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A comparative analysis of outpatient costs in HIV treatment programs

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SUMMARY

Objective: To analyze the costs of human immunodeficiency virus (HIV) outpatient treatment for individuals with different CD4 cell counts in the Brazilian public health system, and to compare to costs in other national health systems. **Methods:** A retrospective survey was conducted in five public outpatient clinics of the Brazilian national HIV program in the city of São Paulo. Data on healthcare services provided for a period of one year of HIV outpatient treatment were gathered from randomly selected medical records. Prices of inputs used were obtained through market research and public sector databases. Information on costs of HIV outpatient treatment in other national health systems were gathered from the literature. Annual costs of HIV outpatient treatment from each country were converted into 2010 U.S. dollars. **Results:** Annual cost of HIV outpatient treatment for the Brazilian national public program was US\$ 2,572.92 in 2006 in São Paulo, ranging from US\$ 1,726.19 for patients with CD4 cell count > 500 to US\$ 3,693.28 for patients with $51 \leq$ CD4 cell count < 200. Antiretrovirals (ARVs) represented approximately 62.0% of annual HIV outpatient costs. Comparing among different health systems during the same period, HIV outpatient treatment presented higher costs in countries where HIV treatment is provided by the private sector. **Conclusion:** The main cost drivers of HIV outpatient treatment in different health systems were: ARVs, other medications, health professional services, and diagnostic exams. Nevertheless, the magnitude of cost drivers varied among HIV outpatient treatment programs due to health system efficiency. The data presented may be a valuable tool for public policy evaluation of HIV treatment programs worldwide.

Keywords: HIV; antiretroviral therapy; highly active; costs and cost analysis; CD4 lymphocyte count; health policy.

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RESUMO

Análise comparativa dos custos ambulatoriais em programas de tratamento de pacientes HIV

Objetivo: Analisar custos de tratamento ambulatorial de pacientes portadores do vírus da imunodeficiência humana (HIV) com diferentes níveis de CD4 no sistema público de saúde brasileiro e comparar aos custos de outros sistemas de saúde. **Métodos:** Foi conduzida pesquisa retrospectiva em cinco ambulatórios especializados do programa DST/AIDS no município de São Paulo. Dados referentes à assistência ambulatorial para tratamento de pacientes HIV durante um ano foram obtidos em prontuários médicos selecionados aleatoriamente. Preços dos recursos utilizados foram obtidos via pesquisa de mercado e bancos de dados do setor público. Informações sobre custos do tratamento ambulatorial de pacientes HIV em outros sistemas de saúde foram obtidos na literatura. Os custos anuais de tratamento ambulatorial de pacientes HIV em cada país foram convertidos em dólares norte-americanos no ano base 2010. **Resultados:** O custo anual de tratamento ambulatorial para pacientes HIV no programa público nacional foi US\$ 2.572,92 em 2006 no município de São Paulo, variando entre US\$ 1.726,19 para pacientes com CD4 > 500 e US\$ 3.693,28 para pacientes com $51 \leq$ CD4 < 200. Medicamentos antirretrovirais (ARVs) representaram aproximadamente 62,0% dos custos de tratamento ambulatorial de pacientes HIV. Comparando-se custos entre diferentes sistemas de saúde no mesmo período, o tratamento ambulatorial de pacientes HIV apresentou custos superiores nos países onde a provisão do tratamento é realizada pelo setor privado. **Conclusão:** Os principais determinantes dos custos de tratamento ambulatorial de pacientes HIV são: medicamentos ARVs, outros medicamentos, profissionais de saúde e exames diagnósticos. No entanto, a magnitude de participação dos determinantes de custos nos programas de tratamento ambulatorial de pacientes HIV varia em decorrência da eficiência do sistema de saúde. Os dados apresentados constituem importante instrumento para avaliação de políticas públicas de saúde relacionadas ao tratamento de pacientes HIV mundialmente.

Unitermos: HIV; terapia antirretroviral de alta atividade; custos e análise de custos; contagem de linfócito CD4; política de saúde.

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INTRODUCTION

Highly active antiretroviral therapy (HAART), adopted in 1996, combines antiretroviral drugs (ARVs) to reduce morbimortality rates among human immunodeficiency virus (HIV) patients, resulting in prolonged life expectancy¹⁻⁵ and increasing treatment costs.

Studies on costs of HIV treatment are usually performed through gross-costing techniques⁶⁻¹¹, analyzing specific healthcare expenditures¹²⁻¹⁹, using private perspective²⁰⁻²⁴ or exclusively using the costs for ARV provision²⁵⁻²⁹; all of which report general trends of HIV treatment costs.

Although there is a general consensus on the considerable share of costs due to ARVs^{6-24,30}, there is still lack of evidence on the major cost drivers of HIV outpatient treatment for individuals in different categories of CD4 cell count, particularly regarding nationwide publicly-financed HIV treatment programs, such as that of Brazil.

The Brazilian public program for HIV treatment was initiated in 1996 through ARVs distribution, prevention campaigns, and a healthcare program for sexually transmitted diseases (STD). In 2006, the program reached 180,000 individuals for HIV treatment within public health system. Currently, the Brazilian STD/ acquired immunodeficiency syndrome (AIDS) program provides inpatient and outpatient HIV treatment, including distribution of 17 HAART drugs^{31,32}.

According to Teixeira et al.⁵, the program resulted in decreased morbimortality and hospitalization rates; however, it also increased the demand for outpatient services and should continuously increase government expenditures due to the HIV incidence of approximately 20,000 cases per year^{31,32}.

Investigation on the cost composition of the Brazilian HIV program seems necessary to promote long-term public policy sustainability. Considering that usually there are data limitations to provide guidance for government decisions, this article seeks to offer evidence to contribute to strategic planning of public policies by analyzing the costs of HIV outpatient treatment for individuals with different CD4 cell counts within the Brazilian public program.

METHODS

CHARACTERISTICS OF THE BRAZILIAN STD/AIDS PROGRAM

The analysis was based on a retrospective survey conducted in five public outpatient clinics in São Paulo, Brazil. The municipal branch of the Brazilian STD/AIDS program in São Paulo, known as the Programa Municipal DST/AIDS de São Paulo (PMDASP), consists of 15 clinics for outpatient treatment, three diagnostic facilities, and one administrative headquarters.

A micro-costing technique was used to perform costs estimates of HIV outpatient treatment for individuals with different CD4 cell counts within the program; based on

identification, measurement, and valuation of resources required to provide the healthcare services demanded³³, from the public provider perspective.

The Brazilian STD/AIDS program is considered a multiservice unit that provides HIV and STD outpatient treatments, HIV/STD diagnoses, and HIV/STD prevention activities. Therefore, the program requires sets of specific resources to provide healthcare services (healthcare-related inputs), and, additionally, a set of unspecific resources shared among several activities (technical-administrative inputs).

Implementation of the micro-costing technique to perform the analysis of costs derived from HIV outpatient treatment in the program encompassed three stages:

1. Identification and measurement of specific resources necessary to provide HIV outpatient treatment, through inventory of medical procedures performed in a sample of patients during 2006, in order to estimate the technical coefficients of the inputs;
2. Identification and measurement of unspecific resources necessary to support HIV outpatient treatment, via assessment of infrastructure and of the administrative sector within the program, and estimation of an overhead allocation factor;
3. Calculation of costs due to HIV outpatient treatment, through valuation of resources required using applicable prices and technical coefficients of inputs or overhead allocation factor, followed by addition of values and further data processing to account for inflation and exchange rates.

INVENTORY OF MEDICAL PROCEDURES

SAMPLE

Sample size estimate was based on a population of 11,373 (67.7%) patients with CD4 cell count < 1,000 cells per μL at the beginning of the research in 2006, considering that CD4 cell count is usually adopted as a health status marker for HIV patients.

A two-stage sampling process was performed in order to assure representativeness. In the first stage, five settings of the program were selected using a stratified purposive sampling method, in order to represent the variability of socio-demographic conditions in five different regions of São Paulo. Distribution of patients according to CD4 cell count within each of the 15 clinical settings was tested, in order to verify similarity in relation to the distribution of CD4 cell count in the program.

In the second stage, medical charts in each clinical setting were stratified according to CD4 cell count. A sample of 20 medical charts from each CD4 cell count stratum was randomly selected from each clinical setting; including a 30% projected rate of losses to follow-up due to abandonment of treatment, incomplete information, lost medical records, and other possible problems.

Data on 441 (88.2%) medical charts were collected, mainly due to problems in the database from one of the selected clinical settings. Information provided in 370 (74.0%) medical charts was properly completed during 2006. Primary data analysis resulted in 352 (70.4%) patients in continuous HIV outpatient treatment during 2006. Mean and variance tests were performed in order to assure sample representativeness, confirming the similarity hypothesis.

Inclusion criteria were: medical charts of individuals in continuous HIV outpatient treatment during 2006, including one CD4 cell count at the beginning of the period and complete information on healthcare services provided. Exclusion criteria were: medical record incomplete or lost, patient's death in 2006, CD4 cell count < 1,000, and abandonment or irregularity in HIV treatment (considering the registry of ARV withdrawals). The study was approved by the Ethical Committee of the Municipal Secretary of Health of São Paulo (Process 0135.0.162.000-06).

TECHNICAL COEFFICIENTS OF INPUTS

Healthcare services provided during one year of HIV outpatient treatment were registered in a questionnaire containing nine sections: 1) socioeconomic data; 2) ARV drugs prescription; 3) other medication prescription; 4) vaccines; 5) diagnostic exams, CD4 cell count, and viral load; 6) other exams; 7) health procedures performed; 8) dental treatments; and 9) other information.

Health professionals were trained to complete the questionnaire, in order to assure quality and standardization in data collection. Healthcare services registered in patients' charts during 2006 were recorded in a single database and summarized as a set of medical procedures and medication annually supplied for integral medical assistance of HIV outpatient treatment.

Each medical procedure was split into the set of resources (e.g. needle, syringe, nurse time, and other) required to perform the health service, according to the technical coefficients of inputs reported in the medical literature.

Certain medical procedures (vaccination and medication withdrawal) and exams (diagnoses) presented insufficient evidence in the literature to support estimates of technical coefficients of inputs; therefore, two strategies were adopted. In the first case, a focus group composed of health professionals collaborated to complete detailed information on technical coefficients of inputs for medical procedures. In the second case, the three dedicated diagnosis facilities within the HIV treatment program provided the accounting data necessary to perform estimates of the economic costs of each exam.

ASSESSMENT OF INFRASTRUCTURE AND ADMINISTRATIVE SECTOR

Infrastructure and administrative resources appraisal was performed for the following categories of overhead: 1) real estate; 2) public utility services (water, electricity, telephone, and other); 3) administrative personnel; 4) other supporting services (cleaning and security); 5) technical and administrative support equipment; and 6) stationery and other office supplies.

Estimates included the 15 outpatient clinics and one administrative headquarters within the program in the city of São Paulo.

Real estate was expressed as area occupied, according to information provided by the PMDASP. Public utility services consumed during 2006 were calculated according to invoice data. Human resources were calculated according to the PMDASP payroll. Other supporting services were recorded through data in outsourcing contracts.

Technical and administrative support equipment were estimated according to basic infrastructure recommended for ambulatory assistance reported in a reference guide for healthcare services published by the Brazilian Ministry of Health. Compliance to recommendations was investigated by comparing references with the infrastructure observed *in loco*. Stationery and other office supplies were calculated according to invoices information.

In order to properly distribute the share of infrastructure and administrative resources among different healthcare services provided within the program, an applicable rate of overhead allocation factor was estimated based on global expenditures and number of patients in follow-up during 2006.

The program covered 16,789 HIV patients and 4,317 STD patients in outpatient treatment in São Paulo during 2006; a global cost of US\$ 63,876,528.60 (figures converted into 2010 U.S. dollars), encompassing US\$ 2,552,545.29 (4.0%) for primary prevention and US\$ 61,323,983.31 (96.0%) for outpatient treatment. Expenditures on outpatient treatment were distributed between HIV patients (86.9% of total cost) and other STDs patients (9.1% of total cost); the former rate was considered an appropriate overhead allocation factor to determine the share of unspecific resources attributable to healthcare services performed for HIV outpatient treatment.

RESOURCES VALUATION

PRICES RESEARCH

Data collection regarding prices included the valuation of resources registered as medical procedures and as infrastructure/administrative sector.

Considering the resources required for medical procedures, prices for ARV drugs were collected from public databases on government purchases during 2006. Prices of vaccines, medications other than ARV, and inputs for

health procedures (e.g. therapy, counseling, medical consultation, curatives, and other) were collected through market research at retail suppliers. Prices related to dental services, diagnostics, and other exams were gathered from public databases on government fees for payment of private providers. Prices related to other inputs required (e.g. infant formula, condoms, and other) were obtained through market research at retail suppliers.

Considering resources required for infrastructure/administrative sector, prices of public utility services consumed during 2006 were based on total expenditures registered in the invoices. Expenditures on supporting services were gathered from the outsourcing contracts. Wages referring to human resources were obtained directly from the PMDASP payrolls. Prices of stationery and other office supplies were collected from the invoices.

Real estate was valued according to the opportunity cost of rental in the area occupied. Technical and administrative support equipment was valued according to market research conducted at retail suppliers. Obsolete equipment not found in market research was valued according to the inventory data from government accountancy systems provided by the Ministry of Health. Information on real estate and durable resource lifecycles was obtained from the Foundation Institute for Economic Research (Fundação Instituto de Pesquisas Econômicas — FIPE), which is responsible for cost of living estimates in São Paulo, in order to allow accounting for depreciation (corresponding to the amortization of the financial capital in each period, inversely related to resource lifecycle), maintenance (considered equivalent to depreciation), and daily opportunity costs due to financial operations in acquisition, using the official long-term interest rate for social programs from the Brazilian Development Bank (Banco Nacional de Desenvolvimento Econômico e Social — BNDES).

COST ESTIMATES

Cost calculation of HIV outpatient treatment for individuals with different CD4 cell counts within the Brazilian public program involved five stages:

1. Obtaining the cost of medical procedures performed, multiplying the prices of inputs required by technical coefficients of inputs, and adding up medical procedures supplied to each patient during 2006;
2. Obtaining the cost of services provided by administrative sector, multiplying the prices of inputs required annually by the overhead allocation factor and, subsequently, dividing by the HIV patients' visits registered in 2006;
3. Obtaining the cost of services provided by infrastructure, dividing the value of real estate or equipment by estimated lifecycle. Annual cost of infrastructure was multiplied by the overhead allocation factor and, subsequently, divided by HIV patients' visits registered in 2006;
4. Annual costs attributable to the set of resources consumed in HIV outpatient treatment for each individual during 2006 were added and converted into U.S. dollars at the official exchange rate of December 29, 2006;
5. Accumulated inflation rate until 2010 was applied in order to provide actual figures in 2010 U.S. dollars, according to the Consumer Price Index reported by the Bureau of Labor Statistics.

Annual costs of HIV outpatient treatment from the Brazilian public program in São Paulo were stratified by CD4 cell count, considering major cost drivers according to categories. Literature research on studies analyzing the cost composition of HIV outpatient treatment in different international health systems was performed, in order to undertake a comparison across countries, considering only studies conducted through similar methodology and costing techniques.

RESULTS

Annual costs estimated for HIV outpatient treatment within the Brazilian public program varied from US\$ 1,726.19 for patients with higher CD4 cell count to US\$ 3,693.28 for patients with $51 < CD4 \leq 200$ (Table 1).

Table 1 – Annual and relative costs of HIV outpatient treatment of the Brazilian public program, according to CD4 strata. São Paulo, Brazil, 2006 (2010 USD)

CD4 cell count	Brazilian costs		(95% CI)
	Direct	Relative	
< 50	3,316.28	100.0%	2,172.40-4,460.17
51-200	3,693.28	111.4%	2,566.07-4,820.49
201-350	2,423.98	73.1%	1,923.73-2,924.24
351-500	2,244.17	67.7%	1,706.89-2,781.45
> 500	1,726.19	52.1%	1,421.50-2,030.87
Mean	2,572.92	77.6%	2,236.10-2,909.74

Patients with higher CD4 cell count had lower outpatient costs, accounting for nearly half of treatment costs estimated for patients with lower CD4 cell count. HIV outpatient treatment costs declined slightly for individuals with CD4 cell count ≤ 50 due to the decrease in ARV costs. Nevertheless, such shift in the structure of costs within the Brazilian public program is compensated by an increase in costs due to other healthcare services (such as dental care) within the program.

There were no significant differences in costs of HIV outpatient treatment in relation to individuals' gender and ethnicity. Regarding age group, average costs due to ARVs and exams were higher for younger individuals (Table 2).

Main cost drivers of HIV outpatient treatment in the Brazilian public program in São Paulo during 2006 were ARVs, medications other than ARV, health professional services, and diagnostic exams.

A significant proportion of HIV outpatient treatment costs was associated to ARV utilization, ranging from 55.8% of the annual outpatient treatment costs for individuals with CD4 cell count ≤ 50 to 66.8% of the annual outpatient treatment costs for individuals with $351 < CD4 \leq 500$.

Medications other than ARV represented 16.1% of the annual outpatient treatment costs for a typical HIV patient in the program, whereas the third cost category in terms of budgetary impact within the program was health professional services (8.7%). The proportion of costs due to medications other than ARVs presented broad variation across CD4 cell count strata, because of opportunistic illness treatment.

The shift in cost composition within the Brazilian public program for individuals with CD4 cell count ≤ 50 appears to be related to the lower consumption of health professional services in the case of patients in worst health condition. However, medications other than ARV take a higher priority among patients with CD4 cell count ≤ 50 , probably due to opportunistic infections.

Literature research on HIV outpatient treatment costs for HAART retrieved seven studies reporting details of healthcare costs from different countries from the late 1990's until 2006-2007, based on micro-costing techniques using the public provider perspective^{16,17,19-21,30,34}. One of the studies did not report ARV costs within HIV treatment¹⁹, and one study failed to present detailed data on HIV outpatient treatment costs²⁰ and therefore both were excluded from the cost composition comparison.

Table 2 – Annual costs of HIV outpatient treatment of the Brazilian public program in the major cost categories, according to demographic and epidemiologic characteristics. São Paulo, Brazil, 2006 (2010 USD)

	n	ARVs	Other medications	Health professionals	Diagnostic exams	Infrastructure	Other materials
Age							
18-29	30	2,208.61	137.08	275.24	783.72	109.22	94.98
30-39	127	1,415.98	143.20	213.55	454.64	109.22	94.98
40-49	130	1,536.84	128.70	229.01	329.24	109.22	94.98
> 50	65	1,774.43	124.35	216.59	341.28	109.22	94.98
Ethnicity							
White	187	1,478.89	142.91	220.49	394.30	109.22	94.98
Black	41	1,891.48	117.17	223.56	432.25	109.22	94.98
Mixed race	99	1,551.63	127.36	226.67	502.21	109.22	94.98
Other/missing	25	2,140.02	119.05	255.58	202.41	109.22	94.98
Gender							
Female	136	1,351.84	139.86	226.86	462.60	109.22	94.98
Male	216	1,747.06	130.05	223.96	385.75	109.22	94.98
CD4 cell count							
< 50	20	1,849.74	885.28	228.61	148.46	109.22	94.98
51-200	80	2,197.21	906.87	222.68	162.33	109.22	94.98
201-350	87	1,543.99	300.94	225.96	148.90	109.22	94.98
351-500	93	1,499.08	191.16	225.73	124.00	109.22	94.98
> 500	72	1,037.52	166.95	224.86	92.65	109.22	94.98
Mean		1,594.36	415.44	225.08	133.84	109.22	94.98

ARV, antiretrovirals.

Cost drivers of HIV outpatient treatment in different health systems presented a certain similarity regarding the share attributable to main cost categories (ARVs, medications other than ARV, health professional services, and exams). However, the cost composition of the Brazilian public program in São Paulo presented some differences in relation to other countries (Table 3).

Additionally, the costs of HIV outpatient treatment in public programs^{16,21,30,34} were considerably lower compared to HIV outpatient treatment costs in private settings for the same period¹⁷. Costs from the Brazilian public program for HIV treatment in São Paulo during 2006 were equivalent to 10% to 20% of the costs reported in the USA study.

DISCUSSION

The results obtained regarding cost composition of HIV outpatient treatment from the Brazilian public program in São Paulo during 2006 match those of the literature^{16,17,21,30,34}, which indicate that the main cost drivers in HIV outpatient treatment are, correspondingly: ARVs, other medications, health professional services, and diagnostic exams. Nevertheless, the magnitude of cost drivers varied among HIV outpatient treatment programs due to health system efficiency, which may be associated with health financing structure and scale.

In terms of HIV program financing, the Brazilian public program for HIV treatment resembles the public financing scheme described in the Mexican study¹⁶, which provides publicly financed healthcare services for HIV outpatient treatment, while the treatment for HIV patients in the USA is usually based on private out-of-pocket expenditures.

ARVs still represented a major part of HIV outpatient treatment costs in the Brazilian public program, independently of CD4 cell count stratum. Although the Brazilian public program for HIV treatment is often discussed regarding ARV patents issues, a comparative study on ARV prices in Brazil and other low- to middle-income countries showed higher ARV prices in Brazil, especially in the case of locally-produced generic ARVs. Furthermore, the study shows that contrary to trends worldwide, generic ARVs prices have been increasing in Brazil since 2003²⁵.

Considering that cost estimates may be subject to different methodologies, the cost comparison among healthcare services provided for HIV patients in different health systems was performed cautiously, in order to accomplish an adequate selection of studies that described in detail the costing techniques, estimation procedures, databases used, and perspective adopted.

According to Levy et al.³⁵, less than 2% of country studies reporting costs of HIV treatment based on HAART provided “adequate data” or “useful estimates” to ensure “a meaningful statement about costs”. Moreover, there are evidences of significant discrepancies between model estimates and country specialists’ estimates on resource requirements for HIV care³⁶.

Only five studies reporting details of HIV outpatient costs based on micro-costing techniques using public provider perspective were retrieved from the late 1990’s to 2006-2007^{16,17,19-21,30,34}. Other studies on HIV treatment costs were performed prior to HAART development, as properly summarized by Gebo et al.¹⁷. No study presenting more recent data on HIV treatment costs was retrieved.

Table 3 – Cost composition of HIV outpatient treatment in different countries using micro-costing techniques, from the public provider perspective (2010 USD)

	Country					
	Developing countries ³⁶	South Africa ²¹	Haiti ³⁰	Mexico ^{16*}	USA ^{17*}	Brazil
Year	2006-2007	2006	2003-2004	1997-2001	2006	2006
Annual cost	894.08	1,002.05	1,251.33	5,336.13	16,553.10	2,572.92
ARVs	64.7%	47.0%	40.4%	87.4%	76.2%	62.0%
Other medications	3.3%	–	4.0%	3.3%	13.9%	16.1%
Human resources	13.4%	16.0%	14.7%	2.1%	5.2%	8.7%
Diagnostic exams	5.8%	19.0%	21.0%	5.9%	3.6%	5.2%
Infrastructure	9.4%	19.0%	5.2%	1.4%	–	4.2%
Other materials	3.4%	–	14.7%	–	–	3.7%
Sample	45 sites	4 sites	1 site	11 sites	3 sites	5 sites
Settings	Subsidized	Public & NGO	Subsidized	Public	Private	Public

ARV, antiretrovirals; NGO, non-governmental organizations. *Based on weighted average of data presented in the studies.

CONCLUSION

Although cost comparison across different countries may be subject to some problems, due to both social context of the health system and methodology adopted for the cost estimates, this study aimed to illustrate the similarities and divergences in cost composition of HIV outpatient treatment provided in different national health systems, presenting the main costs drivers associated to various health financing arrangements.

Public programs for universal HIV treatment, such as the Brazilian case, are widely recognized, but seldom analyzed in terms of economic costs. The few evidences available include government budgetary figures analysis through gross-costing technique^{5,31} or cost-effectiveness analysis based on ARV prescriptions at patient level³².

Additionally, the mortality rates due to HIV in São Paulo have been declining notably since the program was started in 1990's, decreasing from 21.2 to 7.9 deaths per 100,000 inhabitants during the period between 1991 and 2007, according to data from MonitorAIDS, a system from the Brazilian Ministry of Health designed to monitor the AIDS epidemics. The situation poses a challenge regarding strategies for public policy management in the health sector, in order to accomplish a balance between public financing through taxation and healthcare provision for the population.

The present study was designed to comprise a primary tool for public policy evaluation, and its results may be a valuable source of information for HIV programs worldwide. The main limitation of the analysis is the absence of cost estimates for HIV inpatient treatment. Additionally, the representativeness of the sample was calculated to characterize a municipal branch of the Brazilian public program for HIV treatment located in São Paulo and thus some results may not be extrapolated to country level due to scaling effects.

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