Estimation of the Direct Cost of HIV-Infected Patients in Greece on an Annual Basis

Nadia Boubouchairopoulou, BSc, MSc[1],*, Kostas Athanasakis, BSc Econ, MSc Econ, PhD[1], Maria Chini, MD, PhD[2], Nikos Mangafas, MD[2], M.K. Lazanas, MD, PhD[2], John E. Kyriopoulos, MD, MSc, MPH, PhD[1]

[1]Department of Health Economics, National School of Public Health, Athens, Greece; [2]3rd Department of Internal Medicine and Infectious Diseases Unit, Red Cross General Hospital, Athens, Greece

A B S T R A C T

Objective: HIV infection is currently regarded as a global chronic disease. The purpose of this study was to assess the direct cost of illness per patient per year in Greece. **Methods:** A retrospective study for the estimation of the direct cost of HIV infection was performed from the third-party payer perspective. Data from 447 patients monitored in a general hospital of Athens were collected from their medical records. The survey involved all services and treatments that patients (stratified into three health states according to the number of CD4 cells/ml as defined by the Centers for Disease Control and Prevention classification system for HIV infection) received in 1 year, as well as demographic data. **Results:** The annual direct cost per patient was calculated at €6859 ± €4699. Antiretroviral therapy cost was estimated at €5741, while the annual cost of providing health care services regardless of health state was computed at €1118, with laboratory investigation and imaging studies representing €924 (13.5%), outpatient visits €34 (0.5%), and

hospitalization €160 (2.3%) of total cost, respectively. Overall, direct cost per patient was found to increase as the CD4 T lymphocytes decreased, leading to prolonged hospitalization and an increase in the number of laboratory tests. Direct cost for patients with more than 500 CD4 cells/μl was estimated at €6067, whereas for those with 200 to 499 cells/μl and less than 200 cells/μl, it was assessed at €6857 and €7654, respectively. **Conclusions:** The direct cost of HIV infection per patient increased as CD4 T lymphocytes decreased. The largest part of expenses was attributed to antiretroviral therapy, followed by laboratory tests/imaging studies, hospitalization, and finally outpatient visits.
Keywords: antiretroviral therapy, cost of illness, direct cost, health care services, HIV infection.

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Introduction

The first cases of HIV infection were reported in the early 1980s in the United States . As was later discovered, however, the virus appeared several decades earlier and was transmitted to humans by Pan troglodytes troglodytes, a chimpanzee species [1,2]. The HIV infection has captured since then the interest of researchers who bestir themselves in the field of medicine, social sciences, and health economics because its complex pathology affects all these sectors.

Since the 1980s, the transmission of the virus resulted in rapid and fatal spread within a relatively short time. As soon as the virus is transmitted through sexual fluids, blood, or breast milk, it enters host cells with specific mechanisms and starts the replication of the genetic material, resulting in continuous proliferation. Antiretroviral drugs interfere in different stages of the virus life cycle by preventing multiplication. The nonadministration of antiretroviral agents engenders faster disease progression, and finally patient's end of life because of a drop in the immune system [3,4].

Effective disease management represents a challenge for practitioners, as hitherto, current therapies were unable to eradicate the virus. Moreover, the gradual weakening of infected patients' immune system sets important barriers regarding effective disease monitoring [5]. With the advent of antiretroviral therapy in the mid-1990s, patients' life expectancy and quality of life increased, thus leading to an ever-increasing cost of HIV infection, attributed to the high cost of antiretroviral therapy and to the specialized inpatient and outpatient health services required for the monitoring of HIV-positive patients [6,7].

As a result, health care managers, policymakers, and practitioners need to have up-to-date data on costs, especially when considering a country such as Greece where austerity measures have been undertaken, reducing the available resources. Therefore, funds' allocation needs to be more effective, responding to patients' needs, especially when it involves a disease with so many particularities [8]. The growing number of HIV seropositives, antiretroviral therapy, and the chronic nature of HIV infection itself generate the constant rise in expenditures and lead current research to focus on the cost estimation

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of different parameters that contribute to the cost of the disease [9].

The present study aimed at estimating all health care resources consumed by HIV-infected patients in Greece, on an annual basis, as well as their respective costs. The main objective of this analysis was to provide an up-to-date estimation of HIV-infection's direct cost in Greece to redraw and improve the health services provided to this particularly vulnerable patient population.

Methods

Research Design

A retrospective study was performed to estimate the direct cost of HIV infection. In Greece, HIV patients are exclusively monitored by HIV specialists in infectious diseases units of public hospitals. Therefore, all costs associated with HIV management involve health resources consumed in a public hospital setting. Direct medical costs and antiretroviral therapy costs were assessed from a third-party payer perspective.

Study Participants/Patients

The sample was composed of subjects monitored in the Infectious Diseases Unit of a general hospital in Athens. Patients aged 18 years or older, followed in the HIV special unit from July 2, 2012, to July 2, 2013, were included in the study. Out of 489 patients monitored in the unit, 447 finally met the inclusion criteria because clinical data within the aforementioned period were not available for 42 patients. All ethical requirements were met, and each participant returned his or her written informed consent. Data were obtained from their medical records, and medical confidentiality was preserved throughout the course of the survey.

Patients were stratified according to the CD4 T-lymphocyte count at the beginning of the study period. Three main cell-count categories emerged in accordance with the Centers for Disease Control and Prevention classification system for HIV infection. The first category included patients with 500 or more CD4 cells/μl, the second one patients with 200 to 499 cells/μl, and finally the third one patients with less than 200 cells/μl.

Data Collection

The following data were collected through medical records: demographic and clinical characteristics (age, nationality, date of initial diagnosis, sex, mode of transmission, HIV RNA levels, and CD4 T-lymphocyte count), outpatient visits, hospitalizations, laboratory tests and imaging studies, as well as antiretroviral drugs. Outpatient visits only included visits to specialist physicians because in Greece, HIV-infected patients are exclusively monitored by specialists and not by general practitioners. Hospitalizations comprised all admissions related to HIV infection, those recorded in the intensive care unit included. Laboratory investigation subsumed routine laboratory tests that were performed twice a year (CD4 T-lymphocyte count, HIV RNA test, full blood cell count, routine blood biochemistry) and any other test patients were submitted to depending on their health status. Finally, regarding pharmaceutical treatment, only antiretroviral therapy was taken into account.

Cost Estimation

The analysis was performed from a third-party payer perspective and involved all costs related to HIV patients' follow-up. Expenditures were divided into two main categories: medication costs and costs associated with health care services that HIV-infected patients received in the hospital setting. To calculate these costs, the frequency of each treatment or health service used was multiplied by the associated charge. All costs were evaluated in euros and in accordance with the latest Greek price bulletin of August 2013 [10].

Drug costs included the cost of antiretroviral drugs used to treat HIV infection and did not incorporate prophylactic or other medications that HIV-infected patients may have been prescribed. All prescribed treatments were available from the medical records. Cost calculations were based on reimbursable prices. These prices were then multiplied by the amount of drugs that patients received during the reporting year [11].

Costs associated with health care services provided through the Specialized Unit included costs for outpatient visits, hospitalization, laboratory investigation, and imaging tests. Outpatient visits concerned regular HIV clinic visits. Hospitalization costs were obtained via the official Greek price list, based on admission diagnosis, according to the *International Statistical Classification of Diseases, 10th Revision*, and reported on patient's medical record [12]. The cost of laboratory investigation, including all laboratory tests and any other test that HIV-infected patients may have been submitted to, was calculated as cost per test per patient [10].

Results

Patient Characteristics

In a total of 447 patients, 383 (86%) were men and 64 (14%) were women, of which the great majority was of Greek nationality (403 patients), whereas other patients were from Africa, Eastern Europe, Western Europe, Middle East, and Central and South America, in descending order. The mean age of participants was 45 ± 11.86 years. Taking into account the age classification, most patients were from the 36- to 50-year-old age group (N = 203, 45%), followed by the 51- to 65-year-old age group (N = 115, 26%). Nearly 106 patients (24%) belonged to the 18- to 35-year-old age group and finally only 23 (5%) were aged 66 years or older. For the mode of HIV transmission, five main categories were distinguished: homosexual transmission (being the most representative, as for 273 [61%] patients, the virus was transmitted through this mode), heterosexual contact (N = 117, 26%), intravenous drug users (N = 14, 3%), homosexual intravenous drug users (N = 5, 1%), and unknown transmission route (N = 38, 9%) (Table 1).

As mentioned above, patients were stratified into three categories according to the Centers for Disease Control and Prevention classification system for HIV infection, based on the CD4 T-lymphocyte count. The CD4 count considered to classify the participants was the most recent to the starting date of the survey. The great majority of the cohort (N = 288, 64%) was classified in the first category, including patients with 500 or more cells/μl. Patients having between 200-499 cells/μL represented 29% of the sample (128 patients), while 31 participants, counting less than 200 cells/μL were included in the third category, representing 7% of the sample. The mean CD4 T-lymphocyte count, overall health states, was 638 cells/μl (Table 1).

Health Care Utilization

Health care utilization showed that, some exceptions aside, patients with lower CD4 levels presented higher use of health services both in routine laboratory tests, such as viral load tests or CD4 count tests, and in all other tests that patients may have been submitted to. The same pattern was held for outpatient visits. Patients who counted lower CD4 levels, being more prone to infectious diseases, presented a higher percentage of hospital admissions. Patients with lower CD4 levels also suggest a higher percentage of hospital admissions because they are more prone