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Ending HIV/AIDS Epidemic in Bangladesh by 2030

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Abstract

The international community has committed to ending HIV/AIDS epidemics throughout the world by 2030. We address whether this optimistic target for HIV/AIDS is achievable in Bangladesh. The study provides a roadmap for what is required in Bangladesh to end AIDS within the next 10 years (by 2030), which remains aligned with the Sustainable Development Goal 3.3. For ending AIDS in Bangladesh rapid scaling up of prevention and treatment coverage would be required. We have shown that the Fast-Track approach is predicated on a rapid scale-up and maintenance of focused, effective prevention and treatment services over the next 10 years i.e., by 2030.

Keywords: Endings AIDS • 90-90-90 targets • AIDS Epidemic Model (AEM) • Key population • Fast-track • Bangladesh

Abbreviations: Anti-Retroviral Therapy (ART) • Bangladesh (BD) • Cluster of Differentiation 4 (CD4) • Female Sex Workers (FSW) • Men who have Sex with Men (MSM) • Male Sex Workers (MSW) • National Strategic Plan (NSP) • People Living with HIV/AIDS (PLHIV) • People Who Inject Drugs (PWID)

Introduction

Acquired Immune Deficiency Syndrome (AIDS) is caused by an infection with the Human Immunodeficiency Virus (HIV). HIV spreads mainly to humans from unsafe intercourse (including anal and oral intercourse), infected blood transfusions, hypodermic needles, and from mother to child during pregnancy, childbirth, or breastfeeding [1]. According to UNAIDS and World Health Organization (WHO), globally 37.9 million people were living with HIV and 1.1 million people died from AIDS at the end of 20182. According to national case reporting data in Bangladesh, 5,383 people were living with HIV and 1,072 people have died at the end of 2018 [3]. The estimated number of PLHIV in Bangladesh was around 13,800 in 20184. Although Bangladesh is a low HIV prevalent country with less than 0.01% prevalence (overall prevalence in general population over the years), it is one of the seven countries in the Asia and the Pacific region where new infections continue to increase [4,5]. Moreover, in certain geographical areas, key populations have high HIV prevalence.

For instance, the HIV prevalence among PWID was 27.3% in the older parts of Dhaka city and 8.9% in the other parts of Dhaka; among the hijras, the HIV prevalence was 4.3 percent in Hilli- a small border town in the North-western part of Bangladesh bordering the Indian State of West Bengal [6]. Besides, both the international migrants and cross-border migrants are vulnerable to HIV due to their risk behaviours. Migrants constituted about 24.7% of new cases, in 2018 [3]. So, ending the epidemic of HIV and AIDS is necessary and feasible but poses important challenges. We examine the ending AIDS perspective of Bangladesh to reach the 90-90-90 targets by 2030 that is by 2020, 90% of all people living with HIV know their HIV status, 90% of those infected with HIV receive existing antiretroviral therapy, and 90% of all people receiving antiretroviral treatment achieve viral suppression [7].

Modelling studies suggest that without the medical solution or preventive vaccine it is possible to reach the goal of ending AIDS by 2030 using the current health technologies. Harries et al. focus on the diagnosis of HIV that truly points care by considering decentralization and task sharing and therefore wide coverage. They as well focused on ART treatment that can be used in asymptomatic people with or without HIV both to treat HIV and to prevent infection transmission [8]. For particular people, the effects of immediate ART go beyond those too. Initial ART reduces the risk of sexual transmission of HIV, which has been demonstrated not only in clinical trials but also in real-world settings [9,10]. Granich et al. reviewed the issue of the epidemiologic criteria for ending AIDS while placing it in the political context of the global HIV response. They established a framework to understand the history of the HIV response addressing the issue of treatment as prevention, the economics of ending AIDS, major innovations, and last mile issues [11].

To respond, UNAIDS has developed the Fast-Track strategy which aims to provide such a roadmap for the actions required to achieve the global goal of ending AIDS by 2030. Stover et al. focused on a fast-track approach aimed at reducing new infections and AIDS-related deaths by 90% from 2010 to 2030 and introduces a set of biomedical, behavioural and prevention goals for 2020 and 2030 to reach this objective, including the rapid scale-up antiretroviral treatment known as 90-90-90 [12]. Kempton et al. used UNAIDS data to represent country level HIV data and suggest more intensive programmes of diagnosis and treatment are needed in these countries in the effort to reduce global new HIV infections below 500,000 per year by 2020 [13].

In this study, we provide a roadmap for what is required to end AIDS within the next 10 years in Bangladesh and remain aligned with the Sustainable Development Goal 3.3 [14]. We analysed different scenarios for ending AIDS in Bangladesh. Since HIV financing is inadequate and many countries are competing over the limited resources, Bangladesh needs to ensure that the limited resources available for HIV responses are spent more strategically to have the maximum impact [15]. Under the circumstance, the analysis develops 'Investment Cases' to identify investment priorities and solutions to increase the effectiveness, efficiency, and sustainability of the national response to HIV toward the global goal of 'Ending AIDS by 2030' as well as '90-90-90' treatment targets.

Materials and Methods

Data sources

Data for this study was extracted from National Serological and Behavioural Surveillance reports, Bangladesh Demographic and Health Surveys (BDHS),

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and Bangladesh Bureau of Statistics (BBS) for the period of 2000-2018. In this study we also used program coverage data and case reports that were provided by the AIDS/STD Program (ASP) of Ministry of Health and Family Welfare, International Centre for the Diarrhoeal Disease Research Bangladesh (icddr,b), Save the Children, WHO, UNICEF.

A few of the data criteria were based on assumptions as data shortages occurred for some indicators such as high-risk network and mortality of Injecting Drug User (IDU), mobility of key population groups, male circumcision. Also, data on HIV prevalence for Hijra was modified assuming that the data available were for those who are sex workers only. These assumptions were based on the closest existing evidence and were discussed in the National Technical Working Group on M&E and Strategic Information.

Methods

The AIDS Epidemic Model (AEM) was used to provide a picture of Bangladesh's epidemic and enabled policymakers to estimate the future impact of proposed intervention strategies, along with the amount of investment required [16]. The model has already been used in deriving "Ending AIDS" strategies in many countries in Asia including Thailand, Philippines, Viet Nam, Indonesia, Nepal, and Myanmar [17-20].

Using this model, the number of new infections can be calculated as:

$$N_{(\text{new infection})} = n_{(\text{contacts HIV})} \times P_{(\text{per contact})}$$

Where $n_{(\text{contacts HIV})}$ denotes the total number of unprotected contacts with HIV positive partners which can be calculated as:

$n_{(\text{contacts HIV})}$ = Size of risk group × Frequency of contacts × HIV prevalence of partners (Chance to meet positive partners) × Fraction unprotected

and

$P_{(\text{per contact})}$ = Transmission probability x Adjustments for STI & circumcision

For the model input indicators like the size of key populations (KPs), average duration for which people remain in key populations, frequency of risk behaviours (e.g., the number of vaginal or anal intercourse acts per week or number of injections in the last year), levels of protective measures taken with different partner types (e.g., condom use between sex workers and clients, reducing the fraction of injections shared or the prevalence of sharing), HIV and STI prevalence were used. The number of adults receiving ART by gender, information on program coverage among key populations, and unit cost data are also required. Corrections are made by fitting parameters until HIV prevalence is like observed epidemiological trends.

The analytic work for the investment case began with the review and analysis of national and international qualitative and quantitative evidence, as well as global best practices for effective interventions. The process addressed some issues in designing high-impact, cost-effective, and sustainable investment options: prioritizing geographical regions in the HIV response; determining program coverage and unit cost, designing investment (intervention) scenarios separately for geographically prioritized areas and developing investment cases and understanding implications. The program coverage by different KPs, i.e., FSW, PWID, MSM, MSW, and hijra were estimated by using the program Reach data for the year 2018. The denominators used for estimating program coverage were the estimated sizes of each KP calculated as per AEM projections.

Investment scenario's for ending AIDS of Bangladesh

For the Bangladesh Investment Case, 'Ending AIDS' was defined as less than 300 estimated new infections per year [21]. Several investment scenarios for Bangladesh were developed for achieving "Ending AIDS" by 2030 as well as the treatment target "90-90-90" by 2020. Considering diverse investment needs by geographical areas, the scenarios were devolved separately for Dhaka, priority districts, and 41 remaining districts and are presented in Table 1 [22].

All the above scenarios were compared with the baseline scenario (ongoing program) to find out the best scenario to achieve the 90-90-90 targets for Bangladesh as well as "Ending AIDS" by 2030.

Results

To identify the most efficient investment option for Ending AIDS in Bangladesh, we compared the different investment scenarios (Scenario 1 to Scenario 4) with the existing intervention scenario (Baseline Scenario). The impact of each scenario was measured in terms of numbers of new and current infections, people living with HIV (PLHIV), treatment costs. We also measured the return on investment for each scenario to find the most cost-effective and sustainable investment option for Bangladesh.

Impact on estimated new infections

All the investment scenarios were able to reduce the new HIV infections among adults (15+ years) in the projection years between 2019 and 2030 presented in Figure 1. If the rapid scale-up of only prevention programs among KPs (Scenario 1) was considered, the estimated number of new HIV infections would be 468 in 2030, where for Scenario 2 the estimated new HIV infections would be 463 and 338 for the 4th NSP plan (Scenario 3). Finally, fast track scenario can reduce the number of new HIV infections among adults to less than 300 per year by 2030, effectively halting the spread of the epidemic in Bangladesh. (Figure 1).

Impact on PLHIV population

The ongoing scenario for identifying the number of people living with HIV would increase from 13,476 in 2018 to 20,115 in 2025 and eventually reach 24,479 by the end of 2030 in case of different scenarios. In all the scenarios the estimated number of PLHIV would be increasing in the projection years, but with a much lower pace as prevention and treatment coverage increases. For the Fast Track scenario, the estimated number of PLHIV would be increased to 15,108 in 2025 and reached 15,184 by the end of 2030. Whereas under the 4th NSP targets scenario and Test and Treat scenario the number of PLHIV would reach 16,416 and 18,253 respectively by the end of 2030. For Scenario 1 (prevention scale) the number of PLHIV would reach 15,150 in 2022 and after that, it started to decrease and reached 12,742 by 2030. The high rate of deaths among PLHIV along with a relatively lower number of new infections

Table 1. Description of future investment scenarios with baseline scenario.

Scenarios	Description
Baseline: BD Ongoing	Continuation of current prevention coverage among KPs
	Current treatment coverage (CD4<350) will continue (i.e. all interventions, including ART coverage, were held at 2018 programmatic levels).
Scenario 1: BD Prevention scale	At least 90% of the KPs will be reached through a prevention program
	Current treatment coverage (CD4<350) will continue.
Scenario 2: BD Test & Treat	Current prevention coverage among KPs will continue
	Rapid scale-up to universal access to ART by adopting the 'test and treat' model by 2022 (Treating 90% of diagnosed PLHIV regardless of CD4).
Scenario 3: BD NSP	Both prevention and treatment coverage will be scaled up as per the 4th National Strategic Plan (NSP).
Scenario 4: BD Fast Track	90% of the KPs will be reached through a prevention program
	Rapid scale-up to universal access to ART (treating 90% of diagnosed PLHIV regardless of CD4 count).

in the projection years might be the reason for such a decrease of PLHIV numbers with rapid prevention scale-up option (Scenario 1). (Figure 2).

Impact on AIDS deaths

Figure 3 shows the trend in AIDS-related deaths for different scenarios. The current prevention and treatment scenario indicate that death among HIV infected adults would be steadily increasing in the coming years and reach 1,021 in 2030. As compared with the other scale-up scenarios (Scenario 2 - Scenario 4), deaths among HIV infected adults would be highest if only prevention scale (Scenario 1) was considered. In contrast, deaths would be lowest (<300 deaths by 2030) if universal access to treatment (Scenario 2) and Fast Track (Scenario 4) investment options were considered. If the prevention and treatment targets of the 4th NSP (Scenario 3) were considered, deaths would also decrease throughout 2018-2030 and reach 162 by the end of 2030. It is important to note that Scenario 2 (Test & treat), Scenario 3 (4th NSP targets), and Scenario 4 (Fast Track) would be able to reduce deaths among HIV infected adults in 2030. (Figure 3).

Impact on the number of PLHIV on ART

Test & Treat scenario and Fast Track scenarios included 90 percent of estimated PLHIV under ART treatment presented in Figure 4. If Scenario 3 (targets as per 4th NSP) was considered, almost 90 percent of the PLHIV who needed ART would receive treatment by 2030. The percent of PLHIV receiving ART was lower (about 50%) for other scenarios (Baseline and Scenario 1). Therefore, the Test and Treat, Fast Track, and NSP scenarios were able to reach the global treatment targets by 2030. (Figure 4).

Cost-effectiveness

The estimated costs of achieving 90-90-90 targets among different scenarios are shown in Table 2. The cost-effectiveness analysis showed that although Scenarios 2 and 4 in the proposed model are almost the same in terms of new HIV cases averted; Scenario 2 appears to be significantly viable in terms of new infections averted and Disability-Adjusted Life Year (DALY) saved, in both short-term and long-term investment options. However, integrated approaches to addressing HIV to reach the Fast Track targets, may influence the costing enough to make Scenario 4 sustainable as well this is yet to be tested. Cost per HIV infections for the Test & Treat scenario was estimated cost at $6,997 which is 2.9 times lower than the Fast track scenario.

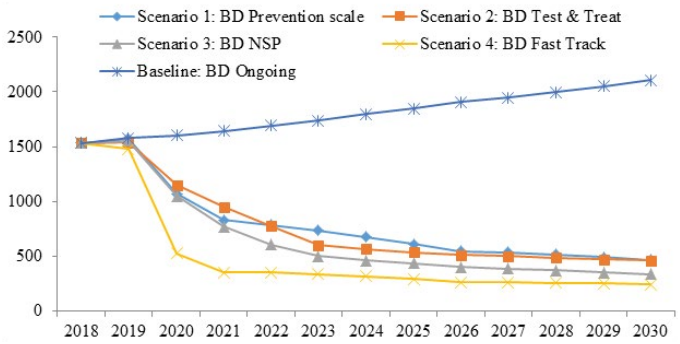

Figure 1. New infections (15+) in different scenarios.

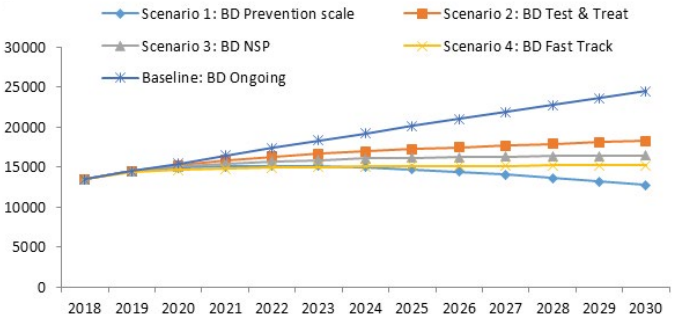

Figure 2. Number of PLHIV (15+) in different scenarios.

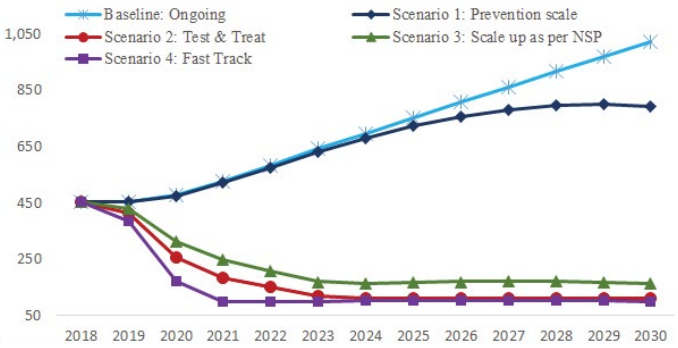

Figure 3. Number of AIDS deaths (15+) in different scenarios.

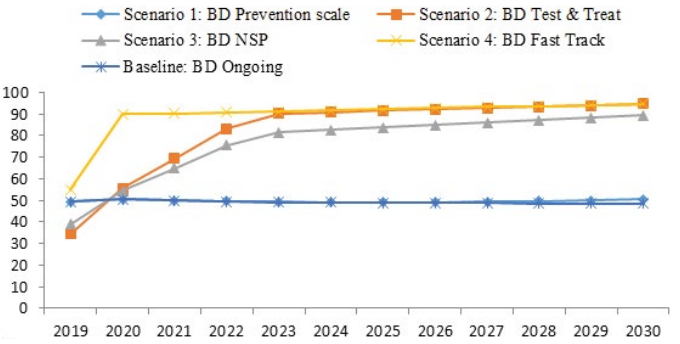

Figure 4. ART coverage among adults in different scenarios.

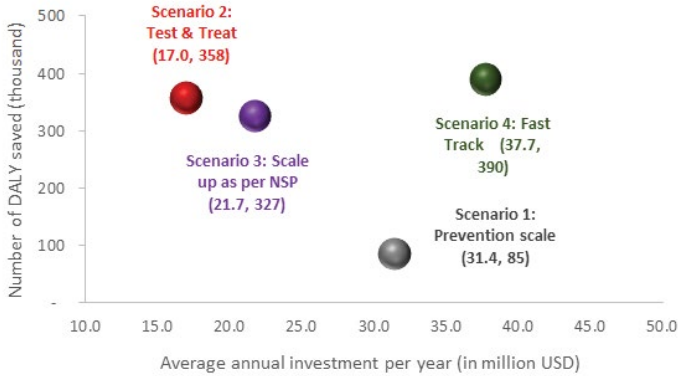

Figure 5. Annual investment and DALYs saved.

Under such circumstance, considering Scenario 3, it is possible to almost reach the Ending AIDS target - thus there is a balance in terms of cost-benefit and program achievement by NSP targets. (Table 2).

If we scale up the prevention among KPs the cost per HIV infection averted would be $26,598 which is much higher than the other scenarios. In case of cost per DALY saved the 'Test and Treat' scenario cost is lower than the others in between 2019-2030. Overall, the analysis of the cost-effectiveness indicators revealed that both the cost per HIV infections averted and cost per DALY saved were lowest for Scenarios 2 and 3, and thus these two scenarios would produce results most cost-effectively.

Return on investment

The number of DALYs that could be saved under each scenario during 2019-2030 is presented in Figure 5, where the Test & Treat scenario saved 358 thousand DALYs. The financial returns would be substantial by 2030, and Test & Treat scenario would save $627 million in future income in between 2019-2030. Comparing the future income saved and additional intervention cost, the cost-benefit ratio (Table 2) for scenario 2 stands at 8.6. Moreover, the marginal cost per DALY saved was $212, which is less than the country's per capita GDP, thus making 'Scenario 2' a sustainable and cost-effective investment option. Considering the program scale-up, the analysis also showed that the marginal cost in Scenario 2, is significantly lowest (13.7 times

in comparison to the highest) than the rest, which is an encouraging finding in program perspective. Where the marginal cost per DALY saved is $406 for Scenario 3 and $832 for Scenario 4. (Figure 5).

Discussion

This analysis has shown what is required for ending AIDS in Bangladesh that is reductions in new infections and HIV related deaths by 2030. Achieving those goals will require a rapid scale-up to near-universal coverage of main prevention and treatment interventions with large epidemics. Most essential would be reaching ART targets for all and cost-effectiveness. Scaling up the "Fast Track" scenario is a key factor for achieving the 90-90-90 treatment targets and a significant reduction in new infections to end AIDS by 2030. Another key factor needed to generate the resources needed will be demonstrating that they are used effectively. We will need even greater efforts to improve cost-effectiveness. With the Fast Track investment option, Bangladesh would need an average investment of USD 37.1 million per year in between 2020-2030. New HIV infections would be reduced to below 300 per year by 2030 and HIV no longer is a major public health concern. Every single USD spent now could generate a return of approximately 2.2 USD in general.

In case of insufficient resource availability, Scale of the current program to reach the "Targets as set in the NSP" would be a feasible investment option in terms of sustainability and program effectiveness. It would produce a high impact to achieve the treatment targets (90-90-90) and would come remarkably close to achieving the "Ending AIDS by 2030" target. With an average investment of USD 21.7 million per year to adopt the targets set in the NSP, new HIV infections could be reduced to 338 per year by 2030, and HIV would no longer be a major public health concern.

Again, sustaining the current prevention programs among KPs along with the "Test and Treat" approach could be a sustainable investment option in the HIV response. With an average investment of USD 17 million per year, this investment option would be able to generate impacts most cost-effectively and sustainably. Every single USD spent now could generate a return of approximately 8.6 USD between 2019-2030. Between 2019 and 2030, this cost-effective investment option would save 7,133 lives and avert 13,368 infections. It would also save 358 thousand DALYs, or healthy, productive life years; save USD 654.64 million in future income with cost-benefit ratio measured at 8.6. The new HIV infections would be reduced to 463 in 2030.

Conclusion

To achieve "Ending AIDS by 2030" as well as the "90-90-90" treatment targets, rapid scaling up of prevention and treatment coverage would be required and this needs immense resources. In contrast, the continuation of current prevention programs among KPs and rapid scale-up of treatment coverage to reach 90-90-90 would generate cost-effectiveness but would not reach the Ending AIDS target. Considering the cost-effectiveness and ending AIDS by 2030, the most feasible option seems to scale up efforts in prevention and treatment to reach the targets of the National Strategic Plan. Although ending AIDS is necessary and feasible 22 but poses several challenges also. However, ending AIDS globally will require continued effort, and increasing the number of people on treatment and integrated efforts need to be introduced to make the Fast Track strategy a cost-effective endeavour.

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Competing Interests

The authors declare that they have no competing interests.

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