Original Article

Analysis of temporal trend in HIV/AIDS infection in western Santa Catarina: a retrospective study 1984 – 2015

Análise da tendência temporal da infecção pelo HIV/aids na região oeste catarinense: estudo retrospectivo 1984 – 2015

Análisis de la tendencia temporal de la infección por el VIH/sida en la región oeste catarinense: estudio retrospectivo 1984 – 2015

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ABSTRACT
Background and Objectives: HIV/AIDS detection rates portray local scenarios and enable the description of epidemiological characteristics of a given phenomenon. This study analyzes the temporal trend in HIV/AIDS detection rates, according to gender and age group, in western Santa Catarina between 1984 and 2015. **Methods:** This is a time-series observational study, with secondary database query. Data were tabulated in Microsoft Excel and detection rates were obtained; temporal analysis was performed using Poisson's Regression. **Results:** The profile of HIV-infected people/patients in western Santa Catarina is: white, male heterosexual, aged between 40 to 59 years and incomplete elementary school. A significant increase was identified in the overall population, especially male. Gender and age group ratio indicate intense dynamics of change since the beginning of the epidemic. Detection rates increased in both genders and in different age groups. **Conclusion:** New epidemic scenarios motivate tools and strategies to promote health and prevent infection, especially among the young male population.
Keywords: HIV. Epidemiology. Acquired Immunodeficiency Syndrome. Health profile.

RESUMO

Justificativa e objetivos: As taxas de detecção do HIV/aids retratam cenários locais e possibilitam a descrição das características epidemiológicas de determinado fenômeno. Este estudo analisa a tendência temporal das taxas de detecção do HIV/aids segundo sexo e faixa etária no oeste catarinense entre os anos 1984 e 2015. **Métodos**: Trata-se de um estudo observacional de série temporal, com consulta em base de dados secundários. Os dados foram transcritos no programa Excel, obtida taxa de detecção e realizada a análise temporal utilizando a Regressão de Poisson. **Resultados:** Homens brancos, heterossexuais, com faixa etária dos 40 aos 59 anos e ensino fundamental incompleto caracterizam o perfil das pessoas/pacientes infectadas pelo HIV no oeste catarinense. Identificou-se um aumento significativo na população em geral, com destaque para a população masculina. A razão de sexos e faixa etária aponta para uma intensa dinâmica de mudança desde o início da epidemia. As taxas de detecção aumentaram em ambos os sexos e em diferentes faixas etárias. **Conclusão:** Os novos cenários da epidemia suscitam ferramentas e estratégias que alcancem a promoção da saúde e prevenção da infecção especialmente entre a população masculina jovem.
Descritores: HIV. Epidemiologia. Síndrome da Imunodeficiência Adquirida. Perfil de Saúde.

RESUMEN
Justificación y objetivos: Las tasas de detección del VIH/sida retratan escenarios locales y posibilitan describir las características epidemiológicas de un determinado fenómeno. Este estudio analiza la tendencia temporal de las tasas de detección del VIH/sida según sexo y grupo de edad en el oeste de Santa Catarina entre los años 1984 y 2015. **Métodos:** El estudio es observacional de serie temporal, con consulta en base de datos secundaria. Los datos fueron transcritos en el programa Excel, y utilizando la regresión de Poisson se obtuvo la tasa de detección y se hizo un análisis temporal. **Resultados:** Hombres blancos, heterosexuales, con grupo de edad entre 40 y 59 años y la secundaria incompleta, caracterizaron el perfil de infección por el VIH en el oeste de Santa Catarina. Se identificó un aumento significativo en la población en general, destacándose la población masculina. La razón sexo y grupo de edad apunta a una intensa dinámica de cambio desde el inicio de la epidemia. Las tasas de detección aumentaron en ambos sexos y en diferentes grupos de edad. **Conclusión:** Los nuevos escenarios de la epidemia suscitan herramientas y estrategias que alcanzan la promoción de la salud y prevención de la infección especialmente entre la población masculina joven.
Palabras clave: VIH. Epidemiología. Síndrome de Inmunodeficiencia Adquirida. Perfil de Salud.

INTRODUCTION

HIV/AIDS is a global phenomenon that occurs, in different parts of the world, as an epidemic with its own characteristics and determinants. The advance of epidemiological studies achieves results that promote the understanding of viral transmission among populations, suggesting mechanisms and policies to replication control and reduction in HIV/AIDS rates.[1]

Estimates indicate that in 2017, 1.8 million new HIV infections were reported worldwide, a significant decrease (47%) compared to 1996, when approximately 3.4 million

new virus infections were reported. In the past seven years, new HIV infections among adults decreased by 16% and, among children, 35%.[2] According to Joint United Nations Programme on HIV and AIDS (UNAIDS) data, in 2017, over half of people living with HIV worldwide (59%) had access to antiretroviral therapy, whereas only 47% were in viral suppression. These numbers represent the challenge to achieve the 90-90-90 targets established for the world. Moreover, new HIV infections and AIDS cases reported differ among countries and regions given their local characteristics.[3-5]

In Brazil, changes in the infection epidemiological profile have been observed throughout the years. The epidemic began within the male homosexual population, followed by the female population, characterizing a feminization and heterosexualization process. Moreover, such infection is related to people of lower education level, called pauperization, and, in a broad social and geographical perspective, internalization, by the epidemic spread to an increasing number of municipalities far from main metropolitan areas.[6.7]

From 2007 to June 2018, more than 247,000 new HIV infections were reported in Brazil. In 2017 alone, over 42,000 cases were reported, comparable to the annual average of new AIDS cases in the last five years within the Brazilian population, of 40,000 cases/year, adding over 926,000 since the beginning of the epidemic in 1980.[8] Santa Catarina is characterized by its high AIDS incidence, being the second Brazilian state with the highest annual disease-detection rate until 2016, when it dropped to third place, with 30.5 cases per 100,000 inhabitants.[8]

The ramification of studies considering local specificities is a strategy for effectively facing the HIV epidemic and, consequently, eliminating AIDS, as their outcomes are related to the different realities observed.[9] Thus, acknowledging HIV/AIDS epidemiology at regional level allows the development of health actions aimed at controlling viral transmission among the studied population, contributing to national and global scenario.

Despite temporal studies available, mostly based on secondary data from health information systems considered the primary source on HIV and AIDS cases, this study will approach real numbers registered in the service, correcting potential information system underreporting and the lack of HIV notification records, which was implemented only from 2014 in the Brazilian society.[8-10]

This study aims to analyze the temporal evolution of HIV/AIDS detection rates in western Santa Catarina, Brazil, according to gender and age group, between 1984 and 2015.

METHODS

This is a time-series observational study, performed by data collection and analysis from care records of registered HIV/AIDS patients, as well as documents and consolidated data organized by the Specialized Assistance Service for HIV/AIDS (SAE), between 1984 and 2015, in the municipality of Chapecó, Santa Catarina, Brazil, considered a reference for medium- and high-complexity health care.

The service provides specialized care, at secondary level, to HIV/AIDS patients from the 27 municipalities of the western Health Region of Santa Catarina. In 2015, the estimated population was 345,838 inhabitants.[11]

Data were collected between July and November 2016. HIV/AIDS clinical/medical records were analyzed from the first registered case, dated 1984, to those registered in December 2015. There were 1,563 cases/medical records in total, according to groups: 242 deaths, 95 dropouts, 450 transfers and 776 under follow-up.

For data collection, a semi-structured instrument was used, in which analysis variables on study outcomes were: year of HIV/AIDS detection, gender (male and female), self-reported race/skin color (white, black, mixed-race, yellow, indigenous and others), age group (0 to 14 years, 15 to 19 years, 20 to 39 years, 40 to 59 years, and 60 years or older), marital status (married, single), schooling (illiterate, incomplete elementary school, complete elementary school, complete high school, complete higher education degree), exposure category (homosexual, bisexual, heterosexual, blood transmission and vertical transmission) and municipality of residence. For transfers group, only variables related to gender, age and municipality of residence were available.

The software 2007 Microsoft Excel (*Microsoft Corporation, Redmond, WA, USA*) was used for data entry, and 11.0 STATA (*Stata Corp LP, College Station, Texas, USA*) for statistical analysis.

For population characterization, variables were described verifying the absolute number and categories percentage. For the calculation of HIV/AIDS detection rates within the region, in the period, the following were considered numerators: total number of cases, number of cases by gender and age group in each year of analysis; and for denominators the respective populations, considering data from the Brazilian Institute of Geography and Statistics (IBGE) for the same period. Given that clinical records were the source of data collection, each individual living with HIV and/or AIDS was identified and counted only once. First record found was considered for diagnosis year and age, correcting possible duplicity.

For temporal analysis of HIV/AIDS detection rates, the analysis periods were selected: period 1: 1984-1989; period 2: 1990-1996; period 3: 1997-2005; and period 4: 2006-2015, initial periods were considered according to reference-years in HIV/AIDS care in Brazil: 1984 – record of first case of HIV/AIDS in the region; 1989 – initiation of HIV screening in blood-bank testing; 1996 – acquired right to receive free medication for AIDS treatment in the Unified Health System (SUS). Subsequent periods follow the last two decades of the epidemic. Poisson regression was used for this temporal analysis, considering the case-counting event. This study was approved by the Research Ethics Committee of Universidade Federal da Fronteira do Sul, under CAAE No. 48911515.5.0000.5564 and Opinion No. 1.290.185.

RESULTS

From the analysis of the 1,563 HIV/AIDS cases medical records, it was possible to verify that 57.6% occurred in males and 42.4% in females. Regarding race, 56.9% were self-reported as white; marital status, 33.5% claimed having a partner, for both genders. For age, the study identified that about 50.2% of the detected cases were between 40 and 59 years old, for both genders. Regarding schooling, 35.3% among male and female did not complete elementary school.

Regarding exposure category variable, heterosexual exposure was predominant: 42.2% among male and 65.1% among female. Within the male population, 12.4% reported homosexual exposure, according to Table 1.

It is worth mentioning the high number of clinical records lacking information about race/color (32.3%), marital status (33.6%), schooling (31.0%) and exposure category (34.8%).

Table 1 – Distribution of HIV/AIDS cases according to socioeconomic and demographic variables, in western Santa Catarina, 2017.

| Variables | HIV/AIDS cases (N=1563) | | | | | | P value* |
| | Male | | Female | | Total | | |
	N	%	N	%	N	%	
Age (in years)							**0.442**
0-14	11	1.2	6	0.9	17	1.1	
15-19 years	16	1.8	17	2.6	33	2.1	
20-39 years old	303	33.7	244	36.8	547	35.0	
40-59 years old	457	50.8	327	49.3	784	50.2	
≥ 60	107	11.9	67	10.1	174	11.1	
No record	6	0.7	2	0.3	8	0.5	
Self-reported race/skin color							**0.168**
White	504	56.0	384	57.9	888	56.9	

							p-value*
Mixed-race	67	7.5	66	10.0	133	8.5	
Others	24	2.7	12	1.8	36	2.3	
No record	304	33.8	201	30.3	505	32.3	
Marital status							**0.175**
Married	278	30.9	230	34.7	508	33.5	
Single	304	33.8	225	34.0	529	32.9	
No record	318	35.3	208	31.3	526	33.6	
Schooling							**0.003**
Illiterate	14	1.6	22	3.3	36	2.3	
Incomplete elementary school	297	33.0	255	38.5	552	35.3	
Complete elementary school	114	12.7	97	14.6	211	13.5	
Complete high school	147	16.3	89	13.4	236	15.1	
Complete higher education degree	32	3.6	12	1.8	44	2.8	
No record	296	32.9	188	28.4	484	31.0	
Exposure category							**0.000**
Homosexual	112	12.4	8	1.2	120	7.7	
Bisexual	45	5.0	2	0.3	47	3.0	
Heterosexual	380	42.2	431	65.1	811	51.9	
Blood transmission	13	1.4	4	0.6	17	1.1	
Vertical transmission	15	1.7	8	1.2	23	1.5	
No record	335	37.2	210	31.7	545	34.8	

* Chi-square Test

Figure 1 shows the yearly evolution of HIV/AIDS detection rate in western Santa Catarina, according to population by gender and gender ratio. It was verified that, during the first and last decade of the analysis, rates were higher in male population than in female population. It is important to highlight the rate increase among women in 1999, and high rates persistence until 2008; as well as male rate peak in 2012. For both genders, rates fluctuate during the period. In the last decade, it ranged from 22 to 36 cases per 100,000 male/year, and from 12 to 30/100,000 female/year. As to gender ratio, until 1991 the incidence of cases was solely among male population. After 1992, cases were reported in female at a 7:1 ratio, decreasing in subsequent years. Between 2000 and 2009, gender ratio fluctuates close to 1:1. It is important to highlight cases growth among male in recent years, reaching a 1.86:1 ratio; that is, 1.86 cases in male for every 1 case in female in 2015.
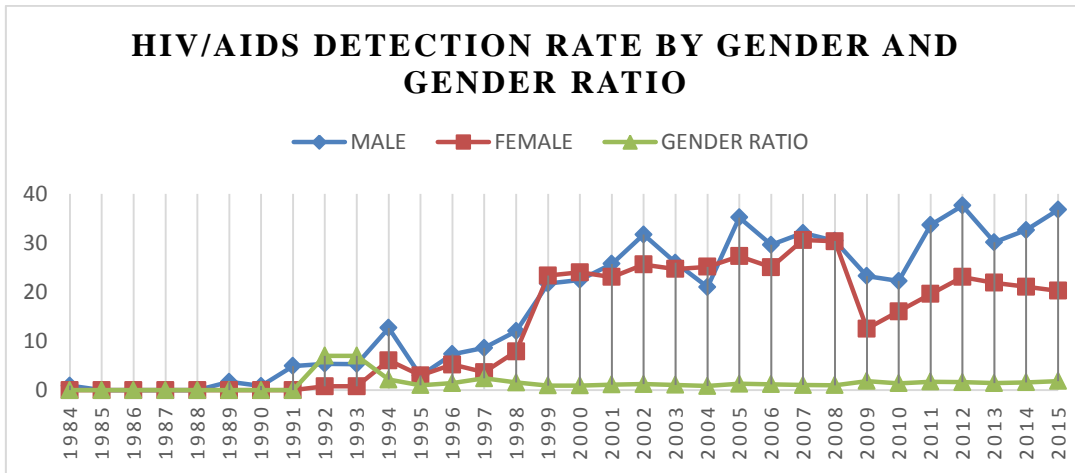
Figure 1. HIV/AIDS detection rate, according to gender and gender ratio in western Santa Catarina from 1984 to 2015, Chapecó-SC, 2017.

Figure 2 shows HIV/AIDS detection rate according to age group. Rates fluctuate within all age groups during studied years, especially from 20 to 39 years, reaching 61 cases per 100,000 people/year in 2002 and 2007. In this age group, rates declined during the last three years (2013-2015). Age group from 0 to 14 years resembles this fact. Among young people aged 15 to 19 years, individuals between 40 and 59 years and older adults over 60 years, curve points to rates increase in this period.
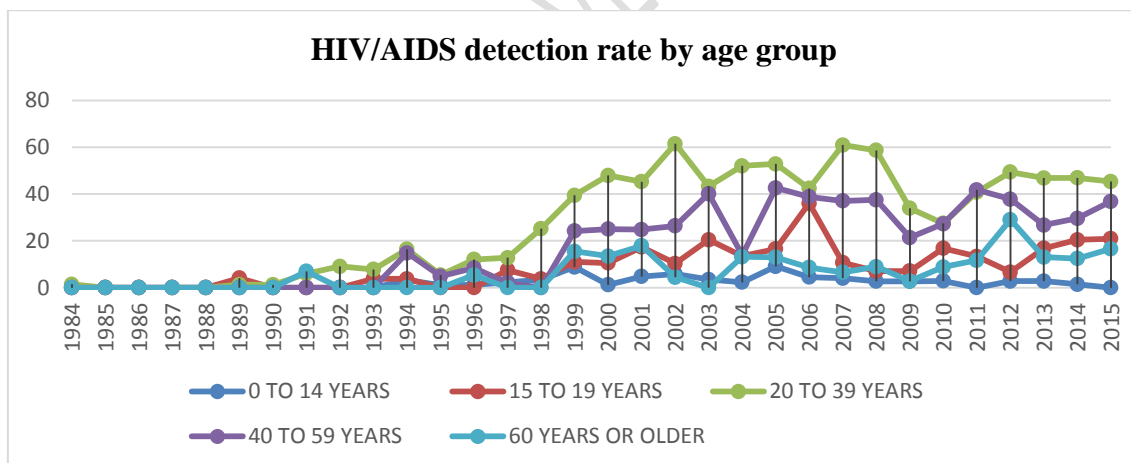

Figure 2. HIV/AIDS detection rate, according to age group in western Santa Catarina from 1984 to 2015, Chapecó-SC, 2017.

Table 2 shows HIV/AIDS detection rates and confidence intervals obtained by Poisson regression applied to data from general population by gender, and gender according to age group for the selected periods (1984-1989, 1990-1996, 1997-2005 and 2006-2015).

The used model indicates that 97% of HIV/AIDS detection rates variation in general population in western Santa Catarina is explained by the independent variable year.

For the general population, there is a statistically significant increasing trend in HIV/AIDS detection rates throughout periods. It starts in period 1 (1984-1989) with 0.23/100,000 people/year, to 4.1 in period 2 (1990-1996), 21.78 in period 3 (1997-2005) and 26.67 in the last analyzed period (2006-2015), reaching 31 among male population and 22 among women. Furthermore, stratification by age group showed a higher rate in male population from 20 to 39 years in the last period analyzed, with 53 cases per 100,000 male/year within this age group. Rates growth in the last decade was likewise noticeable among female over 40 years old.

Table 2. HIV/AIDS detection rates and confidence interval (CI:95%), per 100,000 people/year for the selected periods (1984-1989, 1990-1996, 1997-2005 and 2006-2015) according to population by gender and age group.

	Selected periods			
	Period 1: 1984-1989	**Period 2: 1990-1996**	**Period 3: 1997-2005**	**Period 4: 2006-2015**
	AI (95% CI)	**AI (95% CI)**	**AI (95% CI)**	**AI (95% CI)**
General population	0.23 (0.00 – 0.50)	4.1 (3.16 – 5.04)	21.78 (19.99 – 23.58)	26.67 (24.90 – 28.44)
Male				
Total cases	0.43 (0.00 – 0.93)	5.71 (4.16 – 7.26)	22.87 (20.27 – 25.47)	31.33 (28.63 – 34.04)
0 to 14 years	0.00 (0.00 – 0.00)	0.32 (0.00 – 0.95)	0.75 (0.00 – 1.6)	1.86 (0.48 – 3.24)
15 to 19 years old	1.34 (0.00 – 3.97)	2.24 (0.00 – 5.35)	6.96 (2.41 – 11.50)	14.82 (8.63 – 21.02)
20 to 39 years old	0.88 (0.00 – 2.10)	12.16 (8.30 – 16.03)	44.99 (38.67 – 51.30)	53.34 (47.26 – 59.43)
40 to 59 years old	0.00 (0.00 – 0.00)	5.52 (1.70 – 9.35)	26.39 (19.98 – 32.81)	35.68 (29.99 – 41.37)
60 years and older	0.00 (0.00 – 0.00)	1.92 (0.00 – 5.67)	12.29 (5.03 – 19.55)	18.16 (11.18 – 25.14)
Female				
Total cases	0.00 (0.00 – 0.00)	2.42 (1.38 – 3.45)	20.69 (18.21 – 23.18)	21.95 (19.68 – 24.23)
0 to 14 years	0.00 (0.00 – 0.00)	0.73 (0.00 – 1.75)	4.96 (2.73 – 7.19)	1.67 (0.33 – 3.00)
15 to 19 years old	0.00 (0.00 – 0.00)	0.00 (0.00 – 0.00)	18.1 (10.70 – 25.50)	16.61 (9.96 – 23.25)
20 to 39 years old	0.00 (0.00 – 0.00)	4.56 (2.17 – 6.96)	39.81 (33.86 – 45.76)	36.69 (31.56 – 41.81)
40 to 59 years old	0.00 (0.00 – 0.00)	2.84 (0.05 – 5.62)	19.25 (13.75 – 24.76)	28.76 (23.48 – 34.04)
60 years and older	0.00 (0.00 – 0.00)	1.69 (0.00 – 5.01)	5.79 (1.16 – 10.42)	8.51 (4.34 – 12.68)

Male population from 15 to 19 years old, although not statistically significant, over doubled the rates within the last periods analyzed, from 6.96 cases per 100,000 male/year to 14.82.

Whereas for males aged 20 to 39 years, trend of rates growth between periods 2 and 3 is statistically significant, increasing from 12.16 to 44.99 for every 100,000 male/year. The same is observed among male aged 40 to 59 years, which rates increased from 5.52/100,000 to 26.39.

Regarding female population, cases emerged in period 2 (1990) and grew significantly in the following period (period 3), presenting the highest female detection rates in all age groups, until its stabilization in the last period analyzed (2006-2015).

Regarding this population, highest rates are in age group from 20 to 39 years, with 39.8 cases per 100,000 female/year in period 2 and 36.7 in the last analyzed period.

DISCUSSION

Thirty years after the beginning of the HIV/AIDS epidemic and, despite the declining trends of viral transmission presented by a World Health Organization (WHO) report, infection is still considered an important public health issue, as it is distinctively disseminated among individuals in all parts of the world.[1-2]

The description of HIV/AIDS epidemiological characteristics in western Santa Catarina for over 30 years (1984 – 2015) mainly comprises white individuals, male, aged between 40 and 59 years and with incomplete elementary school. Major exposure category to the infection in the region was sexual transmission, primarily heterosexual relationships. The outcome of male predominance is consistent with Brazilian official data. White race and heterosexual exposure, on the other hand, refute national information. According to the Ministry of Health, in the Brazilian male population over 13 years old, 50.4% had homosexual exposure and 52.8% were black and mixed-race.[10-12]

Despite the observed lack of records, attributed to transferred individuals (29% of the total), and limited to gender and age, white race prevalence observed in this study is supported by historical factors of this territory, which was massively colonized by German and Italian immigrants. Regarding age, within both genders the highest rates were in the age group of 20 to 39 years, restating national data and studies in Chinese provinces that point the majority of HIV population as young adults.[12,13] The differences between gender and age are even more significant when international scenarios are observed. Unlike the Brazilian reality and what was observed in this study, in sub-Saharan African countries new HIV infections and AIDS cases are mostly concentrated among married, heterosexual and under 50 years old.[2.5.8]

Furthermore, in this retrospective study, 59% of registered cases reported heterosexual exposure, based on a reference in the first consultation. Outcomes shall be considered solely in a cultural and local perspective, important factors in the discussion. It is important to stress Southern region own traditions and cultural habits, what may distort these numbers from the existing reality.[14]

Results for HIV/AIDS detection in western Santa Catarina show that rates have fluctuated over the 30 years of epidemic, presenting in the last period, for the most part, a growth trend for males in all age groups and females over 40 years old. HIV/AIDS growth among male population in recent years is reaffirmed by the Ministry of Health by pointing, for 2017, a 2.2 ratio of male cases for each female case.[8] As observed in this study, other studies corroborate the data by similarly indicating the increasing number of cases among the male population.[7.15-17] Although gender ratio is lower than national, during recent years in the

western Santa Catarina, male gender ratio increased in relation to each female from 1.40 in 2013, 1.58 in 2014 and 1.86 male case for each female case in 2015. These results outline the discussion about the stabilization of new cases detection among the female population, and the growth among males, corroborating what is observed in other Brazilian regions.[18.19]

The statistically significant trend of growth in the average annual rate of HIV/AIDS detection over the last decade among the general population and total male cases is noteworthy since it is not observed among the female population. Even in developed countries, such as Poland, the number of HIV/AIDS cases increases each year, especially within homosexual male population, considered a key population.[2.5,20]

Large or small, increase of cases among the male population in different countries and regions has been worrying health authorities and causing reactions in HIV/AIDS surveillance and care systems due to the high rate of viral transmission, especially among subgroups that include men who have sex with men.[9] Among the young male population, the phenomenon is confirmed. In Brazil, it was observed an important increase in detection rates among young males between 15 and 24 years old in the last ten years. Precisely, between 2007 and 2017, detection rates increased over 200%.[8] This study's outcomes reaffirm the considerable increase in HIV/AIDS incidence rate in young male population (15 to 19 years) during the last period. Furthermore, they underline fundamental aspects to effectively involve and discuss HIV/AIDS among this population.

Early sexual debut may be related to the growing new HIV infections in young populations. A study developed by a Brazilian and French technical cooperation confirms, for both nations, the pauperization, feminization and heterosexualization of the epidemic. Yet, the percentage of cases among adolescents in Brazil is 3.5 times higher than in France.[21] According to the Ministry of Health, the mean age for sexual debut is 15 years and it is decreasing over the years due to educational level and condom use. In other words, the lower the age and educational level, the lower the chance of using condom for prevention, and, consequently, the higher the risk of HIV contamination.[21]

Within the female population, rates decrease in younger age groups is stressed, as well as rates growth in female over 40 years. Rates increase among older women (60+ years) indicates the growing transmission of the virus among older people of both genders, as observed by Mangal et al.[7] Another study on trends, conducted with the older adult population, showed an approximately 185% increase in cases of AIDS within the Brazilian older adult population between 2000 and 2015. Thus, it poses an emerging challenge for

public health: the establishment of strategies to capture and identify this population in the national surveillance system.[22]

Similar to the national scenario, in the western region of Santa Catarina the period of 1997 to 2005, second decade of HIV/AIDS epidemic onset in the region, comprises the greater increase in average annual rates within male and female population, and all female age groups. A study on Brazil HIV incidence indicates the first epidemic peak in 1997, with a 34.8/100,000 people/year incidence rate. 2001 presented the second wave of infections, with over 50% increase in rates for both genders.[7] Observed detection rates increase in this period may be associated with HIV/AIDS history in Brazil: firstly, the social mobilization that conquered blood-banks regulation, in 1989; followed by Antiretroviral Therapy (TARV) availability by the Unified Health System, in 1996. From that year on, what previously represented a "death sentence" turned into the rescue of hope of the possibility of living with the virus. On this new reality, the number of detected cases increased by providing treatment and quality of life improvement.[23]

The first case of AIDS reported in the state of Santa Catarina was in the municipality of Chapecó in 1984. Since then, health actions have been developed, as the implementation of services and the adoption of strategies for detecting cases, following national and international HIV/AIDS care policies.[2,24]

The scarcity of information in medical records is noticeable throughout this study, especially about the first cases in the region, in which data collection was restricted to socioeconomic variables. Moreover, there are approximately 42 cases whose independent variable "year of detection" could not be collected, constituting limitations to the study. However, previous studies on the theme in western Santa Catarina were based on information and notification systems data, which did not include reported HIV cases until 2014. Therefore, this study is a pioneer regarding data on HIV infection prior to AIDS notification, obtained directly from medical records and, until then, unavailable in official information systems.

This study is expected to foment actions developed at regional level and support specialized HIV/AIDS care decision-making, emphasizing populations with a growth trend in rates, observed in recent years. This study also enables reflections on new scenarios and trends of the HIV epidemic at regional level. In this regard, it is strictly necessary to overcome barriers and myths to achieve the development of methodologies and tools to reduce case numbers, prevent the disease and promote health.

These considerations made are to the detriment of already adopted measures and actions. Among them, the notification of HIV cases – not only AIDS – represents an advance in public health pursuit of offering better care conditions in health services for people living with HIV. Such measure depicts that the disease is no longer in focus, but rather the epidemiology of HIV infection.

Although facing limitations such as restricted space for data collection, discomfort caused by existing stigmas, insecurity of professionals seeking ethical conduct, and restricted information, it is extremely important to continue analyzing collected data to improve existing services and reinforcing their importance as a health institution.

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