

# Burden and magnitude of risk in HIV/AIDS in the Colombian health system: a real-world data approach

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## Abstract

**Aim:** To assess the epidemiological situation of people living with HIV and AIDS (PLWHA) in the municipalities and regions of Colombia in 2018.

**Materials and methods:** A cross-sectional study was conducted with secondary data from the High-Cost Diseases Fund from February 1<sup>st</sup>, 2018 to January 31<sup>st</sup>, 2019. We included sociodemographic, clinical variables, and related to geographic location. We calculated incidence, prevalence, and mortality according to the Colombian geographical regions, department and municipality of residence. Crude and age-standardized rates were estimated.

**Results:** By 2018, 10,930 new cases of PLWHA were reported, being more frequent in males, aged between 25 to 49 years. 39.32% were reported with AIDS and 35.27% had undetectable HIV viral load. During 2018, there are 109,056 PLWHA in Colombia. The highest age-standardized incidence and prevalence were reported in Florencia (Cauca) (354.28 per 100,000 and 3.32 per 100people, respectively). The age-standardized incidence rate was 22.12 per 100,000 population (95% CI 21.71-22.54). Age-standardized prevalence and mortality were 0.23 per 100 population (95% CI 0.22-0.23) and 3.78 per 100,000 population (95% CI 3.61-3.96), respectively.

**Conclusion:** Different strategies should be implemented to improve the identification of risk factors in the population, especially in some regions of Colombia and prevent transmission.

**Keywords:** epidemiology, AIDS, HIV, prevalence, mortality, Colombia.

## Carga y magnitud del riesgo en VIH/SIDA en el sistema de salud colombiano: enfoque de datos del mundo real

## Resumen

**Objetivo:** Evaluar la situación epidemiológica de las personas que viven con el VIH y el SIDA (PVVS) en los municipios y regiones de Colombia en 2018.

**Materiales y métodos:** Se realizó un estudio transversal con datos secundarios del Fondo Colombiano de Enfermedades de Alto Costo entre febrero 1 de 2018 al 31 de enero de 2019. Incluimos variables sociodemográficas, clínicas y relacionadas con la ubicación geográfica. Calculamos la incidencia, prevalencia y mortalidad según la región geográfica colombiana, el departamento de residencia y el municipio. Se estimaron tasas crudas y estandarizadas por edad.

**Resultados:** Para el 2018, 10.930 nuevos casos de PVVS fueron reportados, siendo más frecuentes en hombres, en edades entre 25 a 49 años. 39.32% fueron reportados con SIDA y 35.27% tuvieron una carga viral de VIH indetectable. 109.056 PVVS en Colombia. Las incidencia y prevalencia ajustadas por edad más altas se informaron en Florencia (Cauca) (354.28 por 100,000 y 3.32 por 100 personas, respectivamente). La tasa de incidencia estandarizada por edad fue de 22.12 por 100,000 habitantes (IC 95% 21.71-22.54). La prevalencia y mortalidad ajustadas por edad fueron 0.23 por 100 habitantes (IC 95% 0.22-0.23) y 3.78 por 100.000 habitantes (IC 95% 3.61-3.96), respectivamente. Se deben implementar diferentes estrategias para mejorar la identificación de los factores de riesgo en la población, especialmente en algunas regiones geográficas de Colombia y prevenir la transmisión.

**Palabras clave:** epidemiología, SIDA, VIH, prevalencia, mortalidad, Colombia.

## Introduction

Colombia is located in the north of South America, is the third-largest in the Latin America region, with 48 million inhabitants<sup>1</sup>, of which 77.1% live in the capital cities. As of June 28, 2019, the country's political and administrative division is:

32 departments, 1,101 municipalities, and island (San Andrés, Providence and Santa Catalina) and 20 non-municipal areas. Additionally, departments are grouped into six geographical regions: Caribbean, Central, Pacific, Eastern, and Bogotá C.D. defined by the National Administrative Department of Statistics (DANE, by its acronym in Spanish)<sup>2</sup>.

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Recibido: 16/08/2020; Aceptado: 13/11/2020

Cómo citar este artículo: S.J. Trujillo-Cáceres, *et al.* Burden and magnitude of risk in HIV/AIDS in the Colombian health system: a real-world data approach. Infectio 2021; 25(3): 163-168

According to the latest data related with the 90-90-90 targets in Latin America the 80% (62 - >95%) of people living with HIV and AIDS (PLWHA) knew their status, 62% of PLWHA accessed to antiretroviral therapy (ART), and 55% were virally suppressed<sup>3</sup>, which may translate that the region has additional challenges.

By 2018, in Latin America there were an estimated of 100,000 (79,000 – 130,000) people with acquired HIV, a 7% increase compared with 2010. The highest increases were observed in Chile (34%) and Bolivia (22%) and the lowest in El Salvador (-48%). In Colombia there are 160,000 (130,000 – 180,000) PLWHA and ranks the third among countries with the lowest rates of HIV infection (incidence per 1,000 population: 0.14 (95% CI 0.10-0.19)). The region's incidence-prevalence ratio continues to decrease, reaching 5.4% (95% CI 4.1-6.8%), but many efforts are needed to reach the 3.0% epidemic transition benchmark<sup>3</sup>.

In Colombia, the health system is funding by public and private sources, and its coverage is closer to 96% of the total population, the remaining 4% is grouped under individual insurance. There are two insurance regimes, and both of them include the same services, procedures, medicines, and interventions. However, different health payers are responsible for managing resources and paying to healthcare providers<sup>4</sup>.

Since the implementation of the national registry of HIV/AIDS managed by the High-Cost Diseases Fund (CAC, by its acronym in Spanish) in 2011-2012 and actualized within the framework of the national resolution 0273 (2019), 109,056 prevalent cases and 10,930 new cases of HIV have been reported until 2019<sup>5</sup>. We aim to assess the epidemiological situation (incidence, prevalence, and mortality) of PLWHA in the municipalities and geographical regions of Colombia during 2018.

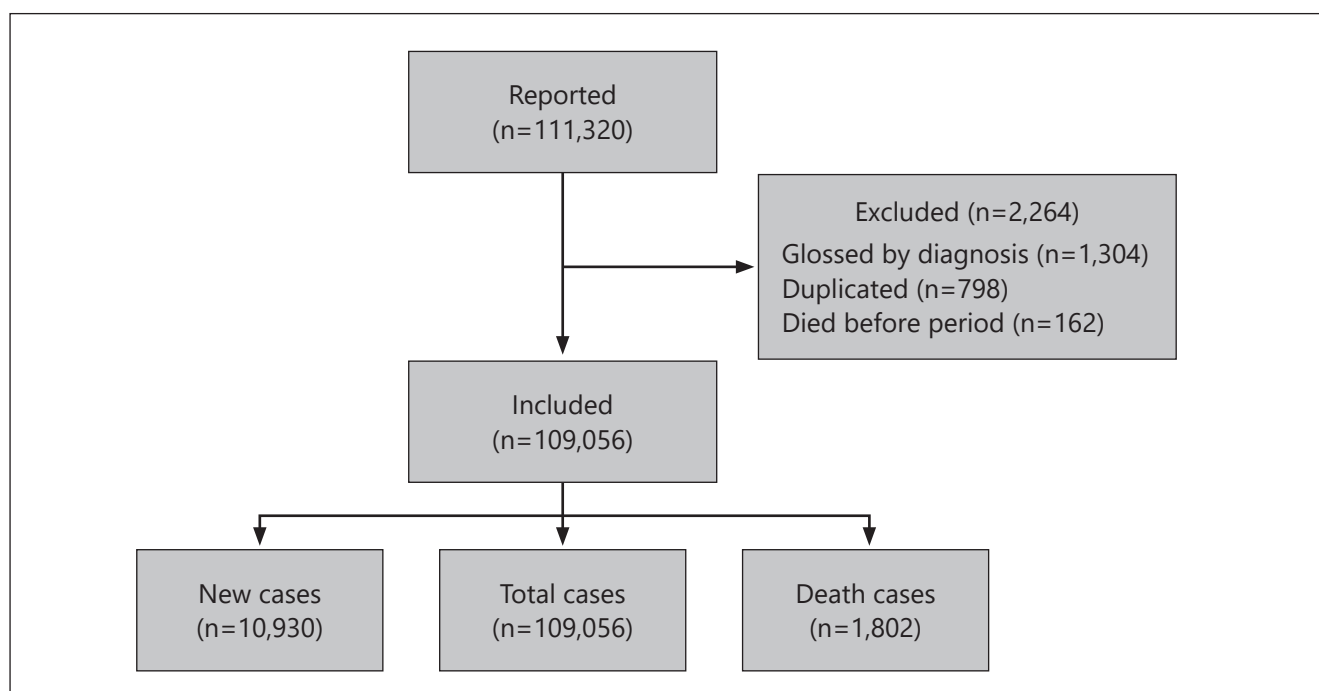
## Materials and methods

We performed a cross-sectional study with secondary data sources, including the information of PLWHA reported to the CAC from February 1<sup>st</sup>, 2018 to January 31<sup>st</sup>, 2019, by their health payers and providers.

Health providers must collect annual data from their affiliates to update the information on a web platform, which was designed to validate the structure, coherence and consistency of the data. Once the information is reported, a cross-checking with other official sources of vital statistics and the affiliation of PLWHA to the health system with the "Unique Affiliate Database" (BDUA, by its acronym in Spanish) is performed.

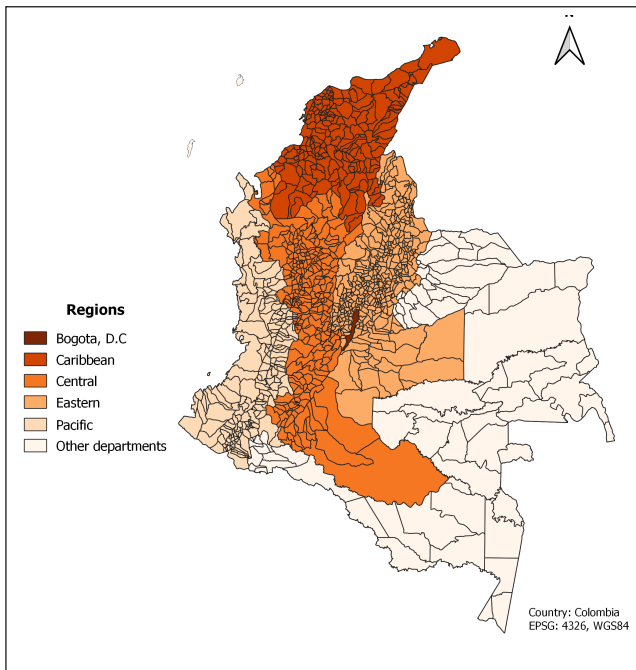
A data monitoring process is used to validated that the information uploaded to the platform corresponds to the electronic/printed medical records. This ensures that the information reported corresponds to described in the supports. We included all confirmed cases with HIV, classified according to the clinical practice guidelines for the care of HIV of the Ministry of Health and Social Protection (MSPS, by its acronym in Spanish)<sup>6,7</sup>.

If the information reported is different from the observed, the data available in the supports were captured and corrected in the database; otherwise, when the data cannot be found in medical records was considered as missing. To ensure the anonymization of the PLWHA, a unique number was assigned, which also made it possible to include unique registries to estimate the epidemiological indicators. People who died before of the beginning of the period and those without a confirmed diagnosis of HIV/AIDS were excluded from the analysis (Figure 1).



**Figure 1.** Flow chart of cases included in the analysis

We included sociodemographic variables, e.g., age and sex, and related to location: geographical region (classification given by DANE) according to the gross domestic product of the departments (Figure 2), as well as department and municipality of residence; variables related to the clinical condition were the current clinical status of the disease, CD4 T cells counts- and HIV viral load. Variables were analyzed with measures of central tendency according to their marginal distribution. Categorical data were presented as absolute values and proportions.



**Figure 2.** Distribution of geographical regions of Colombia according to DANE, 2018.

We calculated the three main epidemiological indicators: incidence, prevalence and mortality. HIV incidence was defined as PLWHA, whose infection diagnosis date occurred within the reporting period, and prevalence was defined as people diagnosed with HIV and reported during the period. Finally, to estimate the mortality, deaths were identified by using the administrative information reported by the providers, and verified in the single register of affiliates from the MSPS. All of these indicators were estimated according to the Colombian geographical regions, department and municipality of residence, highlighting the places with the highest rates.

Crude and age-standardized rates were calculated by using the direct method, taking the Colombian population projected by DANE ( $n = 49,834,240$ ) until July 2018 as the reference. National estimations were standardized using the world population projected by the United Nations for Latin America and the Caribbean for 2020(8). Morbidity and mortality indicators were plotted using QGIS 3.12 (Open Source Geospatial Foundation). STATA version 13.0 (STATA Corp, College Station, Texas, USA) was used to the statistical analysis. Ac-

cording to resolution 8430 of 1993 of the MSPS of Colombia, this investigation has no risk, and not intervention was carried out. However, the confidentiality and anonymization of the information was guaranteed.

## Results

### *HIV incidence in 2018*

In 2018, 10,930 new cases of PLWHA were reported. A summary of the characteristics of the study population is provided in Table 1. PLWHA frequency was higher in males, aged between 25 to 49 years. The median age was 30 years (IQR 24 – 40). Regarding the clinical status, 39.32% ( $n = 4,298$ ) cases were reported with AIDS (stage 3) and 35.27% ( $n = 3,855$ ) had undetectable HIV viral load.

The national age-standardized incidence rate was 22.12 per 100,000 population (95% CI 21.71-22.54). The highest incidence rates were estimated in Bogotá, C.D. and Central regions, which were even higher than the national (Table 2). The five municipalities in Colombia that reported the highest incidence were: Florencia (Cauca) 354.28 per 100,000 (95% CI 106.1-766.89), Barranca de Upía (Meta) 251.10 (95% CI 49.03-852.66), Magangué (Bolívar) 228.53 (95% CI 195.24-266.02), Armenia (Antioquia) 161.41 (95% CI 63.78-340.37) and Aguada (Santander) 128.96 (95% CI 3.26-662.27). Figure 3A shows the municipalities with a higher incidence. In contrast, the lowest incidences were observed in Madrid (Cundinamarca), Cimitarra (Santander), and Potosí (Nariño). The supplementary table 1 describes the data for the 1,122 municipalities in Colombia.

### *HIV prevalence in 2018*

The total number of cases reported in 2018 was 109,056 PLWHA, being more frequent in males, aged between 25 to 49 years. The median age was 38 years (IQR 30 – 49). The geographical region with the highest prevalence was the Central. Regarding the clinical status, 56.4% ( $n = 61,505$ ) cases had AIDS (stage 3). Nevertheless, the highest proportion of PLWHA (63.9%;  $n = 69,682$ ) had undetectable HIV viral load (Table 1).

The age-standardized prevalence was 0.23 per 100 people (95% CI 0.22-0.23), with an increase of 13% in the number of cases compared to 2017. The highest prevalence were estimated in Bogotá, C.D., and Central regions and, were even higher than the national (Table 2). The five municipalities in Colombia that reported the highest prevalence were: Florencia (Cauca) 3.32 (95% CI 2.79-3.91), Magangué (Bolívar) 2.14 (95% CI 2.04-2.24), Armenia (Antioquia) 1.73 (95% CI 0.91-2.82), Santiago (Norte de Santander) 0.93 (95% CI 0.12-2.64) and Armenia (Quindío) 0.92 (95% CI 0.85-0.98). Figure 3B shows the municipalities with a higher prevalence. 14.17% of municipalities did not report cases with HIV (supplementary material, table 1).

**Table 1.** Clinical and sociodemographic characteristics of people living with HIV in Colombia, 2018

Characteristics	Incident cases		Prevalent cases		Deaths	
	n	%	n	%	n	%
<b>Sex</b>						
Female	2,020	18.48	26,348	24.16	456	25.29
Male	8,910	81.52	82,697	75.83	1,346	74.65
Intersexual	0	0.00	11	0.01	1	0.06
<b>Age group (years)</b>						
Less than 2	10	0.09	24	0.02	0	0.00
2 - 14	42	0.38	860	0.79	7	0.39
15 - 24	2,830	25.89	10,250	9.40	82	4.55
25 - 49	6,726	61.54	72,352	66.34	1,069	59.29
≥ 50	1,322	12.10	25,570	23.45	645	35.77
<b>Region<sup>a</sup></b>						
Bogotá, D.C.	2,278	20.84	24,994	22.92	247	13.70
Caribbean	2,463	22.53	23,889	21.91	529	29.34
Central	3,000	27.45	30,154	27.65	478	26.51
Eastern	1,215	11.12	11,875	10.89	196	10.87
Pacific	1,794	16.41	16,622	15.24	312	17.30
Other departments	180	1.65	1,522	1.40	41	2.27
<b>Current clinical status at diagnosis</b>						
Stage 0	71	0.65	214	0.20	2	0.11
Stage 1	2,198	20.11	30,422	27.90	264	14.65
Stage 2	4,101	37.52	33,889	31.07	328	18.20
Stage 3	3,807	34.83	39,435	36.16	1,029	57.10
Not date	753	6.89	5,096	4.67	179	9.93
<b>Current viral load (patient with ART and viral load in the last six months)</b>						
< 50 copies	3,352	42.35	55,727	75.28	112	37.84
≥50 copies to ≤200 copies	1,038	13.11	5,896	7.96	24	8.11
>200 to ≤1000 copies	639	8.07	3,185	4.30	17	5.74
> 1000 copies	2,886	36.46	9,220	12.45	143	48.31
<b>On ART</b>						
Yes	8,639	79.04	91,344	83.76	1,031	57.21
Not	2,291	20.96	17,712	16.24	771	42.79

<sup>a</sup> The regions in Colombia are made up of departments. Departments are formed by a grouping of municipalities. The grouping of regions depends on the department's gross domestic product (GDP) and is available in annual reports from the DANE (Departamento Administrativo Nacional de Estadística) (2). Geographical regions are: Bogotá, D.C.; Caribbean: Atlántico, Bolívar, Cesar, Córdoba, La Guajira, Magdalena and Sucre; Central: Antioquia, Caldas, Caquetá, Huila, Quindío, Risaralda and Tolima; Eastern: Boyacá, Cundinamarca, Meta, Norte de Santander and Santander; Pacific: Cauca, Chocó, Nariño and Valle del Cauca; Other departments: Amazonas, Arauca, Casanare, Guainía, Guaviare, Putumayo, San Andrés, Vaupés and Vichada.

## HIV mortality in 2018

In 2018, 1,802 deaths were reported in PLWHA. The characteristics of people who died during the period are provided in Table 1. Mortality was higher in males, aged between 25 to 49 years. The median age was 43 years (IQR 34 – 55). Regarding the clinical status, 84.35% (n=1,520) had AIDS. The majority of cases had no measurement of the last viral load (42.01%; n=757) and 42.51% (n=766) did not received ART.

The age-standardized mortality rate was 3.78 per 100,000 population (95% CI 3.61-3.96), with an increase of 56.4 % in the number of deaths compared to 2017. The highest mortality rates were estimated in the Caribbean and Central regions, which were even higher than the national (Table 2). The five municipalities in Colombia that reported the highest mortality were: Armenia (Antioquia) 283.08 (95% CI 8.07-1,067.90), Salado blanco (Huila) 141.13 (95% CI 3.57-542.00), Morales (Bolívar) 113.94 (95% CI 13.80-324.36), Vigía del Fuerte (Antioquia) 94.22 (95% CI 3.54-347.12) and Calamar (Guaviare) 78.97 (95% CI 9.56-260.47). Figure 4 shows the municipalities with the highest mortality. Moreover, the municipalities with the lowest mortality were Patía (Cauca), Santa Rosa del Sur (Bolívar), and Piendamó (Cauca) (supplementary material, table 1).

## Discussion

In 2018, there was a slight increase of almost 7% in the number of newly detected HIV infections compared with 2017<sup>3</sup>. The estimated prevalent cases of HIV in 2019, reported by the MSPS through the Spectrum tool, was 157,702 from those, only 69.15% (n=109,056) were reported to the CAC. The final number of PLWHA may be higher. Regarding incident cases, around 10,000 new cases were reported to the CAC and were attended by the health system, while, the Institute of National Health-INH estimated 15,908 new HIV cases by 2019<sup>9</sup>.

The observed gap could be explained because while the CAC records the information provided by the health insurers, the INH performs the epidemiological surveillance of the newly diagnosed cases. This difference can be given by under-registration or the inability of the health system to linkage to care and retain the newly diagnosed HIV population. It is important to highlight that Colombia has a registry of all PLWHA treated within the framework of the health system, established by a resolution from the MSPS and all health insurers in cooperation with their healthcare providers must report all cases to the CAC; for this reason, our approach does not incorporate methodologies such as UNAIDS, which are based on estimates or mathematical models<sup>10,11</sup>.

The HIV infection was more frequent in municipalities located in four of six regions of Colombia. The highest age-standardized incidence and prevalence were reported in Florencia (Cauca) (354.28 per 100,000 and 3.32 per 100 persons, res-

**Table 2.** Epidemiological indicators of HIV/AIDS in Colombia, 2019

Indicator	Geographical region	Crude	Age-standardized rate	95% CI
Incidence*	<b>Bogota, D.C.</b>	<b>27.84</b>	<b>27.17</b>	<b>(26.06-28.31)</b>
	<b>Caribbean</b>	<b>22.83</b>	<b>23.61</b>	<b>(22.68-24.56)</b>
	<b>Central</b>	<b>24.31</b>	<b>24.29</b>	<b>(23.43-25.18)</b>
	Eastern	14.15	14.24	(13.45-15.06)
	Pacific	21.12	20.96	(20.00-21.95)
	Other departments	12.47	12.85	(11.02-14.90)
Prevalence**	<b>Bogota, D.C.</b>	<b>0.31</b>	<b>0.28</b>	<b>(0.28-0.29)</b>
	Caribbean	0.22	0.23	(0.23-0.24)
	<b>Central</b>	<b>0.24</b>	<b>0.24</b>	<b>(0.23-0.24)</b>
	Eastern	0.14	0.14	(0.13-0.14)
	Pacific	0.20	0.19	(0.19-0.20)
	Other departments	0.11	0.12	(0.11-0.12)
Mortality*	Bogota, D.C.	3.01	2.75	(2.41-3.11)
	<b>Caribbean</b>	<b>4.90</b>	<b>5.28</b>	<b>(4.84-5.75)</b>
	<b>Central</b>	<b>3.87</b>	<b>3.80</b>	<b>(3.45-4.16)</b>
	Eastern	2.28	2.29	(1.98-2.63)
	Pacific	3.67	3.65	(3.25-4.09)
	Other departments	2.84	3.37	(2.41-4.59)

\*Per 100,000 population

\*\* Per 100 population

pectively). Among those municipalities, we found that almost 60% of cases had AIDS (stage 3); the above indicates delays in linkage-to-care of people with HIV for early detection as well as the continued risk of onward transmission. If the goals of 90-90-90 are considered, it is evident that Colombia has a limitation in achieving especially the first 90 related to diagnose at least 90% of the infected population. Also, the fact of detecting people when they are already in an advanced stage (34% of incident cases and 54% of people who died) should be an alert to establish early detection programs that include new test and treatment strategies.

According to mortality data, municipalities in the Central region had the highest mortality rates: Armenia (Antioquia) 283.08, Saladoblanco (Huila) 141.13, and Vigia del Fuerte

(Antioquia) 94.22 per 100,000. These results may be explained because most cases were diagnosed in stage 3 (84.35%) and had a viral load  $\geq 1000$  copies/ml. It is important to note that in general, PLWHA, once they are admitted in HIV care programs, maintain a high rate of virological success (viral load  $<200$  copies / ml) (83%).

Regarding the geographical location of PLWHA in Colombia, previous studies have described the HIV epidemic as a disease affecting the entire country<sup>12</sup>. In our study, the trends in all the indicators are consistent in the three major regions, and geographical differences may be explained by ethnic and cultural factors and their relationship with sexual behavior<sup>13</sup>.

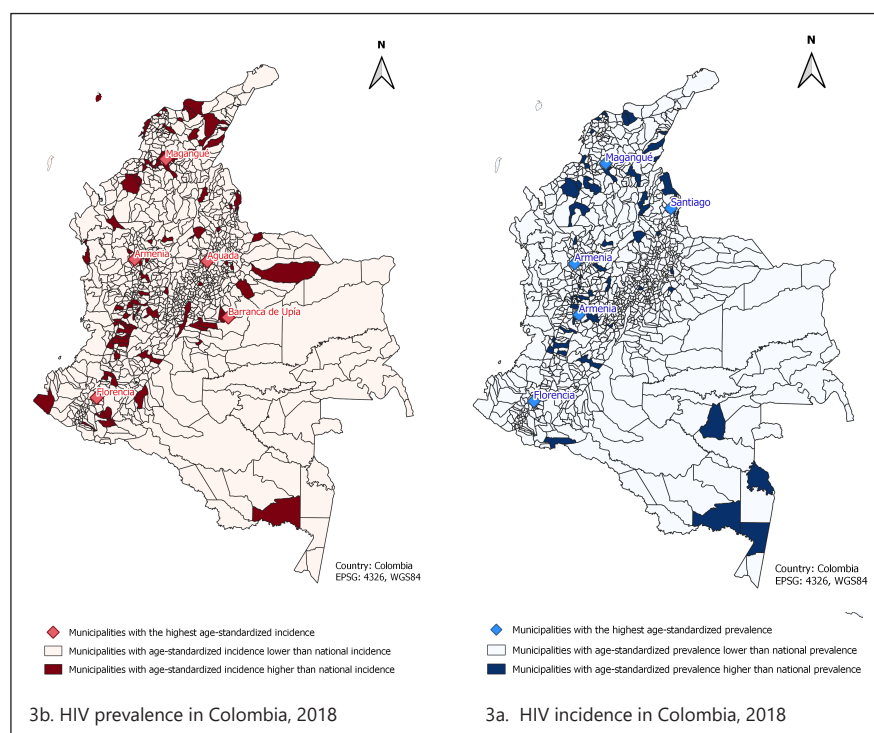
On the other hand, there is a high proportion of people who did not receive ART (20.96%; 16.24% and 42.79% in incident, prevalent and death population, respectively). Therefore, emphasis should be placed on the initiation and retention of highly active antiretroviral therapy (HAART). Reasons to explain that patients have no HAART are various, from lack of adherence, administrative purposes, and not offered by practitioners. The last reason is due to the current clinical practice guideline is outdated and requires an update including the best evidence available<sup>6,7</sup>.

Some strengths of the study will be discussed. Taking into account that HIV/AIDS is considered a high-cost disease of public health interest in Colombia, PLWHA must be reported by their health care insurers and providers to the administrative registry managed by the CAC and, that ensures the completeness of the data. The mandatory nature of the reporting process also allows an epidemiological and clinical follow-up based on real-world information. In addition, there is a competitive compensation mechanism within the health system that obliges insurers to report the variables requested by regulation and allows the characterization of the population with HIV. Among other strengths, data is verified by a data monitoring process against clinical records. Further, information reported to the CAC is one of the sources that MSPS provides to international initiatives such as GAM (Global AIDS Monitoring 2020 – Indicators for monitoring the 2016 United Nations Political Declaration on Ending AIDS)<sup>14</sup>.

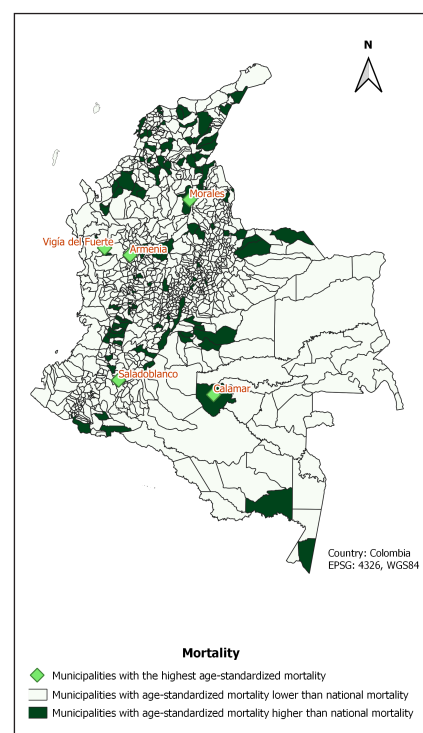
Our estimations could be limited due to under-reporting effect. In fact, we only have the information reported for people enrolled with an authorized public or private insurance agency of the national healthcare system.

Our results allow identifying the geographical and clinical characteristics of PLWHA as well as the epidemiological situation (incidence, prevalence, and mortality) in Colombia. While there are 14% of the municipalities without HIV cases, it is necessary to keep the infection under control and to strengthen the reporting process to the CAC in order to





**Figure 3.** Distribution of HIV incidence and prevalence in Colombia, 2018; 3a. HIV incidence in Colombia, 2018; 3b. HIV prevalence in Colombia, 2018



**Figure 4.** HIV mortality in Colombia, 2018

avoid the under-reporting. Furthermore, future work is needed to integrate data from different sources and follow-up programs within the primary care<sup>15</sup>.

Finally, different strategies should be implemented to improve early detection of risk factors and prevent transmission, emphasizing on specific protection activities and monitoring other sexually transmitted infections. Also early detection strategies guarantee a timely linkage-to-care programs and avoid delays in ART initiation<sup>(16)</sup>.

## Ethical disclosure

**Acknowledgements.** The authors would like to thank the health payers and providers for data report. As well as, to the technical teams of audit and information coordination of the High Cost Diseases Fund to ensure the report and the quality of the data.

**Protection of human and animal subjects.** This research do not use animal nor human material or data.

**Confidentiality of data.** The confidentiality and anonymization of the information was guaranteed.

**Conflicts of interest.** The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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