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Socio-Economic Impact of Antiretroviral Treatment in HIV patients. An Economic Review of Cost Savings after Introduction of HAART

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Abstract

Star celebrities such as Rock Hudson, Freddie Mercury, Magic Johnson, and Isaac Asimov have unfortunately something in common: they were all victims of the HIV global pandemic.
Since then HIV infection has become considered a pandemic disease, and it is regarded as a priority in healthcare worldwide. It is ranked as the first cause of death among young people in industrialized countries, and it is recognized as a public healthcare problem due to its human, social, mass media, and economic impact.
Incorporation of new and highly active antiretroviral treatment, available since 1996 for HIV/AIDS treatment, has provoked a radical change in the disease pattern, as well as in the impact on patient survival and quality of life. The pharmaceutical industry's contribution, based on the research for more active new drugs, has been pivotal. Mortality rates have decreased significantly in 20 years by 50% and now AIDS is considered a chronic and controlled disease. In this review we have studied the impact of HAART treatment on infected patients, allowing them to maintain their status as active workers and the decreased absenteeism from work derived from this, contributing ultimately to overall social wealth and, thus, to economic growth. Furthermore, an analysis of the impact on healthcare costs, quality of life per year, life per year gained, cost economic savings and cost opportunity among other parameters has shown that society and governments are gaining major benefits from the inclusion of antiretroviral therapies in HIV/AIDS patients. **(AIDS Rev. 2009;11:79-90)**
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Key words

Highly active antiretroviral treatment. HAART. HIV/AIDS. Economy. Costs. Quality of life per year. QALY. Economic impact.

Introduction

Around 2.1 million adults and children died from AIDS during 2007 worldwide according to estimates of the World Health Organization[1]. Since its outbreak in 1981, more than 25 million people have died of AIDS and HIV is considered the major factor responsible for this epidemic.

Many attempts to downscale the impact of the HIV infections have been made ever since. From the first antiretroviral azidothymidine or AZT, a nucleoside analog reverse transcriptase inhibitor (NRTI), other anti-HIV drugs, such as nonnucleoside reverse transcriptase inhibitors (NNRTI) and protease inhibitors (PI), have appeared in the therapeutic arsenal. However, the HIV retrovirus has been consistently winning the battle over the different antiretroviral therapies that have been investigated, for example due to the appearance of natural polymorphisms that would grant the viral escape[2].

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Incorporation of new and highly active antiretroviral treatment (HAART), available since 1996 for HIV/AIDS treatment, has provoked a radical change in the disease pattern, as well as in the impact on patient survival and quality of life[3].

There are at present 22 anti-HIV drugs formally licensed for clinical use in the treatment of HIV infections (AIDS). The reverse transcriptase inhibitors work by interrupting the reverse transcriptase process; therefore the RNA is not converted into DNA and thus the virus cannot replicate[4]. The PIs work in a similar fashion. They block the enzyme protease that is essential for HIV to be infectious.

Next, the HIV integrase appeared to be a natural target for HIV chemotherapy because of its central role in the HIV lifecycle and due to the absence of a human homologous of the protein[5]. The development of integrase inhibitors, another class of drugs, exploited and shed light on the complex, multistep process of integration of the HIV provirus into the host genome. Raltegravir, the first compound of this class to be approved for clinical use, inhibits strand transfer of viral DNA and prevents the incorporation of the completed HIV DNA copy into the host DNA cells, the third and final step of the provirus integration. Further, the CCR5 inhibitor maraviroc, an agent newly approved by the U.S. FDA in a new class of HIV drugs, binds to the CCR5 chemokine coreceptor, leading to a conformational change, preventing interaction with the V3 loop of HIV-1 gp120 with the CCR5 coreceptor[6].

The fusion inhibitors are the newest class of antiretroviral drugs, and currently there is only one drug available (enfuvirtide), which blocks the entry of HIV into the CD4 T-cell by binding to glycoprotein 41[7]. Via this mechanism of action, enfuvirtide effectively blocks the HIV, as this is where it needs to attach in order to be able to fuse with the host cell[8].

At present, the current standard treatment is HAART, consisting of a drug regimen that includes three to four drugs used in combination; these combinations are known as drug "cocktails". A standard HAART regimen consists of two reverse transcriptase inhibitors and a PI. Enfuvirtide is reserved for patients that have become resistant to other antiretroviral drugs[9]. The reasons for this resistance development are the speed at which the virus replicates and its replication methods. According to Rodes, et al., a high proportion of treated patients fail their current antiretroviral regimen due to viruses with broad cross-resistant genotypes to available drugs[10]. For this reason, the drugs in the HAART regimen are rotated out and different drugs from the same class are introduced into the combination cocktail as the patient develops resistance. The use of HAART can make HIV practically undetectable in the blood, and has prolonged the lives of many HIV and AIDS patients. Nevertheless, treatment must be used continuously in order to be effective.

The present paper will address the human and economic impact of HIV from its violent propagation till today. Furthermore, it will be shown how the new drug regimens have modified this effect, have led to significant reductions in hospital admissions, and have improved radically the survival and quality of life before and after the application of HAART.

HIV infection and epidemiology worldwide and in Spain

In most countries the HIV epidemic is driven by behaviors (e.g. multiple sexual partners, injecting drug use) that expose individuals to the risk of infection. Information on the knowledge of, levels, and intensity of risk behavior related to HIV/AIDS is essential in identifying populations most at risk for HIV infection and for a better understanding of the dynamics of the epidemic. It is also critical information in assessing changes over time as a result of prevention efforts. One of the main goals of the second generation of surveillance systems is the promotion of a standard set of indicators as defined in the UNAIDS Guide[11] and regular behavioral surveys in order to monitor trends in behavior and to target interventions. Indicators on knowledge and misconceptions are an important prerequisite for prevention programs to focus on increasing people's knowledge about sexual transmission and to overcome the misconceptions that act as a disincentive to behavioral change.

Indicators on sexual behavior and the promotion of safer sexual behavior are at the core of AIDS programs, particularly with young people who are not yet sexually active or who are embarking on their sexual lives, and who are more amenable to accomplish change than adults. Finally, there are the higher-risk male-male sex reports on unprotected anal intercourse, the highest-risk conduct for HIV among men who have sex with men (MSM).

According to the Global Summary of the AIDS Epidemic that was published in December 2007, the total number of people living with HIV is approximately 33.2 million people worldwide[1]. This number supposes a reduction of 16.5% compared to the 39.5 million estimated in 2006. The positive decline, however, is

attributed to advances in the methodology of estimations of HIV epidemics. Out of the 33.2 million people living with HIV, approximately 2.5 million were newly infected with HIV in 2007, 1.7 million of these in Sub-Saharan Africa[1].

Nearly 60% of the people infected with HIV in the USA are women between the ages of 15 and 24. An estimated 1.3 million Americans are currently living with HIV/AIDS, up from 900,000 in 2001. In 2003 there were an estimated 15 million AIDS orphans around the world, expected to increase to 25 million by 2010. Overall, since the beginning of the epidemic, nearly 14 million people have died worldwide.

The AIDS epidemic does not discriminate by race or income. The HIV/AIDS epidemic is most prevalent in Sub-Saharan Africa; their numbers account for approximately two-thirds of the overall HIV/AIDS cases. However, HIV is greatly increasing in Eastern Europe, Central and Eastern Asia, and the Caribbean as well. In the USA, HIV/AIDS is increasing most quickly and disproportionately among ethnic minorities and women. HIV/AIDS is now the leading cause of death among African American women between the ages of 25 to 34[1].

The mode of transmission of HIV is as follows: sexual activity (both hetero- and homosexual), blood product transfusion, intravenous drug use that includes the sharing of needles, accidental needle sticks (this affects mostly healthcare workers, although this way of transmission is very rare, accounting for approximately 0.3% of the infections), and mother-to-infant transmission, both in the uterus (across the placenta) and during delivery, as well as via breastfeeding.

As stated before, the CD4 T lymphocyte cells are the only cells destroyed by HIV. However, because HIV is also capable of invading macrophages, monocytes, and microglial cells (all of which also have CD4 receptors), these sites serve as reservoirs for the virus. In other words, unlike the CD4 T-helper cells, these other cells are not ultimately destroyed by the virus. Instead, the reservoirs may be activated by normal immune processes, leading to the production of more viruses. Moreover, the infected monocytes and macrophages seem to contribute to central nervous system damage (manifested in about half of HIV cases, and including symptoms such as impaired short-term memory, reduced concentration, tremor, fine motor clumsiness, social withdrawal, and irritability), as they can travel into the brain and serve as a reservoir there. These symptoms usually appear in patients with high viral loads.

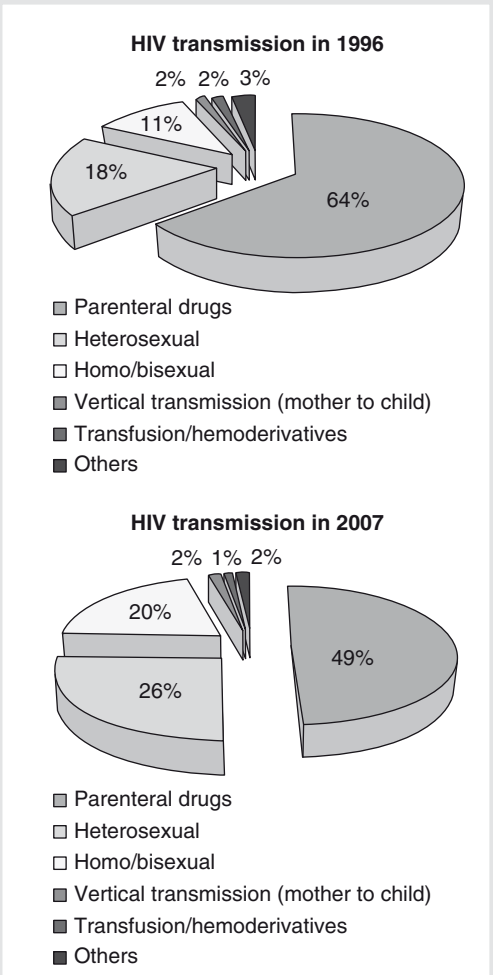

Figure 1. *Differences in HIV transmission from 1996 to 2007.*

HIV infection and epidemiology in Spain

According to conclusions from the Instituto de Salud Carlos III[3] in Madrid, Spain, the major proportion of AIDS patients is of male gender, elderly, and with a low level of education. Regarding the mechanism of HIV infection, the parenteral route via injection by injecting drug users (IDU) is still the most important mode of transmission. However, the incidence of infection through heterosexual and/or homosexual relations is increasing significantly (Fig. 1).

It has been identified that a large proportion of AIDS patients are conducting highly risky sexual behavior. Condoms are sometimes utilized, but not always. This problem should be addressed and preventive interventions

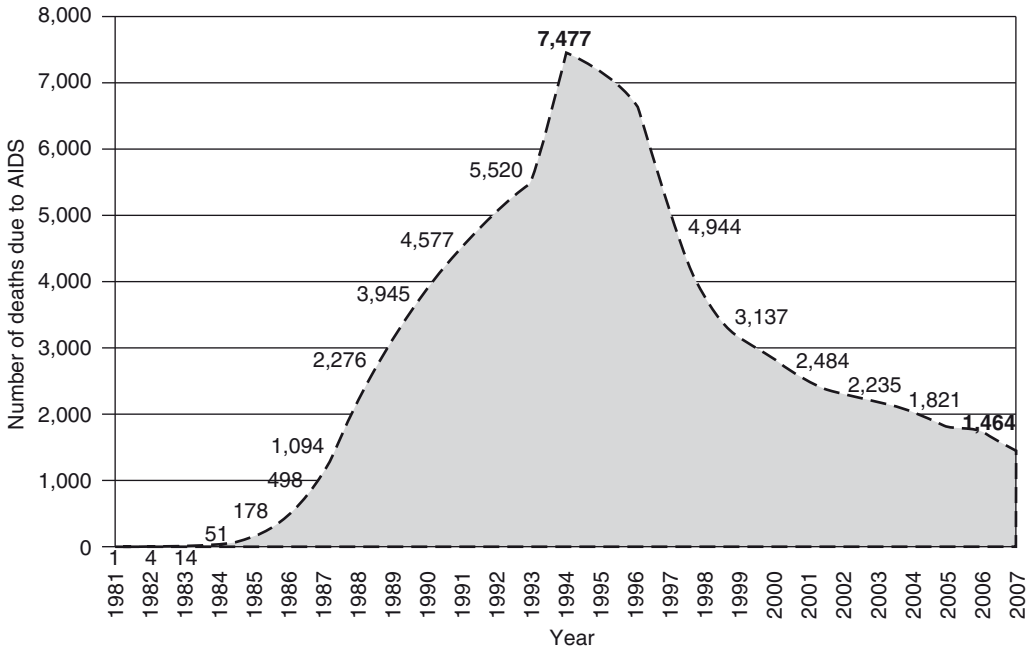

Figure 2. *HIV/AIDS mortality in Spain from 1981 to 2007.*

should be implemented at hospitals and primary care centers.

Due to the strong immigration flow experienced in Spain in the last decade, figures report a significant increase of infection within the immigrant group. Unfortunately, this group is diagnosed very late and their immunologic status is compromised. The use of condoms is reduced within this group and this can be linked to a lower level of awareness of the risk of HIV infection or ignorance about prophylactic measures.

By the end of 2007, the Spanish authorities had reported a cumulative total of 75,733 cases of AIDS, and the deaths of more than 45,000 cases. For the year 2007 itself, 1,464 new AIDS cases have been reported (Fig. 2). It is estimated that between 115,000 and 155,000 Spaniards are living with HIV/AIDS, and that about 75% of them are aware of their serostatus[3].

Data from the regions that report HIV cases show that during the 1980s, HIV spread widely among IDU and, to a much lesser extent, MSM. The large number of sexually active young adults among HIV-positive IDU led to the infection of non-injecting sexual partners and children through vertical transmission. By the start of the 1990s, more than 100,000 people had already been infected with HIV, and HIV-related mortality ranked first in 1994 among the major causes of adult death and potential years of life lost. In the 1990s, intensified targeted interventions led to marked reductions in the incidence of new infections among IDU, MSM, and female commercial sex workers[12].

As of June 2005, most AIDS cases reported in Spain (46%) were IDU. A further 29% had been infected heterosexually, and 16% were MSM. Spain has the largest cumulative total of AIDS cases and of IDU with AIDS of any European country.

The Spanish AIDS epidemic appears to have peaked in 1994, followed thereafter by a rapid decline in the number of annually reported cases: from 7,428 new cases in 1994 to 1,712 in 2004. The number of AIDS deaths peaked in the mid-1990s with more than 5,000 deaths annually. Since then there has been a rapid decline in the number of deaths (78%), reflecting the impact of HAART since its introduction in 1996.

From total patients, 43.7% have been infected through sharing syringes to administer drugs, and this affected 46% of men and 37% of women. People infected through heterosexual practices account for 30% of the cases, and this is still more frequent in men than women.

Table 1. Costs per patient per year (PPY) as a therapeutic strategy in Spain

Therapeutic strategy	PPY costs	Average	Economic saving of HAART	Social saving of HAART: Opportunity cost (GDP)	Total costs-savings derived from HAART treatment
Non HAART treated patients	$30,000 – $40,000	$35,000	–	–	
HAART treated patients	$12,000 – $20,000	$16,000	$19,000	$30,120	$49,120

However, 51% of AIDS diagnoses in 2007 in women were due to the heterosexual route of infection. HIV transmission in MSM is the third most frequent way of infection, accounting for 16% of all cases[13].

Therapeutic impact of HAART treatment

HIV treatment experienced a turning point in 1996, first with the commercialization of PIs, secondly with the new strategy of combining three or more drugs, and thirdly with the possibility of monitoring therapeutic response through viral load measurement in plasma. This cocktail of drugs was named HAART.

About 1.5 days is the estimated period required by the HIV virus to complete its short lifecycle: from viral entry into a cell, through replication, assembly, and release of additional viruses, to further infect other cells[14]. Such a short lifecycle and its elevated error rate cause the virus to mutate very quickly, resulting in the high genetic variability of HIV. Some of those mutations award natural selection dominance compared to parent virus and can enable them to slip past defenses such as the human immune system and antiretroviral drugs. The more active copies of the virus present, the higher the possibility of the appearance of drug resistance to antiretroviral drugs. Thus, antiretroviral combination therapy defends the person against resistance by suppressing multiple HIV replications.

Combinations of antiretroviral drugs create multiple obstacles to HIV replication to keep the number of offspring low and reduce the possibility of a superior mutation. If a mutation arises that conveys resistance to one of the drugs being taken, the other drugs continue to suppress reproduction of that mutation. With rare exceptions, no individual antiretroviral drug has been demonstrated to suppress an HIV infection for long; these agents must be taken in combination in order to have a lasting effect. As a result, the standard of care is to use combinations of antiretroviral drugs. Combinations usually comprise two NRTI and one NNRTI or PI[15]. This three-drug combination is commonly known as a triple cocktail[16].

HAART represents a revolution in antiretroviral treatment due to the important reduction of clinical complications and a spectacular increase of survival rates[17].

Ten years after the establishment of HAART there have been important variations in the AIDS prognosis, epidemic evolution, and the use of health resources[17-19]. However, the possibility to eradicate HIV with the medicines available currently and the therapeutic strategies used is not expected. There exist incentives for the pharmaceutical industry to invest in further research to find either more efficacious drugs or a vaccine to prevent the HIV epidemic[20].

Analysis of cost-efficiency of antiretroviral treatment in HIV/AIDS patients

HAART has drastically reduced mortality and morbidity in HIV-infected patients and at the same time has improved patient's quality of life[21,22]. However, due to mortality reduction rates and a growth in the number of infected patients, the costs of antiretroviral treatment are progressively increasing. Total treatment costs include not only drugs, but complementary costs, including doctor's fees, tests, and psychosocial support. In the USA, total costs vary between $ 12,000 and $ 20,000 per patient per year[22].

In Spain, there is an average estimation of the cost of HAART at € 7,400 per patient per year[23], which correlates with currency exchange of Dollars to Euros and purchasing power parity. In Spain a cost per patient per year analysis demonstrated that treating patients with HAART was a cost-efficient strategy (Table 1).

The total cost for HIV-related healthcare assistance was € 739,048. The cost related to admissions was € 150,766; € 8,631 for first visits and € 49,199 for successive visits; € 5,085 for day care unit; € 14,920 for outpatient surgery; € 7,655 for emergency room visits; and € 491,342 for antiretroviral treatment. A significant

Antiretroviral treatment	68%
Hospital inpatient costs	21%
First visit	1%
Successive visit	7%
Per day care unit	1%
Outpatient surgery	1%
Emergency room (ER) visit	1%
Total cost of HIV-related healthcare assistance	0,1%

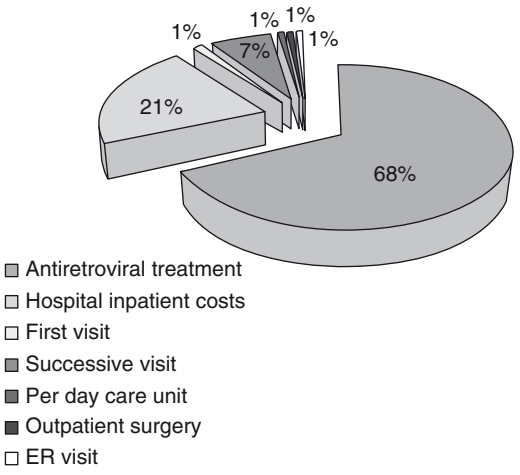

Figure 3. *Total costs of HIV treatment.*

proportion of the total outpatient assistance was given by physicians other than HIV specialists, namely, 63% of the costs attributed to the first visit and 41% per successive visit[23].

In the following figure (Fig. 3) a breakdown of total costs is shown and this proportion is shown graphically in the corresponding diagram to further visualize it.

Costs related to inpatients at hospitals have been largely reduced due to the antiretroviral treatment that now comprises 67% of the total costs. In some articles it is shown that an additional reduction of costs derived from inpatient hospitalization due to the introduction of new anti-HIV therapies[24,25]. In the USA, Gebo, et al. observed that when protease inhibitors were included in the therapeutic regimen, costs from inpatients at hospitals are further reduced; however there is an increase of pharmaceutical costs[26].

Pharmacological treatment of AIDS is an important part of the total health budget, together with the costs related to inpatient days at hospital. The total budget of pharmacological treatment is constantly increasing due to the increase in life expectancy and in the number of patients undergoing HAART treatment.

Therefore, the majority of policies controlling health costs derived from HIV infection are directed towards the control and optimization of HAART treatment. It has been demonstrated that HAART treatment is regarded as a cost-effective intervention in the majority of cases[23,27,28].

Choosing among different therapeutic options requires an efficacy evaluation of different treatments and balancing the adverse effects, together with resources consumed or costs associated with the treatment.

Although the direct costs of medicaments are elevated, their high efficacy may reduce the utilization of other health services and pose net savings for the national health system. HAART treatment and doctor's visits increase the costs of patient treatments; however, there are savings in other costs. The use of HAART regimens diminishes the incidence rate of opportunistic infections and its associated costs, reducing the number of hospital admissions and also the number of hospital inpatient days. Such a scenario makes the treatment of AIDS patients a cost-effective approach for hospitals currently applying the use of those drugs[29].

Despite geographic variations, in France a hospital has estimated a net saving of $ 248,852 in one year, or $ 1,212 per patient per year, after applying HAART treatment to their patients. This is the outcome of the effective antiretroviral treatment that has directly favored a reduction in the number of hospital admissions and inpatient days[30].

The evolution of total costs of the treatment of HIV/AIDS patients derived from medical expenditures shows

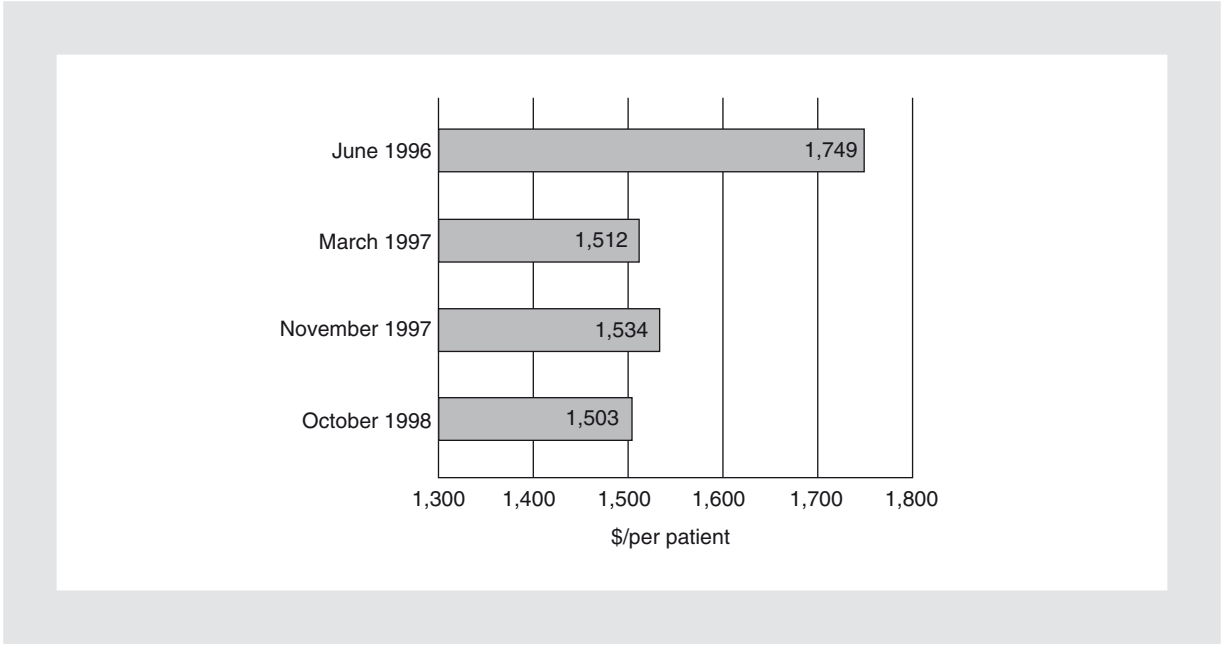

Figure 4. *Reduction of monthly costs in HIV/AIDS patients after HAART treatment.*

an important reduction after the extension of antiretroviral treatment. This improvement has been identified as shown in figure 4, where the monthly costs per HIV patient has been reduced by $ 246 from 1996 to 1998, and maintained since then[31] (Fig. 4). These savings have been confirmed by different studies[32].

HIV/AIDS patients not treated with HAART generate more health costs than those treated with such a therapeutic regimen (Fig. 5A)[26].

If we analyze the different healthcare costs contributing to the total costs, it is observed that the utility weight of HAART treatment has been proportionally increasing since 1996 (Fig. 5B).

However, these healthcare costs have been compensated due to the inpatient and outpatient costs, due basically to the cost reduction of opportunistic diseases and inpatient days derived from it. As a consequence, there has been a substitution, given the increase in the use of the HAART treatment and the decrease of other health services.

Further, the percentage of HIV-infected persons is increasing among active workers (Fig. 6). One of the reasons is that after the appearance of HAART, HIV-positive persons were able to continue working due to an enhanced quality of life[32]. Hence, the proportion of unemployed infected persons is decreasing, probably due to the efficacy of antiretroviral treatment allowing HIV/AIDS patients to work and contribute to social wealth and economic growth through their productivity in the labor market.

The introduction of antiretroviral treatments has had an impact in the increase of HIV/AIDS patients' quality of life. The quality-adjusted life-year (QALY) measures the benefits of a treatment quality and the quantity of life delivered by a given treatment regime. One interpretation of QALY would be how much lifespan a person would be prepared to give up for one year of perfect health from the current state of illness.

According to Simpson, et al.[33], there was a comparative benefit for antiretroviral treatment-experienced patients in quality-adjusted life-months of 4.6 net gain after subtracting QALY. In addition, there were 5- to 10-year overall cost savings of between € 947 and € 6,594 per patient after five years. The impact on costs ranged from € 308 increase (for France) to a cost saving of € 7,388 (for Spain) at year 10. The lifetime incremental cost-effectiveness ratios ranged from the highest for Spain to € 12.5 per QALY for Italy.

As our goal is to show the gain derived from the use of a treatment, in order to calculate per life-year gained, the total costs were divided by the number of extra years the treated patients lived. HAART treatment was evaluated according to economic and quality of life parameters in three different countries, Spain[33], South Africa[34], and the USA[35], compared with no treatment (Table 2).

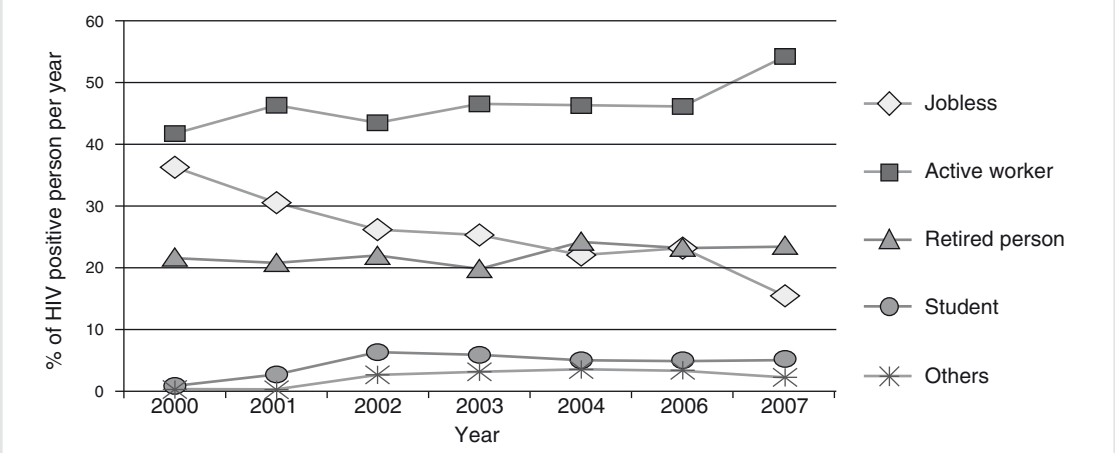

Figure 6. *Working status of HIV-positive people.*

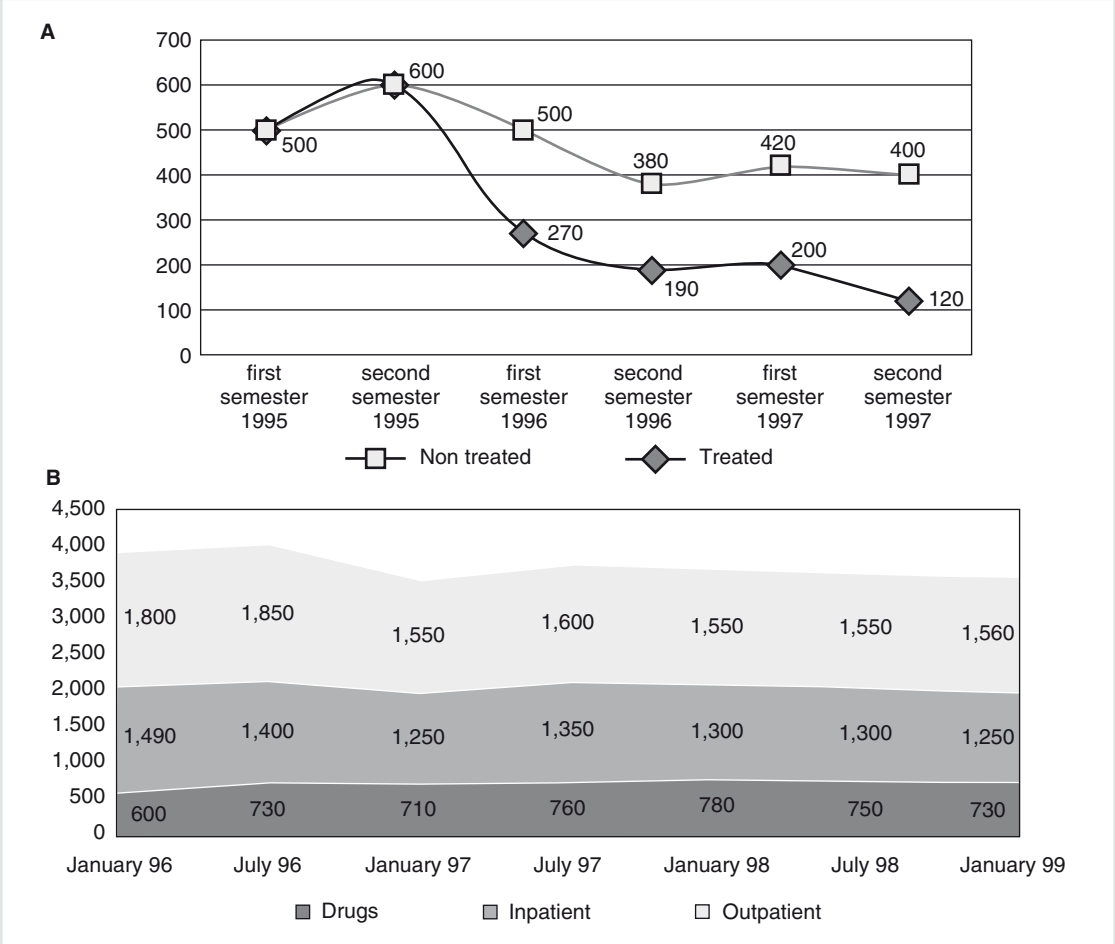

Figure 5. ***A:*** *Differences in costs of $ per patient per month associated to HIV/AIDS to US Medicaid.* ***B:*** *Monthly expenditure $ per patient.*

Table 2. Analysis of different parameters for economic evaluation of HAART treatment of HIV/AIDS

	PPY costs Costs per patient per year	LYG (Per life-year gained)	ICER Incremental costs-effectiveness ratio	QALY (quality-adjusted life per year)	GDP per capita*
With no treatment	$30,000-$40,000	0	–	4.7 QALY	–
South Africa	$200-$1,000	$984 per life year gained	$1,102 per QALY	8.0 QALY	In 1996: $5,951.370 (4.23 %) In 2007: $9,761.387 (7.12 %)
Spain	$12,000	$9,083 per life year gained	$17,784 per QALY	12.5 QALY	In 1996: $17,874.173 (4.12 %) In 2007: $30,120.351 (4.69 %)
US	$12,000-$20,000	$14,587 per life year gained	$50,000 per QALY	13.1 QALY	In 1996: $28,996.237 (4.44 %) In 2007: $45,845.477 (3.92 %)

* Definition of GDP - per capita (PPP): This entry shows GDP on a purchasing power parity basis divided by population as of 1 July for the same year[35].

Table 3. Societal consequences of HAART treatment

Parameters	1997: non HAART treatment	2007: HAART treatment
Cost of AIDS treatment	Before HAART treatment: $30,000 and $40,000 per patient per year	Actual cost of treatment: $12,000 and $20,000 per patient per year
Mortality rates	–	Decreased 50% compared to 1997
Months per year of absenteeism	3.49	0.19
Work productivity: Costs of HIV employee/per year	$1,416.39	$81.34
Productivity gains	$0.0	$1,562.52

The estimation of the cost per patient per year (PPY) is therefore defined by:

$$C_i = GDP_i * WYLL_i$$

where C_i represents the cost per patient *i*, GDP_i is the GDP per capita, and $WYLL_i$ represents the potential working years of life lost through the illness by individual *i*. The potential years of life lost are calculated by subtracting the average age at which individuals die compared to their expectancy of life without illness given their age.

Work productivity and absenteeism

Many studies have analyzed in depth the advantages of applying HAART therapy in different cities around the world. New York City released a study in 2003[36], showing a mortality rate drop from 131 to 31 deaths per 1,000 persons/year, and a reduction of 50% in mortality risk.

Mortality rates, months per year of absenteeism, work productivity rates, and productivity gains have been calculated to estimate the societal consequences of HAART treatment (Table 3)[22,29]. Not only have mortality rates decreased, but also there has been an increase in the quality of life of patients and thus in their ability to produce in society, thanks to treatments available to date. Hence, the months of absenteeism have been reduced from three months to half a month per year, and the productivity of an employee treated with antiretroviral treatment has been estimated to increase by $ 1,562 per year[35].

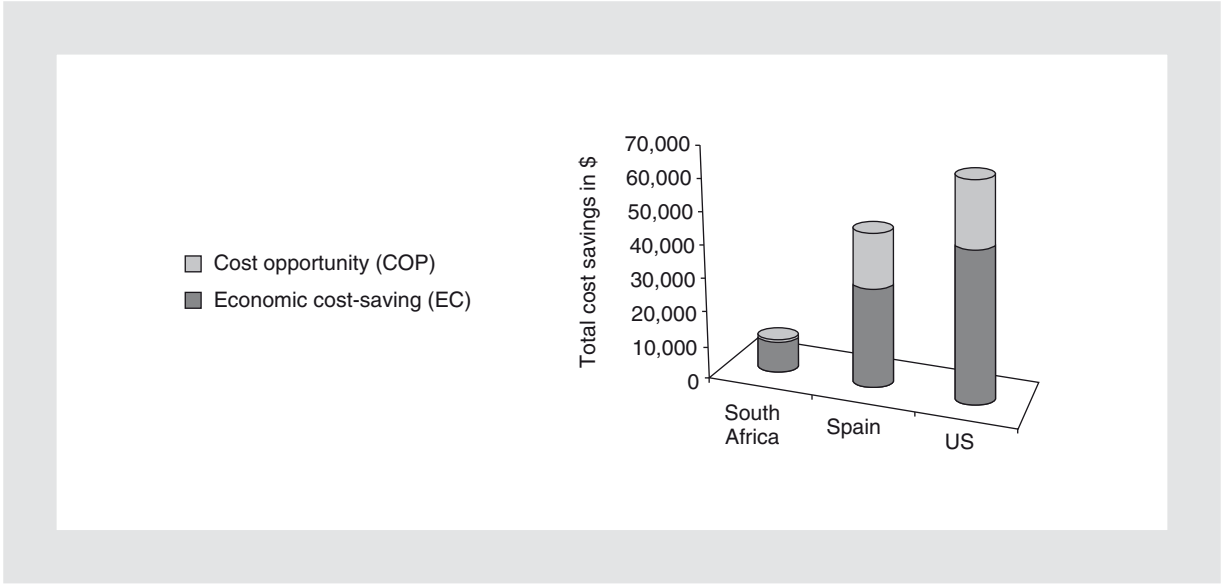

Figure 7. *Total Costs savings derived from treatment of HIV/AIDS patients with HAART in three different countries.*

Cost economic savings and cost opportunity

In our analysis, the economic saving (EC) of treating a HIV/AIDS patient are calculated using the costs of patients with HIV/AIDS non-treated (CNOT) minus the costs of patients HIV/AIDS treated with HAART (CT), as follows:

$$EC = CNOT - CT$$

Further, our methodology presents a definition of total costs savings of HAART treatment (TCS) as the economic saving of treating an HIV/AIDS patient (EC) plus adding the cost-opportunity derived from the patient being able to work and be productive for society (COP). This is presented in the following formula:

$$TCS = EC + COP$$

where COP is derived from the GDP per capita and must be calculated per country. As can be seen in figure 7, the total costs savings (TCS) of applying HAART treatment in the three different countries studied are cost-efficient and cost-beneficial from both an economic point of view and societal aspects[37]. Infected individuals are able to continue working, and thus they are able to produce for the society in the labor market (Fig. 7). This trend supposes a transformation in the category of the disease, which has become a chronic condition. As we have observed in table 1, also the quality of life of HIV/AIDS patients has been enhanced after initiation of an antiretroviral regimen.

Discussion and conclusions

New antiretroviral regimens have considerably reduced the high incidence of opportunistic diseases, inpatient days, and mortality rates in HIV/AIDS-infected patients and they have enhanced patient quality of life.

Data shown in this review show the impact indicator of HAART treatment on lengthening both the time period between HIV infection to AIDS and AIDS survival, but they also reflect some changes in the transmission of HIV infection pattern in our setting (with an increase of heterosexual transmission).

Although the primary rationale for wider access to HAART is humanitarian, a national HAART program targeting patients with symptomatic HIV disease, using low-cost HAART prices, would also significantly decrease hospital services utilization by HIV-infected patients, resulting in either health expenditure saving by cost deferral or freeing substantial resources for healthcare of non-HIV patients[38].

Evaluating healthcare costs since the introduction of HAART only represents one part of the equation.

The net gain in health parameters such as length and quality of life is the real improvement after introducing HAART[39]. A crucial point is the cost- effectiveness of HAART by representing an efficient use of available resources. In addition to healthcare costs, another important consideration is the changes in productivity costs considered from a societal perspective. Due to their improved health status resulting from HAART, patients may be able to return to work or work until later in their life[34]. When these productivity gains are included, HAART is a cost-saving strategy. HAART has the potential to be one of those few treatments that lead to improvements in health outcomes as well as savings in costs, and thus it is a principal strategy. There is an improvement of HIV patient's quality of life after HAART treatment in current days.

Health expenditure on HAART treatment is clearly cost-effective, as shown in the data provided in this review. Thus, the provision of healthcare for chronic HIV/AIDS patients is of major interest for public or private healthcare. We have shown the existence of economic savings derived from treating an HIV/AIDS patient, plus the societal costs of allowing a patient to continue working after being treated. Here, the opportunity cost of work constitutes a fundamental pillar of patient quality of life plus psychological health from a socioeconomic perspective.

HAART treatment also affects the stock of health capital by improving considerably the number of years of survival after infection, life-years gained and QALY. In Spain, where HAART therapy is free and therefore accessible to everyone, HAART exerts little influence among different levels of wealth of the patient[40]. Here, the social inequalities of educational levels affect mostly the adherence to treatment due to the poor understanding and difficulties in following the long and complex therapeutic regimens.

The world is confronted by these new challenges to transform the economic resources available into benefits and providing services for those who need it.

It has been estimated that the available treatments are not directed to the people who really require it, but to the ones who are living in big cities and with easier access[38]. To cover the real need of HIV/AIDS patients, countries must increase the total cost coverage designated to AIDS. In summary, every country must employ more efforts to make antiretroviral treatments available where they are really needed in order to attain those societal and economic benefits.

Acknowledgments

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