

BACKGROUND

Little is known about the impact of HIV on the work and home productivity of HIV-positive individuals in sub-Saharan Africa. Most existing evidence originates from individuals employed in the formal sector and at specific disease stages, which are not representative of the general adult population.

This study was conducted in two of the most HIV/AIDS affected countries globally; South Africa and Zambia, to compare the productive days lost (PDLs) by HIV-positive individuals with those lost by HIV-negative individuals. It is the first analysis of the association between PDLs and HIV/AIDS in a random sample of adults. It includes individuals in formal and informal employment, and those not in the labour force. Most previous studies that attempted to estimate excess PDLs analysed HIV-positive individuals at a specific disease stage, and used comparison groups based on self-reported HIV-negative status

This study provides a rare insight into the productivity of PLWH at all stages of engagement with HIV care, including PLWH before diagnosis. HIV status was determined from blood samples taken during the survey and confirmed with laboratory testing. Treatment status and length of time on treatment was based on self-reported information.

METHODOLOGY

STUDY POPULATION AND DATA

The survey was conducted as the baseline of the on-going HPTN 071 (PopART) cluster-randomised trial measuring the effect of a combination prevention intervention on population level HIV-incidence. HPTN 071 was implemented in 21 communities: 12 in Zambia covering four provinces and six districts, and 9 in South Africa in the Cape Metro and Cape Winelands districts of the Western Cape province.

The study population is a cross-sectional random sample of adults between the ages of 18-44 years resident within a household in the communities enrolled in the HPTN 071 (PopART) trial. Study participants consented to complete a research questionnaire, and to donate a venous blood sample annually.

The data used in this paper was gathered between November 28, 2013 and March 31, 2015 during the study's first annual survey, undertaken alongside the first year of the intervention. The survey includes data from all communities in the trial.

DEFINING PRODUCTIVE DAYS LOST (PDLs)

PDLs were measured as responses to the question "In the last 3 months, how many days have you been prevented from doing your usual work due to your own sickness or seeking healthcare?".

PREVIOUS LITERATURE

SEARCH CRITERIA

We searched the EconLit, Embase, Health Management Information Consortium (HMIC), Global Health and Medline databases on March 15 2018 for studies published between 1 January 1995 and March 15 2018, using the terms ['HIV' OR 'human immunodeficiency virus' OR 'AIDS' OR 'acquired immune deficiency syndrome'] AND ['absen*' OR 'product*' OR 'work' OR ('labor' OR 'labour')] OR 'output' OR 'efficien*' OR 'employ*' OR 'morbidity'] in the title and [house* OR unpaid OR domestic] in the text.

- We identified 9 studies: One from the USA, 8 from Sub-Saharan Africa. All studies focused on individuals in formal employment.
- There was no study that analysed sickness days for individuals informally employed, or individuals that were unemployed or not in the labour force.
- One early study analysed employed patients of a healthcare facility, and one study used a sample of employees from 42 companies.
- Three studies analysed PLWH at all stages of disease, while four analysed HIV-positive employees before and after initiation on ART, and two focused on PLWH shortly before death.
- All studies except three benchmarked HIV-positive against employees with unknown HIV status, i.e. the comparison groups contained an indeterminate number of HIV-positive.

ADDED VALUE OF THIS STUDY

This study is the first to analyse the association between excess PDLs and HIV-infection in informal sector workers, which make up nearly 90% of the labour force in Sub-Saharan Africa. This study undertook a direct comparison with HIV-negative persons, which constitutes the benchmark of population average PDLs.

'In the labour force' (ILF) was defined as those self-reporting being currently employed, self-employed, unemployed (looking for work or waiting to start new work) or waiting to continue agricultural work. 'Not in the labour force' (NILF) included homemakers, students, retirees and others not looking for work. Those reporting being permanently sick or disabled were excluded from the analysis.

STATISTICAL ANALYSIS

- Multivariate negative binomial regression (NegBin) models with variance expressed as a quadratic function of the mean were used to evaluate the effect of HIV status on PDL.
- Models included gender, age, ethnic group, education, use of recreational drugs and community fixed effects. Models were estimated separately for Zambia and South Africa
- PDLs in our sample are over-dispersed with a variance greater than its mean and the Poisson density is likely to predict a smaller proportion of a low number of PDLs compared to observed data. (Table 1)
- Results are presented as both marginal effects and predicted values evaluated at the means of all other covariates. A positive marginal effect represents the additional or "excess PDLs" that HIV-positive individuals lose due to illness and/or accessing health care over three months when compared to HIV-negative individuals.
- To evaluate model fit, we examined whether the NegBin model reduced differences between the observed distribution of PDLs, and the distribution predicted by the model for each count, compared to the Poisson model.

FINDINGS

SAMPLE

The full survey sample included:

- Responses from 19,750 (83%) of 23,676 randomly selected individuals in Zambia and 18,941 (88%) of 21568 randomly selected individuals in South Africa.
- Laboratory confirmed HIV status was available for 19,330 (98%) participants in Zambia and 18,004 (95%) in South Africa; of whom 4,128 (21%) and 4,012 (22%) were HIV-positive, respectively.

Among HIV-positives in Zambia, 13% reported having more than 3 PDLs in the past three-months, compared to 7% of HIV-negative individuals (Table 1). There was no difference between the two groups in South Africa (2%). In both countries, average PDLs were higher for HIV-positive men (Zambia: 3.2, SD: 11.53; South Africa: 0.89, SD: 6.73) than HIV-positive women (Zambia: 1.97, SD: 7.51; South Africa: 0.40, SD: 3.67).

MARGINAL EFFECTS

HIV-positive individuals lost more productive days to illness than HIV-negative individuals in both countries (Table 2). Excess productive days lost by HIV-positive individuals in a 3-month period were 0.74 (95%CI:0.48-1.01;p<0.001) in Zambia and 0.13 (95%CI:0.04-0.23;p=0.007) in South Africa compared to HIV-negative individuals.

Comparison of model fit showed the Poisson model underestimated the probability of 0 and 1 PDLs compared to the observed distribution of PDLs, and NegBin provided a better fit.

TABLE 1. Distribution of PDLs by HIV status and country

PDLs	Zambia		South Africa	
	HIV negative	HIV positive	HIV negative	HIV positive
0	87.39	80.97	95.96	95.29
1	1.17	1.24	0.75	0.65
2	1.8	1.62	0.93	0.99
3	2.27	2.86	0.74	0.79
3 or more	0.07	0.13	0.02	0.02
N	14496	3952	12862	3821

TABLE 2. Excess days lost disaggregated by HIV status and uptake of ART from the Negative binomial regression model

	Zambia	South Africa
HIV-positive (all categories)	0.74 (95%CI:0.48-1.01,p<0.001)	0.13 (95%CI:0.04-0.23,p<0.007)
HIV-positive individuals not on treatment	0.61 (95%CI:0.30-0.92,p<0.001)	0.03 (95%CI:-0.05-0.11,p=0.416)
HIV-positive individuals on treatment for less than one year	1.24 (95%CI:0.34-2.14,p=0.007)	1.41 (95%CI:-0.004-2.82,p=0.051)
HIV-positive individuals on treatment for one to two years	1.08 (95%CI:0.06-2.11,p=0.038)	0.18 (95%CI:-0.19-0.54,p=0.341)
HIV-positive individuals on treatment three years or more	0.79 days (95%CI:0.16-1.41,p=0.014)	0.001 (95%CI:-0.13-0.14,p=0.961)

TABLE 3. Predicted productive days lost over 3 months by HIV-status

	Zambia	South Africa
HIV-negative	0.95 [0-876,1-023]	0-18 [0-149,0-201]
HIV-positive	1-70 [1-441,1-952]	0-31 [0-220,0-400]
HIV-positive not on ART	1-56 [1-261,1-858]	0-21 [0-136,0-280]
HIV-positive on ART < 1 yr	2-19 [1-296,3-084]	1-58 [0-172,2-997]
HIV-positive 1-2 yrs	2-03 [1-011,3-056]	0-35 [-0-011,0-714]
HIV-positive on ART 3 yrs +	1-74 [1-119,2-357]	0-18 [0-050,0-307]

MODEL PREDICTIONS

Results for excess days lost disaggregated by ART status are presented in Table 2. When examining differences in total predicted values for both countries, PDLs were much lower in South Africa than in Zambia for nearly all subgroups (Table 3).

INTERPRETATION

In Zambia, the 21% of individuals who were HIV-positive had 0-74 more PDLs than HIV-negative individuals over three months. The 22% HIV-positive in South Africa had 0-13 more PDLs than HIV-negative South Africans.

Our estimates are markedly lower than those from previous studies, the median excess PDLs across eight previous studies was 5-1 days over three months, with high standard deviation of 9-55 and estimates ranging between zero to over 33 excess PDLs for HIV-positive workers in their final year of life. However, most previous studies analysed PLWH in formal employment who were not representative of the population of PLWH, which may explain some of the divergence.

There is a significant burden in lost work and home productivity due to HIV in the general population, but it is smaller than existing estimates for samples dominated by formal sector workers. Productive days lost need to be considered when evaluating the benefit of HIV prevention from a societal perspective. The findings will support policy makers in building an investment case for HIV interventions.

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