


Nursing diagnosis risk for infection and cross-infections in aids patients

Diagnóstico de enfermagem risco de infecção e infecções relacionadas à assistência à saúde em pacientes com aids

Diagnóstico de enfermería Riesgo de Infección e Infecciones Asociadas a la Atención de Salud en pacientes con sida

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Marques CC, Barreto VP, Silva BC, Santos MM, Medeiros ER, Guedes GS, et al. Nursing diagnosis risk for infection and cross-infections in aids patients. Acta Paul Enferm. 2021;34:eAPE00365.

DOI

<http://dx.doi.org/10.37689/acta-ape/2021A000365>

**Keywords**

Nursing diagnosis; Acquired immunodeficiency syndrome; Risk factors; Cross infection

Descritores

Diagnósticos de enfermagem; Síndrome de imunodeficiência adquirida; Fatores de risco; Infecção hospitalar

Descriptores

Diagnóstico de enfermería; Síndrome de inmunodeficiencia adquirida; Factores de riesgo; Infección hospitalaria

Submitted

February 28, 2020

Accepted

December 2, 2020

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Abstract

Objective: To identify which risk factors of the Nursing Diagnosis Risk of infection are associated with a greater chance of Hospitalized People Living with HIV/AIDS developing Healthcare-associated Infections.

Methods: This is a case-control study in which the cases were composed by hospitalized AIDS patients who presented Healthcare-associated Infections (n=104) and, the controls by those who did not progress to Healthcare-associated Infections (n=104). The Pearson Chi-square test, Odds Ratio calculations for risk factors and Logistic Regression were used.

Results: Altered peristalsis, smoking, decreased hemoglobin and leukopenia were significantly associated with the outcome investigated. In logistic regression, the decrease in hemoglobin was considered a predictor factor for the detection of infection risk.

Conclusion: The indicators smoking, leucopenia and decreased hemoglobin were recognized in the regression as the most important predictors for identifying the risk of infection in People Living with HIV/AIDS.

Resumo

Objetivo: Identificar quais fatores de risco do diagnóstico de enfermagem risco de infecção estão associados a chances maiores de pessoas com HIV/aids hospitalizadas desenvolverem Infecções Relacionadas à Assistência à Saúde.

Métodos: Estudo caso-controle no qual os casos foram pacientes com aids hospitalizados que apresentaram Infecções Relacionadas à Assistência à Saúde (n = 104) e os controles foram pacientes com aids hospitalizados que não evoluíram para Infecções Relacionadas à Assistência à Saúde (n = 104). Usaram-se o teste qui-quadrado de Pearson e a regressão logística, e calculou-se a *odds ratio*.

Resultados: Peristaltismo alterado, tabagismo, nível reduzido de hemoglobina e leucopenia foram significativamente associados com o desfecho estudado. Na regressão logística, a redução na hemoglobina foi considerada um fator preditor da detecção de risco de infecção.

Conclusão: Os indicadores tabagismo, leucopenia e nível reduzido de hemoglobina foram identificados na regressão como os preditores mais importantes para identificar o risco de infecção em pessoas vivendo com HIV/aids.

Resumen

Objetivo: Identificar qué factores de riesgo del diagnóstico de enfermería Riesgo de Infección están relacionados con mayores probabilidades de que personas con el VIH/sida hospitalizadas presenten Infecciones Asociadas a la Atención de Salud.

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Conflicts to interest: none to declare.

Métodos: Estudio caso-control, en el cual los casos fueron pacientes con sida hospitalizados que presentaron Infecciones Asociadas a la Atención de Salud (n = 104) y los controles fueron pacientes con sida hospitalizados que no contrajeron Infecciones Asociadas a la Atención de Salud (n = 104). Se utilizó la prueba χ^2 de Pearson y la regresión logística y se calculó el *odds ratio*.

Resultados: El peristaltismo alterado, el tabaquismo, el nivel reducido de hemoglobina y la leucopenia fueron significativamente asociados al resultado estudiado. En la regresión logística, la reducción de la hemoglobina fue considerada un factor predictor de la detección del riesgo de infección.

Conclusión: Los indicadores tabaquismo, leucopenia y nivel reducido de hemoglobina fueron identificados en la regresión como los predictores más importantes para identificar el riesgo de infección en personas que viven con el VIH/sida.

Introduction

The Acquired immunodeficiency syndrome (AIDS), although almost 40 years after the onset of the epidemic, is still a serious public health problem worldwide.⁽¹⁾ However, in recent years, there has been a decrease in the number of deaths from the disease (from 1.9 million in 2005 to 1.0 million in 2016), which is attributed to the regular use of Antiretroviral Therapy (ART).⁽²⁾

In Latin America, the availability of this therapy occurred earlier than in other regions of the world, nevertheless, the decline in deaths was only 16% when compared to other regions, such as Asia and the Pacific, where the reduction was 39%.⁽²⁾ The decrease in mortality trends in Brazil is notable, which are similar to the continental epidemiological situation.⁽³⁾

The late diagnosis of HIV/AIDS infection and lack of adherence to antiretroviral therapy (ART) are still realities experienced today. These two factors favor the damage to the immune system, leading to the development of AIDS since the individual becomes prone to acquire a variety of comorbidities, and is vulnerable to opportunistic infections.⁽⁴⁻⁶⁾

ART was made available by the Brazilian Unified Health System (SUS) in the 1990s and access to this medication brought a number of benefits to people living with HIV/AIDS (PLHA), including increased survival and improved quality of life, and therefore, reducing the spread of the epidemic.⁽⁷⁾

However, side effects and complications of prolonged use of ART have been observed, such as the progressive increase of non-infectious disease as the main health problem in this population. Currently, metabolic problems such as dyslipidemia, insulin resistance, and increase of intra-abdominal fat and loss of peripheral fat, cardiovascular and neoplastic

diseases are leading the causes of death in patients with HIV/AIDS.^(8,9)

Chronic diseases, toxicity to long-term ART and aging are factors that may intensify the need for hospitalization in these patients.⁽¹⁰⁾ The need for hospitalization exposes individuals to several therapeutic procedures in order to promote improvement of the patients' clinical condition. However, performing these procedures, such as central venous catheters and urinary catheters, leaves patients more susceptible to Healthcare-associated Infections (HAIs), and to death.^(11,12)

Thus, nursing plays an important role in the early detection and prevention of HAIs because it is responsible for developing a set of deliberate and systematic actions, aiming to reduce the incidence and severity of these infections⁽¹³⁾ and for that reason, performing an accurate diagnose becomes essential to assess the risk of infection.

Determining the presence of the diagnosis Risk of infection specifically in people living with HIV/AIDS (PLHA) is not always an easy task, considering that there is a common knowledge that the infection is already established, and then, is a situational diagnosis. Consequently, the nurse practitioner overlooks the patient's risk of acquiring other infections from the hospital environment.

To prevent this, we have the Nursing Process (NP) and the Systematization of Nursing Assistance (SNA) and their respective taxonomies. Specifically, for the diagnostic stage, the NANDA-1 Taxonomy is used.

Thus, in search of more precise ways to diagnose the risk of infection in PLHA during hospitalization, this research aimed to identify which risk factors of the Nursing Diagnosis Risk of infection are associated with a greater of hospitalized PLHA developing HAIs.

Methods

This is a retrospective and analytical case-control study. The source of cases and controls was the medical and statistical archive service of a hospital specialized in infectious diseases, toxicology and special immunobiological diseases, located in the city of Natal, Rio Grande do Norte, Brazil.

The population consisted of 321 patients hospitalized with AIDS. The sample was selected in a single hospital institution in order to minimize sampling bias. Inclusion criteria were: individuals older than 18 years, of both sexes, with AIDS, hospitalized in the infirmary and the Intensive Care Unit of the above-mentioned hospital, between the years 2010 and 2016. Patients whose medical records were not identified to complement the information were excluded.

The cases and controls were defined from the records of the hospital's Infection Control Committee (ICC). Cases were classified as hospitalized AIDS patients who presented HAIs and as controls, those who did not develop nosocomial infection during hospitalization.

In order to obtain greater statistical precision and the small size of the population, we decided to use the census sample. Group 1 (case) included all subjects who evolved to HAI and who followed the inclusion criteria, totaling 104 individuals. To form Group 2 (control), we chose to make a simple draw to reach a value proportional to that of Group 1, with the proportion of controls being 1:1.

The instrument used was of form type. It was elaborated according to the risk factors of the nursing diagnosis Risk of infection NANDA-I⁽¹⁴⁾ and the literature on the subject.

As for the composition of the instrument, it had four parts which, each one, were filled according to the established sequence. The first part contained sociodemographic variables such as age, sex, marital status, educational level, occupation and origin. In the second part, clinical variables: year of diagnosis of HIV infection, use of antiretroviral therapy, hospitalization reason, sector, hemoglobin value, leukocyte value, development of HAIs, use of invasive device, peripheral venous access, central venous

access, urinary catheter, nasogastric catheter, nasoenteral catheter, tracheostomy, orotracheal tube and drain. The third part was allocated to group 01 (exposed) with the healthcare-associated infection data: type of material harvested for culture, antibiogram result and site of the HAIs. The fourth part contains, specifically, the risk factors of the Nursing Diagnosis and Risk of infection NANDA-I.

Among the risk factors contemplated in the Risk of Infection, those consistent with the patients' condition, possible to be collected and measured from data from research records and medical records were selected. The following variables were selected: chronic disease, invasive procedure, inadequate primary defenses (altered skin integrity, altered peristalsis, and smoking) and inadequate secondary defenses (decreased hemoglobin and leukopenia).

The instrument was pre-tested with 10% of the sample to verify its suitability. There was an operational difficulty in collecting the following risk factors: malnutrition, obesity and inadequate secondary defenses (immunosuppression, suppressed inflammatory response and inadequate vaccination). It was verified during the pre-test that these risk factors were not available in the medical records or that there was no possibility of assessing the suppressive effect in the case of immunosuppression and suppressed inflammatory response, which made the inclusion in the research form impossible after its adaptation. To do so, they were reformulated to meet the research objectives. The charts collected during the pre-test phase were discarded.

After the adequacy of the instrument, data collection was started, which occurred between April and August 2017 by the researcher, six undergraduate nursing students, extension project and undergraduate research fellows, and a graduate student in nursing. Hospital infection investigation records were requested from the ICC in order to identify the subjects that met the inclusion criteria, the identification number of the medical records, to carry out the collection of the infection data and, later, to seek the medical records in medical and statistical archives service (MSAS) to complement the data that were not included in the research file.

The data were organized in Microsoft Excel 2013's spreadsheets and for data analysis, descriptive and inferential statistics were performed through the statistical program IBM SPSS Statistics version 20.0.

For socioeconomic and clinical data, descriptive statistics were used to calculate absolute and relative frequencies, measures of dispersion (standard deviation) and central tendency (mean and median).

In the inferential analysis, Pearson's Chi-square test was used to verify the association between risk factors of AIDS patients according to case and control groups and those with a p-value less than or equal to 0.05 were considered statistically significant. The odds ratios for each risk factor were also calculated.

In order to identify the factors associated with the diagnosis, a logistic regression was developed with statistically significant risk factors. The Wald Test were applied to verify the significance of the coefficients present in the regression. The Hosmer-Lemeshow Test was used to evaluate the difference between the observed and expected frequencies. The Omnibus Test to verify the significance of the developed model. The Nagelkerke R² Test to measure the overall performance of the regression model.

After the analysis, the data were grouped into tables presenting sociodemographic, clinical data, HAIs' sites, microorganisms found in the results of antibiograms and the factors associated the presence of the diagnosis - discussed through the evidence found in the literature.

The study was approved by the Ethics and Research Committee and followed the norms that regulates research involving human subjects in Brazil. The manipulation of the medical records was authorized by a consent term signed by the manager of the medical and statistical archive service.

Results

The sample was composed predominantly of men (63.5% of the cases and 75.9% of the controls), individuals who did not have a partner (41.3% of the cases and 77.9% of the controls), were current-

ly working (43.3% of the cases and 64.4% of the controls) and 41.3% of the cases lived in the country, while 50.9% of the controls were from the state capital. Although the study was not matched by age group, nearly the entire sample (94.2% of the cases and 91.3% of the controls) consisted of adults up to 59 years of age.

Regarding the clinical variables presented in table 1, 36.5% of the cases and 46.1% of the controls were diagnosed with HIV between the years 2007-2016, 69.2% of the cases did not use ART (antiretroviral therapy). While 53.8% (67.3%) of the cases were hospitalized in the ICU, 57,7% of the controls in the hospitalization unit and 31.7% of the cases and 21.1% of the controls were admitted with Neurotoxoplasmosis.

Table 1. Clinical characterization of patients with AIDS who developed (case) and did not develop (control) healthcare-associated infection

Clinical variables	Groups	
	Case n(%)	Control n(%)
Year of HIV diagnose		
Not mentioned	56(53.8)	32(30.7)
Between 1983-1994	2(1.9)	1(0.9)
Between 1995-2006	8(7.6)	23(22.1)
Between 2007-2016	38(36.5)	48(46.1)
Antiretroviral therapy use		
Absent	72(69.2)	48(46.1)
Present	32(30.7)	56(53.8)
Hospital sector		
Non informed	5(4.8)	1(0.9)
Hospitalization unit	29(27.8)	60(57.7)
ICU	70(67.3)	40(38.4)
Tuberculosis ward	0(0)	3(2.8)
Reason for hospitalization		
Neurotoxoplasmosis	33(31.7)	22(21.1)
Pneumonia	15(14.4)	10(9.6)
Oral candidiasis	11(10.5)	10(9.6)
Pulmonary Tuberculosis	8(7.6)	12(11.5)
Diarrhea	8(7.6)	10(9.6)
Histoplasmosis	7(6.7)	7(6.7)
Pneumocystose	5(4.8)	14(13.5)
Respiratory Insufficiency	5(4.8)	5(4.9)
Syphilis	3(2.9)	4(3.8)
Dermatitis	2(1.9)	2(1.9)
Diabetes	2(1.9)	4(3.8)
Papillomavirus	2(1.9)	2(1.9)
Non informed	6(5.7)	2(1.9)

Hemoglobin and leukocyte values presented, respectively, an average of 4.84 g/dl and 4.563/mm³ as shown in table 2.

Table 2. Characterization of clinical variables hemoglobin and leukocytes in patients with AIDS who developed infection related to health care

Variable	Mean	Median	Std. Deviation	Minimum	Maximum
Hemoglobin*	4.84	0.00	5.34	0.00	27.10
Leucocytes*	4563.00	3050.00	5443	0.00	24600.00

Table 3 below presents the results of the Pearson Chi-square test performed to assess the association between the risk factors of AIDS patients according to the case and control groups and shows the results of the odds ratio.

Table 3. Characterization of risk factors according to the AIDS patients who developed (case) and not developed (control) healthcare-associated infection

Risk factors	Groups		Total n(%)	p-value*	OR	CI 95% [LL; UL]
	Case n(%)	Control n(%)				
Chronic illness						
Present	85(49.4)	87(50.6)	172(82.7)	0.427	1.144	[0.557; 2.349]
Absent	19(52.8)	17(47.2)	36(17.3)			
Invasive procedure				0.445	2.58	[0.489; 13.513]
Present	5(71.4)	2(28.8)	7(3.3)			
Absent	99(49.3)	102(50.7)	201(96.6)			
Alteration in skin integrity				1.000	1.000	[0.312; 3.208]
Present	6(50.0)	6(50.0)	12(5.77)			
Absent	98(50.0)	99(50.0)	196(94.2)			
Change in peristalsis				0.167	1.620	[0.814; 3.220]
Present	87(52.4)	79(47.6)	166(79.8)			
Absent	17(40.5)	25(59.5)	42(20.2)			
Smoking				0.005	2.967	[1.416; 6.211]
Present	92(55.1)	75(44.9)	167(80.3)			
Absent	12(29.3)	29(70.7)	41(19.7)			
Decreased hemoglobin				<0.001	6.993	[3.484; 14.084]
Present	52(80.0)	13(20.0)	65(31.2)			
Absent	52(36.4)	91(63.6)	143(68.8)			
Leukopenia				0.001	3.030	[1.610; 5.714]
Present	85(57.8)	62(42.2)	147(70.7)			
Absent	19(31.1)	42(68.9)	61(29.3)			

*Pearson's Chi-square test; OR – Odds Ratio; CI – Confidence Interval; LI – Lower Limit; LS – Upper Limit

Based on table 3, we can infer that at the significance level of 5% the null hypothesis is rejected – there is evidence that there is an association between smoking, decreased hemoglobin and leukopenia with infection and for the other variables there was no evidence of association. Risk factors that showed evidence of association showed relevant Odds Ratio, that is, the presence of the infection increases the chances of presenting these risk factors.

Table 4 presents the analysis of risk factors as possible association of the nursing diagnosis Risk of infection. For that, we selected the risk factors that presented statistical significance, namely: smoking, decreased hemoglobin and leukopenia. These indicators were tested through logistic regression to verify the combined association of risk factors in order to expose the occurrence of the nursing diagnosis Risk of infection.

Based on table 4, among the risk factors that showed statistical significance, smoking, leukopenia and decreased hemoglobin were identified as significant associated factors for the diagnosis Risk of infection. In addition, the logistic model applied exhibited statistical significance according to the Omnibus Test ($p < 0.001$), so that it was possible to identify the presence of the diagnosis studied from the three risk factors mentioned above. The results of the Hosmer-Lemeshow test exhibited significance higher than 0.05 indicating that the predicted values are not significantly different from those observed.

The Wald test ($p < 0.05$) indicated that the coefficients of each risk factor included in the model were significant. The coefficient of determination of the model presented a value of 0.267, signifying that the factors included in the regression model explain 26.7% of the occurrence of HAIs.

Table 4. Logistic regression for risk factors predictive of the presence of nursing diagnosis Risk of infection in patients with AIDS who developed Healthcare-associated infection

Risk factors	Estimation	Wald	p-value	OR	CI 95% [LL; UL]	Tests	X ²	p-value
Smoking	0.944	5.316	0.021	2.569	[1.152; 5.731]	Hosmer-Lemeshow	0.33	0.988
Leukopenia	0.747	4.581	0.032	2.110	[1.065; 4.182]	Omnibus	46.563	<0.001
Decreased hemoglobin	1.755	22.857	0.032	5.785	[1.77; 47.62]	Nagelkerke R ²	-	0.267

OR – Odds Ratio; CI – Confidence Interval; LI – Lower Limit; LS – Upper Limit

Discussion

Based on the obtained results, a greater number of males were identified in the socio-demographic characterization, which corroborates with the Brazilian epidemiological bulletin on HIV/AIDS.⁽¹⁵⁾ Thus, the aforementioned finding relates to the reality of the Brazilian population in which the cases of AIDS are predominantly in men, fact verified in the clinical practice where a great number of patients of male gender living with AIDS are detected.

Regarding the marital status, there is a predominance of patients who did not have a partner, a result similar to the data found in other studies.⁽¹⁶⁻¹⁸⁾ As for occupation, the majority of the individuals had an employment, similar to another study.⁽¹⁹⁾

Regarding the clinical characterization, the majority of the patients who developed HAIs were hospitalized in the ICU, which confirms the research carried out by other researchers.⁽²⁰⁾ This finding relates to the fact that this sector admits patients with greater severity and immunosuppression, and this factors associated with the complexity of the patients culminates in a greater demand for invasive interventions, excessive use of antibiotics and prolonged hospital stay, aspects related to the development of infections.

On the other hand, the controls were concentrated in the infirmaries, which are destined for admissions only to PLHA. Being hospitalized in this ward requires fewer interventions and this may contribute to minimizing the chances of the patient developing HAIs.

Regarding the clinical characterization, neurotoxoplasmosis was the first cause of hospitalization, followed by pneumonia, oral candidiasis, pulmonary tuberculosis and diarrhea. Several studies have shown the same comorbidities in PLHA as the ones found in this study.⁽²¹⁻²⁷⁾

Neurotoxoplasmosis in immunosuppressed patients has become the most serious opportunistic infection, considering its frequency, severity and difficulty in the therapeutic regimen. Low CD4 T cell counts and positive serology for toxoplasmosis are their strong predictors.⁽²⁸⁾

Regarding the analysis of associated factors for the diagnosis risk of infection in hospitalized AIDS patients, the indicators that composed the logistic regression model were: smoking, leukopenia and decreased hemoglobin – considering that they were the only ones that showed statistical significance in the model, using the Wald test.

A study has shown that smoking is associated with increased viral load in HIV/AIDS patients in which daily smokers were found to be twice as likely to have a viral load above 10,000 cp/ml. This study highlighted that tobacco use affects the response to HAART, presents a higher risk of rebound virology and a significant increase in oxidative stress that could explain the mechanism of increased viral load. As consequence to the increased viral load, there is a decrease in CD4 T cells, which leads to an increased risk of the patient being affected by HAIs.⁽²⁹⁾

Leukopenia presented statistical association with the outcome studied, increasing the chances of its occurrence by 3 times. Leukopenia stands out in the regression as being associated factor for the occurrence of infection. It is associated with significant loss of CD4 + cells and increased viral load in people living with HIV/AIDS, thus, treatment with HAART is appropriate and beneficial for reversing myelosuppression and leukopenia.⁽³⁰⁾

A study showed that the risk of developing severe leukopenia was significantly associated to patients who used ART with Zidovudine (ZDV) compared to those who started another first-line therapy regimen. Due to the association of ART with ZDV, the patients presented low leukocyte count.⁽³¹⁾ In this study, 30.7% of the cases and 53.8% of the controls used ART, probably the verified leukopenia is linked to this fact.

The decrease in hemoglobin was a prevalent factor in the studied sample, which is linked through logistic regression as a associated factor for the occurrence of infection. Such an outcome corroborates with another study⁽³²⁾ that found that anemia is the most common hematological alteration in people living with HIV, and its prevalence is expressively high and associated to the increase of disease progression.

The occurrence of anemia has a multifactorial cause, such as the presence of opportunistic infections, nutritional deficiencies, suppressive effect of HIV on hematological factors and toxic effects of antiretroviral drugs.⁽³³⁾ In this study, the decrease in hemoglobin may be related to the early presence of opportunistic infections on the patient's admission to the hospital, advanced clinical status, and AZT-based ART regimen. According to research,⁽³³⁾ AZT has been shown to inhibit bone marrow activity, reducing blood cell production and increasing the risk of anemia.

Therefore, we emphasize that smoking, leukopenia and decreased hemoglobin are factors that both isolated and together are considered factors associated for the risk of infection in the researched patients due to the association between them.

The associated factors can be used by nurses to facilitate the implementation of nursing interventions according to the needs of each individual living with HIV/AIDS, and thus, contributing to the reduction of complications due to the illness progression and treatment.⁽³⁴⁾

This finding contributes to the nurse's ability to make a diagnostic inference by identifying the diagnosis Risk of infection in patients with characteristics similar to that of the sample, so that the presence of this indicator should not be considered as a good associated factor for the establishment of this diagnosis in this specific population.

The limitations of the study were the lack of information in the medical records, exemplified by the lack of laboratory test results; inconsistencies in the reports made by the health team, such as the lack of record of the risk factors for malnutrition, obesity and inadequate secondary defenses; And finally, the loss of medical documentation, this last limitation made it impossible to include some subjects in the sample. According to the measures used to avoid bias, the selection of a random sample of individuals who developed HAI (cases) and those who did not (controls). Based on minimizing sampling bias, controls were selected at the same hospital as the cases and the study participants were blinded to try to reduce the risk of bias.

Conclusion

This study verified a high frequency of three clinical indicators in the studied sample: invasive procedure, altered skin integrity and decreased hemoglobin. This study confirms the initially teste hypothesis that the risk factors of the nursing diagnosis Risk of infection is frequent in hospitalized AIDS patients. Among the factors included in this diagnosis that may be associated its occurrence, smoking, leukopenia and decreased hemoglobin, both together and isolated, are capable to associated the risk of infection in hospitalized AIDS patients. Among these, the risk factor that alone and together showed a more significant association with the diagnosis was the decreased hemoglobin. As a result, the nurses involved in the care of such patients, when choosing the studied diagnosis for the patients surveyed, should consider which were the risk factors highlighted in this study as indicators for the occurrence of Risk of infection in order to affirm the diagnosis with precision.

Acknowledgements

This study was funded by *Conselho Nacional de Desenvolvimento Científico e Tecnológico* (National Council for Scientific and Technological Development) - CNPq - Brazil in Support of Research Projects / MCTI / CNPQ / Universal, protocol number 460777 / 2014-9.

Colaborações

Marques CC, Barreto VP, Silva BCO, Santos MMP, Medeiros ER, Guedes GSD, Martins ES e Feijão AR declaram que contribuíram com a concepção do estudo, análise e interpretação dos dados, redação do artigo, revisão crítica relevante do conteúdo intelectual e aprovação da versão final a ser publicada.

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