INTRODUCTION

According to a 2014 report by the World Health Organization (WHO), 35 million people are infected worldwide with the human immunodeficiency virus (HIV) [1]. In 2013, 2.1 million people were newly infected, with the number of deaths related to acquired immune deficiency syndrome (AIDS) about 1.5 million [1]. In Turkey, according to Ministry of Health data published in 2013, more than 6000 people were infected with HIV [2]. The numbers of new cases in 2010, 2010, and 2013 (the first 6 months) in the same report were 589, 1,068, and 587, respectively [2].

HIV transmission includes heterosexual intercourse, homosexual/bisexual intercourse, intravenous drug use, nosocomial transmission, vertical transmission, and unknown reasons [3]. The HIV-1 RNA concentration (viral load) is an important predictor of the HIV transmission level through sexual intercourse, needle sharing, or from mother to infant [3]. The CD4 cell count is the most important predictor of patient survival when starting antiretroviral (ART) HIV therapy. In patients with lower CD4 cell counts, the immune deficiency may be irreversible and early treatment shows more benefits when compared to delayed treatment [4].

In 2009, the WHO recommended new regimens for ART treatments and recommended ART treatment for adults and adolescents with early stage disease [5,6]. These revised ART treatment guidelines also recommended ART treatment for all adults and adolescents, including HIV-infected pregnant women.
with a CD4 count of < 350 cells/mm$^3$, regardless of clinical symptoms [5]. While the WHO’s 2009 guidelines were outdated, the newly published guidelines recommend treatment as soon as possible [6]. According to data from a cost-effectiveness study in sub-Saharan Africa, HIV prevention was 28 times more cost-effective than highly active ART treatment (HAART) [7]. According to that study, each 1 year of life acquired by HAART equaled to 28 years of life acquired by prevention. In the meta-analysis of Creese et al. [8], there were gross differences between interventions in terms of cost-effectiveness. Furthermore aiming at condom dispensation in treatment of sexually-transmitted diseases and selective blood safety measurements led to $11 cost for each prevented HIV patient, and 1 DALY (lost life year) was gained for each 1 $ [8].

Today in Turkey diagnostic methods and ART treatment are provided free of charge to HIV patients as part of a national insurance system [9]. However, no previous studies have reported the disease- and treatment-related costs of HIV in Turkey. The main goal of the present study was to determine the treatment costs of HIV patients in Turkey.

**MATERIALS AND METHODS**

**Data collection**

To obtain data for the cost analysis, patient files of a university hospital in Ankara were retrospectively evaluated. The university hospital in Ankara was one of the first HIV clinics in Turkey and is a reference center for the entire country. Within a 12-year follow-up period (2001-2012) in the university hospital, 252 patients allocated, and data included polyclinic, clinic, intervention, laboratory and imaging tests, medications, side effects, comorbidities, treatments, and complications.

**Classification of the patient groups**

The HIV patients were classified according to their CD4 cell counts (cell/mm$^3$). Group 1 consisted of patients with CD4 cell counts of <100 cells/mm$^3$, Group 2 consisted of those with cell counts of 100–300 cells/mm$^3$, and Group 3 consisted of those with cell counts of >300 cells/mm$^3$. Patient distribution of the university hospital was used as the generalization of estimation of expert opinions (Table I).

**Health service-related cost calculations**

In the analysis, the total cost of hospital outpatient clinics was calculated by using gynecology, infectious disease, psychiatry, neurology, dermatology, physical therapy and rehabilitation, emergency medicine, internal diseases/endocrinology visits, percent of patients in visits, number of visits per patient, and cost of visit. Cost of tests were calculated by using percent patients requiring test, number of tests per patient, and cost of each test. The cost of infection was calculated by using data on the number of hospitalizations per year, percentage of patients requiring hospitalization, mean number of days of hospitalization, daily costs of hospitalization, and total costs of hospitalization. The total costs of complications were calculated based on the percentage of patients with side effects and treatment duration of the complications. Clinical and intensive care hospitalization costs were included in the cost calculations. The clinical and intensive care hospitalization costs were calculated by using the number of annual hospitalizations, percentage of patients requiring hospitalization, mean duration of the hospital stay, and daily cost of hospitalization. The annual number of interventions, percentage of patients requiring interventions, number of interventions, and costs of interventions were used to calculate the total cost of intensive care interventions. In the cost calculation, the cost of health services was based on the 2013 prices of the Health Administration Notification of Social Security Institution. The costs obtained in Turkish lira were converted into U.S. dollars based on the mid-year exchange ratio in 2013 of $1.90.

**RESULTS**

The costs of the treatment in the three groups and the weighted mean cost of HIV patients are reported in Table II. The healthcare costs
of Group 1, 2, and 3 were $5,637.04, $2,211.54, and $2,182.34, respectively. When these data were used to calculate the annual HIV weighted cost per patient, the cost was $3,344.64.

**DISCUSSION**

In Turkey, the treatment cost of HIV/AIDS is not evaluated in terms of the disease burden. This may be due to the lower numbers of HIV patients compared with those in developed countries. However, considering reports of increases in the numbers of new patients in Turkey [2], it may be necessary to determine the cost of HIV to understand the burden of the diseases in the country.

The cost of HIV infections in the U.S. was estimated to be $36.4 billion (direct and indirect costs) in 2002. Of this, $6.7 billion comprised direct treatment costs, and $29.7 billion comprised indirect costs. According to a sensitivity analysis of the cost analysis in the United States, universal ART utilization and more effective ART regimes would reduce the disease cost [10]. In the U.S the direct and indirect costs of HIV increased from $36.4 billion in 2002 to $51.2 billion in 2009, and HIV was among the top 20 diseases in terms of disease cost [11]. Another analysis based on Medicaid claims in the state of California reported that the medical cost per patient was $36,469 [12].

The cost of HIV treatment per patient was estimated to be €11,638, €32,110, €14,821, €6,399, and €25,340 in Spain, Germany, France, Italy, and the U.K. respectively [13]. According to that report, there was great disparity in the total medical costs for patients with CD4 lymphocyte counts of 200-500 cells/mm³ [13]. For example, in Italy the total healthcare cost of HIV treatment per patient was reported to be €19,252, €12,227, and €6,399 for CD4 counts of < 200, > 200 but < 500, and > 500, respectively [13]. According to a study conducted in the U.S. in 2006, adult HIV patients with a CD4 count higher than 350/ml who were receiving ART treatment had a predicted expected life expectancy of 24.2 years [14]. In that study, the reduced and unreduced life cost of these patients were $385,200 and $618,900, respectively. Of these costs, ART drugs accounted for 73%, hospitalization accounted for 13%, outpatient treatment accounted for 9%, and HIV-related drugs and laboratory tests accounted for 5%.

According to a 2011 study conducted in 22,315 patients, starting earlier ART treatment of patients led to significantly increased survival [15]. The primary goal of ART treatment is to prevent mortality and morbidity related to chronic HIV infection. According to previous research, patients with a CD4 cell count of < 200 cell/mm³ had higher cumulative direct HIV treatment costs in cases of delayed treatment when compared to patients who had early treatment [16].

According to another study, decreased HIV transmission due to ART treatment might reduce the growth of the HIV epidemic and related costs [17].

The results of the analysis highlight the cost of HIV healthcare in Turkey. According to the analysis, the weighted mean healthcare cost

<table>
<thead>
<tr>
<th>HIV classification</th>
<th>Outpatient visits ($ pro capita)</th>
<th>Laboratory ($ pro capita)</th>
<th>Inpatient visits ($ pro capita)</th>
<th>Complications ($ pro capita)</th>
<th>Total healthcare cost ($ pro capita)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>192.07</td>
<td>1,297.09</td>
<td>1,888.81</td>
<td>2,259.05</td>
<td>5,637.04</td>
</tr>
<tr>
<td>Group 2</td>
<td>82.00</td>
<td>760.04</td>
<td>306.72</td>
<td>1,062.78</td>
<td>2,211.54</td>
</tr>
<tr>
<td>Group 3</td>
<td>76.57</td>
<td>773.20</td>
<td>47.36</td>
<td>1,285.20</td>
<td>2,182.35</td>
</tr>
</tbody>
</table>

Table II. Total healthcare costs of HIV patients
*The costs of ART pharmaceuticals were excluded

![Figure 1. Annual cost ($) per patient in the CD4 cell count classification groups](image)
of treating each HIV patient in Turkey was $3,344.64. In addition, the treatment cost of patients with a CD4 level of <100 cell/mm³ was two-fold higher than that of patients with a CD4 level of 100-300 cell/mm³ or >300 cell/mm³. These findings are similar to those reported in the international literature [10-17].

A limitation of the present study is the study sample, which consisted of patients who attended a university hospital. These might not be representative of the greater population in Turkey.

**CONCLUSION**

This study is the first economic analysis of HIV in Turkey. Given the continued rise in the number of new patients diagnosed with HIV/AIDS annually in Turkey, its social and economic impacts on the Turkish population need to be determined to understand the burden of the disease. Future studies should include a greater number of hospitals and centers to reflect the national context.

The present analysis demonstrated that the cost of treatment rose in accordance with a decrease in CD4 levels, possibly pointing to a direct relationship between CD4 levels and treatment costs. Start treatment at an early stage prior to a fall in CD4 cell counts may reduce healthcare costs. These findings may be useful to clinicians treating HIV patients and decision makers charged with shaping future of HIV/AIDS health care policies.

**REFERENCES**

