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Economic Impact of HIV in the Highly Active Antiretroviral Therapy Era - Reflections Looking Forward

Juan Oliva-Moreno[1] and Marta Trapero-Bertran[2]

[1]Department of Economic Analysis and Finance, Universidad Castilla La-Mancha, Toledo, Spain; [2]Research Institute for Evaluation and Public Policies (IRAPP); Universitat Internacional de Catalunya, Barcelona, Spain

Table 1. Health care costs of HIV-positive people in the HAART era

Authors	Publication year	Journal	Sample size	Country	Data source	Cost type			Medical direct cost (**)	Prices (year)
						Hospitalization	Consultation, tests	Medication		
Stoll et al.[34]	2002	European Journal of Medical Research	201	Germany	Primary	√	√	√	€24,482	2001
Krentz et al.[37]	2003	HIV Medicine	654	Canada	Primary	√	√	√	$1,075 per patient per month (≤50 years)	2010
Basuyau et al.[39]	2004	International Journal of STD and AIDS	1212	France	Primary	√	-	√	€27,567 per patient per year	-
Flori et al.[38]	2004	Pharmaco-economics	2203	France	Primary	√	√	√	€4,356 per patient per half-year	1999
Tramarin et al.[35]	2004	Pharmaco-economics	74	Italy	Primary	√	√	√	€11,465 per patient per year	1999
Merito et al.[36]	2005	Health Policy	5422	Italy	Primary	√	√	√	€3,149 per patient per year for the antiretroviral treatment	1997
Guaraldi et al.[52]	2013	Clinico Economics and Outcomes Research	11416	Italy	Primary	√	√	√	$14,061 per patient per year	2009
Perelman et al.[45]	2013	Revista Saúde Pública	150	Portugal	Primary	√	√	√	€14,277 per patient per year	2008
Trapero-Bertran and Oliva[40]	2014	Health Economics Review	9	Germany Spain France United Kingdom	Systematic review	√	√	√	€32,110 €11,638 €14,821 €25,340	2010
Brennan et al.[49]	2015	BMC Health Services Research	326	Ireland	Primary	-	√	√	€973 per patient per month	2012
Heslin and Elixhauser[41]	2015	Statistical Brief	2016	United States	Primary	-	-	-	$13,300 per patient per stay	2013
Krentz and Gill[50]	2015	HIV Medicine	581	Canada	Primary	√	√	√	$1,140 ± 291 average cost per patient per month	2010
Long et al.[42]	2015	PLOS One	469	South Africa	Primary	√	√	√	$1,783 per admission (9.3 days)	2013
Nakagawa et al.[30]	2015	PLOS One	Hypothetical population (use of a simulation model)	-	-	√	√	√	The estimated mean lifetime cost of treating one person was £185,200 (€246,000) (annual discount rate: 3.5%)	2013
Nosyk et al.[43]	2015	Pharmaco-economics	11836	Canada	Primary	√	√	√	CAN$2,159 of medical costs unrelated to ART	2010
Schackman et al.[46]	2015	Medical Care	Hypothetical population (use of a simulation model)	United States	-	√	√	√	$326,500 per person (discounted data) (lifetime cost)	2012
Treskova et al.[47]	2016	Medicine	1022	Germany	Primary	√	√	√	€22,231 per patient per year	2012
Gimeno-Garcia et al.[51]	2017	Revista Clínica Española	199	Spain	Primary	√	√	√	€8,929 (median) per patient per year	2014

HAART: highly active antiretroviral therapy

Table 2. Labor force participation of HIV-positive people in the HAART era

Authors (publication year)	Journal	Sample size	Country	Main results	Authors' conclusions/ recommendations
Auld (2002)[66]	Health Economics	280	Canada	The negative impact of learning of the diagnosis of the presence of HIV reduces the likelihood of being employed by 25%	In the sample considered, a negative association was identified between income and health. The author attributes this mainly to the effect of changes in the individual incentives arising from changes in life expectancy
Dray-Spira et al. (2003)[61]	AIDS Care	840	France	Depending on the region considered, the employment rate ranged from 47% to 59%. 30% of unemployed people stated their intention to return to work. The situation before the HIV diagnosis (place of residence, education, age, nationality) and the state of health at the time of the interview were significantly associated with the likelihood of being employed. Receiving disability benefit was negatively associated with the intention of returning to work	Social interventions must seek to avoid patients – especially the socially most vulnerable – leaving work at acute stages of their disease and must promote labor reintegration of the unemployed
Rabkin et al. (2004)[62]	Psychosom Med	141	United States	After a 30-month follow-up period, 20% were working full-time, 9% were working part-time, and 40% were unemployed. The occupational state of 31% of the sample changed over the period	Most people who were employed at the start of the study stayed in work throughout the follow-up period. However, despite the health improvement, most people who were unemployed at the start of the study did not find a job
Goldman and Bao (2004)[63]	Health Services Research	2,864	United States	The results indicate that highly active antiretroviral treatments increased the probability of staying employed among HIV-positive people (in the 6 months after treatment, the probability of staying in work shifted from 58% to 94% compared to the pre-HAART stage)	This paper is one of only a few studies (together with the following one) that compares permanence at work between the pre-HAART and the HAART stages
Bernell and Shinogle (2005)[64]	Health Policy	2,864	United States	The results suggest that people undergoing highly active antiretroviral treatment are more likely to be employed and that HIV-positive people with private health insurance are more likely to use a highly active antiretroviral treatment than people under public insurance or no insurance	This study uses the same sample as the previous one (HIV Cost and Services Utilization Study) and provides useful information for estimating the social value of highly active antiretroviral treatments.
Dray-Spira et al. (2007)[78]	AIDS	2,750	France	The employment rate was 56.5%. 44.9% of participants had stayed in work since diagnosis, and 11.6% had found work after the diagnosis. Being in good health, not being coinfected with other diseases, and having a strong immune system were positively associated with being employed.	Staying in work continued to be a challenge for the HIV-positive population despite therapeutic advances (HAART). The probability of being employed was associated with both sociodemographic characteristics and with state of health
Fogarty et al. (2007)[68]	AIDS	1,690	Australia	The percentage of unemployed was 43% Unemployment was more likely among those having any comorbidity relating to HIV/AIDS such as mental disorders or greater age People who had completed a higher level of educational attainment, and who self-reported better health, were more likely to be employed	Social and health-care information should be combined to reach an understanding of unemployment among HIV-positive people. Interventions aimed at improving the employment opportunities of HIV-positive people should identify age and educational differences
Sendi et al. (2007)[72]	Social Science and Medicine	4,041	Switzerland	The results indicate that salary is not a variable that affects the labor force participation of HIV-positive people. However, receipt of non-employment income does have a significant effect	This is one of only a few studies that analyse the role of key variables in labor force participation, such as salary and non-employment income
Galarraga et al. (2010)[69]	Health Economics	1,234 women	United States	Among women receiving HAART, after controling for individual characteristics and local features of the job market, the use of antidepressants is associated with higher probability of employment (29% more likely)	Improved diagnosis and treatment of depression among HIV-positive patients may improve not only clinical indicators but also labor force participation outcomes
Rodger et al. (2010)[70]	Occupational Medicine	545	United Kingdom	74% of people were employed. Unemployment was associated with poor psychological health and a poor attitude toward employment. No association was identified between the probability of employment and objective health measures (CD4 count)	Physical health is not the main barrier for employment in HIV-positive people. However, mental health was strongly associated with joblessness Psychological support programs may be vital for helping patients to keep their jobs or return to the job market.
Oliva (2010)[67]	Health Economics	3,376	Spain	Non-health-related variables (sex, level of educational attainment) may be as significant in explaining the probability of employment as health-related variables (stage of disease, immunological strength). The average employment rate for the period 2001-2004 was 48%	Employment protection and occupational reintegration policies for HIV-positive people should consider both health-related and other aspects, in common with the non-HIV population
Rueda et al. (2011)[71]	AIDS Care	361	Canada	Occupational status was strongly related to better physical and mental quality of life. It was also found, however, that occupational status influenced physical and mental quality of life (with a greater effect on the former)	Quality of life and being employed are interrelated by mutual feedback. Using cross-sectional database does not allow to identify the direction of the causal relationship
Dray-Spira et al. (2012)[65]	AIDS	376	France	The cumulative probability of leaving work was 14.1% 2 years after diagnosis and 34.7% 5 years after Diabetes, hypertension and, to a lesser extent, signs of depression were associated with an increased risk of leaving work. The stage of the disease and the experience of HIV-related discrimination were found not to be statistically significant with regard to the likelihood of leaving work	Despite therapeutic improvements, the risk of leaving work in HIV-positive people was very high. Comorbidities not directly associated with HIV may significantly affect whether a person stays in work or not
Elzi et al. (2016)[73]	Open Forum Infectious Diseases	5,800	Switzerland	4,382 people (75.6%) were fully able to work, 471 (8.1%) were able to work part-time, and 947 (16.3%) were unable to work Recovering the full capacity to work was associated with higher educational attainment and viral suppression. The presence of psychiatric comorbidity and greater age was negatively associated with working.	The differences in the improvements in HIV-positive people's ability to work and employment rates suggest that barriers exist for the labor force participation of HIV-positive people
Groß et al. (2016)[76]	Int J Public Health	527 males	Germany	The probability of unemployment is higher among the HIV-positive population than among the general population. The presence of frailty and the severity of the disease adversely affect the probability of being employed	The authors underline the importance of improving HIV treatments and associated comorbidities (e.g., hepatitis C virus) to improve the probability of employment
Annequin et al. (2016)[75]	PLOS One	1,010+1,663 HIV-positive people compared to 175,648 + 265,697 general population	France	From 2003 to 2011, the employment rate among HIV-positive people declined slightly (60.9% vs. 59.5%), and the unemployment rate increased (12.6% vs. 15.9%) The employment and unemployment rates in the general population remained stable (71.9% vs. 71.6%; 5.7% vs. 6.1%, respectively)	Despite advances in medical treatments, in the midst of an economic downturn, the unemployment rate among the HIV-positive population was more affected than that for the general population
Wagener et al. (2017)[74]	J Occup Rehabil	315	Netherlands	Age (from 40 years onwards) and the presence of mental and physical function problems reduced the probability of being employed. Being employed at the time of diagnosis raises the probability of staying employed	HIV-positive people in the Netherlands aged 40-54 years displayed notably lower employment rates than those of the general population

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