Patient Characteristics and Determinants of CD4 at Diagnosis of HIV in Mexico from 2008 to 2017: A 10-Year Population-Based Study

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Title Page

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ABSTRACT (280 words- 350 allowed)

Background: Worldwide, around 37.9 million people are living with HIV, of which 220,000 live in Mexico. In 2007-2012 the Mexican government launched the National HIV program and there was a major change in HIV policies implemented in 2013-2018, when efforts focused on prevention, increase in early diagnosis and timely treatment. Thus, the objectives of this study were to identify the determinants of late HIV diagnosis (i.e. CD4 count less than 200 cells/mm$^{3)}$ in Mexico from 2008 to 2017 and to evaluate the impact of the 2013-2017 National HIV program.

Methods: Using patient level data from the SALVAR database, which includes 64% of the population receiving HIV care in Mexico, an adjusted logistic model was conducted. Main study outcomes were HIV late diagnosis which was defined as CD4 count less than 200 cells/mm3 at diagnosis.

Results: the study included 106,830 individuals newly diagnosed with HIV and treated in Mexican public health facilities between 2008 and 2017 (mean age: 33 years old, 80% male). HIV late diagnosis decreased from 45% to 43% (P <0.001) between 2008-2012 and 2013-2017 (i.e. before and after the implementation of the 2013-2017 policy). Multivariable logistic regressions indicated that being diagnosed between 2013-2017 (odds ratio [OR]= 0.96 [95% Confidence interval [CI]: [0.93, 0.98]) or in health facilities specialized in HIV (OR=0.64 [95% CI: 0.60, 0.69]) was associated with early diagnosis. Being male, older than 29 years old, diagnosed in Central East, the South region of Mexico or in high-marginalized locality increased the odds of a late diagnosis.

Conclusions: The results of this study indicate that the 2013-2017 National HIV program in Mexico has been marginally successful in decreasing the proportion of individuals with late HIV diagnosis in Mexico.

Keywords: HIV, Late diagnosis, Mexican *SALVAR*.

[Word count 3,022 including heading and subheadings. excluding references, tables, and figures]

BACKGROUND

Worldwide, more than 37.9 million people are living with HIV (PLWH) of which around 220,000 live in Mexico (1,2). In Mexico and elsewhere, the number of individuals diagnosed with HIV has increased during the last decade due to more transmission as well as disease awareness and the implementation of programs aimed to identify people at the early stage of the disease (3). In 2019, approximately 17,000 Mexicans were diagnosed with HIV, most of them were male (85%), between the ages of 25-39 years (70%) and contracted HIV due to sexual contact (71%) (4). Recognizing the problem as a public health matter, the Mexican government established twenty years ago different programs to improve HIV national indicators and the overall health of PLWH. In the beginning, efforts were focused on prevention for high risk populations (5), and the implementation of rapid testing aimed at pregnant women (2). An important improvement in HIV policies happened in 2003 when the Mexican government expanded the coverage of HIV treatment and care in public health facilities to people who were unemployed and individuals from the informal sector (6,7). In 2007, the National HIV program targeting prevention of HIV transmission in key high-risk populations -e.g. men who have sex with men , sexual workers- was launched and was in effect for 5 years (2,5). A major change in HIV policies in Mexico was observed in 2013 when the 2013-2018 National HIV program was implemented with the mandate to expand efforts beyond the prevention of HIV transmission among high-risk populations to include populations at a lower risk (e.g. young people and women) and to increase early diagnosis and timely treatment (8). One of the key objectives of the 2013-2018 National HIV program was to decrease the percentage of individuals diagnosed with a late HIV diagnosis to 30% in 2017. To support these efforts, the HIV budget also doubled and additional resources were

allocated to improve HIV care across Mexico (9,10). For example, the number of HIV facilities outside of Mexico City increased from 49 in 2007 to 137 in 2017 (3,11).

Timely diagnosis and initiation of antiretroviral therapy are crucial to ensure optimal health outcomes among PLWH (12). However very few studies have been conducted to evaluate the impact of Mexican HIV policies on outcomes. For example, one study reported that in 2012 (5 years after the implementation of 2007-2012 HIV national program), more than half of patients died within six months after diagnosis, and the main factor associated with death was a late diagnosis (13). More recent government reports have documented that the percentage of individuals diagnosed with less than 200 CD4 cells/mm^3 decreased from 50% to 40% between 2015 and 2018 (14,15), suggesting a positive impact of the HIV policy in Mexico. However, only one study has examined the predictors of late diagnosis in Mexico using data from 2007 to 2014. While results indicate that men and older adults (more than 50 years old) were at a higher likelihood of late diagnosis (12) compared to the general population, this situation may have changed following the modifications in HIV policies that happened in Mexico after 2013. To better identify people at high-risk for a late diagnosis, and to inform further policies and strategies in Mexico to reach these people early, the main objectives of this study were to identify the determinants of late HIV diagnosis in Mexico between 2008 and 2017 and to evaluate the impact of the 2013-2017 National HIV Program.

METHODS

Study design

The design was a retrospective population-based cohort study using Mexican administrative health data from the antiretroviral therapy administration, logistics, and surveillance system (*Sistema de Administración, Logística y Vigilancia de Antirretrovirales - SALVAR* for its acronym in Spanish).

Data source

The *SALVAR* database is an electronic system created in 2006 by the National Center for the Prevention and Care of HIV/AIDS to manage the clinical information of PLWH enrolled in the HIV/AIDS program led by the Mexican Ministry of Health (approximately 64% of all PLWHs in Mexico). While *SALVAR* was developed in 2006, it was not until 2008 that it was operational across Mexico. Currently, the system contains information on more than 172,000 Mexicans living with HIV (15).

Study population

The study population includes adults (18 years or older) diagnosed with HIV between January 1st, 2008, and December 31st of 2017 in health facilities affiliated to the Ministry of Health. Pregnant women, children, people who are incarcerated, and people receiving antiretroviral prophylaxis were excluded from the analyses. Individuals with incomplete information on gender, age, date of diagnosis, and results of the first measurement of Viral Load (VL) and CD4 were also excluded.

Study outcomes

The primary outcome of the study was HIV late diagnosis which was defined as CD4 count less than 200 cells/mm^3 at the first measure reported in *SALVAR*. Secondary outcomes included CD4 cell count at time of diagnosis, CD4 cell count stratified based on WHO recommendations: less than (<) 200, 200-349, 350-499 and, equal or more than (≥) 500 cells/mm^3 (16), and VL at time of diagnosis stratified as VL ≤100,000 units by milliliters of blood (u/ml) and more than 100,000 u/ml (17) for descriptive proposes. For CD4, a lower limit of zero and an upper limit of 2,000 cells/mm^3 was established based on clinical literature (12,18,19).

Independent variables

Age was described as a continuous variable reporting the mean and median, also age was categorized in groups (18-29, 30-39, 40-49, 50-59, and ≥60 years old). Gender was stratified as male, female, and transgender. Characteristics related to health facilities were also included. For the purpose of the study, Mexico was divided into five regions (13,20) (Central West, Central East, Northwest, Northeast, and South) and Mexico City was also counted as an additional region due its large population (25% of Mexicans live in Mexico City) and distinct structural characteristics. In addition, marginalization indices (12,21) grouped into three categories (high/ very high, medium and very low/low) were used to capture social and economic differences by locality of the health facilities where care is provided. Health facilities in which diagnosis and care are provided were described in terms of 1) Hospitals and National Institutes that provides primary and specialty care in a tertiary level hospital; 2) Ambulatory Centers for Prevention and Attention for HIV/AIDS and Sexually Transmitted Infections (*CAPASITS* in Spanish) facilities which are specialized, stand-alone centers that provide ambulatory care for HIV and STI; and 3) Condesa, a specialized clinic for HIV located in Mexico city and which provides HIV ambulatory care for more than 15,000 PLWH in Mexico City.

Statistical analysis

Key characteristics of the study population were divided and compared in two periods according to policies changes, between 2008-2012 and 2013-2017. Student t-test and Welch test were presented for normally and non-normally distributed continuous variables while Chi-square tests were used for categorical variables. Due to expected skewness of some variables, mean values along with standard deviations (SDs) as well as median values and interquartile ranges (IQR) were used to summarize continuous variables (e.g. age, CD4

levels). Discrete variables were presented using percentages. Patients' and healthcare facilities' characteristics as well as outcomes (i.e. CD4 and VL) were presented for the periods of analysis to illustrate trends over time.

Logistic regressions were conducted to identify the determinants of late HIV diagnosis (i.e. CD4 < 200 cells/mm^3). All models were adjusted by the covariates mentioned above. In addition, a dummy variable corresponding to the period when diagnosed (2008-2012; and 2013-2017) was used to estimate the impact of the 2013-2018 HIV policies implemented in Mexico. To have a better understanding of the determinants of late HIV diagnosis before and after the implementation of the National HIV program in 2013, separate models were estimated for the period 2008-2012 and 2013-2017. Logistic models were reported using Odds Ratios (OR) and associated confidence interval. Models' goodness of fit was evaluated with Receiver Operating Characteristic (ROC) curves and C-statistic (22), where a C-statistic value of 0.70 or greater indicates good discrimination.

RESULTS

Study population characteristics

From the initial 128,796 individuals included in the *SALVAR* database for the period 2008-2017, 5,688 were children or pregnant women, 13,510 did not have information on diagnosis, CD4 counts or VL results' date, 1,842 patients did not have information about CD4 and VL, 23 people were on prophylaxis, and 494 were people deprived of their liberty. After excluding these groups (Figure 1), the study population consisted of 106,830 individuals.

Figure 1. Sample Flow for Analysis

[INSERT FIGURE 1]

SALVAR: *Sistema de Administración, Logística y Vigilancia de Antirretrovirales - SALVAR* for its acronym in Spanish

Table 1 summarizes the patients' characteristics at diagnosis over the period 2008-2017 and for each of the two periods of the analysis (2008-2012 and 2013-2017). The median age of the population was 31 years old (IQR=25, 39) and 80% were males. Almost two thirds of the study population were diagnosed in *CAPASITS* facilities, one third in the Central East region and 94% in regions with low marginality index (less deprived areas). Most of the health facilities were in regions of low marginalization index. Several changes were observed over the two periods of analysis (i.e. 2008-2012 and 2013-2017). For example, the median age decreased from 32 (IQR: 26, 40) to 31 (IQR: 25, 39) years old between 2008-2012 and 2013-2017 (*P<0.001*) while the proportion of individuals aged 18 to 29 years of age at diagnosis increased from 40% in the period 2008-2012 to 45% in 2013-2017 (*P<0.001*). During the same period, the proportion of male individuals at diagnosis increased from 77% to 81% (*P<0.001*). More individuals were diagnosed in the South of Mexico over time (*P<0.001*) and less in the Northwest region (*P<0.001*). Table 1 provides the details.

Table 1. Summary Statistics and Patients' Characteristics at Diagnosis, 2008-2017

	Total	**2008-2012**	**2013-2017**	***P*-value**
Sample	106830	47613 (44.57%)	59214 (55.43%)	
Age				
Mean (SD)	33.13 (10.43)	33.55 (10.34)	32.80 (10.48)	<0.001
Median (IQR)	31 (25, 39)	32 (26, 40)	31 (25, 39)	
%				
18-29 yo	43.06	40.04	45.72	
30-39 yo	31.83	34.38	30.39	
40-49 yo	16.85	17.88	15.94	<0.001
50-59 yo	6.04	5.92	6.14	
≥60 yo	1.8	1.79	1.81	
Gender (%)				
Male	79.57	77.84	81.5	
Female	19.66	21.74	18.09	<0.001
Transgender	0.41	0.40	0.41	
Health facility (%)				
Hospital/ National Institute	20.59	21.12	19.38	<0.001

CAPASITS	66.46	66.32	66.31	
Specialized clinics	13.1	12.57	14.31	
Region (%)				
Mexico City	16.85	16.68	17.27	
Central East	30.89	31.60	31.14	
Central West	13.10	13.61	13.18	<0.001
Northeast	13.10	13.89	11.84	
Northwest	8.49	8.61	8.39	
South	16.85	15.61	18.17	
Marginality Index (%)				
High	2.05	1.85	2.21	
Medium	1.20	1.13	1.26	<0.001
Low	93.61	97.02	96.53	

SD: Standard Deviation. Yo: years old. IQR: Interquartile. CAPASITS: Ambulatory Centers for Prevention and Attention for HIV/AIDS and Sexually Transmitted Infections in Spanish.
Source: Authors' creation with information of *SALVAR*

CD4 cells and Viral Load levels over time

Table 2 presents the data on CD4 and VL (log10) for the whole population over 2008 and 2017 and for each of the two periods of analysis (2008-2012 and 2013-2017). Overall, the number of individuals with a late diagnosis (CD4<200 cells/mm^3 decreased significantly from 45% in 2008-2012 to 43% in 2013-2017 (*P<0.001*)). In parallel, the percentage of individuals diagnosed with a VL>100,000 u/ml increased from 35% to 38% in the same period (*P<0.001*).

Table 2. Summary Statistics for CD4 and Viral Load at Diagnosis

	Total	**2008-2012**	**2013-2017**	***P*-value**
Sample	106830	47616	59214	
CD4 cells				
Mean (SD)	288 (253)	286 (256)	291 (251)	<0.001
Median (IQR)	233 (88, 417)	226 (88, 410)	238 (89, 422)	<0.001
%				
<200	44.93	45.58	43.8	
200-349	22.47	22.44	22.36	<0.001
350-499	15.91	14.84	16.01	
>=500	17.79	17.14	17.83	
Viral Load (log10)				

Mean (SD)	4.28 (1.39)	4.15 (1.42)	4.38 (1.36)	<0.001
Median (IQR)	4.67 (3.56, 5.27)	4.59 (3.13, 5.19)	4.73 (3.80, 5.32)	
%				
≤100,000 u/ml	62.72	64.76	61.35	<0.001
>100,000 u/ml	37.44	35.24	38.65	

SD: Standard Deviation. IQR: Interquartile. Source: Authors' creation with information of *SALVAR*

Figure 2 presents over time the proportion of individuals diagnosed with CD4 <200 cells/mm^3 according to the type of facilities where they were diagnosed. Considering both periods, less individuals were diagnosed with a late diagnosis in Condesa compared to the population diagnosed in *CAPASITS* or other hospitals/institutes (*P<0.001*).

Figure 2. Percentage of individuals with a late diagnosis (CD4 < 200cells/mm^3) by health facility and year

[INSERT FIGURE 2]

Source: Authors' creation with information of *SALVAR*

Determinants of late diagnosis

The results of the multivariable logistic regression for CD4 at diagnosis are shown in Table 3. For CD4, being diagnosed during the period 2013-2017 compared to the previous period was associated with lower odds of late diagnosis (0.96 [95% CI: 0.93, 0.98]). Other factors associated with lower odds of late diagnosis were being diagnosed at *CAPASITS* facilities (0.89 [95% CI: 0.86, 0.93]) or specialized clinics (0.64 [95% CI: 0.60, 0.69]), compared to Hospitals. The variables that significantly increased the odds of a late diagnosis were being male compared to female (1.26 [95% CI: 1.24, 1.32]), being older than 29 years old (1.84 [95% CI: 1.79, 1.90], 2.24 [95% CI: 1.79, 1.90], 2.42 [95% CI: 2.30, 2.56], 2.34 [95% CI: 2.13, 1.31] respectively for each age group), being diagnosed in a Central East (1.16 [95%

CI: 1.08, 1.26]) or South region (1.21 [95% CI: 1.12, 1.31]) compared to Mexico City, and in a high marginalized locality (1.23 [95% CI: 1.12, 1.35]). However, as shown by the stratified analyses by time period (Table 3), being diagnosed outside Mexico City became a factor associated with lower odds during the period 2013-2017, while it increased the odds of a late diagnosis when diagnosed before 2013. The odds associated with a diagnosis at a later age were also greater for the period 2013-2017. Table 3 provides the details including the coefficients difference test across periods (Hausman test). As shown in these tables the C statistics in all models were below 0.70.

Table 3. Multivariate Logistic Regression for CD4 at Diagnosis, 2008-2017

Variable	OR CD4 (1: <200 cells/mm^3) All periods	OR CD4 (1: <200 cells/mm^3) 2008-2012	OR CD4 (1: <200 cells/mm^3) 2013-2017
Period of diagnosis (reference 2008-2012)			
2013-2017	0.96** (0.93, 0.98)		
Gender (reference female)			
Male	1.28** (1.24, 1.32)	1.33** (1.27, 1.40)	1.26** (1.20, 1.32)
Transgender	0.94 (0.77, 1.15)	1.09 (0.81, 1.47)	0.84 (0.64, 1.10)
Age group (reference 18-29)			
30-39	1.84** (1.79, 1.90)	1.65** (1.59, 1.73)	2.00** (1.92, 2.08)
40-49	2.24** (1.79, 1.90)	1.87** (1.78, 1.97)	2.59** (2.47, 2.72)
50-59	2.42** (2.30, 2.56)	1.97** (1.82, 2.1)	2.83** (2.63, 3.04)
>60	2.34** (2.13, 2.57)	1.79** (1.56, 2.05)	2.87** (2.53, 3.25)
Region (Mexico City)			
Central East	1.16* (1.08, 1.26)	1.50** (1.34, 1.67)	0.90 (0.80, 1.01)
Central West	0.89* (0.82, 0.96)	1.16* (1.04, 1.29)	0.68** (0.61, 0.76)
Northwest	0.97 (0.89, 1.05)	1.28** (1.14, 1.43)	0.74** (0.66, 0.86)
Northeast	1.05 (0.97, 1.15)	1.47** (1.30, 1.66)	0.77** (0.68, 0.86)
South	1.21**	1.55**	0.94

	(1.12, 1.31)	(1.39, 1.74)	(0.84, 1.05)
Type of health facility (reference hospital/National Institute)			
CAPASITS	0.89* (0.86, 0.93)	0.84** (0.80, 0.89)	0.93* (0.89, 0.99)
Specialized clinics	0.64** (0.60, 0.69)	0.70** (0.63, 0.78)	0.56** (0.50, 0.62)
Index of marginalization (reference low)			
Medium	1.05 (0.93, 1.18)	0.90 (0.75, 1.08)	1.17** (1.00, 1.37)
High	1.23** (1.12, 1.35)	0.99 (0.86, 1.15)	1.43** (1.27, 1.62)
Observations	*106, 830*	*47,616*	*59,214*
C-Statistics	*0.6158*	*0.6009*	*0.6165*

** p<0.01, * p<0.05, +p<0.10. (95% Confidence Interval). OR: Odds Ratio. CAPASITS: Ambulatory Centers for Prevention and Attention for HIV/AIDS and Sexually Transmitted Infections in Spanish

DISCUSSION

By analyzing 10 years of data this study has provided new information to better understand the characteristics of the individuals diagnosed with HIV in Mexico between 2008 and 2017 and the impact of HIV policies implemented since 2007. Compared to the 2008-2012 period, more individuals were diagnosed at a younger age, less women were identified HIV positive, and more individuals were diagnosed in the South of Mexico in the period 2013-2017. Our univariate and multivariable analyses indicate that the actions implemented during the period 2013-17 to reduce late diagnosis of HIV (12) in Mexico were marginally successful as the odds of a late diagnosis decreased by 4% during that time period compared to 2008-2012. However, still 42% of Mexicans are being diagnosed with CD4 <200 cells/mm^3 compared to a governmental objective of 30% late diagnosis in 2017 (8). Our stratified analyses also showed a strong regional effect during the period 2013-2017, with living outside of Mexico City decreased the odds of a late diagnosis. These results could be explained by an increase in HIV health facilities (i.e. *CAPASITS*) outside Mexico City (from 49 in 2007 to 137 in 2017) (3,11) and the change from a decentralized to an integrated approach to HIV treatment

and care in all HIV facilities in Mexico (8) as a result of the implementation of the 2013-17 National plan.

It is difficult to compare our results to other studies conducted in Mexico due to different study designs or period of analysis. However our results are similar to the findings of Carrizosa et al. (23) who reported a late diagnosis rate of 43.2% in 2010. Findings are also aligned with the results presented by Hernandez Romieu et al.(12) who reported using data from 2007 to 2014 that being male and being older increased the odds of a late diagnosis. Compared to this study, we also showed that being diagnosed in *CAPASITS* or Condesa reduced the risk of a late diagnosis compared to being diagnosed in non-specialized HIV hospitals. Another study among women using 2012-13 data from 4 clinics in Mexico also found that being older increased the risk of late diagnosis (24). On the other hand, while we found that being male increased the risk of a late diagnosis, a study conducted in 2011-12 in Mexico city, reported that women were more likely to be diagnosed later given that they have no suspicious of risk of infection due to their cultural and social disadvantage (11,24). These results could indicate that the prevention programs and early diagnosis policies no longer exclusively target high-risk populations (men who have sex with men and transgender population) and are consistent with the objectives established in the National Program in 2013 (8). Similarly, belong to the younger group represents a protective factor for a late diagnosis, which could be explained for a higher perception of risk and, therefore routinely testing, or because the treatment is free, even unemployed and unsecured young people could access care (12,21). Compared to the studies previously conducted in Mexico around HIV, our study provides new information as we also evaluated the impact of the 2013 National Specific Action program. We also showed that determinants of late diagnosis changed before

and after the implementation of the 2013-2017 HIV policies and found important differences at the regional level.

When interpreting the results a few limitations should be noted. First it was assumed that the 1st measure observed in *SALVAR* database for CD4 and VL was the measure associated with the diagnosis of HIV, which may not be always accurate. While we conducted regression analyses to identify the determinants of late diagnosis and VL levels, we were constrained by the list of variables available in the database and there may be unmeasured confounders such as the increase in number of health facilities and distribution across Mexican regions or the type of population reaching heath care. This could explain why our logistic regression models had moderate discrimination. Additionally, *SALVAR* does not account for the whole PLWH in Mexico, only for those registered in the Ministry of Health. Additionally, given the design of the models, we cannot claim that policy was completely responsible of changes in levels of late diagnosis, these could be also part of an increasing awareness, and a reduction on discrimination and stigma. However, we adjust the model by possible trend with a period variable and the study represents a first approach to associate measurable factors with late diagnosis and provide evidence for further research. Despite these limitations, our study has several strengths including the use a population-based cohort representing approximately 64% of the population receiving HIV care in Mexico. This is also the first study using and analyzing data later than 2014.

As it was mentioned before, some hypotheses can be formulated with all the information presented. We have identified key indicators, trends, and predictors of CD4 and VL levels at diagnosis to inform about the HIV/AIDS epidemic in Mexico. Although we observed a decrease in the number of individuals with a late diagnosis after the implementation of the 2013 National Specific program, this proportion is still high regarding the objective set in the

2013-2018 national plan (30%), and efforts should continue to improve HIV outcomes at diagnosis and reduce HIV transmission. Future research is also required to continue to evaluate the effectiveness of prevention programs such as increasing the HIV diagnosis rates and reaching to broader populations for early detection, Furthermore, the information from *SALVAR* database could be analyzed to identify time from diagnosis to treatment, and what can be improved to ensure access to antiretroviral therapy through the universal access program in Mexico. Finally, additional research should be made to measure the specific differences in economic resources and possible improvements to lead changes in national programs to reduce inequalities across health facilities and Mexican regions.

CONCLUSIONS

The results of this study indicate that the proportion of individuals with a late HIV diagnosis decreased marginally following the National HIV program implemented in 2013 in Mexico. However, the proportion of late HIV diagnosis remains much above the proposed levels in the National Specific Action Plan 2013-2018. Analyzing those factors that identify high-risk populations for a late diagnosis could expedite the achievement of policy objectives and improve national indicators of HIV in Mexico. Therefore, more efforts should be allocated to improve early detection and treatment of HIV.

List of abbreviations

PLWH -- People living with HIV

SALVAR -- Antiretroviral therapy administration, logistics, and surveillance system in Spanish.

VL -- Viral Load

CAPASITS -- Ambulatory Centers for Prevention and Attention for HIV/AIDS and Sexually Transmitted Infections in Spanish

SDs -- Standard deviations

IQR -- Interquartile

OR -- Odds ratios

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Declarations

Ethics approval and consent to participate

We used secondary data. Analyzed data is from an anonymized database. Authors have not contact with participants or their sensitive information such as name or address or any other data that could identified them. Authors received consent for the use of the SALVAR data set

Consent for publication

We used secondary data. Authors have not contact with participants or their specific information such as name or address. Authors received consent for the publication of results derived from the SALVAR data set.

Availability of data and materials

The data that supports the findings of this study are available from SALVAR and CENSIDA Mexico, but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of SALVAR and CENSIDA Mexico.

Competing interests

This study is part of AA PhD thesis. AA declares that he works full-time for Gilead Sciences Mexico S. de R.L. de C.V. AA declares that he did not receive any financial support from the firm to perform the analysis. The information contained in all data set was not used for the firm's benefit, promotion or strategies. The analysis we are presenting do not intend to promote or recommend any of the products mentioned in the paper.

The other authors have no conflicts of interest to declare.

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Authors' contributions

All authors have contributed to the conception and design of the analysis; data; drafting and reviewing of the manuscript; and approval of the final version.

- AA: Conception and design of the analysis, data analysis, drafting and reviewing of the manuscript
- JET: Conception and design of the analysis, data analysis review, drafting and reviewing of the manuscript, and approval of the final version.

- SB: Conception and design of the analysis, data analysis review, drafting and reviewing of the manuscript, and approval of the final version.
- FS: Conception and design of the analysis, drafting and reviewing of the manuscript, and approval of the final version.
- LM: Conception and design of the analysis, data analysis review, drafting and reviewing of the manuscript, and approval of the final version.
- AC: Conception and design of the analysis, drafting and reviewing of the manuscript, and approval of the final version.

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Figures

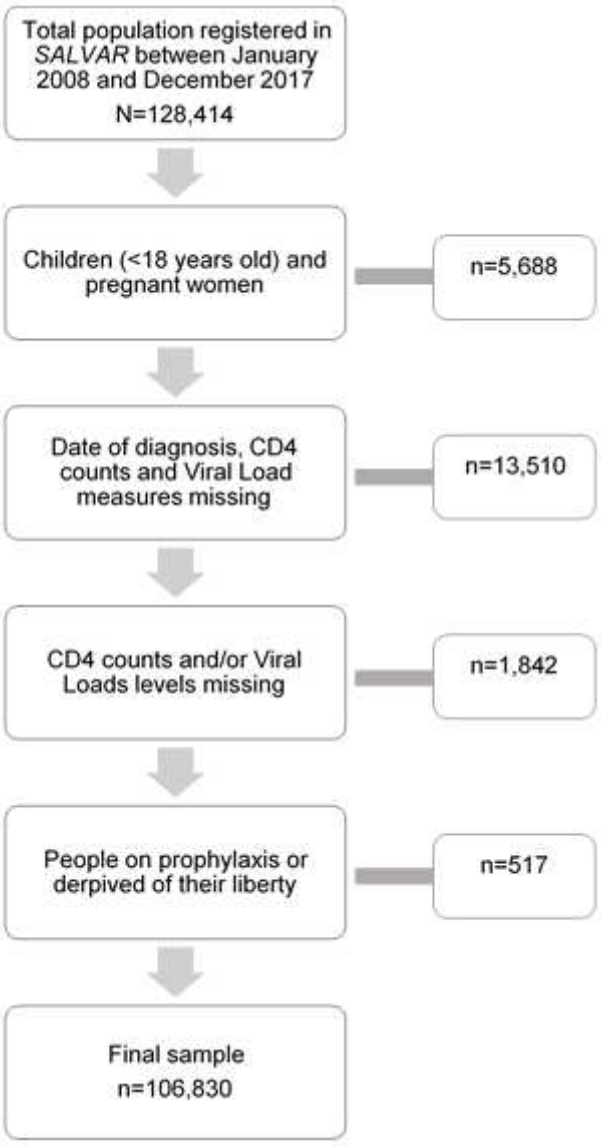

Figure 1

Sample Flow for Analysis. SALVAR: Sistema de Administración, Logística y Vigilancia de Antirretrovirales - SALVAR for its acronym in Spanish

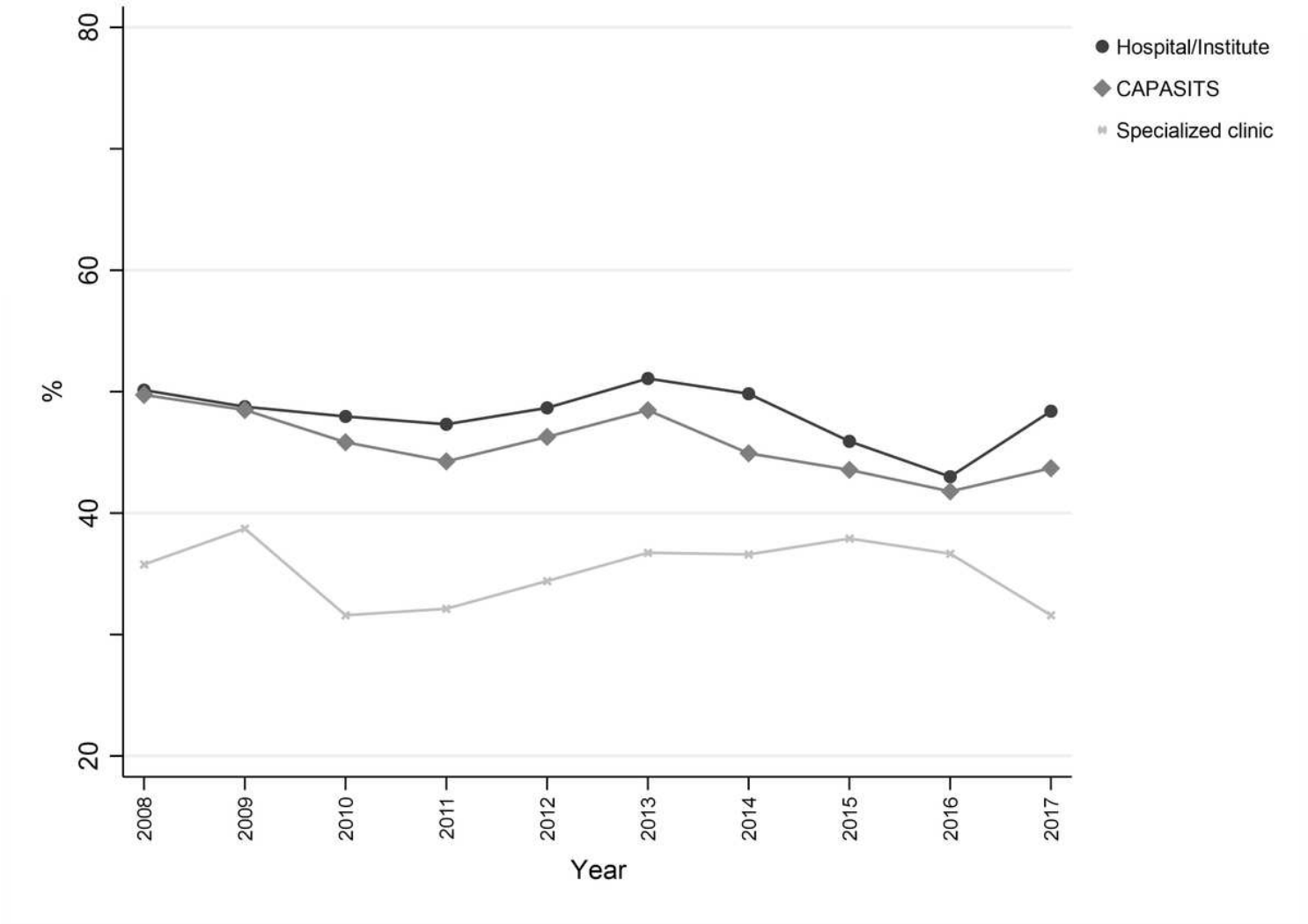

Figure 2

Percentage of individuals with a late diagnosis (CD4 < 200cells/mm3) by health facility and year. Source: Authors' creation with information of SALVAR