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Magnitude of Tuberculosis Cases Notified in a Municipality Epidemiological Profile, Risk Factors and Comorbities: A Temporal Analysis

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Abstract

Introduction: Tuberculosis remains among the most prevalent infectious diseases worldwide; Risk factors include sociodemographic factors and comorbidities such as alcohol consumption, diabetes mellitus, the use of legal and illegal drugs and HIV. This research aimed to estimate the incidence of tuberculosis cases and describe the epidemiological profile of all tuberculosis cases reported to the National System of Notifiable Diseases in the city of Campo Grande/MS.

Methods: This is a cross-sectional survey of secondary data that analyzed all cases reported in the city from January 2014 to December 2019.

Results: There was a predominance of males (80.3%). The most affected age group corresponded to individuals of working age (20 to 59 years), with 84% of the total data. As for comorbidities, 70.5% had at least one. Smoking was the most prevalent health issue (27%), followed by the use of psychoactive substances, alcohol consumption and HIV/Aids co-infection (13.8%). Diabetes was the lowest rated disease, with 5.4%.

Discussion and conclusion: The data obtained points to the need to assess directly observed treatment (DOT) in the capital, given the alarming engagement rate of 3.8%. One third of tuberculosis cases were diagnosed in hospitals, supporting the hypothesis of delayed diagnosis. The incidence coefficient in the city was higher than the ones found in the state and in the country, especially in the years 2018 and 2019, with an incidence rate of 51.42 and 41.6, respectively.

Keywords: Tuberculosis; Epidemiology; Comorbidity; Public health

Introduction

Tuberculosis (TB) remains among the most prevalent infectious-contagious diseases in the world. One third of the global population is found to be infected with Mycobacterium tuberculosis. Brazil remains on the list among countries with a high burden of TB and TB-HIV co-infection, considered a priority center by the World Health Organization (WHO) for the endemic control. The increase in the incidence coefficient of TB in the country between the years of 2017 and 2018 in relation to previous periods corroborates the current picture. In this period of time, there was a decrease in incidence within individuals over 65 years of age and an increase in on other age groups.

Pulmonary TB is the most frequent form, considered the maintenance manifestation of the transmission chain. During 1 year, a person with a positive bacillary form can infect from 10 to 15 people in average, in a community. It is estimated that 10% get infected: 5% during the first two years after infection and 5% throughout life.

Multiple factors are involved in the process that facilitates contagion. Intradomiciliary contact with people infected with bacilliferous pulmonary form and its intensity, such as proximity, time and favorable or unfavorable convivial environment, are cited with frequency among the different factors. Therefore, early diagnosis of positive pulmonary forms and effective treatment of the ill are central aspects on TB control. However, in most health services, the diagnosis is late, as well as there is no confirmation through laboratory.

Many factors contribute to the transmission and progression to active tuberculosis after infection: endogenous factors, especially the integrity of the immune system, and exogenous factors, which include associated comorbidities, such as diabetes mellitus, malnutrition, alcoholism, the use of legal and illegal drugs and HIV co-infection,. All are described as increasing rates of illness due to TB [1]. Therefore, it is important to identify comorbidities in order to ensure early diagnosis for those that fit these conditions.

After the emergence of AIDS, the TB scenario intensified. Co-infection has been expanding, changing the epidemiology and prognosis of the disease. The risk of developing tuberculosis is 10% per year for HIV-positive individuals, while for patients free of the virus; the percentage becomes 10% throughout life. In 2020, 76.5% of new TB cases were aware of their HIV status [2]. Furthermore, among people with TB-HIV co-infection, only 45.1% underwent antiretroviral therapy (HAART) during TB treatment.

Smoking plays an important role in maintaining the transmission chain and enhancing the disease. It is estimated that 1.3 billion people use tobacco worldwide, with the majority of individuals living in

underdeveloped or developing countries. Mortality drops significantly with the cessation of the act; in about 65% when compared to those who persist smokers, indicating that cessation of the addiction is a significant factor in the containment of morbidity and mortality.

Due to the fact that the active search for TB cases among populations at risk of illness is one of the pillars for reducing the incidence of the disease and given the scarcity of studies of this nature in the city of Campo Grande/MS, this research was aimed to describe the epidemiological profile of patients diagnosed with tuberculosis and estimate the incidence of comorbities and associated risk factors of all cases notified by its health services in the capital over a 6-year period.

Materials and Methods

This is a descriptive, retrospective, quantitative and cross-sectional study of secondary data. Data were obtained from the National System of Notifiable Diseases (SINAN), provided by the Health Department of Campo Grande, MS (SESAU/CG-MS) in the form of a database, standardized by the Ministry of Health [3]. The sample consisted of all cases, diagnosed, notified and registered in the period from January 1, 2014 to December 31, 2019, covering all existing health services in the capital.

The analyzed variables included sex, age, reporting health unit, type of entry (new case, abandonment, relapse and others), ethnicity, pulmonary and extrapulmonary clinical forms, tests performed for diagnosis and follow-up, relation to other diseases and conditions: smoking, HIV co-infection, use of psychoactive substances, alcoholism [4]. The origin of diagnose, covering the prison system, hospitals and health units in the health care network of the municipality, as well as the number of patients who received the Directly Observed Treatment (DOT) strategy, were also evaluated.

Regarding data analysis, Bioestat 5.0 program was used to prepare the epidemiological census. The tables were made using Microsoft Excel program [5]. To calculate the TB incidence coefficient and its association with other diseases, the standard formula was applied: the number of new cases notified divided by the local population, multiplied by the number of 100,000 inhabitants. Descriptive analysis was expressed by frequency (n) and proportion (%) for categorical and numerical data. Health indicators were calculated using original data, based on the percentages found to calculate incidence rates in the city. The population data necessary were obtained through the Brazilian Institute of Geography and Statistics (IBGE) [6]. The Project was approved by the Research Ethics Committee, nº 3.951.339. STROBRE checklist was used for observational and cross-sectional studies in epidemiology to assess the merits of this research.

During the study period, 2806 cases of tuberculosis were reported in the city, considering all forms of manifestation, with 2062 (73.5%) corresponding to new cases. The incidence rate of new cases in the city in 2019 was 41.6 cases/100,000 inhabitants, lower than the rate in 2018, of 51.42 cases/100,000 inhabitants [7]. In 2017, the coefficient was 34.98 cases/100 thousand inhabitants. In 2016, the rating was 34.76. In 2015 it was 31.56 and in 2014 a rate of 33.21 cases/100 thousand inhabitants was obtained.

Results

Regarding gender, 2254 (80.3%) were male and 552 were female (19.7%). As for the age groups, under 10 years old children corresponded to 44 cases (1.6%), while 113 (4%) were reported in individuals between 10 and 19 years old, 2358 (84%) between 20 and 59 years old and 291 cases in older than 60 years (10.4%). A total of 1468 cases were brown (52.3%), while 667 (23.8%) were white, followed by 229 black (8.2%), 35 yellow (1.2%), 13 indigenous (0.5%), while 394 were listed as ignored or empty (14%). The clinical pulmonary form predominated, with 2342 cases (83.5%), of which 1218 had positive bacilloscopy, corresponding to 52% of the pulmonary cases [8]. The Directly Observed Treatment (DOT) modality was performed in 106 (3.8%) of the cases. Of these, 90 were new cases (84.9). Of the 582 cases of recurrence and treatment after abandonment, 12 (2.1%) underwent TOD (Table 1).

Variables	N	%
Gender		
Female	552	19,7%
Male	2254	80,3%
Age group		
<10 years	44	1,6%
10 to 19 years	113	0.04
20 a 59 years	2358	0.84
>60 years	117	10,4%
Ethnicity/color		
White	667	23,8%
Black	229	8,2%
Brown	1468	52,3%
Yellow	35	1,2%
Indigenous	13	0,5%
Ignored	394	0.14
Residence area		
Urban	2554	0.01
Rural	220	7,84%
Periurban	32	1,14%
Clinical form		
Pulmonary	2343	83,5%
Extrapulmonary	463	16,5%
Observed Treatment		
Yes	106	3,8%
No	2700	96,2%
Total cases	2806	100%
Note: N: Number of cases, %: percentage of cases.		

Table 1: Sociodemographic and epidemiological characteristics of tuberculosis cases notified to Sinan by the municipality of Campo Grande/MS from 2014 to 2019.

The reporting units included health services from Primary/ Secondary Care, Hospital Network and Prison System [9]. The Primary Care Units notified 1245 cases (44.4%), followed by the Hospital Network, with 865 (30.8%), and the prison system, with 696 (24.8%) of the total cases (Table 2).

Notification health units	N	%
Primary/secondary care	1245	44,4%
Tertiary care	865	30,8%
Prison system	696	24,8%
Total	2806	100%
Note: N: number of cases, %: percentage of cases		

Table 2: Distribution of the number and percentage of TB cases diagnosed and notified according to the organization of the municipality's Health Services in the period 2014 to 2019.

Among the 2806 cases, 1984 (70.5%) had at least one comorbidity. Smoking was the most prevalent health problem, with 757 cases (27%), followed by the use of psychoactive substances, with 608 (21.7%), and alcoholism, with 582 of the study population (20.7%) [10]. The association between chemical dependency, alcoholism and TB occurred in 184 cases (6.5%) of the census, as the most prevalent association of three comorbidities. The second most common association was between alcoholism and users of psychoactive substances, followed by TB-HIV co-infection and substance abuse. Among the 582 alcoholics, 256 were users of psychoactive substances (44%). Among illicit drug users, 84 (13.8%) were HIV positive. The fourth most prevalent comorbidity was HIV/Aids co-infection, with 387 (13.8%) cases. The rapid HIV test was performed at the time of TB diagnosis for 2315 cases (82.5%). Diabetes was the lowest rated disease, with na association rate of 5, 4% (Table 3).

Comorbities	Pulmonary		Positive	
	N	%	N	%
Smoking	757/2806	0.27%	666/757	88%
Alcoholism	582/2806	20,7%	436/582	79,1%
Psychoactive substances	608/2806	21,7%	548/608	90,1%
HIV/AIDS	356/2806	13,8%	209/387	54%
Total	2806	100%	757	100%
Note: N: number of cases, %: percentage of cases				

Table 3: Distribution of the number and percentage of positive pulmonary TB cases diagnosed and notified by the municipality in the period 2014 to 2019, according to the number of comorbidities and associated injuries.

Chest radiography was performed in 1751 (62.4%) cases. Regarding sputum smear microscopy, 2179 reported cases of pulmonary TB underwent the examination (77.6%). Of these, 1248 cases had a positive bacilloscopy (57.3%), considering those who underwent the examination in the pulmonary form [11]. As for culture of BK from the sputum, 1557 individuals in the pulmonary form underwent this procedure (71.45). The TRM/TB molecular test was performed in 742 cases (26.4%), of which 595 had a positive result (80.2%) (Table 4).

Exames	N	%
Sputum bacilloscopy test		
Positive	2179	57,3%
Negative	524	0.24
Total	2703	100%
Chest radiography		
Suspicious	1587	90,6%
Normal	135	7,5%
Other diseases	29	1,6%
Total	1751	100%
Sputum culture		
Positive	869	55,8%
Negative	688	44,2%
Total	1557	100%
Note: N: number of cases, %: percentage of cases		

Table 4: Distribution of pulmonary TB cases diagnosed and notified by the municipality in the period 2014 to 2019 according to diagnostic tests.

During the period of research analysis, the predominance of TB cases occurred in males, with a total of 2254 cases (80.3%). However, the rates found were considerably higher than those described in the literature [12]. Most studies describe an incidence percentage of 60-70%. The WHO quantifies the male/female ratio ranging from 1.5:1 to 2.1:1. In this research, the ratio found was 4:1. These variables can be justified by economic, social and cultural factors [13]. Negligence in relation to their own health and greater exposure to risk factors are characteristics described in the male population when compared to females. Men are more likely to live on the streets and deprived of liberty, as well as to adhere to smoking, alcoholism and the use of psychoactive substances, health problems that considerably increase the incidence of the disease.

The incidence of tuberculosis stratified by gender is similar until adolescence, However, after 15-20 years, this similarity does not occur. Men between 25 and 40 years old get ill more often than women, an event linked to lifestyle [14]. This was the age group with the highest incidence, accounting for more than 60% of the study population. The distribution by age group follows the national pattern, showing a predominance of involvement in the age group of 20 and 39 years, which is one of the most active phases of life the total number of cases reported, 696 (26.9%) occurred in prisons, of which 685 (98.4%) were male, reaffirming confinement and gender as a risk factor for the incidence of TB. The population's hygiene and basic sanitation conditions, social class and, above all, population agglomerations are factors linked to the incidence of TB. Cases are mostly notified in the periphery regions, where there is greater agglomeration. It is not different in Campo Grande, considering that a

representative number of this disease is registered in prisons, corresponding to almost a third of the total number of notifications.

Discussion

Behavioral aspects present in the prison population also contribute to the higher risk of infection. Most inmates have a history of malnutrition and use of alcohol, unprotected sex, tobacco and other drugs, maintaining risky behavior even when incarcerated.

Most diagnoses occurred in Primary/Secondary Care. Primary care units are considered the gateway for patients with suspected TB, where preventive measures, health promotion and early diagnosis of respiratory symptoms, risk groups and their comorbidities are carried out, as well as treatment and monitoring of cases.

It was identified that one third of TB cases were diagnosed in hospitals, possibly in advanced stages or with signs of seriousness, either by TB itself or by associated diseases. This further indicates that the active search for cases by Primary Health Care (PHC) in the municipality does not reach the 80% goal recommended by the Ministry of Health for disease control in the country, which aims to increase the early diagnosis of new cases, with a consequent decrease in the incidence and morbidity of the disease4.

Comorbidities and health problems such as HIV/AIDS, drugs, tobacco, alcoholism, diabetes and mental illnesses are considered the risk factors of greater propensity to become ill with TB. Of all the cases reported in the municipality, 80% of the patients presented, at the time of diagnosis had at least one comorbidity.

The use of tobacco represented an incidence of 27% of all cases reported during the period, rising as the foremost association. There is a strong relationship between TB and the consumption of alcohol, tobacco and illicit drugs, whereas smoking is the most significant. The combustion of tobacco and the consequent inhalation of smoke is considered to play a fundamental role, from the perpetuation of a culinary dysfunction, causing a reduced immune response, to defects in the macrophage immune response, occurring with or without a decrease in CD4 count.

These factors increase the risk of bacillus persistence after treatment and the risk of Latent TB Infection (LTBI), as well as the progression of active TB, lower adherence to treatment and interference in sputum test collection, predisposing false-negatives.

HIV confection was the fourth most frequent comorbidity. Currently, TB remains the leading cause of death among people living with HIV, accounting for about one in three AIDS-related deaths [15]. A person living with HIV is 28 times more likely to contract TB than a person who does not carry the virus.

In the year 2019, about 10 million people developed TB worldwide, with approximately 9% living with HIV, while 1.7 million acquired HIV. The proportion of TB-HIV confection in Brazil in 2016 was 9.4%, that is, from the 69,000 new cases of tuberculosis registered in 2016, 6,500 also tested positive for HIV. It is also estimated that 44% of people living with HIV and tuberculosis are unaware of their co-infection status and, therefore, are not receiving proper health care.

In this municipality, 387 cases of TB/HIV co-infection (13.8%) were notified, of which 256 (92%) were previously infected. A minority of cases (8%) were new HIV diagnoses. Thus, most patients were already known to have the virus or were in the AIDS stage prior to the diagnosis of TB, raising discussions about the long-term control of the disease and the effectiveness of prevention and timely treatment after diagnosis by the health systems and society. The public health service must offer HIV screening through rapid testing at the time of TB diagnosis. The examination was not performed in 17.5% of cases, which reveals a possible failure in the patient's assessment or lack of material resources at the diagnosis site.

The proportion of new TB-HIV cases has grown dramatically. In 2019, data showed that 76.1% of new TB cases already knew their status for HIV infection, with 8.4% of new cases being positive. The South region had the highest percentages of testing and showed the highest proportions of TB-HIV co-infection, along with Amazonas and the Federal District.

Thereby, such data reveal an improvement in the diagnosis of TB co-infection with HIV, a fact that is in line with national guidelines for the prevention of TB in patients with HIV. After all, the diagnosis must occur early in the entire population craving a timely evaluation of the occurrence of TB.

TB incidence among alcoholics is significantly higher than in the general population. Alcoholism and chemical dependence had a high incidence when compared to other diseases, occurring in 20.5% and 20% of reported cases, respectively. The predominant consumption of alcohol and tobacco in the productive age of individuals is associated with the population's age organization. Although many studies infer that mortality from TB is higher among people that identify as brown and black, this study pointed the association between both comorbidities on individuals of the white ethnicity/color.

Alcoholism is an important risk factor for TB infection, interfering both in contagion and in its evolution, serving as a predictor of dropout, since it is associated with low adherence and irregular use of medications, which negatively influence in treatment with consequent risk of multidrug resistance. In addition, there is an associated risk of intoxication by illicit drugs, another risk factor.

Alcoholism is also associated with relevant social determinants, such as lack of fixed housing, low socioeconomic status and malnutrition; after all, chronic drinkers have immunosuppression due to protein-calorie and vitamin deficiencies resulting in poor nutrition, making the host susceptible to bacillus infection and disease development.

Directly Observed Treatment (DOT) is an important approach in the treatment of TB, especially in alcoholic patients and users of psychoactive substances, mainly due to the difficulty of adherence. It is indicated as a specific action in the Tuberculosis Control Program (TCP) to detect dependence, even during TB treatment, to offer and encourage abstinence.

Regarding the percentage of individuals who performed the DOT, the rate was much lower than in the rest of the country. Only 3.8% of the total diagnosed cases received this strategy. Considering the 582 cases of recurrence and abandonment alone, only 12 cases (2.1%) received the TDO strategy, na alarming data, which signals the need for the municipal TB control program find out causes and solutions. In 2016 in Brazil, 36.2% of new cases of pulmonary TB had their treatment in the TDO modality, whose laboratorial proven cure percentage was 73.0%. The municipality of Campo Grande in the same year was the capital with the lowest percentage of laboratory-proven cure in relation to the country, with only 10.9%. The leading healing capital was Macapá, with 86.1%, and the states that reached the highest percentages were Acre (84.2%) and São Paulo (81.6%).

This low percentage observed in this survey may point to problems in managing the program and updating information on Sinan.

The data obtained in this study highlights a great incidence of smoking, alcohol consumption, HIV co-infection and the use of legal and illegal drugs among TB cases, reinforcing the disease as an important public health problem, aggravated by the comorbidities presented. The male gender, emerging as highly superior to the female, raises hypotheses about the epidemiology of the municipality and collective health actions for this population. The data obtained points out to the need of DOT assessment in the capital, given the alarming rate of 3.8%. Adherence below recommended on HIV screening reveals possible failure in patient assessment or lack of material resources at the diagnosis site, raising discussions about the long-term control of the disease and the effectiveness of prevention and timely treatment after diagnosis by the health systems and society. There was a possible delay in diagnosis, as a third of the TB cases were diagnosed in hospitals, in addition to having an incidence rate higher in the municipality than in the state of Mato Grosso do Sul and in the country, with an incidence rate of 51.42 and 41.6 cases/100 thousand inhabitants, respectively, in 2018 and 2019.

Conclusion

The predominant incidence of smoking, alcoholism, PAS and HIV/AIDS is supported in the literature and dialogues with risk factors for illness and treatment failure, whether due to diseases, negligence, and higher incidence in males and in prisons. This points to the need for health services to implement their actions of prevention, diagnosis and adequate treatment of these risk factors and comorbidities, not only when diagnosing, but prior to becoming ill with TB, in addition to the need to restructure the set of actions articulated in the network that aim to implement the early diagnosis of tuberculosis in basic health units, which are fundamental actions to obtain a decrease in the incidence of the disease.

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