

# Healthcare-associated infections among HIV-positive and HIV/AIDS-negative patients: a casuistic from the Amazonian Region

Infecções relacionadas à assistência à saúde em pacientes HIV-positivos e HIV/aids-negativos: uma casuística da Região Amazônica

Infecciones asociadas a los cuidados de salud en pacientes VIH-positivos y VIH/SIDA-negativos: una casuística de la Región Amazónica

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## ABSTRACT

**OBJECTIVE:** To investigate and compare the incidence of healthcare-associated infections (HAIs) involving HIV and non-HIV/AIDS patients. **METHODS:** Analytical, observational and prospective study. Setting: The Infectious Disease Nursery at the Hospital Universitário João de Barros Barreto in Belém, Pará State, Brazil. Patients: HIV and non-HIV/AIDS inpatients from February to December 2007. The patients were monitored daily from admission to the day of discharge. **RESULTS:** During the study period, there were 20,276 reported patient-days. Out of the 1,130 discharged patients, 40 patients acquired HAIs, and HAIs occurred more frequently in the HIV-positive patients (57.5%), with 29 (60.4%) HAI episodes ( $p \leq 0.05$ ). A total of 11 (55%) HIV-positive patients showed a TCD4 cell count  $< 100 \text{ cell/mm}^3$ , and 15 (65.22%) HIV-positive patients died from complications associated with the HAIs ( $p = 0.009$ ). The most frequent infections were urinary tract infections related to urinary catheter use per 1,000 catheter-days in non-HIV patients, with 12.11 episodes ( $p = 0.13$ ). However, HIV-positive patients were more often infected with pneumonia, with 1.6 episodes per 1,000 patient-days ( $p = 0.04$ ). **CONCLUSION:** HAI are more likely to occur in HIV-positive patients, most likely as a consequence of their immune condition, and this risk, which is associated with invasive procedures, justifies the need for preventive measures.

**Keywords:** Cross Infection; HIV; Pneumonia; Risk Factors.

## INTRODUCTION

Infection with human Immunodeficiency Virus (HIV) starts a progressive process of TCD4+ lymphocyte destruction, leading to infections that are caused by opportunistic

microorganisms<sup>1</sup>. With the advent of antiretroviral therapy, the survival of patients with AIDS has increased; however, HAIs can occur in hospitals where nosocomial microorganisms are present<sup>2</sup>. According to the Center for Disease Control (CDC)<sup>3</sup>, HAI results from treatment in a hospital setting, where immune-compromised patients are most susceptible thus constituting a public health problem, which is characterized by high rates of mortality and morbidity<sup>2</sup>. HAI data are not well-characterized in Brazil; however, a study assessing 8,624 patients over 24 hours of hospitalization, with an average length of stay of 11.8 days, identified 1,129 patients with HAIs, representing an

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incidence rate of 15.5%<sup>4</sup>. In a study that focused on the HAI incidence among HIV carriers, which was performed in a hospital in São Paulo, 29 (14.9%) HAI cases were detected among 195 hospitalizations<sup>5</sup>. Numerous studies have reported HAIs and the risk factors for the population in general. However, few studies have addressed the risk of HAIs in HIV-positive patients, especially in Brazilian and Amazonian contexts, where a great diversity of tropical pathologies are observed. Therefore, the purpose of this study was to compare the HAI indicators among HIV-positive and non-HIV/AIDS patients.

## METHODS

### PATIENT POPULATION

The analytical, observational, and prospective study occurred at an infectious disease ward at the Hospital Universitário João de Barros Barreto (HUJBB) situated in the City of Belém, Pará State, in north Brazil, where 64 beds are available for HIV/AIDS and other infectious diseases, with four isolation rooms.

The study population consisted of patients of both sexes and aged at least 13 years who were admitted to the infectious disease ward during the period of February to December 2007. The population was classified into two cohorts, HIV/AIDS (HIV-positive) patients and HIV-negative patients, according to the clinical and laboratorial diagnoses at the patient's admission. The exclusion criteria included patients admitted with infections from other hospitals, patients transferred from other clinics and patients with a length of stay of less than 48 hours. This study followed 451 HIV-positive and 679 non-HIV patients. The patients within the cohorts were followed throughout their hospital stay until discharge. The variables considered for both populations were: the use of an invasive device (e.g., urinary catheter (UC), central vascular catheter (CVC) and mechanic ventilator (MV), healthcare-associated infection episodes and mortality associated with HAIs. The dependent variable for the HIV-positive population was the TCD4+ cell count collected during the hospitalization period.

### SURVEILLANCE OF NOSOCOMIAL INFECTIONS

By using active and prospective epidemiological surveillance and the National Nosocomial Infections Surveillance System (NNISS/CDC) components methodology, data were collected, and the CDC's diagnostic criteria for HAIs were employed<sup>6</sup>.

Patients were monitored for HAIs from their admission until the discharge day at the Infectious Disease Nursery based upon: medical records, invasive device inspection, reports from the microbiology laboratory, anti-microbial files from the hospital pharmacy and the daily census report service.

The indicators calculated were: the rate of nosocomial infectious episodes (number of HAI episodes/outputs x 100), the density of incidence of HAI episodes (number of nosocomial infectious episodes/patient-days x 1,000), the rate of patients with HAIs (number of patients with HAIs/outputs x 1,000), the density of incidence of HAIs associated with invasive procedures

(number infections in accordance with the risk of the invasive procedure/invasive procedure day x 1,000), the utilization rate of invasive procedures (number of invasive procedure days/patient-days) and the mortality rate associated with nosocomial infections (number of deaths associated with HAIs/infected patients x 100). The number of outputs matched the number of discharges, transfers and deaths; the number of patient-days signified the sum of the total days of stay for all patients during the period under review, and the number of invasive procedure-days was considered the sum of the total length of stay for the invasive procedures during the period considered.

The Microsoft Office Excel 7.0 program and the BioEstat 5.0 software were employed, and the statistics tests used were the Chi-squared and the *t*-test, with a confidence interval (CI) of 95%, 5% error, and  $p \leq 0.05$ .

### ETHICAL APPROVAL

The project was submitted to the Human Research Ethics Committee of the HUJBB and approved on January 24, 2007. The protocol was n° 3,888/06 and was in conformity with the National Health Council Resolution n° 196/96.

## RESULTS

During the study period, there were 451 HIV-positive patients (9,373 HIV-positive patient-days) and 679 non-HIV patients (10,903 non-HIV patient-days) observed, with a total of 1,130 discharges from the infectious disease ward, and 40 patients acquired HAIs. Seventeen (42.5%) of those patients were non-HIV patients, with 19 (39.6%) HAI episodes, and 23 (57.5%) of those patients were HIV-positive patients, with 29 (60.4%) HAI episodes ( $p \leq 0.05$ ). The rate of nosocomial infections was higher among HIV-positive patients when the denominator was the number of discharges. However, when patient-days was the denominator, there was no significance. The mortality rate associated with nosocomial infections was significantly higher among HIV-positive patients compared to the HIV-negative group,  $p = 0.009$  (Table 1).

**Table 1** – Epidemiological indicators of healthcare-associated Infections (HAIs) in HIV-positive and non-HIV patients from an Amazonian infectious disease ward, Brazil, from February to December 2007

Epidemiological indicators	HIV-positive		Non-HIV		p values
	n	Rate	n	Rate	
HAIs per 100 discharges	29	6.43	19	2.8	0.009*
Patients with HAI per 100 discharges	23	5.1	17	2.5	0.0128*
HAIs per 1,000 patient-days	29	3.09	19	1.74	0.0527*
Mortality associated with HAIs	15	65.22	4	23.53	0.009†

Source: Data from hospital surveillance.

\* $p < 0.05$  (*t*-test); † $p < 0.05$  (Chi-squared *t*-test).

The average hospitalization time was longer for the HIV patients and was 19.42 days compared to 15 days for the HIV-negative patients. Despite this result, a higher urinary tract catheter utilization rate (0.04) was observed in HIV-negative patients compared to HIV-positive patients (0.02). No differences were observed for ventilators or central vascular catheters between the two groups (Table 2).

**Table 2** – Invasive device-days and rates of use of invasive devices per 1,000 patient-days from an Amazonian infectious disease ward, Brazil, from February to December 2007

Invasive devices per day	HIV-Positive	Rate	Non-HIV	Rate	Total	p values*
Urinary tract catheter-days	227	0.02	413	0.04	640	0.01
Respiratory therapy-days	93	0.01	62	0.01	155	0.41
Central vascular catheter-days	309	0.03	224	0.02	533	0.25

Source: Data from hospital surveillance.

\*p < 0,05 (t-test).

The most frequent type of HAI was pneumonia ((PNEU), n = 21), with 44%, followed by urinary tract infections ((UTIs), n = 14), with 29%. Bloodstream infections (BSIs) accounted for 2% of the infections (n = 1). Pneumonia was more frequent among HIV-positive patients, p = 0.04 (Table 3).

**Table 3** – Nosocomial infections associated or not with invasive devices in HIV-positive and non-HIV patients in an Amazonian infectious disease ward, Brazil, from February to December 2007

Infection site	HIV-positive	Rate	Non-HIV	Rate	p values*
Non-ventilator associated PNEU	15	1.60	6	0.55	0.04
VAP	3	32.26	–	–	–
Non-catheter associated UTI	6	0.64	8	0.73	0.57
CAUTI	1	4.41	5	12.11	0.13
Non-CVC associated BSI	1	0.11	–	–	0.34
CVC-BSI	–	–	–	–	–

Source: Data from hospital surveillance.

PNEU = Pneumonia; VAP = Ventilator-associated pneumonia; UTI = Urinary tract infection; CAUTI = Catheter-associated urinary tract infection; CVC = Catheter vascular catheter; BSI = Bloodstream infection. Conventional sign used: – Numeric data not equal to zero due to rounding, \*p < 0,05 (t-test).

The TCD4 cell count of the HIV-positive patients who acquired healthcare-associated infections demonstrated that low immunity was not related to poor outcome (Table 4).

**Table 4** – TCD4 cell count according to the type of hospital discharges among HIV-positive patients from an Amazonian infectious disease ward, Brazil, from February to December 2007

CD4 (mm <sup>3</sup> )	Live	%	Dead	%	Total	%	p values*
< 100	2	28.6	9	69.2	11	55	0.0684
100 - 200	1	14.3	2	15.4	3	15	0.2285
> 200	4	57.1	2	15.4	6	30	0.4569
Total	7	100	13	100	20	100	–

Source: Data from hospital surveillance.

\*p < 0,05 (t-test).

## DISCUSSION

HIV-positive patients were more likely to have HAIs than HIV-negative patients in our Amazonian casuistic. These data confirm the high susceptibility of HIV-positive patients documented by other studies, in which HIV-positive patients had higher HAI rates compared to patients with other underlying diseases, with an incidence ranging from 3.6 to 8.6 episodes per 1,000 patient-days<sup>7,8</sup>. However, this ratio has decreased after the HAART era, due to the reduction of hospitalizations<sup>1,9,10</sup>.

The specific risk factors for the HIV/AIDS population must be considered and include: abnormalities in cell-mediated and humoral immunities, phagocytic cell dysfunctions, low TCD4 lymphocyte counts, secondary neutropenia due to drugs or diseases, modified microbial flora due to the selection of antibiotic-resistant microorganisms by prophylactic medications, difficult diagnoses of atypical diseases, invasive procedures and unpredictable responses to antibiotics and vaccines<sup>11,12</sup>. In this study, invasive procedures did not influence the occurrence of HAIs.

A TCD4 < 100 cell/mm<sup>3</sup> count was observed in 55% of the HIV-positive patients who acquired HAIs, suggesting that the TCD4 cell count might be a risk factor. In fact, Panis et al<sup>2</sup> found a 2.5% rate of HAIs in patients with an AIDS diagnosis, where the mean TCD4 cell count was 158.4 cell/mm<sup>3</sup> and the mean time of stay in the hospital was of 36.16 days. In addition, other studies showed a correlation between low TCD4 cell counts and respiratory infections<sup>13,14</sup> and bloodstream infections<sup>11,15</sup>.

In our study, the average length of stay of the HIV-positive patients was longer than that of the non-HIV patients (19.42 versus 15 days, respectively). However, the study design did not allow us to evaluate if the length of stay in the hospital was directly related to HAI occurrences.

Nosocomial pulmonary infections are considered one of the most important infections among HIV patients<sup>2,16</sup>. Non-ventilator associated pneumonia was the most frequent infection among HIV-positive patients, with an incidence of 1.75 episodes per 1,000 patient-days in our study. However, similar to the observation in the study carried out by Tenore<sup>5</sup>, ventilators had little influence on the incidence of HAIs, most likely due to the difficulty in diagnosing pneumonia as a consequence of HAIs from other opportunistic diseases.

UTIs were the second most frequent HAI among both groups of patients. Although HIV-negative patients were more likely to use urinary tract catheters ( $p = 0.01$ ), there was no difference between the incidence of UTIs between the cohorts ( $p = 0.57$ ). UTIs may be under-reported in HIV-positive patients, although AIDS caused microscopic proteinuria, hematuria and nephropathy in some cases.

According to Padoveze et al<sup>8</sup>, BSIs were found to be the main type of HAIs (44%), with an incidence of 18.4 episodes per 1,000 CVC-days in HIV-positive patients, which was greater than the incidence in HIV-negative patients (7.39,  $p = 0.24$ ). These data differed from the present study in which only one BSI episode, which was unrelated to the CVC, occurred. The low incidence of BSIs in our casuistic may be a consequence of an educational campaign held at the intensive care unit of the hospital, which emphasized the importance of hand hygiene prior to the manipulation and insertion of CVCs, contributing to a reduction in the BSI incidence<sup>17</sup>. Other studies have confirmed these findings through educational studies employed as tools to reduce BSIs associated with CVCs<sup>18,19</sup>.

Nosocomial infections can worsen the clinical condition of HIV-positive patients, which may explain

the higher mortality rate associated with HAIs in the HIV-positive group.

The design of this study could not confirm the relationship between HAIs and severe immunosuppression in HIV-positive patients or between HAIs and the mortality associated with infection.

## CONCLUSION

We conclude that there is a high susceptibility to nosocomial infections among HIV-positive patients compared to non-HIV patients, despite providing the same environmental conditions and care for both groups (patients from both groups were admitted in the same ward).

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## CONFLICT OF INTERESTS

The authors: Danielle Saraiva Tuma dos Reis, Irna Carla do Rosário Souza Carneiro, Dilma Costa de Oliveira Neves, Lourival Rodrigues Marsola and Rita Catarina Medeiros declare no conflict of interests.



## Infecções relacionadas à assistência à saúde em pacientes HIV-positivos e HIV/aids-negativos: uma casuística da Região Amazônica

### RESUMO

**OBJETIVO:** Investigar e comparar a incidência de infecções relacionadas à assistência à saúde (IRAS), envolvendo pacientes HIV e não HIV/aids. **MÉTODO:** Estudo analítico, observacional e prospectivo ocorrido na Enfermaria de Doenças Infecciosas do Hospital Universitário João de Barros Barreto em Belém, Estado do Pará, Brasil. Pacientes: Internos, portadores de HIV e não HIV/aids, de fevereiro a dezembro de 2007, com monitoramento diário da admissão até a alta hospitalar. **RESULTADOS:** Durante o período de estudo, foram relatados 20.276 pacientes/dia. De 1.130 pacientes com alta, 40 contraíram IRAS, e as IRAS ocorreram mais frequentemente nos HIV-positivos (57,5%), com 29 (60,4%) episódios de IRAS ( $p \leq 0,05$ ). Um total de 11 (55%) HIV-positivos apresentou contagem de células TCD4  $< 100$  células/mm<sup>3</sup>, e 15 (65,22%) HIV-positivos morreram de complicações associadas com as IRAS ( $p = 0,009$ ). A infecção mais frequente foi a do trato urinário, associada ao uso de cateter urinário, 1.000 cateteres-dia em pacientes não HIV, com 12,11 episódios ( $p = 0,13$ ). Entretanto, os HIV-positivos apresentaram pneumonia mais frequentemente, com 1,6 episódios em 1.000 pacientes-dia ( $p = 0,04$ ). **CONCLUSÃO:** As IRAS apresentam maior probabilidade de ocorrência em HIV-positivos, provavelmente devido as suas condições de imunidade, e esse risco, que está associado com procedimentos invasivos, justifica a necessidade de medidas preventivas.

**Palavras-chave:** Infecção Hospitalar; HIV; Pneumonia; Fatores de Risco.

## Infecciones asociadas a los cuidados de salud en pacientes VIH-positivos y VIH/SIDA-negativos: una casuística de la Región Amazónica

### RESUMEN

**OBJETIVO:** Investigar y comparar la incidencia de infecciones asociadas a los cuidados de la salud (IACS), involucrando a pacientes VIH y no VIH/SIDA. **MÉTODO:** Estudio analítico, de observación y prospectivo en la Enfermería de Enfermedades Infecciosas del Hospital Universitário João de Barros Barreto en Belém, Estado de Pará, Brasil. Pacientes: Internos, portadores de VIH y no VIH/SIDA, de febrero a diciembre de 2007, con monitoreo diario desde el ingreso hasta el alta hospitalaria. **RESULTADOS:** Durante el período de estudio, se relataron 20.276 pacientes/día. De 1.130 pacientes con alta, 40 contrajeron IACS, y las IACS fueron más frecuentes en los VIH-positivos (57,5%), con 29 (60,4%) episodios de IACS ( $p \leq 0,05$ ). Un total de 11 (55%) VIH-positivos presentó conteo de células TCD4  $< 100$  células/mm<sup>3</sup>, y 15 (65,22%) VIH-positivos murieron de complicaciones asociadas con las IACS ( $p = 0,009$ ). La infección más frecuente fue la del trato urinario, asociada al uso de catéter urinario, 1.000 catéteres-día en pacientes no VIH, con 12,11 episodios ( $p = 0,13$ ). No obstante, los VIH-positivos presentaron neumonía más frecuentemente, con 1,6 episodios en 1.000 pacientes-día ( $p = 0,04$ ). **CONCLUSIÓN:** Las IACS presentan más probabilidad de suceder en VIH-positivos, probablemente debido a sus condiciones de inmunidad, y ese riesgo, que está asociado a procedimientos invasivos, justifica la necesidad de medidas preventivas.

**Palabras clave:** Infección Hospitalaria; VIH; Neumonía; Factores de Riesgo.



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