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Are people living with HIV less productive at work?

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ABSTRACT

Health problems may cause decreased productivity among working people. It is unclear if this also applies for people living with HIV (PLWH). This cross-sectional study compares data of PLWH of one of the main HIV treatment centres in the Netherlands ($n = 298$) to data of the general working population from a previously conducted study ($n = 986$). We investigate whether productivity at work differs between these groups.

The questionnaires used in these studies contained a core of identical questions regarding productivity losses, in the form of absenteeism and presenteeism, over a four-week period and a variety of baseline characteristics, including health status measured with EQ-5D. For PLWH additional clinical data were collected from patient records. From the data, descriptive statistics were computed to characterize the samples. Pearson correlations were used to explore significant associations of productivity with baseline characteristics. A two-part model was used to evaluate both the occurrence and of size of productivity losses in working PLWH and an aggregated sample of PLWH and the general population.

It was observed that, on average, total productivity losses do not differ significantly between working PWLH and the general working population, but that the occurrence and size of absenteeism and presenteeism were different. Furthermore, more health problems were associated with higher productivity losses. HIV status was not significantly associated with productivity losses.

We conclude that among working people, health status was related to productivity losses but HIV status was not. However, further research is needed into the relation between HIV status and unemployment.

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Introduction

Due to improving treatment, HIV has turned into a chronic illness. People diagnosed with HIV nowadays have a better prospect of a healthy future than ever before and nearly the same life expectancy as people without HIV (Deeks, Lewin, & Havlir, 2013; Nakagawa, May, & Phillips, 2013). However, people living with HIV (PLWH) still face an unpredictable disease course and need to adapt accordingly (Blalock, Mcdaniel, & Farber, 2002). Consequently, many new challenges emerge, such as issues of occupational functioning and employment (Bogart et al., 2000). PLWH aspire to be part of the workforce in order to be normal productive members of society, and to increase personal income (Dray-Spira, Lert, & VESPA Study Group, 2007). However, despite the desire to be productive, many PLWH do not actively pursue labour force participation because of perceived barriers to employment. This prevents them to improve their social functioning and, hence, quality of life (Brooks, Martin, Ortiz, & Veniegas, 2004).

Studies have found several barriers that PLWH experience when thinking of starting or returning to work, including: general concern regarding loss of government benefits, vulnerability to discrimination, potential mental health complications, concerns regarding job skills, the impact of gaps in one's employment history, and fear of acquiring additional viruses and medical complications that interfere with their ability to work (Braveman, Levin, Kielhofner, & Finlayson, 2006; Ferrier & Lavis, 2003; Martin, Brooks, Ortiz, & Veniegas, 2003).

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Additionally, PLWH in the workforce face several problems in persistence at work, particularly those with impaired neurocognitive functioning (van Gorp et al., 2007). Furthermore, fatigue is an issue among PLWH, with a prevalence of 20–60% (Jong et al., 2010). Finally, comorbidities like diabetes, hypertension and depression have been identified as risk factors for work cessation (Dray-Spira et al., 2012).

Employers and policy makers may also be concerned with the labour force participation and productivity of PLWH, albeit for different reasons. There is increasing evidence that health problems with subsequent functional limitations may cause decreased productivity at work (Schultz & Edington, 2007). Productivity losses may result from absenteeism and presenteeism. Absence from work due to illness is called absenteeism (Weinstein, Siegel, Gold, Kamlet, & Russell, 1996). When a person is at work, but delivers lower quantity and/or quality of work due to illness, is called presenteeism (Brouwer, Koopmanschap & Rutten, 1997). In one of the few studies on productivity losses among PLWH, the mean annual productivity costs per patient were estimated at 22,910 Swiss Francs (≈EUR 33,700 / US$ 34,600) (Sendi et al., 2004). They found that a higher ability to work was associated with better clinical prognostic factors, such as a lower age, a more recent first positive HIV test, higher CD4 cell count, and no history of IV drug use or an AIDS-indicator disease. They also found that a higher education and a stable partnership during the last 6 months were also associated with a higher ability to work.

Further evidence on productivity losses in PLWH is scarce and little is known about productivity losses in PLWH compared to those in people with other diseases or in the general population. Consequently, it is difficult to answer the question whether PLWH are less productive at work. Therefore, this study aimed to quantify the productivity losses of a specific group of PLWH in the Netherlands, explore the main determinants of productivity losses, and compare the results with data from the general population. Based on the literature we hypothesized that gender, education, marital status, quality of life and several health characteristics influence the height of productivity losses. To our knowledge, there is no sufficient previous literature to sustain a hypothesis about the influence of the diagnosis HIV on productivity.

Methods

Study design

We use data from two studies, collected through survey questionnaires. Data for the PLWH sample were obtained from the baseline measurements of the TREVI project, a longitudinal cohort study with a 2-year follow-up aiming to study cognitive function disorders among PLWH in relation to their employment, productivity, and social functioning (Wagener et al., 2018). Data for the sample from the general working population (GWP) originate from a study that investigated the relation between health and productivity costs in the Netherlands (Krol, Stolk, & Brouwer, 2014).

Study populations

The PLWH sample consisted of patients attending the outpatient clinic of the Erasmus Medical Centre in Rotterdam, the Netherlands. Patients were eligible for enrolment if they were over 18 years and adequately mastered the Dutch language. Patients were excluded if they currently had: an opportunistic central nervous system infection, schizophrenia, a severe affective disorder believed to account for the subject's cognitive impairment, or a neurological disorder. All 600 eligible patients visiting the outpatient clinic of Erasmus MC between 12/2012 and 12/2013 were asked to participate; of the 400 interested patients, 315 gave informed consent and completed the survey. For comparability with the reference population, 17 respondents were excluded because they were older than 65. From the remaining 298 respondents, 63% had a paid job of at least 12 h per week at the time of the survey. This study was reviewed and approved by the Medical Ethics Committee of the Erasmus Medical Centre (Wagener et al., 2018).

The reference population consisted of 986 members of the general public in the Netherlands, representative of the adult population (aged 18–65), with paid work >12 h per week in terms of gender, age and level of education. The data were collected in 2010 by a market research organization using an online survey (Krol et al., 2014).

Measures

The baseline characteristics gender, age, educational level, marital status, and employment status were similarly collected for respondents in both samples. Education level (the highest completed level of education) was divided into three categories: low (no, primary or lower secondary, and lower vocational education), middle (intermediate secondary and middle vocational education), and high (university (of applied sciences)). Marital status was dichotomized as: married/cohabiting versus single (including divorced or widowed). Employment status was dichotomized into having paid employment (>12 h per week) or not.

In both samples, health status was assessed using the EQ-5D (EuroQol Group, 1990). This instrument measures health-related quality of life on five dimensions: mobility, self-care, usual activities, pain/discomfort, anxiety/depression. The questionnaire completed by PLWH included the recently introduced 5-level version of the instrument (Herdman et al., 2011), whilst the questionnaire completed by the general population included the 3-level version (EuroQol Group, 1990). EQ-5D scores were used to calculate a misery index, the non-weighted sum of the dimension levels (Oppe, Devlin, & Szende, 2007). To make the misery index scores comparable between the two samples, the scores were linearly rescaled to range from 0 to 10; 0 indicating no health problems and higher scores indicating more health problems.

For all respondents, productivity losses, absenteeism and presenteeism, over the past 4 weeks were measured using the iMTA Productivity Cost Questionnaire (iPCQ) (Krol & Brouwer, 2014). The questionnaire measured absenteeism and presenteeism in the following way: absenteeism was assessed by asking respondents whether they had been absent from their work due to illness, and if so, how many days (0–20). Presenteeism was estimated by asking respondents whether there were days they had been at work but they were less productive because of illness. If so, they were asked how many days (0–20) and which percentage of their usual work they had been able to perform on those days (0–100%). The method measured total productivity losses by aggregating the number of days absent and the number of days with presenteeismmultiplied by the percentage of work not performed on those days. Finally, productivity costs were computed by multiplying the total productivity loss (in hours) of respondents by their hourly wage rate (derived from the monthly wage rate question).

Finally, for characterizing the PLWH group, their cognition was measured by extending the EQ-5D with a cognition dimension (Krabbe, Stouthard, Essink-Bot, & Bonsel, 1999), clinical data (CD-4 count, CD-4 nadir and viral load) were obtained from patient records, and a question about year of diagnosis was included in the questionnaire.

Statistical analyses

We observed a number of irregularities in the data from the PLWH sample. These problems and how we decided to address them are described in this paragraph.Firstly, four missing values for *year of diagnosis* were replaced with the median of their age group (in 10-year brackets). Secondly, 20 respondents who ticked the box "other" for marital status (rather than *married*, *living together*, *single (never married)*, *divorced* or *widowed*) were classified as "single". Thirdly, three of forty-two respondents reporting absenteeism and one of the fifty-one respondents reporting presenteeism did not indicate the length. We used the mean of other respondents' length of absenteeism/presenteeism as approximation. Finally, missing income information for fifteen respondents reporting to be in paid employment was approximated using multiple imputation (van Buuren & Groothuis-Oudshoorn, 2011). Additionally, for the calculation of productivity losses the workweek was maximized at five working-days and sixty working-hours. Eight respondents in the PLWH sample and forty-eight in the general population sample reported over 20 days of absenteeism or presenteeism over the past four weeks, and eight respondents in the general population sample reported to a 60+ hour workweek; these values were adjusted.

The analysis was performed in R studio. Baseline characteristics and productivity losses in the two samples were inspected using descriptive analysis. Pearson correlations and Fisher exact tests were used to estimate statistically significant relations between variables. PLWH, working PLWH and GWP were compared on variables available for all populations, using logit-models (Appendix A). In the analysis of productivity losses, we distinguish the working PLWH population and an aggregated sample, which includes both the working PLWH and the GWP samples. We first used logit-models to explore the determinants of the presence of absenteeism and presenteeism. Next, we used two-part models (2PM) (Manning & Mullahy, 2001) to investigate the determinants of the presence and size of productivity losses. To account for non-linear relations, second-degree polynomials were added for continuous variables.

Results

Characteristics of the samples

Comparing the PLWH and its subsample: working PLWH to the GWP we find that there are several differences between the samples. At the baseline level (Appendix A) the PLWH sample as a whole and the working PLWH sample were more often male, older, higher educated, single, and reported more health problems compared to the GWP sample. Within the PLWH sample, cognitive problems and a higher score on the misery index were negatively associated with employment. The working PLWH reported slightly longer workweeks than the GWP: 35.9 [range 12–40] versus 32.6 [range 12–60] hours per week. Descriptive statistics of the characteristics of our sample are shown in Table 1, our

Table 1. Baseline characteristics of our sample.

Type of variable	Variable	Measure	PLWH ($n = 298$)	Working PLWH ($n = 188$)	General population ($n = 986$)
Demographic	Gender (Female = 1)	%	13.4	11.7	48.8
	Age	Mean (SD)	46.9 (9.7)	45.9 (8.5)	41.3 (12.3)
Socio-economic	Education Low	%	21.8	17.6	25.4
	Education Middle	%	33.9	35.6	42.8
	Education High	%	44.3	46.9	31.8
	Work hours	Mean (SD)	22.7 (17.9)	35.9 (5.9)	32.6 (9.3)
	Income after taxes	€ (SD)	–	2,342.59 (1,088.03)	1,877.91 (1,405.78)
Health	Health[a]	Mean (SD)	1.24 (1.41)	0.78 (1.08)	0.64 (1.07)
	Months since diagnosis	Mean (SD)	91.9 (78.5)	79.5 (69.1)	NA
	Cognitive problems	%	0.41	0.31	NA
	Partner	%	51.3	58.0	74.7
	Single	%	48.7	42.0	25.3
	CD4	Mean (SD)	0.64 (0.33)[b]	0.63 (0.27)[c]	NA
	CD4Nadir	Mean (SD)	0.26 (0.17)[b]	0.26 (0.17)[c]	NA
	Viral Load	Mean (SD)	2.52 (1.58)[d]	2.66 (1.78)	NA

[a]Misery index; range 0–10. [b]$n = 296$. [c]$n = 187$. [d]$n = 297$.

samples are PLWH of which the subsample of working PLWH is displayed separately, we compare the working PLWH to the GWP.

Productivity losses

The proportion of working PLWH reporting absenteeism in the past four weeks was lower than in the GWP, but the average number of days on which absenteeism was experienced was higher. For presenteeism, working PLWH reported higher proportions and number of days, but also higher quantity of work performed on these days (i.e., 75% among PLWH versus 45% in general population). Total productivity losses were similar between the samples (i.e., 40.1 versus 38.6 h), but productivity costs were higher for PLWH (i.e., €649.5 versus €511.7) because of the higher mean income in the PLWH sample. These descriptive statistics on absenteeism, presenteeism, producitivy losses and productivity costs are summarized in Table 2. The PLWH with employment and GWP are compared.

Table 2. Productivity losses in the past 4 weeks.

Variable	Measure	PLWH employed ($n = 188$)	General population ($n = 986$)
Absenteeism	%	22.3	26.2
Presenteeism	%	27.1	20.7
Absenteeism and presenteeism	%	10.6	13.7
Days of absenteeism	Mean (SD; range)	11.05 (19.86; 1–20)	5.31 (4.39; 1–20)
Days of presenteeism	Mean (SD; range)	8.56 (6.20; 1–20)	6.10 (4.84; 1–20)
Quality of work in presenteeism	Mean (SD; range)	0.75 (0.19; 0–1)	0.45 (0.19; 0–1)
Productivity losses (hours, per person)	Mean (SD; range)	40.11 (42.97; 0–160)	38.6 (40.54; 0–228)
Productivity losses (hours, total)		2,928.36	12,621.29
Productivity costs (€, per person)	Mean (SD; range)	649.54 (823.38; 0–3,399.6)	511.7 (616.6; 0–3,749.5)
Productivity costs (€, total)		47,416	167,332

Note: Not all have productivity losses (presenteeism of X days). 4 missing values "days of absenteeism" -> said to have absenteeism but not how many days. 1 missing values "days of presenteeism" -> said to have presenteeism but not how many days. Assumption: hours per week/5. Rescaling for > 20 days and those with over 60 h, assign 60 h. For income we used Use Multiple Imputation for 16 missing cases (out of 192); we used education, gender and age.

Correlations

First, the correlations between the independent variables and scope of productivity losses were estimated. We find that in the total sample, consisting of working PLWH and GWP, only the level of health problems was associated with productivity losses (in hours), with more health problems leading to higher productivity losses. Within the sub-sample of those who experience absenteeism and/or presenteeism, correlations show that being part of the PLWH sample is not significantly associated with productivity losses measured in hours. It can also be shown that being female was associated with lower productivity losses, whereas being older, lower educated and having more health problems was associated with higher productivity losses. An overview of all correlations can be found in Table 3.

Table 3. Correlations of independent variables with productivity losses (in hours) in aggregated working sample.

	Total sample ($n = 1,177$)	Sub-sample with absenteeism and/or presenteeism ($n = 400$)
HIV	0.03	0.01
Gender [female = 1]	−0.03	−0.16**
Age	0.02	0.21***
Education low	0.03	0.11**
Education middle	0.01	−0.08
Education high	−0.03	−0.01
Partner [yes = 1]	−0.03	−0.04
Health	0.38***	0.26***

Note: significance level of p-value ***$p < 0.001$ **$p < 0.01$ *$p < 0.05$.

Productivity losses within the working PLWH

From the analysis we find that, within the working PLWH sample, health is an important determinant those in worse health states within this sample are more likely to experience absenteeism or presenteeism. This is also a determinant of the height of productivity losses, as can be observed from the second part of the two-part model. Both a higher age and worse health are positively, non-linearly related to the scope of productivity losses. The significance of the squared variables indicates that there are diminishing effects. The first part of this model shows that the occurrence of productivity losses was only associated with age (squared), although with a small coefficient. These results are displayed in Table 4.

Comparing the GWP and working PLWH: productivity losses

To compare the working PLWH to the GWP, the presence of absenteeism and/or absenteeism is analysed. Overall, we find worse health to be a consistent determinant in the presence and scope of productivity losses. Baseline differences already showed that PWLH experience more presenteeism, and this is confirmed in the multivariate analysis. The 2PM model shows that the occurrence of productivity losses in the aggregated working sample was only associated with the level of health problems. The second part of the 2PM, a GLM (with Gamma-distribution and log-link) indicates that having more health problems was associated with higher productivity losses (in hours), and that among those who experienced absenteeism and/or presenteeism, females had lower productivity losses. In other words, PLWH more often showed presenteeism, but overall did not show a difference in productivity (losses) measured in hours. All models are summarized in Table 5.

Discussion

This study is one of the first studies examining the productivity of working PLWH compared to the GWP. We found that among working PLWH the level of productivity losses was similar to the GWP. Productivity costs were higher for working PLWH than for the GWP, but this was due to differences in average income between samples. Therefore, this study supports previous evidence that HIV has a considerable economic impact due to the indirect costs of productivity losses, but adds that these productivity losses are not different from those in the GWP (Lopez-Bastida, Oliva-Moreno, Perestelo-Perez, & Serrano-Aguilar, 2009).

Note that only PLWH receiving HAART were included in this study. Gonzalo, García Goñi, and Muñoz-Fernández (2009) argued that due to HAART, PLWH experience a higher quality of life and increased productivity. The outcomes might thus be different for other groups of PLWH, in particular those with a worse health situation regarding their HIV. Additionally, this study compares productivity between working populations. In our sample of PLWH the health of those not working was significantly lower than the health of those working (with misery index of 2.03 and 0.64, respectively; see Table A2). The employment rate among PLWH may be lower than in the GWP (Annequin, Lert, Spire, Dray-Spira, & ANRS-Vespa2 Study Group 2016; Legarth et al., 2014; Oliva, 2010), and therefore productivity losses/costs could be higher. In our sample of PLWH, 37% did not have paid employment of at least 12 h per week. Although this is considerably higher than the national unemployment rate, the data we have at our disposal is not suitable to make a direct comparison of the total productivity losses between working PLWH and general population samples (i.e., the differences in productivity at work, as presented

Table 4. The occurrence and scope of productivity losses in the working PLWH sample.

	Absenteeism[a] (logit model)		Presenteeism[b] (logit model)		Productivity losses (two-part model)			
					Part 1[c] (logit)		Part 2[d] (log-OLS)	
	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.
Intercept	−10.690*	5.132	2.085	4.144	−6.409*	2.892	−9.248*	4.034
Gender [female = 1]	0.655	0.616	0.476	0.587	0.213	0.435	0.747	0.563
Age	0.438	0.231	−0.225	0.188	0.229	0.131	0.566**	0.190
Age (squared)	−0.005	0.003	0.002	0.002	−0.003*	0.001	−0.006**	0.002
Education middle	−0.682	0.587	0.376	0.637	0.593	0.438	−0.933	0.605
Education high	−0.393	0.540	0.667	0.615	0.766	0.422	−0.929	0.547
Partner [yes = 1]	−0.309	0.389	0.486	0.400	0.380	0.303	−0.412	0.351
Health	0.948**	0.342	0.993**	0.365	0.357	0.282	0.969**	0.302
Health (squared)	−0.072	0.061	−0.056	0.079	−0.039	0.057	−0.150**	0.045
Cognitive problems [yes = 1]	−0.153	0.451	0.761	0.430	0.260	0.346	−0.424	0.390
Months since diagnosis	−0.001	0.010	0.008	0.010	−0.001	0.006	0.003	0.009
Months since diagnosis (squared)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: Significance level of *p*-value ***$p < 0.001$ **$p < 0.01$ *$p < 0.05$.[a]absenteeism yes = 1, no = 0. [b]presenteeism yes = 1, no = 0. [c]productivity losses (absenteeism and/or presenteeism) yes = 1, no = 0. [d]productivity losses in hours (if absenteeism and/or presenteeism = yes).

Table 5. The occurrence and scope of productivity losses in the aggregated working sample (PLWH and GWP).

	Absenteeism[a] (logit model)		Presenteeism[b] (logit model)		Productivity losses (two-part model)			
					Part 1[c] (logit)		Part 2[d] (Gamma log-link)	
	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.
Intercept	0.855	−1.587	0.963	−1.854	−0.787	0.828	3.781***	0.616
Working PLWH sample [yes = 1]	−0.214	0.215	0.518*	0.220	0.345	0.196	−0.183	0.145
Gender [female = 1]	0.073	0.151	0.209	0.171	0.107	0.146	−0.246*	0.108
Age	0.013	0.044	−0.009	0.049	0.000	0.042	−0.011	0.032
Age (squared)	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.000
Education middle	0.184	0.187	0.008	0.204	0.151	0.178	−0.205	0.135
Education high	0.071	0.198	−0.117	0.218	−0.063	0.188	−0.193	0.144
Partner [yes = 1]	−0.035	0.160	0.192	0.181	0.057	0.154	−0.116	0.114
Health	0.932**	0.136	1.280**	0.141	1.147**	0.136	0.272**	0.084
Health (squared)	−0.093**	0.034	−0.115**	0.033	−0.095**	0.035	−0.032	0.018

Note: significance level of *p*-value ***$p < 0.001$ **$p < 0.01$ *$p < 0.05$. [a]absenteeism yes = 1, no = 0. [b]presenteeism yes = 1, no = 0. [c]productivity losses (absenteeism and/or presenteeism) yes = 1, no = 0. [d]productivity losses in hours (if absenteeism and/or presenteeism = yes).

here, combined with differences in employment rate because of illness).

We found that having more health problems was associated with the occurrence of absenteeism/presenteeism in both the PLWH and GWP samples. We also found that a higher level of health problems is positively associated with higher productivity losses for both samples. This is consistent with similar studies in other chronic diseases (van den Heuvel, Geuskens, Hooftman, Koppes, & van den Bossche, 2010; Schultz & Edington, 2007). The reported level of health problems was higher among PLWH than among the general population, which can be explained by the increasing burden of comorbidities (Dray-Spira et al., 2012) and side effects of medication (DiBonaventura et al., 2012). These side effects have been shown to be associated with work productivity before (daCosta et al., 2012). The level of health problems was higher among non-working PLWH than among working PLWH, indicating that labour force participation may decrease as disease progresses.

Previous studies described a negative effect of decreased neurocognitive functioning on employment (van Gorp et al., 2007; Rabkin, McElhiney, Ferrando, Van Gorp, & Lin, 2004; Vance, Cody, Yoo-Jeong, & Nicholson, 2015). Here, we did not find a significant relation between cognitive functioning and productivity. This might be due to how problems with cognitive function were measured or the limited variation in cognitive problems among participants in this study, but it could also be that cognitive function has more effect on employment and is less relevant for productivity in a working population. Further research on the relation between neurocognitive functioning and employment is therefore recommended.

For practical reasons, this study focussed on PLWH speaking Dutch adequately. However, PLWH in the Netherlands consists of various ethnicities, who do not always speak Dutch (van Sighem et al., 2016). These PLWH might experience different issues affecting their productivity, such as discrimination because of their ethnicity or limited command of the Dutch language. Further research into these subgroups and their problems in the labour market is advised.

A limitation of this study is the comparability of the PLWH sample and the reference population. The samples differed on a number of characteristics relevant for the analysis: the number of variables available in both studies, enabling direct comparison, was limited. To improve comparability, a number of measures in the PLWH sample questionnaire were copied from the general population questionnaire. Still, many variables of interest for the current study were not included in the general population sample, or not in sufficient detail; e.g., a more extensive measure of cognitive problems. Future research would benefit from working with a larger shared questionnaire.

Another limitation is that this study is based on cross-sectional data, therefore we could only investigate associations. Furthermore, there may be selection bias in the PLWH sample, as we only included about half of the eligible patients: better functioning PLWH may be more willing to participate in a study about productivity at work. Moreover, to calculate productivity costs, we had to imputed data on income. Finally, this study only addressed productivity losses at work, not unemployment because of illness. As we observed a higher rate of unemployment among PLWH, a study addressing both participation and absenteeism/presenteeism is necessary to understand the total impact of HIV on productivity.

A strong point of this study is the direct comparison of the productivity of PLWH with the GWP. This enabled to explore how productivity losses and its determinants differ between PLWH and others, and showed that the level of health problems is the main variable driving productivity losses.

This study provides relevant information for counselling and care for PLWH. The finding that HIV is not associated with additional productivity losses among working PLWH stresses the importance of effective treatment. Counselling could also address the reasons for not working, including the role of changing health status and factors such as disclosure, stigma and discrimination on starting, returning or persevering at work.

Concluding, this study indicates that working PLWH in the Netherlands overall seem to have similar levels of productivity losses at work as the working general population, with the level of health problems being the main determinant. Proper counselling and care are important for PLWH to function as productive members of society.

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MW contributed to the design of the study, analysis of the data and writing of the manuscript.

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HM contributed to the design of the study and provided comments to draft versions of the manuscript.

EG contributed to the design of the study and supervised the data collection.

WB contributed to the design of the study and provided comments to the data analysis and draft versions of the manuscript.

JE contributed to the design of the study, supervised the analysis and contributed to writing of the manuscript.

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References

Annequin, M., Lert, F., Spire, B., Dray-Spira, R., & ANRS-Vespa2 Study Group. (2016). Increase in unemployment over the 2000's: Comparison between people living with HIV and the French general population. *PLoS One*, *11* (11), e0165634.

Blalock, A. C., Mcdaniel, J. S., & Farber, E. W. (2002). Effect of employment on quality of life and psychological functioning in patients with HIV/AIDS. *Psychosomatics*, *43*(5), 400–404.

Bogart, L. M., Catz, S. L., Kelly, J. A., Gray-Bernhardt, M. L., Hartmann, B. R., Otto-Salaj, L. L., … Bloom, F. R. (2000). Psychosocial issues in the era of new AIDS treatments from the perspective of persons living with HIV. *Journal of Health Psychology*, *5*(4), 500–516.

Braveman, B., Levin, M., Kielhofner, G., & Finlayson, M. (2006). HIV/AIDS and return to work: A literature review one-decade post-introduction of combination therapy (HAART). *Work*, *27*(3), 295–303.

Brooks, R. A., Martin, D. J., Ortiz, D. J., & Veniegas, R. C. (2004). Perceived barriers to employment among persons living with HIV/AIDS. *AIDS Care*, *16*(6), 756–766.

Brouwer, W. B., Koopmanschap, M. A., & Rutten, F. F. (1997). Productivity costs in cost-effectiveness analysis: Numerator or denominator: A further discussion. *Health Economics*, *6* (5), 511–514.

Deeks, S. G., Lewin, S. R., & Havlir, D. V. (2013). The end of AIDS: HIV infection as a chronic disease. *The Lancet*, *382* (9903), 1525–1533.

DiBonaventura, M. D., Gupta, S., Cho, M., & Mrus, J. (2012). The association of HIV/AIDS treatment side effects with health status, work productivity, and resource use. *AIDS Care*, *24*(6), 744–755.

Dray-Spira, R., Legeai, C., Le Den, M., Boué, F., Lascoux-Combe, C., Simon, A., … Meyer, L. (2012). Burden of HIV disease and comorbidities on the chances of maintaining employment in the era of sustained combined antiretroviral therapies use. *AIDS*, *26*(2), 207–215.

Dray-Spira, R., Lert, F., & VESPA Study Group. (2007). Living and working with HIV in France in 2003: results from the ANRS-EN12-VESPA Study. *AIDS*, *21*(suppl 1), S29–S36.

EuroQol Group. (1990). EuroQol - a new facility for the measurement of health-related quality of life. *Health Policy*, *16*(3), 199–208.

Ferrier, S. E., & Lavis, J. N. (2003). With health comes work? People living with HIV/AIDS consider returning to work. *AIDS Care*, *15*(3), 423–435.

Gonzalo, T., García Goñi, M., & Muñoz-Fernández, M. A. (2009). Socio-economic impact of antiretroviral treatment in HIV patients. An economic review of cost savings after introduction of HAART. *AIDS Review*, *11*(2), 79–90.

Herdman, M., Gudex, C., Lloyd, A., Janssen, M. F., Kind, P., Parkin, D., … Badia, X. (2011). Development and preliminary testing of the new five-level version of EQ-5D (EQ-5D-5L). *Quality of Life Research*, *20*(10), 1727–1736.

Jong, E., Oudhoff, L. A., Epskamp, C., Wagener, M. N., van Duijn, M., Fischer, S., & van Gorp, E. C. (2010). Predictors and treatment strategies of HIV-related fatigue in the combined antiretroviral therapy era. *AIDS*, *24*(10), 1387–1405.

Krabbe, P. F., Stouthard, M. E., Essink-Bot, M. L., & Bonsel , G. J. (1999). The effect of adding a cognitive dimension to the EuroQol multiattribute health-status classification system. *Journal of Clinical Epidemiology*, *52*(4), 293–301.

Krol, M., & Brouwer, W. (2014). How to estimate productivity costs in economic evaluations. *Pharmacoeconomics*, *32*(4), 335–344.

Krol, M., Stolk, E., & Brouwer, W. (2014). Predicting productivity based on EQ-5D: An explorative study. *The European Journal of Health Economics*, *15*(5), 465–475.

Legarth, R., Omland, L. H., Kronborg, G., Larsen, C. S., Pedersen, G., Dragsted, U. B., … Obel, N. (2014). Employment status in persons with and without HIV infection in Denmark: 1996–2011. *AIDS*, *28*(10), 1489–1498.

Lopez-Bastida, J., Oliva-Moreno, J., Perestelo-Perez, L., & Serrano-Aguilar, P. (2009). The economic costs and health-related quality of life of people with HIV/AIDS in the Canary Islands, Spain. *BMC Health Services Research*, *9*(1), 55.

Manning, W. G., & Mullahy, J. (2001). Estimating log models: to transform or not to transform? *Journal of Health Economics*, *20*(4), 461–494.

Martin, D. J., Brooks, R. A., Ortiz, D. J., & Veniegas, R. C. (2003). Perceived employment barriers and their relation to workforce-entry intent among people with HIV/AIDS. *Journal of Occupational Health Psychology*, *8*(3), 181–194.

Nakagawa, F., May, M., & Phillips, A. (2013). Life expectancy living with HIV: Recent estimates and future implications. *Current Opinion in Infectious Diseases*, *26*(1), 17–25.

Oliva, J. (2010). Labour participation of people living with HIV/AIDS in Spain. *Health Economics*, *19*(4), 491–500.

Oppe, M., Devlin, N. J., & Szende, A. (2007). Comparative review of TIme Trade-Off value sets. In M. Oppe, N. Devlin, & A. Szende (Eds.), *EQ-5D value sets: inventory, comparative review and user guide*. Berlin: Springer Science & Business Media. (Vol. 2).

Rabkin, J. G., McElhiney, M., Ferrando, S. J., Van Gorp, W., & Lin, S. H. (2004). Predictors of employment of men with HIV/AIDS: A longitudinal study. *Psychosomatic Medicine*, *66*(1), 72–78.

Schultz, A. B., & Edington, D. W. (2007). Employee health and presenteeism: A systematic review. *Journal of Occupational Rehabilitation*, *17*(3), 547–579.

Sendi, P., Schellenberg, F., Ungsedhapand, C., Kaufmann, G. R., Bucher, H. C., Weber, R., & Battegay, M. (2004). Productivity costs and determinants of productivity in HIV-infected patients. *Clinical Therapeutics*, *26*(5), 791–800.

van Buuren, S., & Groothuis-Oudshoorn, K. (2011). mice: Multivariate imputation by chained equations in *R*. *Journal of Statistical Software*, *45*(3), 1–67.

Vance, D. E., Cody, S. L., Yoo-Jeong, M., & Nicholson, W. C. (2015). The role of employment on neurocognitive reserve in adults with HIV: A review of the literature. *Journal of the Association of Nurses in AIDS Care*, *26*(4), 316–329.

van den Heuvel, S. G., Geuskens, G. A., Hooftman, W. E., Koppes, L. L., & van den Bossche, S. N. (2010). Productivity loss at work; health-related and work-related factors. *Journal of Occupational Rehabilitation*, *20*(3), 331–339.

van Gorp, W. G., Rabkin, J. G., Ferrando, S. J., Mintz, J., Ryan, E., Borkowski, T., & Mcelhiney, M. (2007). Neuropsychiatric predictors of return to work in HIV/AIDS. *Journal of the International Neuropsychological Society*, *13*(1), 80–89.

van Sighem, A. I., Boender, T. S., Wit, F. W. N. M., Smit, C., Matser, A., & Reiss, P. (2016). Monitoring Report 2016. *Human immunodeficiency virus (HIV) infection in the Netherlands* (Report no. 15). Amsterdam: Stichting HIV Monitoring. Retrieved from www.hiv-monitoring.nl

Wagener, M. N., van den Dries, L., Van Exel, J., Miedema, H. S., van Gorp, E. C., & Roelofs, P. D. (2018). Determinants of employment in people living with HIV in the Netherlands. *Journal of Occupational Rehabilitation*, *28*, 45.

Weinstein, M. C., Siegel, J. E., Gold, M. R., Kamlet, M. S., & Russell, L. B. (1996). Recommendations of the panel on cost-effectiveness in health and medicine. *JAMA: The Journal of the American Medical Association*, *276*(15), 1253–1258.