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Night work and fatigue symptoms are associated with clinical monitoring indicators among workers living with HIV

Trabalho noturno e sintomas de fadiga estão associados aos indicadores de monitoramento clínico de trabalhadores vivendo com HIV

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ABSTRACT | Background: Infection with the human immunodeficiency virus (HIV) acquired the features of a chronic disease, thus requiring long-term follow-up. Different forms of work organization might prevent or increase the likelihood of poorer clinical prognosis. **Objective:** To analyze HIV clinical monitoring indicators according to work shift, work ability and fatigue symptoms relative to workers living with HIV. **Methods:** Cross-sectional study conducted with 115 workers (daytime: 97; night shift: 18) living with HIV followed up at the Specialized Care Service of Santos, Sao Paulo, Brazil. Generalized linear models (with LSD as *post hoc* test) were fitted to compare viral load, CD4+ T cell count and CD4+/CD8+ ratio according to work shift, work ability and fatigue symptoms adjusted for sex, age, time since diagnosis, duration of antiretroviral therapy, use of efavirenz and psychoactive substances, and emotional disorders. **Results:** We found association of fatigue symptoms with CD4+ T cell count and CD4+/CD8+ ratio; the CD4+ T cell count was higher among the participants with moderate need for recovery after work (p=0.02) and the CD4+/CD8+ ratio among those with lower need for recovery (p=0.03). We also found a borderline relationship (p=0.05) between work shift and CD4+ T cell count, which was lower for night workers. Difference was not found in the analyzed indicators as a function of work ability. **Conclusion:** HIV clinical monitoring indicators were poorer for night workers and better for those with more severe fatigue symptoms. Work ability did not influence HIV clinical monitoring indicators.

Keywords | HIV; night work; occupational health.

RESUMO | Introdução: A infecção pelo vírus da imunodeficiência adquirida (HIV) assumiu características de doença crônica, tornando necessário seu acompanhamento em longo prazo. Nesse aspecto, a organização do trabalho pode tanto prevenir quanto aumentar a vulnerabilidade a um pior prognóstico clínico. **Objetivo:** Avaliar os indicadores de monitoramento clínico do HIV de acordo com o turno de trabalho, capacidade para o trabalho e sintomas de fadiga entre trabalhadores vivendo com HIV. **Métodos:** Estudo transversal com 115 trabalhadores vivendo com HIV (97 diurnos e 18 noturnos), em seguimento clínico pelo Serviço de Assistência Especializada de Santos, São Paulo. Para comparação da carga viral, contagem de linfócitos T CD4 e relação CD4/CD8 em função do turno, capacidade para o trabalho e sintomas de fadiga, foram realizados modelos lineares generalizados (*post-hoc* LSD) ajustados por sexo, idade, tempo de diagnóstico, tempo de terapia antirretroviral, uso de efavirenz, substâncias psicoativas e distúrbio emocional. **Resultados:** Verificou-se associação dos sintomas de fadiga com linfócitos T CD4 e relação CD4/CD8, em que trabalhadores com moderada necessidade de recuperação após o trabalho apresentaram maior contagem de linfócitos T CD4 (p=0,02) e trabalhadores com maior necessidade apresentaram maior relação CD4/CD8 (p=0,03). Também se verificou associação limítrofe entre turno e linfócitos T CD4, em que trabalhadores noturnos apresentaram menor contagem de linfócitos T CD4 (p=0,05). Não houve diferença nos indicadores em função da capacidade para o trabalho. **Conclusões:** Trabalhadores noturnos apresentam piores indicadores de monitoramento clínico do HIV, enquanto trabalhadores com mais sintomas de fadiga apresentam melhores indicadores. A capacidade para o trabalho não influencia os indicadores de monitoramento clínico do HIV.

Palavras-chave | HIV; trabalho noturno; saúde do trabalhador.

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INTRODUCTION

Infection with the human immunodeficiency virus (HIV) is the second leading cause of immunodeficiency among human beings, following malnutrition only. Ever since the first cases of HIV infection were registered in the 1970s, more than 25 million people have died from the acquired immunodeficiency syndrome (AIDS). There were 36.9 million people living with HIV (PLHIV) worldwide in 2017, 866,000 of whom in Brazil, which thus represented 2.3% of the global prevalence[1]. In Santos, state of Sao Paulo — considered the "AIDS capital" of Brazil in the period from 1980 to 2000 — at least five new cases of AIDS are diagnosed every week. Although Santos is currently considered a reference in the combat against HIV, infection is still epidemic. In December 2015, 5,522 PLHIV were enrolled in the Specialized Care Service (SCS) of the Municipal Health Network, 4,717 of whom were regularly followed up[2].

As a function of advances in antiretroviral therapy (ART), diagnostic methods and clinical monitoring protocols, HIV infection is increasingly acquiring the characteristics of a chronic disease. PLHIV therefore require long-term monitoring, since outcomes do not only impact their lives, but also their social environment[3].

Living and working conditions are considered social determinants of health. Several studies indicate that work is one of the most relevant factors to cope with HIV infection[4,5]. Having a paid job might help stabilize disease by affording better socioeconomic conditions and reinforcing the positive aspects of interpersonal relationships. Indeed, in the face of disease, adequate social support increases the will to live and the self-esteem of people, thus contributing to the success of treatment[5].

Given the relevance of the work environment to health, in its HIV and AIDS Recommendation[6] the International Labor Organization (ILO) observes that public policies targeting these conditions should be developed to promote workplace health and safety. It further states that PLHIV should not been denied the possibility of continuing to carry out their work, with reasonable accommodation if necessary. The form of work organization is a crucial aspect in this regard, as it might contribute to the well-being of workers, but also to the manifestation of symptoms.

As a diurnal animal, human beings are metabolically conditioned to perform activities during the day and to sleep at night. Shift and night work might desynchronize circadian rhythms, namely, biological rhythms associated with the light/dark cycle and which last "about one day.[7]" Night work has considerable impact on the physical, mental and social well-being of workers[8]. According to recent studies, changes in the sleep/wake cycle related to shift work are associated with cardiovascular, endocrine-metabolic and musculoskeletal disorders. These changes are associated with noncommunicable diseases and their risk factors, as e.g. inadequate diet, physical inactivity, smoking and alcohol consumption[9,10]. For sleeping at a time they should be awake, the quality of sleep night workers is poor and their total sleep time shorter, with consequent impact on their metabolic balance and physical and mental recovery[11].

The many advances notwithstanding, employers — considered as part of the civil society — still fail to acknowledge their responsibility in regard to HIV infection within the world of work. On the contrary, several studies found that living with HIV is a reason for discrimination and exclusion from the labor market, which factors impair the access of the involved workers to social benefits and increase their susceptibility to poorer clinical prognosis[12]. In addition, we could not locate any study on the repercussions of shift and night work on PLHIV.

As a function of the aforementioned considerations, the aim of the present study was to analyze indicators used for clinical monitoring of HIV according to work shift, work ability and fatigue symptoms relative to workers living with HIV.

METHODS

STUDY DESIGN

In the present cross-sectional epidemiological study with quantitative analysis we tested associations between selected variables analyzed at one single time-point.

STUDY SETTING

The present study was conducted at the SCS of Santos, which since its creation in 1990 provides care to PLHIV and individuals with other sexually transmitted diseases through the Treatment Reference Center Coordination, which is part of the STD/AIDS and Viral Hepatitis Municipal Program implemented by the State Secretariat of Health.

STUDY POPULATION AND SAMPLING

The study population was represented by all PLHIV who were receiving ART and were followed up at the SCS of Santos, to a total of 2,000 individuals in 2014 — the year when the present study was started. On these grounds, and considering a significance level of 5%, sampling error of 0.05 and variation of ±5%, the calculated sample size was 292 participants. Adding 10% to compensate for potential losses increased the sample size to 322 participants. At the end of data collection we excluded 15 subjects who had returned questionnaires with incomplete or inconsistent responses. Therefore, the number of eligible subjects became 307, 122 of whom who met the inclusion criteria were included in the study, to wit, PLHIV from both sexes, aged 18 or older and having a paid job. Seven individuals who failed to report their working time were further excluded. As a result, the final sample comprised 115 participants. Statistical power (82%) was calculated *a posteriori* based on the selected independent variables (G*Power 3.1.4).

DATA COLLECTION

Data collection was performed at SCS, Santos, on alternate dates and times (Monday to Friday between 8 a.m. and 6 p.m. as per the service working hours) from February through June 2016. The data collection instrument was administered during interviews, which lasted 45 minutes, on average; interviewers were undergraduate students at Universidade Católica de Santos, who were duly trained not to interfere with the participants' responses.

Information on ART was gathered from the participants' records at SCS pharmacy, which is charged of delivering the medication. The data on clinical monitoring indicators were obtained from the CD4+/CD8+ and Viral Load Laboratory Test Control System (SISCEL) at SCS in September and October 2017. We only considered the results of the latest tests at the time when the interviews were performed, to a maximum interval of six months. This interval was established based on the Clinical Protocol and Therapeutic Guidelines for Management of HIV Infection in Adults[13], according to which laboratory tests to monitor PLHIV should be performed every six months.

VARIABLES

The sample was described according to:

- Sociodemographic variables: age (difference between interview and birth dates), sex, gender, marital status, educational level and financial stress at the end of the month;
- Occupational variables: employment relationship, length in the current job, night shifts per month, main reason for night work, daily working time, number of work days in the month and work accidents in the past year;
- Health variables: time since HIV diagnosis, duration of current ART regimen, concomitant use of other medication;
- Lifestyle variables: smoking, alcohol consumption and use of illegal drugs.

Dependent variables were indicators used for clinical monitoring of PLHIV:

- Viral load as measured with RT-PCR (Abbott Real Time HIV-1); viral load <50 copies/mL was considered undetectable[14];
- CD4+ T cell count, categorized as <200 or ≥200 cells/mm[3,14];
- CD4+/CD8+ ratio, categorized as <1 or ≥1[13].

Independent variables corresponded to the following occupational characteristics:

- Work shift, categorized as diurnal (5 a.m. to 10 p.m.) or night work (10 p.m. to 5 a.m.);
- Work ability, assessed by means of the translated and validated version of the Work Ability Index (WAI)[15,16] — scores were categorized as: 7–36 — low or moderate and 37–49 — good or excellent work ability[17];
- Fatigue symptoms according to the translated and validated version of the Need for Recovery (NFR)

scale[18,19] — scores were categorized as lower (first tercile), moderate (second tercile) or higher (third tercile) need for recovery after work[20].

DATA ANALYSIS

Absolute and relative frequencies of qualitative variables were calculated to describe the sample. The normality assumption was investigated with the Shapiro-Wilk test. Parametric variables were described as mean and standard deviation (SD) and non-parametric variables as median and interquartile range (IQR=P25-P75). Differences in average age according to work shift and work ability were analyzed by means of the Mann-Whitney test. Differences in average age according to fatigue symptoms were investigated with the Kruskal-Wallis test.

The average values of the clinical monitoring indicators and occupational variables were compared by means of three generalized linear models (GLM): (1) work shift, (2) work ability, and (3) need for recovery after work. LSD was performed as *post-hoc* test to identify the groups with significant difference between them. Adjustment variables were: sex, age, time since HIV diagnosis, ART duration, use of efavirenz, use of sleep medication, use of illegal drugs and mild and/or severe emotional disorders. As emotional disorders we considered mild or severe depression, tension, anxiety and/or insomnia diagnosed by a physician, based on the list of disorders included in WAI[15,16]. The adjustment variables were defined *a priori* as a function of the selected theoretical framework[13,14,21,22]. Due to collinearity, variable mild and/or severe emotional disorders was not used when fitting the models to compare clinical monitoring indicators according to WAI.

The significance level was set to 5% in all the tests. Statistical analysis was performed with software Stata 12.0 and STATISTICA 7.

ETHICAL ISSUES

We duly complied with all the ethical principles for research involving human beings. An informed consent form was prepared in accordance to Resolution no. 466/2012. Participation was voluntary. The participants were informed of their right to withdraw consent without any implications for their treatment at SCS, and the confidentiality of the data was ensured. The present study was authorized by the Municipal Secretariat of Health of Santos and approved the research ethics committee of Catholic University of Santos (ruling no. 1,237,142).

RESULTS

The sample comprised 97 workers with daytime jobs and average age 43.6 (SD=10.1) years old and 18 night workers with average age 39.5 (SD=10.4) years old; these two groups did not differ as a function of age (p=0.17). For the entire sample, age varied from 21.2 to 65.5 years old, mean 43 (SD=10.3) years old. Most participants were male (54.8%), had completed secondary school (51.3%) and did not have a partner (71.3%). The largest proportion of participants self-identified with the male gender (49.6%) and did not report month-end financial stress (48.2%).

Most participants had informal jobs at the time of the interview, but had had jobs with formal employment relationship in the past. Only one participant reported having been involved in a work accident in the previous year. Most of the sample exhibited good or excellent work ability, and the largest proportion (34.5%) higher need of recovery after work (Table 1).

The median length of work in the current job was 6 years (IQR=2–19 years). Most participants worked 6 to 10 hours/day and up to 5 days/week. Night workers worked 19.8 nights/month (SD=8.2) on average. "To increase income" was the main reason adduced to perform night work (35.3%).

The median time since diagnosis of HIV infection was 9 years (IQR=4–17) and the median duration of ART 7 years (IQR=1–12). For most participants, the ongoing ART regimen was the first and only even taken (61.5%) and included efavirenz in 48.7% of the cases. About 38.6% of the participants also made continuous use of other medications, 15.8% of whom sleeping pills more than once per week.

About 27.8% of the participants were smokers and 33.9% reported present or past use of illegal drugs, mainly marijuana (64.1%). Most participants denied consuming alcohol (96.5%).

For most of the sample, the viral load was undetectable and the CD4+ T cell count ≥200 cells/mm^3; however, the CD4+/CD8+ ratio was below the recommended range (Table 2).

The average age of the participants with lower, moderate and higher need of recovery after work was 38.9, 44.3 and 39.4 years old, respectively; the groups did not differ in this regard (p=0.31).

Table 1. Occupational characteristics of workers living with the human immunodeficiency virus (HIV) followed up at the Specialized Care Service of Santos, Sao Paulo, Brazil, 2016 (n=115).

Variables	n (%)
Employment relationship	
Formal	53 (46.5)
Informal	61 (53.5)
If informal, whether participants ever had a formal job	
Yes	52 (85.3)
No	9 (14.7)
Working hours/day	
Less than 6	10 (8.8)
6 to 10	80 (70.8)
11 or more	23 (20.4)
Work days/week	
Up 5	59 (51.7)
6 or 7	55 (48.3)
Work accidents in the past year	
Yes	1 (0.9)
No	114 (99.1)
Work ability	
Good or excellent	57 (57.0)
Low or moderate	43 (43.0)
Need for recovery after work	
Lower	36 (31.9)
Moderate	38 (33.6)
Higher	39 (34.5)

We found association of fatigue symptoms with the CD4+ T cell count and CD4+/CD8+ ratio. We further detected borderline association between work shift and CD4+ T cell count (p=0.05).

The average age of the participants with good/excellent and moderate/low work ability was 41.7 and 43.1 years old, respectively; the groups did not differ in this regard (p=0.40). We neither found statistically significant difference in clinical monitoring indicators as a function of the work ability level (Table 3).

The CD4+/CD8+ ratio was higher for the participants with moderate need of recovery after work compared to those with lower need (Figure 1). In turn, the CD4+/CD8+ ratio was higher for the participants with higher need compared to those with lower need of recovery after work (Figure 2).

DISCUSSION

The CD4+ T cell count and CD4+/CD8+ ratio were higher for the participants with moderate or higher need of recovery after work. We could not locate any report of similar findings because, as a fact, there are no studies in the literature which analyzed need for recovery after work for this population of patients. In most cases immune reconstitution occurs immediately after the onset of ART,

Table 2. Values of clinical monitoring indicators relative to workers living with the human immunodeficiency virus (HIV) followed up at the Specialized Care Service of Santos, Sao Paulo, Brazil, 2016 (n=115).

Variables	n (%)
Viral load	
Undetectable	85 (75.9)
Detectable	27 (24.1)
CD4+ T cells	
<200/mm^3	12 (10.6)
≥200/mm^3	101 (89.4)
CD4+/CD8+ ratio	
<1	81 (71.7)
≥1	32 (28.3)

while other individuals might remain with significant immunodeficiency even when the CD4+ T cell count is high (≥1,000/mm^3)[13]. Immunodeficiency is associated with release of inflammatory biomarkers, such as interleukin (IL)-6, tumor necrosis factor alpha (TNF-α) and C-reactive protein (CRP) and continuous cytotoxic activity, evidenced by chronic elevation of the CD8+ T cells. All together, these data indicate that despite a high CD4+ T cell count and adequate ART, some individuals might still exhibit physical, mental and endocrine-metabolic abnormalities[23] potentially associated with occurrence of fatigue symptoms. As concerns the association between mental disorders and biochemical markers, a previous study found a relationship between common mental disorders and higher viral load among PLHIV

Table 3. Generalized linear models for indicators according to occupational characteristics relative to workers living with the human immunodeficiency virus (HIV), Santos, Brazil, 2016 (n=115).

Generalized linear models	n	Viral load				CD4+ T cells				CD4+/CD8+			
		Mean	SE	F	p-value	Mean	SE	F	p-value	Mean	SE	F	p-value
Work shift*													
Daytime	96	16,441.7	10,374.9	0.069	0.79	877.5	124.1	3.778	0.05	0.8	0.1	0.068	0.79
Night	17	9,100.2	7,952.3			727.8	42.6			0.7	0.1		
Work ability**													
Excellent/good	57	2,529.8	1,261.1	1.508	0.22	750.9	55.5	1.493	0.22	0.8	0.1	0.726	0.40
Moderate/low	42	34,305.8	23,524.0			835.1	69.3			0.8	0.1		
Need for recovery after work*													
Lower	36	3,814.1	2,070.4			604.8	65.2			0.7	0.1		
Moderate	38	29,186.0	24,457.8	1.262	0.29	842.3	76.2	3.293	0.04	0.7	0.1	3.426	0.04
Higher	37	13,151.9	10,270.1			831.0	64.8			0.9	0.1		

*Model adjusted to sex, age, time since HIV diagnosis, antiretroviral therapy duration, use of efavirenz, use of sleep medication, use of illegal drugs, mild and/or severe emotional disorders; **model adjusted to sex, age, time since HIV diagnosis, antiretroviral therapy duration, use of efavirenz, use of sleep medication and use of illegal drugs; SE: standard error.

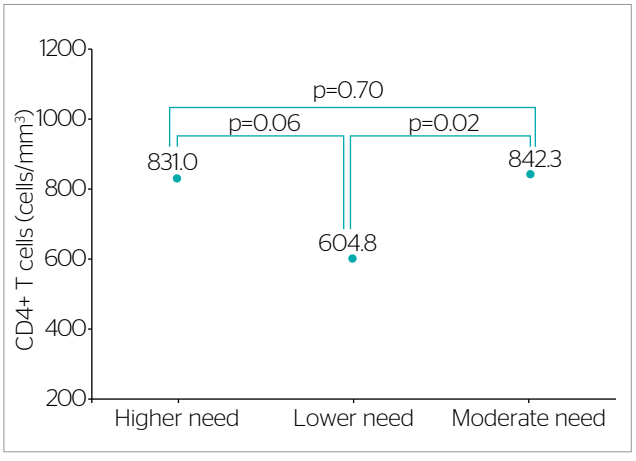

Figure 1. Mean CD4+ T cell count according to need for recovery after work relative to workers living with the human immunodeficiency virus (HIV), Santos, Brazil, 2016 (n=115).

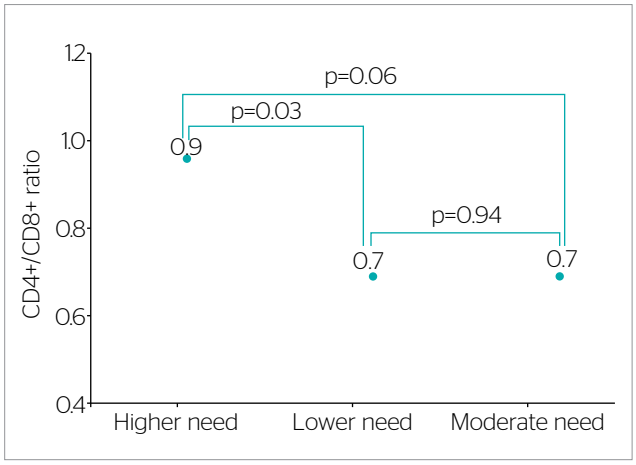

Figure 2. Mean CD4+/CD8+ ratio according to need for recovery after work relative to workers living with the human immunodeficiency virus (HIV), Santos, Brazil, 2016 (n=115).

under clinical follow-up, while no interference was found in the CD4+ T cell count and CD4+/CD8+ ratio[24].

We found borderline association between night work and lower CD4+ T cell count. We could not locate any study that analyzed repercussions of shift and night work for PLHIV. However, individuals properly synchronized to a social regime consisting of daytime work and night rest exhibit stable phase relationships between the various physiological rhythms, resulting in formation of an internal time order indispensable for health[25]. This balance might be disrupted among night workers as a function of the circadian desynchronization induced by the inversion of the sleep-wake cycle. For sleeping at a time they should be awake, the quality of sleep is usually poor among this group of workers and their total sleep time shorter, with consequent impact on their metabolic balance and physical and mental recovery[11]. PLHIV are often exposed to the consequences of chronic sleep deprivation in association with the pathophysiological mechanisms involved in HIV infection and ART adverse effects[26]. Therefore, one might conclude that several determinants contribute to impair the HIV clinical monitoring indicators.

We did not find significant relationship between work ability and clinical monitoring indicators. Once again, we could not locate any study that addressed this association among PLHIV. One might hypothesize that PLHIV might be afraid of reporting their actual work ability for fear of becoming stigmatized within the labor market or even terminated from their job. However, some of the results of descriptive analysis in the present study are deserving of attention. As Pereira observed[27], lack of data on work — i.e. one of the main aspects associated with well-being among PLHIV — for the Brazilian context indicates that this subject is not considered a priority for academic research.

In addition to the associations found and discussed above, it is worth attempting to achieve a better understand of the population of PLHIV analyzed in the present study. For this reason, we list next some of the sample characteristics to provide context to the study results. Most participants were males of economically active age, nonetheless, the proportion of participants with informal jobs was higher than that of 50.8% reported by ILO for the economically active population in South America[28]. As Pereira stated[27], high rates of informal jobs among PLHIV might be related to economic issues, because having healthy employees who do not lose productive hours due to disease is crucial for employers, while chronic illnesses might impair their work ability.

While most participants exhibited good/excellent work ability, the prevalence of moderate/low work ability was high (43%). For the purpose of comparison, a systematic review of the work ability of Brazilian workers found that the prevalence of inadequate work ability was 1.7%[29]. Salcedo et al.[30] observe that the work ability of PLHIV might be impaired by mental health problems and difficulties in interpersonal relationships derived from stigma and discrimination. In addition, the prevalence of moderate/low work ability found in the present study might be due to the high percentage of participants with informal jobs.

To summarize, the work environment is determinant for the quality of life of PLHIV. However, for the employment relationship to have positive impact on living conditions, access to the formal labor market is necessary[31]. One fundamental aspect in this regard is to pay particular attention to PLHIV with inadequate work ability to restore it or improve it[29].

Also the results relative to clinical monitoring indicators are deserving of attention. The rate of undetectable viral load (<50 copies/mL) was lower than that described in the 2016 HIV Clinical Monitoring Report: about 84% of Brazilian PLHIV under ART aged 18 or older succeeded in attaining viral suppression; the rate for the state of Sao Paulo was 85%[14]. Therefore, the rates of viral suppression found for the analyzed sample were lower compared to both state and national averages.

The proportion of PLHIV with CD4+ T cell count >200/mm^3 found in the present study is similar to those reported in other studies which analyzed samples similar in age, time since diagnosis and ART duration[22,32]. These and other studies mentioned above reported satisfactory results in terms of CD4+ T cell count for most PLHIV taking ART and monitored at specialized services, which thus reinforces the relevance of the corresponding public policy.

However, the CD4+/CD8+ ratio is the most remarkable parameter. According to Serrano-Villar et al.[21], the

immune profile of PLHIV under ART with low CD4+/CD8+ ratio, independently from the CD4+ T cell count, is similar to that of healthy older adults, i.e. it exhibits signs of immunosenescence. These authors found that recovery was better among PLHIV who started ART within the first six months since diagnosis compared to those who started treatment two or more years later. These observations agree with our findings, since there also was an interval of almost two years between the median time from diagnosis to ART onset.

While only viral load and CD4+ T cell count are currently recommended for clinical monitoring of PLHIV, low CD4+/CD8+ ratio is associated with immune activation, chronic inflammation and immunosenescence, and consequently with higher morbidity and mortality. These data have paramount importance, because they indicate that immune reconstitution is often incomplete even after long exposure to ART. They also suggest that return to normal of the CD4+ T cell count and CD4+/CD8+ ratio might be required to characterize treatment as successful[33].

The present study has several limitations. As is known, the type of job performed might influence the analyzed occupational characteristics. As concerns night work, including shift schedule, shift start and end time and the content of work into analysis is necessary to draw inferences on its true impact on the state of health of workers[34]; however, we did not collect this information.

As is known, ethnicity might be associated with behavioral and biological characteristics, stigma and discrimination at healthcare facilities and in the workplace. According to the Clinical Protocol and Therapeutic Guidelines for Management of HIV Infection in Adults[13], stratifying clinical monitoring indicators according to this key-variable contributes to the identification of barriers related to social inequalities to which PLHIV are exposed.

The same is the case of adherence to treatment, namely, ideal ART in terms of doses, intake schedule and prescribed indications. According to the Clinical Protocol and Therapeutic Guidelines for Management of HIV Infection in Adults[13], adherence to treatment is a collaborative process susceptible to interference by several factors, such as regimen complexity, adverse effects, mental disorders, use of psychoactive substances, fear of discrimination and lack of social support. In the present study, these characteristics — which might be investigated based on self-report — were not inquired. Therefore, we suggest for future studies to stratify analysis according to these aspects.

One further limitation derives from the cross-sectional design of the study, which does not allow establishing causal relationships between variables. Nevertheless, given the scarcity of information on occupational aspects of PLHIV, studies like the present one are essential to provide grounds for future research of different type and for putting hypotheses forward[35].

Among the strengths of the present study, we emphasize the description of a relevant sample of PLHIV followed up with focus on occupational characteristics. The study results — which also afford a description of several aspects of the analyzed sample and allowed identifying work-related factors associated with HIV clinical monitoring indicators — will certainly contribute to the discussion of public policies for work and health targeting this population of workers.

CONCLUSION

Night workers exhibited the poorest HIV clinical monitoring indicators (CD4+ T cell count) while the participants with higher need for recovery after work exhibited better indicators (CD4+ T cell count and CD4+/CD8+ ratio). In turn, work ability did not influence clinical monitoring indicators among workers living with HIV.

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