prevalence and up to 61% reduction in HIV incidence⁵⁰.

As empiric evidence of the community level impact of combination HIV prevention is still rudimentary, mathematical modelling (see supplementary materials) was used to explore the potential impact of combining a range of existing proven HIV prevention technologies, such as ART, VMMC, and PrEP (Figure 1). This model shows that each additional intervention adds incremental impact on HIV incidence. In combination, these interventions could have a profound impact on diminishing HIV incidence at a population level, bringing us closer to reaching “The End of AIDS”.

In a cost-effectiveness analysis of the scale up of combination prevention in South Africa, the implementation of expanded HIV counselling and testing (HCT), ART provision, VMMC, microbicides and PrEP could avert over 60% of new HIV infections after 10 years⁵¹. However, scale-up of HIV prevention technologies is not without challenges and many prevention strategies are currently not being implemented at the necessary scale and magnitude to those most in need.

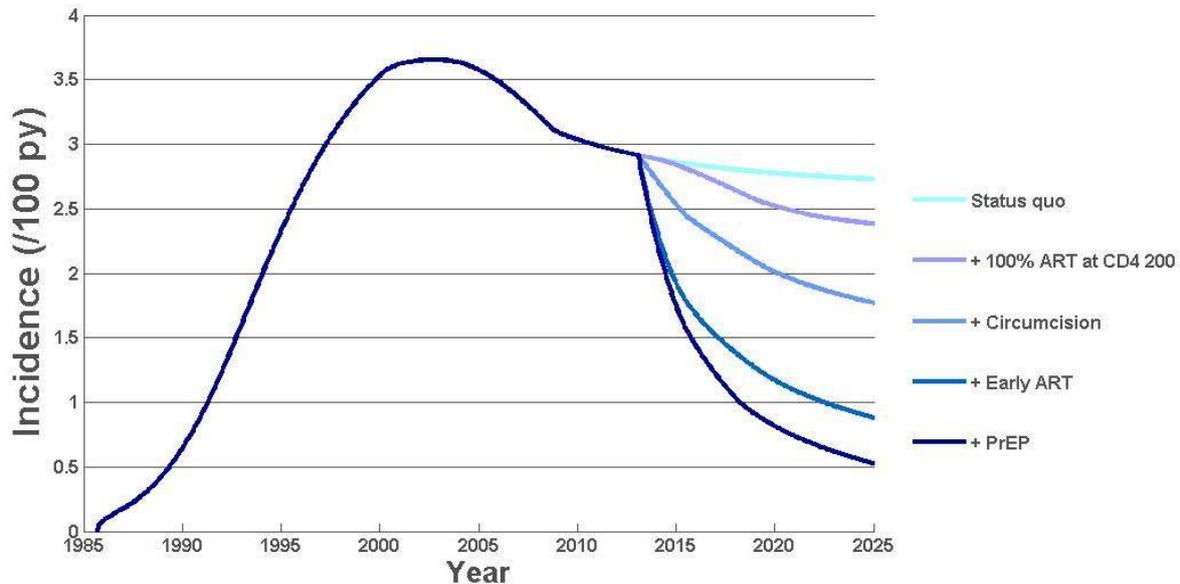


Figure 1: Model showing the impact in the HIV epidemic if HIV prevention options are implemented at scale. Adapted from Cremin et al ⁵²

For VMMC scale-up, substantial progress towards 2015 targets has been made in countries like Ethiopia and Kenya, which have reached 57% and 63% coverage respectively ⁷. However, several other countries have not even reached 10% of their targets yet ⁷. Demand creation for and uptake of VMMC by early adopters has been one of the innovative approaches to increase uptake. To address the shortage of medical doctors to perform the procedure, which is the key challenge in VMMC services in several low-resource settings, non-surgical technologies such as the PrePex device ⁵³ have been introduced. This has, in turn, facilitated the task-shifting of circumcisions from doctors to mid-level health professionals including nurses ⁵⁴. These innovations and strategies are helping countries accelerate VMMC implementation to reach target coverage.

The challenges of scale-up are particularly daunting for ART provision. While significant advances in scaling-up ART have been achieved globally, an estimated 18.6 million more ART eligible people, based on current World Health Organization guidelines ⁵⁵, have not yet initiated treatment ⁷. Knowledge of HIV status is an essential first step in accessing treatment (and prevention) services. Although HCT has been scaled-up substantially, stigma, denial and a lack of understanding of risk have contributed to lower-than-expected HIV testing rates ⁵⁶. To overcome these challenges, several strategies, such as provider-initiated testing ⁵⁷ and home-based testing ⁵⁸ have been developed to improve HCT uptake. Once identified as HIV positive, linkage to care, ART initiation and retention in care are additional challenges that are part of the treatment cascade. Treatment cascades are useful tools that can assist national planners and programme implementers in devising focused interventions to improve treatment outcomes. While the cascade is more complex than a linear sequential process, achieving and maintaining viral suppression is the key objective for preventing transmission as well as minimising the development of drug resistance. Second and third line antiretrovirals, needed for patients with drug resistance, are costly as they have not yet benefitted to the same extent as first line drugs, from low cost access programmes or the Trade-Related Aspects of Intellectual Property Rights (TRIPS) agreements for affordable medicines. Countries are encouraged to use flexibilities allowed by the TRIPS agreement, including compulsory licensing, to affordably meet local demands for first, second and third-line antiretroviral drugs ⁵⁹.

With regard to PrEP, empiric evidence of community level effectiveness is not yet available but mathematical models suggest that implementation of oral PrEP⁵² and topical microbicides⁶⁰ could be cost effective and lead to substantial declines in HIV incidence, especially when provided to those at highest risk and able to sustain high adherence, particularly when combined with scale-up of VMMC and early ART initiation. A significant concern about PrEP that emerged during clinical trials is sub-optimal adherence. Other challenges facing PrEP implementation are cost, health systems capacity to provide these services, potential drug resistance and the extent to which people engage in risky behaviours because of their use of PrEP (behaviour disinhibition). Small scale demonstration projects have been initiated in several countries to find solutions to these challenges as a prelude to developing country-specific guidelines for the implementation of PrEP. Thus far, only the USA has officially licensed Truvada for HIV prevention⁶¹ and published guidance for its use^{62, 63}. The opportunity to add PrEP to a comprehensive AIDS response and benefit from its additive effect on the course of the HIV epidemic will depend on the extent to which regulators, policy-makers, health service providers, community leaders, funders and researchers are able to translate this new evidence into effective programs.

In many instances there are structural obstacles preventing scale up of HIV prevention interventions, especially for key populations. For example, sex workers may not be able to access prevention programmes in a setting where sex work is illegal. Similarly, gender inequality and the threat of gender-based violence may be an obstacle for young women to insist that their partners use condoms. These highlight the importance of addressing broader social, legal and political impediment as an integral part of implementation programmes that scale up biomedical HIV prevention strategies.

Many countries around the world still have laws that criminalize sex work⁶⁴, sex outside of marriage⁶⁵, drug use⁶⁶, and same sex relationships⁶⁷. Implementation of the recommendations of the Global Commission on HIV and the law⁶⁸ will help address this problem by promoting law reforms, legal services, rights literacy, training of health care workers in non-discrimination, sensitization of police, and stigma reduction. Although progress in eliminating stigma and discrimination is difficult to quantify, several projects, programmes and activities have successfully challenged stigma and discrimination^{69, 70}. Programmes that have been successful in reducing stigma and discrimination have resulted in increased HIV testing⁷¹ increased access of services⁷² and ensured better adherence to HIV treatment and care^{73, 74}.

Community engagement, a consistent feature of the AIDS response, needs to continue to be strengthened in order to help address the structural impediments of the AIDS response. Involvement of affected communities in planning and implementing HIV initiatives can raise awareness of stigma and discrimination, societal barriers and harmful gender norms and can hold governments accountable for meeting the needs of citizens for better services and improved service outcomes. Using social media to reach youth, as seen in the CrowdOutAIDS campaign⁷⁵ helped improve understanding of the needs and priorities of young people in relation to HIV. New partnerships and alliances across multiple communities will also be important to strengthen links between movements advancing the cause of AIDS, maternal and child health, women, gender inequality, sexual orientation, youth and people living with disabilities, amongst others, in order to foster a comprehensive AIDS response.

Linking the AIDS response to broader primary health care is essential as HIV is integrally linked with and has a direct impact on many health issues, including other STIs⁷⁶, maternal and child mortality⁷⁷, malaria and TB⁴⁰. Integration of HIV services with existing sexual and reproductive health programmes and family planning services has the potential to improve health systems in general⁷⁸. For example, scale-up of HIV treatment services for pregnant women who attend health care facilities in Rwanda and Tanzania has led to improvements in maternal health outcomes in both HIV-infected and uninfected in women^{79, 80}. Further,

integration of TB and HIV treatment improves survival⁸¹⁻⁸³, can improve health outcomes⁸⁴ and is cost effective⁸⁵. When the services are not integrated there are often long delays in initiating ART⁸⁶. In many countries, upgrading health facilities and infrastructure for the provision of AIDS services has also improved primary health care services and strengthened health infrastructure, laboratories and pharmaceutical services^{87, 88}. As access to ART has expanded and people are starting to live longer, a new set of non-AIDS co-morbidities associated with aging and long-term exposure to ART, like cardiovascular, kidney and liver disease, have emerged.. The AIDS response of the future will need to incorporate and integrate services for the growing burden of these chronic disease co-morbidities within a comprehensive health systems response⁸⁹.

In summary, scaling-up HIV prevention and treatment that includes targeted interventions for key populations at high risk of infection, with political commitment, resource mobilisation, community involvement, initiatives to address structural constraints (such as stigma, discrimination and gender inequality) and accelerate law reform can create the kind of comprehensive AIDS response that can make “The End of AIDS” feasible.

V. THE END OF AIDS REQUIRES ONGOING SCIENTIFIC INNOVATION

A distinctive characteristic of the AIDS response over the last 3 decades has been the process of evidence generation, constant learning and continual improvement. Learning from past mistakes and building on past successes have seen a progressive improvement in the AIDS response. As each new challenge emerges, innovative solutions are created. For example, an innovative solution to improve HCT uptake in individuals unwilling to attend health facilities could be the provision of an over-the-counter home HIV test kit⁹⁰ and studies are on-going to test its feasibility, acceptability and impact.

There is a compelling need for scientific innovation to create an AIDS vaccine or cure. While the “The End of AIDS” is feasible with current technologies, an AIDS vaccine and/or cure could substantially advance the achievement of this goal. Recent reports of individuals being cured^{91, 92} or in remission⁹³ have created optimism that a cure is feasible. Glimmers of hope that an HIV vaccine is possible emerged with the findings from the RV144 trial in Thailand⁹⁴, scientific advances in understanding the types of immune responses that may contribute to a vaccine’s protective effect^{95, 96} and highly effective new strategies to deliver HIV vaccines⁹⁷. Examples of other important scientific innovations needed to hasten “The End of AIDS” include HIV prevention methods for women such as microbicides, a diagnostic for primary HIV infection, long-acting antiretroviral drugs, a point-of-care viral load diagnostic, and better treatment options for paediatric patients. Greater investments are needed to support scientific research to facilitate and accelerate reaching “The End of AIDS”.

VI. CONCLUSION

“The End of AIDS” is a bold future vision for the global AIDS response in the post-MDG era. It will depend on the ability to build on successes, learn from failures and implement to scale existing biomedical and social / structural interventions. This needs strong political commitment from world leaders, continued international support and active planning, co-ordination, implementation and monitoring in each country. The evidence indicates that “The End of AIDS” is an achievable goal but there are many challenges that still need to be overcome. These should not deter us; now is the time to re-invigorate our efforts to reach “The End of AIDS”.

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