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# The burden of tuberculosis disease in women, Colombia 2010-2018

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**Resumen**

***Objetivo:*** estimar los años de vida ajustados por discapacidad en mujeres atribuibles a Tuberculosis, Colombia 2010-2018.
***Métodos:*** Estudio descriptivo retrospectivo. Se estudiaron las variables: año de ocurrencia, grupos de edad y procedencia. Se incluyeron 41.354 mujeres que consultaron en la red hospitalaria y 2530 casos de mortalidad en mujeres, registrados en el sistema de estadísticas vitales del país. Mediante la metodología abreviada propuesta por la Organización Mundial de la Salud para la medición de la carga de la enfermedad, se estimaron los años de vida perdidos, años de vida con discapacidad y años de vida saludable perdidos por mujeres a nivel subnacional.
***Resultados:*** La tasa de años de vida ajustados por discapacidad del periodo de estudio fue de 427,2 (II95% 353-492,3) por cada 100.000 mujeres. Las mujeres en edad reproductiva (10 a 49 años) concentran el 57,9% de estos. Amazonas 1.426 (725,4-2541,4) y Guajira 1.001,1 (693,3-1260) presentaron las tasas más altas. Doce entidades territoriales tienen aumento de la carga de enfermedad.
***Conclusiones:*** La tasa de años de vida ajustados por discapacidad por tuberculosis en mujeres durante nueve años, fue alta y presenta diferencias subnacionales quizás debidas a las grandes brechas sociales o económicas o déficit de capacidades institucionales o programáticas.

***Palabras clave:*** Tuberculosis, Años de Vida Ajustados por Discapacidad, mujeres, Colombia.

**La carga de enfermedad por Tuberculosis en mujeres, Colombia 2010-2018**

**Abstract**

***Objective:*** to estimate disability-adjusted life years in women attributable to tuberculosis in Colombia 2010-2018.
***Methods:*** A retrospective descriptive study was conducted. The following variables were studied: year of occurrence, age groups and origin. This study included 41,354 women who consulted in the hospital network and 2530 cases of mortality in women, registered in the country's vital statistics system. Using the abbreviated methodology proposed by the World Health Organization for measuring the burden of disease BD, years of life lost, years of life with disability and years of healthy life lost by women at the subnational level were estimated.
***Results:*** The Disability-Adjusted Life Years rate for the study period was 427.2 (95% II 353-492.3) per 100,000 women. Women of reproductive age (10 to 49 years old) account for 57.9 per cent of these. Departments such as Amazonas 1,426 (725.4-2,541.4) and Guajira 1,001.1 (693.3-1,260) had the highest rates (per 100,000 inhabitants). Twelve territorial entities have an increasing burden of disease.
***Conclusions:*** The rate of disability-adjusted life years due to tuberculosis in women for nine years was high and presents subnational differences perhaps due to large social or economic gaps or deficits in institutional or programmatic capacities.

***Key words:*** Tuberculosis, Disability-Adjusted Life Years, women, Colombia.

## Introduction

Tuberculosis (TB) is a preventable and curable communicable disease, which can affect the lung parenchyma or any other organ and generate continuous disability. This disease makes a major contribution to the global burden[1]. TB is expected to be the second leading cause of death from a single infectious agent, after COVID-19[2].

Globally, 9.9 million people developed TB in 2020, bringing the global death toll to 1.6 million; of these, 1.4 million in HIV-negative people (32% in women) and 187,000 in HIV-positive people (38% in women)[3]. The Region of the Americas reported an incidence rate of 30 and a mortality rate of 3.1 per 100,000 population. Colombia, the study site, bears a high burden of TB, presented incidence rate of 41 and mortality rate of 5 per 100,000 inhabitants[2] (2) and 35.1% of cases of disease in women[4]. The high burden of TB is fueled by risk factors such as HIV, malnutrition, diabetes, among others[5].

Colombia for its health diagnosis has as a strategic input the Health Situation Analysis ASIS, which uses simple indicators. The use of composite indicators such as Disability Adjusted Life Years (DALYs) to measure burden disease BD with the up-

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dated methodology of the World Health Organization WHO is recent in the country. It has been used for the global burden in the Colombian Orinoquía[6] and for the regionalized national order for TB[7,8], however, although these include the variable sex, the specific behavior in women is not analyzed.

This disease also has serious consequences for women[9], who are drastically and disproportionately affected[10]. Some factors related to gender inequality and systemic discrimination against women and girls may be influencing the impact that TB causes in Colombian women. These factors have been described: increased risk of malnutrition and food insecurity[11], Increased illiteracy[12], barriers to access and appropriate care, increased stigma[13], increased TB rates in women with HIV[14] and gender norms that require negotiation with their husbands when they are sick[15], among others. These related factors are present in Colombia. Therefore, it is essential to estimate for the first time the burden that TB causes in Colombian women to identify their health status, progress in ending the epidemic, addressing the health system, and understanding the contextual issues influencing TB management in this population.

TB has been declared a priority in public health, where its common denominator is the inequitable distribution in the population and its overlap in regions with less development, in which it is important to address inequalities in women[7]. Studies in Colombia regarding gender gaps have shown that for women there are marked inequalities regarding their own income, economic participation rate, wages, among others[16,17].

In this study, the objective was to determine the burden of TB attributable disease in women in Colombia 2010-2018. The results obtained allow us to specify that there is a knowledge gap regarding the realization and clear understanding of the BD in women in Colombia.

## Materials and methods

A descriptive epidemiological study was conducted. The cases (morbidity and mortality) of TB occurred in the period 2010-2018 were obtained from the Integrated Information System for Social Protection SISPRO. For cases of mortality the source is the Vital Statistics System RUAF. To control for overestimation of morbidity, due to multiple consultations of the same woman to the hospital network, the database provided by the Ministry of Health and Social Protection was filtered by identification in the data source, before being delivered anonymously to researchers. We included all cases reported in the country in women during 2010-2018 at any age with morbidity and basic cause of death from any type of TB. The exclusion criteria were duplicate registrations and stillbirths and registrations in which the country of residence was not Colombia. All women diagnosed with tuberculosis in Colombia, regardless of the country of origin, are included in the database analyzed for this study. Considering the programmatic aspects of centralized drug distribution from the Ministry of Health and Social Protection and the strictly supervised shortened treatment, it is necessary to be included as a resident in the analyzed database. Given the above, no case was excluded from the database of Colombian women who have emigrated to different neighboring countries and who arrive in search of medical attention in Colombia. Based on these criteria, 41,354 women were selected to consult the country's hospital network and 2530 who died and were admitted to the RUAF.

### *Data analysis*

We proceeded to identify the sociodemographic characteristics with respect to morbidity and mortality data by territorial entities TE. For mathematical calculations of years of life lost to premature death (YYL), Years Lived with Disability (YLD) and DALY correlations versus years of occurrence per entities, the SPSS™ program version 23 licensed was used. The construction of indicators by TE for each year and for the period of the study was carried out using as a numerator the number of cases and as denominator the population projection, according to the report of the census 2005 (considering that eight of the nine years of the study are under the projections of the 2005 census), by age group according to TE and a constant of 100,000 inhabitants, for the study period, the rates were calculated taking into account the mid-term population. The uncertainty intervals (II95%) for YLL, YLD and DALY were performed using Bootstrap (1000 samples) with bias corrections with the licensed XLSTAT 2021 software (Colombia 2021).

### *DALYs or Healthy Life Years Lost to TB*

The indicator DALYs summarizes in a single value the data on the occurrence of mortality, morbidity, representing them as the healthy life time lost by a subject6. DALYs estimate the BD and are composed of the sum of YLL and YLD18. YLL are the years a person stops living when they die before meeting a theoretical life expectancy19. YLDs measure the deviation from health in any of the domains that a person lives in6. The calculation expression is:

$$DALY_{c,a,s,t} = DALY_{c,a,s,t} = YLD_{c,a,s,t} + YLL_{c,a,s,t}$$

In the previous expression DALYs (c,a,s,t) is the total Disability-Adjusted Life Years, YLD are Years Lived with Disability, YLL are Years of Life Lost, by cause (c) in age group (a), sex(s), and year t. This research used for the first time for Colombia, the updated metric of the indicator[18], used by WHO in the Global Burden of Disease study GBD.

### *Bias control*

The theoretical assumption of attributing mortality to the underlying cause was used to control for competitive risk bias. Regarding the underreporting of mortality, Dicker reports

completeness for Colombia's vital statistics system, from 2004 to 2015[20]. The underreporting bias in morbidity could not be corrected due to the lack of integrity measures of the vital statistics system[21]. With the inclusion of all reported cases in the different levels of care of the hospital network of all TE of the country, together with the reports of the Institute of Legal Medicine and Forensic Sciences, health care bias was mitigated.

## Results

In the study period, 41,354 cases of women diagnosed with TB were reported in the country's hospital network and 2530 cases of mortality, corresponding to 37.4% and 29.7% of total TB records, respectively. The highest mortality rates were in Amazonas (23.7) and Guajira (21.3); Vichada reported no deaths in the study period and Guaviare had the lowest rate (1.7). The highest morbidity rates were in Amazonas (698.8) and Chocó (415.7) and lowest in Boyacá (52.5). By age group, women of childbearing age (10-49 years) accounted for 32.3% of mortality and 59.2% of morbidity (Table 1).

### *YLL: Deadly Effects of Tb*

The YLL rate in women in Colombia during the study period was 370.1 years (II95% 315.9-416.8). By TE, in Amazonas it was 1189.9 (II95% 381.7-2093.9) and Guajira of 915.4 (II95% 635.5-1175.8) presented the highest rates; Vichada reported no deaths and San Andrés had the lowest rate 44.4 (II95% 0-88.8). Women of reproductive age (10-49 years) are the most affected and concentrate 57.2% of these.

### *YLD: Nonfatal Effects of Tb*

The YLD rate in women in Colombia during the study period was 57.1 (II95% 42.6-67.8). By TE Amazonas 236.4 (II95% 197.6-285.4) and Guaviare 161.5 (II95% 107.8-239.4) presented the highest rates; and Boyacá had the lowest rate 17.5 (II95% 13.5-21.5). Women of reproductive age (10-49 years) are the most affected and concentrate 59.2% of these.

### *DALYs or Healthy Life Years Lost to TB*

The DALY rate in women in Colombia during the study period was 427.2 (II95% 353-492.3). By TE, Amazonas 1426 (II95% 725.4-2541.4) and Guajira 1001.1 (II95% 693.3-1260) presented the highest rates; and Vichada had the lowest rate 69.1 (II 95% 48-98.6). Women of reproductive age (10-49 years) are the most affected and concentrate 57.9% of these. Table 2 shows data on YLL, YLD and DALY rates for the period 2010-2018.

Pearson's correlation showed differences between TE, a group of 21 departments with negative correlation in which the burden of TB in women would be decreasing especially Valle (-0.843), Cauca (-0.601) and Magdalena (-0.555) (table 3) and another group of 12 TE that presented positive correlation where the burden of TB could denote an increase (increase in time), especially Caquetá (0.719), Cesar (0.716) and Guajira (0.546) (table 4).

**Table 1.** Tuberculosis morbidity and mortality in women by territorial entity, Colombia, 2010–2018.

| Territorial entities | Morbidity | | Mortality | |
|---|---|---|---|---|
| | Cases | Adjusted rate | Cases | Adjusted rate |
| AMAZONAS | 265 | 696,8 | 9 | 23,7 |
| ANTIOQUIA | 8306 | 266,5 | 354 | 11,4 |
| ARAUCA | 301 | 230,6 | 14 | 10,7 |
| ATLANTICO | 3354 | 279,2 | 231 | 19,2 |
| BOGOTA | 2709 | 72,1 | 271 | 7,2 |
| BOLIVAR | 1223 | 118,0 | 91 | 8,8 |
| BOYACA | 335 | 52,5 | 30 | 4,7 |
| CALDAS | 869 | 180,1 | 46 | 9,5 |
| CAQUETA | 484 | 204,4 | 26 | 11,0 |
| CASANARE | 376 | 211,5 | 18 | 10,1 |
| CAUCA | 901 | 130,1 | 47 | 6,8 |
| CESAR | 979 | 192,9 | 75 | 14,8 |
| CHOCO | 1029 | 415,7 | 36 | 14,5 |
| CORDOBA | 885 | 104,8 | 71 | 8,4 |
| CUNDINAMARCA | 970 | 73,7 | 61 | 4,6 |
| Territorial entities | Morbidity | Mortality | Territorial entities | Morbidity |
| | Cases | Adjusted rate | | Cases |
| GUAINIA | 43 | 217,6 | 2 | 10,1 |
| GUAVIARE | 96 | 167,7 | 1 | 1,7 |
| HUILA | 916 | 160,0 | 60 | 10,5 |
| GUAJIRA | 1208 | 262,3 | 98 | 21,3 |
| MAGDALENA | 853 | 135,3 | 60 | 9,5 |
| META | 1297 | 274,8 | 85 | 18,0 |
| NARIÑO | 584 | 67,5 | 52 | 6,0 |
| NORTE DE SANTANDER | 1272 | 190,9 | 82 | 12,3 |
| PUTUMAYO | 343 | 198,6 | 10 | 5,8 |
| QUINDÍO | 676 | 245,0 | 38 | 13,8 |
| RISARALDA | 1681 | 364,7 | 73 | 15,8 |
| SAN ANDRÉS | 39 | 102,4 | 1 | 2,6 |
| SANTANDER | 1729 | 170,6 | 109 | 10,8 |
| SUCRE | 240 | 56,2 | 20 | 4,7 |
| TOLIMA | 1272 | 180,8 | 91 | 12,9 |
| VALLE | 6008 | 271,5 | 365 | 16,5 |
| VAUPÉS | 39 | 182,2 | 3 | 14,0 |
| VICHADA | 72 | 208,2 | 0 | 0,0 |
| COLOMBIA | 41354 | 159,8 | 2530 | 9,8 |

**Table 2.** Rates of YLL, YLD and DALY for Tuberculosis in women by territorial entity, Colombia, 2010–2018*.

| Territorial entities | YLL rate (II 95%) | YLD rate (II 95%) | DALY rate (II 95%) |
|---|---|---|---|
| Amazonas | 1189,9 (381,7-2093,9) | 236,4 (197,6-285,4) | 1426 (725,4-2541,4) |
| Guajira | 915,4 (635,5-1175,8) | 85,7 (71,6-99,2) | 1001,1 (693,3-1260) |
| Atlántico | 676,1 (557,7-828) | 81,1 (61,7-100,5) | 757,2 (553,8-901,1) |
| Choco | 603,1 (348,5-928,8) | 138,4 (111,3-175) | 741,5 (543,9-1230,7) |
| Meta | 648,1 (483,1-804,6) | 91,7 (69,2-115,4) | 739,8 (607,3-907,7) |
| Risaralda | 599,4 (449,7-733,7) | 115,9 (92,8-134,8) | 715,3 (541,8-907,4) |
| Valle | 557,6 (461,2-648,6) | 85 (72,6-103,7) | 642,6 (534,9-783,8) |
| Cesar | 530,5 (422,2-696,3) | 64,7 (55,5-82,5) | 595,2 (460,9-737,7) |
| Antioquia | 428 (317,3-544) | 84,8 (68,6-108,8) | 512,8 (394,1-682,2) |
| Quindío | 432,6 (224,5-687,1) | 78,7 (58,4-97,4) | 511,3 (310,8-719,6) |
| Tolima | 433,8 (303,7-554,7) | 60,5 (46,7-76,2) | 494,3 (345,8-631,1) |
| Norte de Santander | 412,5 (303,1-530,1) | 62,5 (49,6-74,6) | 475,1 (360,1-570,2) |
| Caquetá | 403 (279,4-633,5) | 68,7 (54,2-92,9) | 471,7 (297,4-678,8) |
| Guaviare | 304,2 (0-608,9) | 161,5 (107,8-239,4) | 466,2 (108,3-1077,1) |
| Colombia | 370,1 (315,9-416,8) | 57,1 (42,6-67,8) | 427,2 (353-492,3) |
| Vaupés | 366,2 (0-844,6) | 60,3 (37,8-89,2) | 426,5 (114,4-824) |
| Magdalena | 378,1 (264,1-527,2) | 46 (34,7-57) | 424,2 (311,8-538,6) |
| Huila | 338,6 (245,1-480,2) | 53,7 (43,3-64,9) | 392,3 (280,5-517,7) |
| Territorial entities | YLL rate (II 95%) | YLD rate (II 95%) | DALY rate (II 95%) |
| Santander | 327,9 (264,2-381) | 55,5 (41,8-67,9) | 383,4 (317,3-455,2) |
| Arauca | 282,1 (156,2-450,9) | 77,8 (67,2-90,5) | 359,9 (198,9-509,8) |
| Caldas | 298,7 (233,9-351,3) | 45,5 (36,1-55,8) | 344,1 (291,2-405,4) |
| Córdoba | 308,4 (233,9-405,9) | 34,3 (29,1-42,6) | 342,7 (264,5-437,7) |
| Bolívar | 291,3 (192,1-432,7) | 39,3 (30,5-47,5) | 330,6 (220,5-463,8) |
| Casanare | 212,3 (52,7-397,9) | 72,7 (53,9-85,4) | 285 (140,2-396,3) |
| Cauca | 237,4 (141,6-329,5) | 44,5 (35,9-52,6) | 281,9 (196,2-413,5) |
| Putumayo | 190,1 (86,7-291) | 67,9 (48,2-85,4) | 257,9 (153,2-434) |
| Nariño | 222,1 (158,9-285,6) | 22,7 (16,8-26,8) | 244,8 (188,2-303,9) |
| Bogotá | 192,4 (158,5-228,6) | 25,4 (19,8-30,7) | 217,8 (168,5-263) |
| Sucre | 173,9 (104,3-271,1) | 19,2 (11,8-22,6) | 193,1 (121,6-309,2) |
| Guainía | 154,9 (0-305,2) | 27,2 (18,2-36,2) | 182,1 (21,6-492,2) |
| Boyacá | 152,3 (104,5-210,9) | 17,5 (13,5-21,5) | 169,8 (126,7-231,9) |
| Cundinamarca | 120,9 (79,9-161,4) | 24,4 (18,4-29,8) | 145,3 (110,1-188,9) |
| San Andrés | 44,4 (0-88,8) | 33,9 (19,7-46,2) | 78,3 (26,3-206,9) |
| Vichada | 0 (0-0) | 68,8 (46,6-97,7) | 69,1 (48-98,6) |

*Abbreviations: YYL: years of life lost to premature death; YLD: Years Lived with Disability; DALY: Disability Adjusted Life Years

**Table 3.** Negative Pearson correlation of DALY rates for Tuberculosis in women by territorial entity, Colombia, 2010–2018

| Territorial entities | Coefficient |
|---|---|
| Valle | -,843** |
| Colombia | -,671* |
| Cauca | -,601 |
| Magdalena | -,555 |
| Bogotá | -,550 |
| Meta | -,519 |
| Casanare | -,516 |
| Bolívar | -,448 |
| Quindío | -,444 |
| Amazonas | -,426 |
| Santander | -,360 |
| Antioquia | -,345 |
| Putumayo | -,339 |
| Córdoba | -,338 |
| San Andrés | -,290 |
| Chocó | -,279 |
| Nariño | -,267 |
| Guainía | -,172 |
| Norte de Santander | -,169 |
| Territorial entities | Coefficient |
| Boyacá | -,136 |
| Risaralda | -,113 |
| Vichada | -,095 |

*. The correlation is significant at level 0.05 (bilateral).
**. The correlation is significant at level 0.01 (bilateral).

## Discussion

This research presents for the first time for the subnational level of Colombia, the BD attributable to TB in women, measured with the updated methodology with which WHO performs the GBD.

What was found in the study against the low casuistry of TB reported in women, agrees with international studies[3], however, it is a significant cause of death among women aged 15-44 years worldwide. This may be the result of consistently lower diagnosis and reporting of TB in women, patterns of social contact[21] and low detection[22], due to differences in access and care, biological and behavioral factors[23], high-incidence environments[24], the possibility of underestimation of the load on them[25], among others.

TB mortality guides decision-making. Risk factors for TB mortality include late diagnosis, HIV positivity, among others. YLL rates are high and have subnational gaps, which poses a major challenge, considering regional disparities.

Amazonas and Guajira had the highest rates of fatal TB effects measured by YLL, consistent with previous mortality studies conducted in Colombia[7, 26]. This disparity may be contextually entrenched given the particularities of these regions, where factors such as multidimensional poverty, and unequal access to health care are critical. Most health inequalities within countries are explained by population density, income, education and occupation[27, 28]. These territories are highly rural, a higher risk for TB has been described in the literature in rural areas with unbalanced socioeconomic development[29]. The presence of indigenous population, whose living conditions, health inequalities and stigma can generate crises, is another factor to consider in future research. Other TE such as Vichada and Guaviare share similar geographical and population conditions, however, there are low or no reports of cases. In the case of Vichada, the underreporting of mortality in women, estimated for its vital statistics system, was 64%, while in men it was 49%, evidencing the possibility of underreporting of mortality from TB[30] in this entity. In addition to the above, in the BD study conducted for the Colombian Orinoquia, the rate of YLL in women from Vichada was 124.1 (II95% 9.9-366.9) for 2017, which may be due to the adjustment for completeness that was made in that study[6] that did not differentiate events, however, in our study Vichada did not report deaths.

These findings underscore the influence of the social environment on TB distribution and the need to identify economic and social barriers to accessing care, which in this study we cannot explore further, given the available data.

In terms of non-fatal effects of TB measured by YLD, Amazonas and Guaviare had the highest rates. These entities share structural and intermediate social determinants. Gender inequalities as a proximal determinant can interact with other determinants

**Table 4.** Positive Pearson correlation of DALY rates for Tuberculosis in women by territorial entity, Colombia, 2010–2018

| Territorial entities | Coefficient |
|---|---|
| Caquetá | ,719* |
| Cesar | ,716* |
| Guajira | ,546 |
| Huila | ,480 |
| Caldas | ,355 |
| Tolima | ,203 |
| Vaupés | ,155 |
| Arauca | ,138 |
| Sucre | ,131 |
| Guaviare | ,105 |
| Atlántico | ,039 |
| Cundinamarca | ,033 |

*. The correlation is significant at the 0.05 level.
**. The correlation is significant at level 0.01.

and respond to social norms, roles and status[26], where women face barriers such as stigma within the home, lack of financial independence, among others. Studies in Colombia show marked educational inequalities in women regarding TB[26], perhaps this is a likely explanation in these regions. Health literacy is considered an indicator of the use of health care services and low literacy can translate into underutilized preventive services[31]. Another explanatory route may be related to resilience [32] and that it has a direct relationship between its levels and positive health conditions[33]. The social permeability that captures the "mix" between ages and genders and patterns of traveling locals[34] it may be another figuration. Another hypothetical mechanism may be immunity compressed by prolonged exposure to psychosocial stress that induces physiological wear and tear and leads to decreased immune function[35].

The demographic structure of the population is known as a key determinant of the spread of infectious diseases[36]. The concentration of DALYs in women of childbearing age, which is also the economically active population, is a relevant finding given the increased likelihood of presenting TB-HIV coinfection and developing severe forms of TB[37, 38]. It is also important, due to the possibility of pregnancies in this age group. Pregnancy leads to a state of relative immunosuppression and a theoretically increased probable susceptibility to activation or infection by intracellular microbes such as TB-causing *Mycobacterium tuberculosis*[39]. Another hypothesis could be that the burden of domestic work and childcare is added, which allows them little time to access medical care, which leads to a greater BD.

Although this research did not contemplate differential analysis between pregnant women or women with newborn children, it is a relevant factor to consider for future research. This is due to the fact that being mothers with TB they have a higher risk of transmitting the infection to the child, increasing the risk of complications due to prenatal care and postnatal morbidity, a situation reported especially in developing countries[40]. Another important aspect is related to the importance of the carcinogenic effect of TB, considering that 1.61% of cancers could be attributed to TB[41], so the burden of TB in women should raise awareness about it.

Territorial differences show data of success or progress in some that reflect, at least hypothetically, improved participation of community organizations and workers, as well as the involvement of the private sector expanding TB care. Likewise, entities that show a stagnation or tendency to decrease, perhaps due to the seriousness of their social problems or the deficit of institutional or programmatic capacities, prevent them from facing the burden they have, as well as the differences between the needs of citizens and the improvement of capacities for their approach[42]. Another explanatory route for these regional discrepancies may be differences in environmental, demographic, behavioral, and socioeconomic factors, which may include inadequate accessibility to health services and housing conditions[43]. Perhaps the differences between regions such as Valle and Caquetá are due to less access to treatment and prevention services given cultural norms and inequalities, delays in diagnosis and the lower effectiveness of services due to stigmatization[44], the difficulties of integrating TB services with services such as sexual and reproductive, maternal and child health, deterrence due to low privacy or lack of childcare facilities, among others. In a study carried out in four Colombian cities, including the capitals of Valle and Caquetá, it was found that, for example, there is a perception that TB does not exist in Caquetá, which could, together with what has been described above, explain the differences found[45]. This same study shows in the Valley the creation of intersectoral alliances, monitoring and follow-up to the strategic plan, research and knowledge management, strategies such as community peers and positioning of the process, a situation not reported for Caquetá.

Given the focus of screening commonly towards areas with high rates of case reporting, disparities can be exacerbated by excluding areas that already face barriers to accessing diagnostic services.

Social permeability as an important factor could be explored further, integrating community-level typologies with genomic techniques to map the introduction of strains and chains of community transmission. A regionally balanced and culturally appropriate approach is needed, which, together with the performance of screening as a tracer indicator, helps programmes prioritize areas where screening activities can have the greatest impact. It is essential to integrate the most vulnerable groups, address and remedy social inequalities and, intersectorally, positively mobilize the social determinants of health, given the paradigm of TB as an infectious disease with a high social component.

Finally, the research described here is important to fill the knowledge gap on the use of DALYs as a composite indicator, which in addition to resolving the antagonisms for decision-making generated by simple indicators, unifies the quantification in the same unit of measurement of morbidity as a suboptimal health status and mortality as the time lost when dying before reaching life expectancy[6]. Additionally, to fill the knowledge gap on finding the causes of subnational gaps in TB disease burden in women.

The findings of this study may allow the planning of effective interventions that consider differences in women's habits and risk factors. They also underscore the importance of considering gender, ethnic and socioeconomic differences in the formulation of public policies for TB control. It can build on the analysis and results of this research and, consequently, reorient current policies or implement public policies, to improve health and eliminate disparities in women.

The possible limitations of this research may be related to the use of secondary data, which as far as possible, were solved with the validation process and bias control.

## Ethical considerations

This study met all the requirements of Resolution 8430 of 1993 for health research in Colombia. Access was granted to the authors under the terms of article 10 of Law 1581 of 2012 and under the legal considerations indicated by the Constitutional Court in judgment C748 of 2011. Confidentiality was safeguarded by not using names or identity numbers.

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**Conflicts of interest.** The authors declare that they have no conflict of interest

**Authors contribution.** LP designed the study, obtained the databases from the Ministry of Health and Social Protection, examined the databases for analysis, and carried out the statistical analyses led by OG. LP, OG and FC interpreted the results, prepared, reviewed, and wrote the manuscript. All authors reviewed the manuscript and approved the final version. All authors have read and agreed to the published version of the manuscript.

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