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Original Article

Economic Burden of HIV/AIDS in Iran: A Modelling Approach

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Abstract

Background: HIV/AIDS is a leading cause of mortality and morbidity in Low-and-Middle-Income-Countries (LMICs). It might potentially lead to an economic burden on the health system. There is no certainty about the prevalence of HIV/AIDS in Iran. Therefore, we aimed to estimate the cost of illness of HIV/AIDS in Iran.

Methods: We applied a societal perspective to capture the direct and indirect costs attributed to HIV/AIDS in Iran. We used data for age-standardized prevalence produced by the country HIV/AIDS Surveillance System for 2018. The study estimated both direct and indirect costs for a hypothetical cohort of the Iranian adult population (here equates to all registered cases with Surveillance System). For mitigating the uncertainty around the estimations, we have used an optimistic and pessimistic analysis.

Results: The base case scenario showed that total direct costs and indirect costs attributed to the HIV/AIDS were US$7,946,530 and US$ 1,288,586 at the end of 2018. Moreover, the total cost is 8,785,116 US$.

Conclusion: Direct costs have formed approximately 85% of total costs. The policymakers and planners should consider that these costs are only related to diagnosed or registered infected populations. These costs will be raised dramatically with increasing the diagnosed patients.

Keywords: HIV/AIDS; Antiretroviral therapy; Cost of illness; Economic burden

Introduction

HIV/AIDS is recognized as an adverse social and economic burden. Households who have HIV/AIDS diagnosed member(s) must pay higher expenditure for health services (1, 2). They also are harmed by social and cultural stigma, a lower chance for employment, and lower social supports. Each 1% prevalence increase in HIV/AIDS causes a 0.47% decrease in per capita income in Sub-Saharan countries (3).

The Global Burden of Diseases (GBD) 2019 reported that 36,8 million (95% CI: 35,1- 38.9) people, living with HIV. The deaths attributed the HIV/AIDS was 863837.35 (95% CI: 786074.86–996044.87), which shows about a 37% decrease compared to 1990. However, in

Iran, the number of deaths due to HIV/AIDS has increased by 108% from 1990 to 2019 (566 to 1177 deaths) (4).

GBD 2020 shows the HIV/AIDS has moved up from 30th to 11th causes of Disability Adjusted Life Years (DALYs) from 1990 to 2019 for all ages. However, tracking the leading causes of DALYs by different age groups demonstrate the HIV/AIDS is the second cause of DALYs in the 24-49 yr age group. However, about the age group 50-74 yr, HIV/AIDS is not even among the first thirty causes of DALYs (5).

The highest rate of deaths is among men and women aged 25-54 yr. It implies the excessive degenerative impact of HIV/AIDS on the economic outcomes of countries (4).

The projection from the Joint United Nations Programme on HIV/AIDS (UNAIDS) has estimated 59,000 (95%CI 33,000-130,000) as the number of people lived with HIV/AIDS in Iran in 2019(6).

It also predicts 4,100 (95% CI 1,200- 12,000) new cases will add yearly. This projection also estimated the number of deaths as approximately 2,500 (95% CI 1,200- 5600) (6).

Iran HIV registry system has reported the number of diagnosed HIV/AIDS cases equates to 38,966 at the end of 2018. Of them, about 87% are male, that ~68% of them are in the age 16 to 40 yr old. Also, 18% of the PLWH have received ART regimens at the end of 2017(7).

In Iran, in line with many other WHO member states, Antiretroviral Therapy (ART) is the government's main national free-of-charge plan to manage HIV/AIDS. ART mainly depends on a combination of drugs for long-term management, therefore, the patients' adherence to the treatment is the main problem for policymakers (8, 9). Furthermore, the long-term and multi-drug regimen's identity of the ART will lead to considerable direct costs imposed on health systems. The indirect cost associated with early deaths, and the employment condition of PWLHs, is another part of the total cost of HIV/AIDS.

The economic burden of HIV/AIDS literature seems rich in either developed or Low-and-Middle-Income countries (LMICs). In the USA, the total direct expenditures were US$ 31,147 (95% CI $23,645–$38,648) more than those without HIV/AIDS. The aggregation costs for this study revealed that this seems to be US$ 10.7 billion higher than the costs for non- HIV/AIDS people (10).

The attributed costs to the HIV/AIDS for the Nepalese households are Nepalese Rupee Nepalese Rupees (NRs) 2233 per month (US$ 30.2/month). It equates to 28.5% of the monthly income of the sampled households. The average cost associated with productivity loss was NRs 721 (US$ 9.7) (11).

In China, the average HIV/AIDS hospitalization costs are at 23,555 RMB (the currency of China) (about $3489), which is about five times the average hospitalization expenses per person (12).

The Cost-of-Illness (CoI) analysis is used to the countries' budget allocation in tackling HIV/AIDS. The output of a cost-of-illness study implies insightful directions to health policymakers and planners to make a better decision on efficient spending the financial resources. In Iran, there is a national plan for controlling HIV/AIDS across the country, and the country's Ministry of Health leads the efforts to tackle this problem. Therefore, generating evidence for efficient financial allocation is a necessity. To our best knowledge, there is a lack of evidence in this regard. We aimed to provide HIV/AIDS cost-of-illness in Iran by a modelling approach.

Methods

We applied a cost-of-illness analysis through a societal perspective to estimate the HIV/AIDS attributed direct and indirect costs in 2018.

The age-standardized prevalence data of the HIV/AIDS was obtained from the Iran Infectious Diseases Surveillance System (IIDSS). Data is available for registered and diagnosed PWLHs. We also obtained the costs of drugs, human resources, and other consumable medical and clinical items from the online systems of affiliated bodies to the Iran Ministry of Health (IMoH). The World Bank database for the country's

Gross Domestic Production (GDP) per capita in 2018 was used to compute the indirect costs (13).

The study included a hypothetical cohort of adults equal to all people who are living with HIV/AIDS (PWLHAs) in the country who were taking up ART regimens in 2018. According to HIV Surveillance System, 34,820 PWLHSs had been registered by the time we were collecting the data. Of them, 84% of cases were men. The number of PWLHAs that took up the ART regimens was 6,848 (19.66%) of all registered people. Almost of infected people are Drug Users (66.9%) (14).

We used the current IMoH guideline in managing HIV/AIDS among adults. Figure 1 demonstrates the model structure. The guideline includes all required detailed explanations on how to provide ART (15). The progression of the service provision from earliest to latest steps is accessible in the guideline. The guideline also includes more information for patients with co-infections (such as Hepatitis C or B, or Tuberculosis). A team of community health workers, social workers, General Practitioners, health promotion experts, and infectious specialists work together to provide services.

For each person who goes to an IMoH's health or clinical centre (these centres are usually called Behavioural and Infectious Diseases Centre), the HIV/AIDS diagnostic test (the primary and confirmatory tests) will be free of charge. After confirmation of the positive results in both mentioned tests, patients go under ART. The initial assessment includes explanations about the advantages and probable harms of the treatment discussed with patients. At the same time, some members of the team provide supportive consultancies to the patients' families.

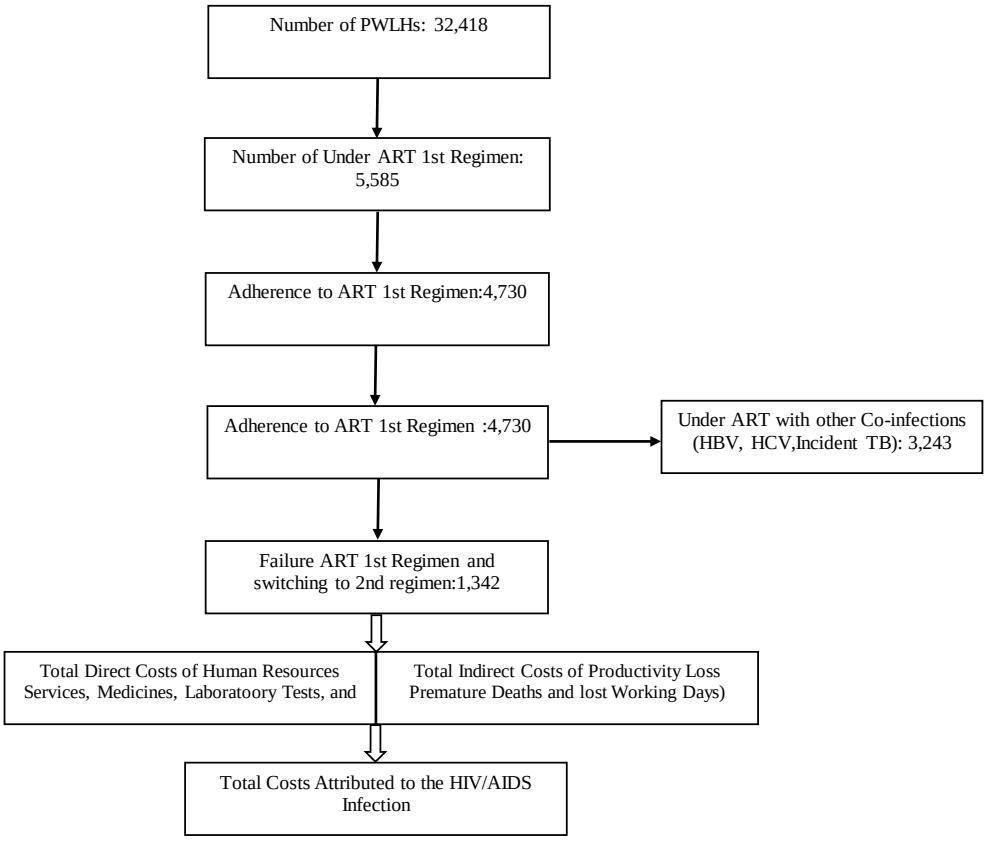

Fig. 1: Model structure of economic burden of HIV/AIDS

Adherence to the treatment is a common problem in managing HIV/AIDS cases. At least two subsequent visits were allotted to ensure the commitment and accountability of patients and their families for starting and continuing the treatment before starting the treatment.

In addition, a team of providers predicts any other complementary actions for avoiding drug resistance. This includes some educational advice for patients in taking the drugs. These tests are more common in cases of co-morbidities for Hepatitis B and C and Tuberculosis.

Currently, there are two ART regimens in Iran: preferred and alternative. For those patients with co-infections such as Hepatitis B, C, and tuberculosis, ART is provided by some adjustments. The progression of the treatment should be monitored on a routine basis, especially for the first month. It is because of ensuring the sufficient response of the patient to the treatment. The progression is checked through measurement of the virologic response or staging provided by the WHO.

Estimating Costs

For calculating the direct costs, we used the formula (1) below:

$$\begin{aligned} DC = \\ costs\ of\ health\ and\ social\ care + \\ HIV\ diagnostic\ tests\ costs + \\ Drugs\ costs + \\ Nutrious\ Supplements\ Costs + \\ Transprotation\ costs + Hotel\ Costs \end{aligned}$$

In this formula, DC is direct costs, and the right side includes each element of it. In addition, we used the Human Capital approach; for calculating the indirect cost. Formula (2) presents how to calculate the indirect costs.

$$\begin{aligned} IC = (YLL \times GDP\ per\ capita) \\ + (Absence\ Days \\ \times (\frac{GDP\ percapita}{292 working} days) \end{aligned}$$

IC is indirect costs; YLL is years of life lost due to premature deaths. GDP per capita has been collected from the World Bank dataset for Iran in 2018. Finally, the total costs attributed to HIV/AIDS in Iran were calculated by summing the formulas 1 and 2.

Analysis of Uncertainties: For calculating the direct and indirect costs, we used different parameters. Because all calculations are for the same year (2018), we have considered the discount rate equal to zero. The main challenging aspects of the CoI model were about the prevalence of it and the number of people who are receiving the ART regimen. We applied optimistic and pessimistic approaches based on the HIV/AIDS prevalence in the country to analyse the uncertainty.

The model parameters: All parameters for performing the cost-of-illness modelling have been presented in the appendix.

Ethics approval

All procedures performed in this study were by the ethical standards of the Ethics Committee of the University of Social Welfare and Rehabilitation Sciences. Ethical approval code: IR.USWR.REC.1396.386.

Results

Tables 1-4 present the results of estimations for direct and indirect costs associated with HIV/AIDS in Iran in 2018.

If we consider the base case scenario, the major proportion of the direct costs are related to medical and pathological tests (75.8%), and then general practitioner visits and consultancies (19.7%). Table 2 provides the details of Anti-Retroviral Drugs costs, according to the current recommended ART in the country.

Table 1: Anti-retroviral outpatients related services costs 2018 in US dollar*

Services	*Base case*	*Optimistic*	*Pessimistic*
Infectious Specialists (Visits and Consultancies)	229,384	281,257	202,071
General Practitioner (Visits and Consultancies)	409,567	502,187	360,800
Public Health Workers (Consultancies)	297,867	365,227	262,400
Nutritionist (Consultancies)	42,552	52,175	37,486
Social Workers (Consultancies)	106,381	130,438	93,714
Clinical Psychologists (Consultancies)	221,405	271,474	195,043
Medical and Pathological Tests	5,020,189	6,155,462	4,422,440
Vaccination Costs	295,212	361,971	260,061
Total Costs	6,622,557	8,120,191	5,834,015

* Notice that these costs by US$ in 2018 were as US$1 = IRR 42,000

Table 2: Anti-retroviral drug regimens costs for patients who are under ART 2018 in US dollar*

Drug Regimen	*Base case*	*Optimistic*	*Pessimistic*
Efavirenz+ Lamivudine+ Zidovudine	54,822	52,580	54,362
Nevirapine+ Lamivudine+ Zidovudine (For Pregnant)	1,911	1,373	2,660
Tenofovir+ Lamivudine+ Efarivenz (in case of co-infection with HBV)	1,362	2,399	2,646
Tenofovir+ Lamivudine+ Efarivenz+ Zidovudine (in case of co-infection with HCV)	37,185	46,744	26,112
Tenofovir+ Efavirenz+ Lamivudine+ Rifampin (HIV and TB co-incident)	6,847	5,039	14,295
TDF (Tenofovir)+ 3TC(Lamivudine)/FCT (Tenofovir)+ LPV/r (Lopinavir+ Ritonavir) or ATV/r (Atazanavir) in cases of failure initial regimen	11,325	11,890	14,705
Total ARV Costs	113,452	120,025	114,780

* Notice that these costs by US$ in 2018 were as US$1 = IRR 42,000

The base case scenario in Table 2 shows that 48.32% of drug costs are attributed to the first regimen. Hospitalization as an outcome for HIV/AIDS may be common especially because of opportunistic infections. Table 3 shows the costs of provided services in the hospital.

Table 3: Costs of hospitalization services for patients who are under ART 2018 in US dollar*

Service	*Base case*	*Optimistic*	*Pessimistic*
Inpatients Visits and Consultancies	149,477	183,280	131,679
Hoteling	573,749	703,497	505,433
Other Costs	37,296	45,731	32,855
Total Hospitalization Costs	760,522	932,508	669,967

* Notice that these costs by US$ in 2018 were as US$1 = IRR 42,000

Table 3 shows that the main proportion of the hospitalized costs are associated with the length of staying in the hospitals. It includes 75% of those costs and has been paid for occupying the beds. Table 4 depicts the sum of direct costs and indirect costs. This table also includes the total costs.

Table 4: Direct, indirect, and total Costs of HIV/AIDS for who are under ART 2018 in US dollar*

Costs Type	*Base case*	*Optimistic*	*Pessimistic*
	(a) Direct Costs		
Outpatients	6,622,556	8,120,191	5,834,016
ARV	113,452	120,026	114,781
Hospitalization	760,522	932,507	669,967
Total	7,496,530	9,172,724	6,618,764
	(b) Indirect Costs		
Premature Deaths	484,685	282,693	756,322
Work Absence Days	803,901	309,128	1,091,717
Total	1,288,586	591,821	1,848,039
	(c) Total Costs		
Direct costs	7,496,530	9,172,724	6,618,764
Indirect costs	1,288,586	591,821	1,848,039
Total	8,785,116	9,764,545	8,466,803

*Notice that these costs by US$ in 2018 were as US$1 = IRR 42,000

Table 4-a presents the total direct costs for ART. Hospitalization services costs are the main part of direct costs (88%).

Another aspect of the cost of illness for managing HIV/AIDS is an indirect cost. It is associated with the financial loss caused by decreasing in labour productivity. Patients might be absent from their economic activities because of receiving the ART or hospitalization. It also includes premature deaths and losing the opportunity to participate in the country's economy. Table 4-b indicates how much costs are incurred to the patients and society during the management of their illness. Work absence days are a notable driver of the indirect costs to society (about 62%). Eventually, table 4-c shows the total costs of HIV/AIDS in Iran.

Discussion

HIV/AIDS has imposed US$ 8,785,116 on the country in 2018. Direct costs of HIV/AIDS are a major part of the economic burden (85% of total costs). This figure only implies the costs for patients under the ART regimen. Of course, nobody can ignore the possible considerable health services-related indirect costs of the infection. These costs are associated with health, social, and psychological care, alongside costs spent for drugs, hospitalization services, and other relevant services. Indirect costs constitute about 15% of total HIV/AIDS costs in Iran.

In Ethiopia, the mean (SD) annual cost of HIV/AIDS per patient was $78 ($170) (14). The direct costs constituted 69% of the total cost (16). In Nepal, 30.2 US$ calculated as the average monthly cost of HIV/AIDS. The direct cost was 20.4 US$, and the indirect cost was 9.7 US$ in 2017(11).

In Brazil, the HIV-associated total cost was US$ 1558; by considering the AIDS attributed mortality, it goes up to US$ 2828. For cases with incident Tuberculosis (TB), it increased to US$ 5298 (15).

However, in Iran, the major proportion of HIV/AIDS cases have not been identified and registered via official bodies. Therefore, it might be considered an Iceberg phenomenon (16). Because of mentioned issue, we have tried to run our estimations in three scenarios. Of course, the IMoH established a Surveillance System in 2009 to monitor and register newly diagnosed cases of HIV/AIDS through its affiliated Medical Universities around the country (17). However, the main problem in identifying the total number of infected or suspected HIV/AIDS infected people will have remained.

We must consider other complementary policies and plans for controlling the indirect cost of the

infection. The government must focus on the social, mental, and psychological needs of HIV/AIDS cases. The government needs to develop well-designed and integrated mental and social services with current health services. This may lead to a reduced burden of depression and give them a better venue to be involved in economic activities (18).

Conclusion

This is the first cost-of-illness study of HIV/AIDS patients in Iran that calculates both direct and indirect costs. However, estimating the costs of HIV/AIDS by the WHO's staging definitions, and CD4 numbers may have more implications for managing the budgets and financial resources of the health system. The available data was not capable enough to carry out such analysis. The attributed costs to HIV/AIDS might be more if we could access the real number of people who are living with HIV/AIDS in the country.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Conflict of interest

The authors declare that there is no conflict of interests.

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