



Rate estimation and trend analysis of new HIV infections among the international migrant population in Chile from 2013 to 2022

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ABSTRACT

Background: International migrants are central to HIV research, but comparative data on their infection rates versus resident populations, including in Chile, are scarce. This study compares HIV incidence rates between international migrants and Chileans.

Methods: A longitudinal study was conducted. Crude and standardized rates of new HIV infections reported by the Institute of Public Health of Chile (ISP) were calculated for the period 2013 to 2022, using data from public and private health facilities nationwide. Population estimates for international migrants and Chileans were obtained from the National Institute of Statistics (INE) and the National Migration Service (SERMIG). Rates were adjusted for age and sex using the direct method.

Results: A total of 51,513 validated new HIV infections were analyzed, of which 14,936 (29.0 %) occurred in international migrants and 36,577 (71.0 %) in Chileans. International migrants showed an increase in incidence rates between 2013 and 2022 (adjusted rate from 22.6 [95 % CI: 18.3 – 27.0] to 115.6 [95 % CI: 110.5 – 120.7] new HIV infections per 100,000 population). Throughout the study period, the ratio of adjusted incidence rates between international migrants and Chileans increased from 1.0 [95 % CI: 0.9 – 1.2] to 7.6 [95 % CI: 7.2 – 8.0].

Conclusions: HIV incidence rates were higher in international migrants than in Chileans and increased over the study period. This may be influenced by various exogenous factors, including social determinants of health and the COVID-19 pandemic. It is crucial to focus on HIV diagnosis, prevention, and control strategies for international migrants in Chile.

1. Introduction

One of the Sustainable Development Goals established by the United Nations (UN) for 2030 aims to end the epidemics of HIV/AIDS, tuberculosis, malaria, neglected tropical diseases, as well as combat hepatitis, water-borne diseases and other communicable diseases (Naciones Unidas 2015). Particularly for HIV, the Joint United Nations Programme on HIV/AIDS (UNAIDS) has set a 2025 target: 95 % of people living with the virus should know their diagnosis, 95 % of those diagnosed should receive treatment, and 95 % of those on treatment should achieve undetectable viral loads. This initiative aims to reduce HIV-related inequalities, new infections, and related deaths, steering the global

response to control this public health issue by 2030 (Programa Conjunto de las Naciones Unidas sobre el VIH/Sida 2022).

In Chile, the latest HIV estimation in 2021 showed an increase in the population living with the virus, reaching a total of 84,000 people living with HIV (PLHIV), for all ages. An estimated incidence of 0.2 new infections per 1000 population and a prevalence in the 15 to 49 age group of 0.6 % was reported. Among those infected, 87% were aware of their diagnosis, 77% were receiving treatment, and 97% of those on treatment had achieved undetectable viral loads (Departamento de Epidemiología, Ministerio de Salud de Chile 2022). In this scenario, the “National Health Strategy for Sanitary Objectives by 2030”, a set of long-term sanitary objectives established by the Ministry of Health (MINSAL), considered

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reducing HIV/AIDS incidence among the population aged 15 to 49. The expected results of this high-impact objective is to reduce unsafe sexual behaviors in this particular age group, increase access to testing services for the entire population, and facilitate access to health services for people exposed to higher risk (Ministerio de Salud de Chile 2022).

In recent years, international migrants residing in Chile have become one of the marginalized populations that have gained special interest regarding the HIV epidemic. The lack of access to healthcare services and social protection are both factors that exacerbate HIV vulnerability in this particular group (The gap report 2014 — Migrants; Ross et al., 2018). According to estimations from INE, the foreign population residing in Chile reached 1482,390 individuals in 2021, representing an increase of 98.6 %, 14.1 %, and 1.5 % compared to the years 2017, 2018, and 2020, respectively (Instituto Nacional de Estadísticas de Chile 2022). During the same period (2017 to 2021), the Department of Epidemiology of MINSAL reported an increase in the proportion of international migrants among the total reported HIV infections, from 20.2 % to 33.8 % (Departamento de Epidemiología, Ministerio de Salud de Chile 2022).

The importance of understanding the magnitude of new HIV infections in international migrants, the significant rise in international migration in recent years (Instituto Nacional de Estadísticas de Chile 2022), and the lack of publications in Chile estimating new HIV infection rates by nationality (Departamento de Epidemiología, Ministerio de Salud de Chile 2023; Instituto de Salud Pública de Chile 2019; Villanueva-Pabon et al., 2022) were key motivations for investigating this sensitive epidemiological topic. Furthermore, the primary objective of this study is to estimate and compare the incidence rates of new HIV infections between international migrants and Chileans from 2013 to 2022.

2. Materials and methods

2.1. Study design and data consolidating procedure

A longitudinal study was conducted on new HIV infections registered by the ISP between the years 2013 and 2022, which includes all infections from both public and private health facilities across the country. A 'new HIV infection' was defined as any individual with a positive HIV result confirmed for the first time by the ISP during this period. Serological methods (ELFA, EQLIA, LIA, and ICT) and molecular methods (nucleic acid amplification, DNA (provirus), RNA (circulating virus)) were used for diagnosis (Instituto de Salud Pública de Chile 2023), without considering previous diagnoses made in other countries.

The analysis utilized the HIV laboratory surveillance database of the ISP, encompassing information from samples received for HIV confirmation from various health facilities, public and private clinical laboratories and blood services. The samples were sent to the ISP for confirmation after obtaining a reactive result in HIV screenings in adults (≥ 13 years old) or in follow-ups until at least the third month of life in children under 13 years of age, as established in the Joint Norm for Prevention of Vertical Transmission of HIV and Syphilis from MINSAL (Ministerio de Salud de Chile 2012).

A description of new HIV infections was performed by age, sex, laboratory regional origin of the sample, year of confirmation, and nationality. Any individual indicating a country of origin or birth different from Chile or specifying a nationality other than Chilean, regardless of the duration of residence in Chile, was considered of foreign nationality or international migrant, based on current international definitions (Naciones Unidas — Desafíos globales 2022; McAuliffe and Triandafyllidou, 2021). In new infection records lacking this information in the ISP database, the information was complemented with notified infection records from the Department of Epidemiology of MINSAL (Fig. 1).

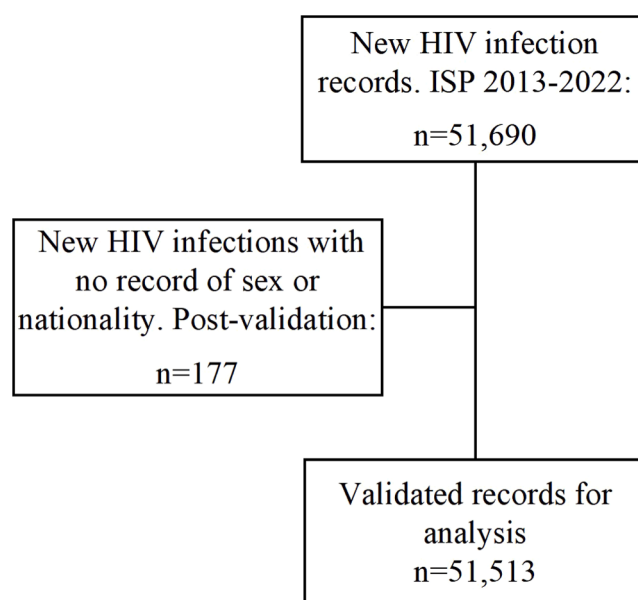


Fig. 1. Flowchart of consolidated records of new HIV infections. Chile, 2013–2022. Illustrates the consolidation process of new HIV infections from 2013 to 2022. This flowchart depicts the number of infections initially reported, infections lacking information on sex or nationality post-validation, and the final count of validated records for analysis. International migrants were identified as individuals whose country of origin or birth is not Chile, or who specified a nationality other than Chilean, regardless of their residence duration in Chile. Missing data in the ISP database were supplemented with records from the Department of Epidemiology of MINSAL.

2.2. Crude and adjusted incidence rate calculation

Population denominators, obtained from the 2017 Census (Instituto Nacional de Estadísticas de Chile 2017), were adjusted by age and sex based on estimates of foreigners residing in Chile provided by INE and the SERMIG of the Ministry of Interior and Public Security (Instituto Nacional de Estadísticas de Chile 2022; Departamento de Extranjería y Migración 2016; Instituto Nacional de Estadísticas de Chile 2021). The annual Chilean population corresponded to the total population estimated for the country, minus the estimated population of resident foreigners for that same year. For years without foreign population estimates, a linear interpolation approach was employed. The difference in population between the last year with available data and the penultimate year was calculated. This difference was then evenly distributed across the missing years, assigning a proportional increase to each of these years starting from the penultimate year with information. This linear interpolation method assumes a constant rate of change in population over time and provides a simplified solution for estimating missing values (Swanson and Siegel, 2004).

Annual crude and adjusted incidence rates of new HIV infections were estimated by age and sex using the direct method and expressed per 100,000 population with 95 % CI. It is important to note that these incidence rates reflect the confirmation of new HIV infections rather than the exact time of infection, as the exact onset of infection is unknown. First, crude rates were determined for the total annual population and for each age and sex group. These rates were obtained by dividing the number of new HIV infections by the corresponding population for each group and multiplying the result by 100,000 to project it in terms of a rate per 100,000 population. Second, to adjust these crude rates and allow valid comparisons between populations with different demographic structures, we employed the direct adjustment method. Specifically, this process involves multiplying the age- and sex-specific rates by the corresponding weights of the reference population and summing the results to obtain an overall adjusted rate (Organización

Panamericana de la Salud 2018). This standard population corresponds to the population of Chile in 2002, as per the projections from the 2017 Census (Instituto Nacional de Estadísticas de Chile 2017), replicating the reference population for the adjustment of mortality rates used in reports from the Department of Statistics and Health Information (DEIS) of the MINSAL (Ministerio de Salud de Chile 2022). Variation within population characteristics play a vital role in estimating population-level risk measures. It is important to consider the structural demographic differences across age and sex, as these factors can influence incidence rates. The previous step recalibrated rates to represent a population with a uniform distribution, thereby providing comparable groups. The sum of all rates weighted in this manner provided us with the adjusted rate for the complete study population. This rigorous and detailed approach in rate calculation ensures that our conclusions regarding HIV incidence are statistically robust and comparable between different populations and time periods.

Data analyses were performed using Microsoft® Excel® for Microsoft 365 MSO (version 2310 build 16.0.16924.20054) 64-bit, R version 4.0.2 statistical software (R Foundation for Statistical Computing).

2.3. Ethical approval

The study was approved by the Ethical-Scientific Committee of the Eastern Metropolitan Health Service, Santiago, Chile.

3. Results

A total of 51,513 new HIV infections were confirmed by the ISP during the years 2013 to 2022 were analyzed. The year 2018 recorded the highest number of new infections ($n = 6935$, 13.5 % of the period), with 2591 (37.4 %) corresponding to international migrants and 4344 (62.6 %) to Chileans.

Throughout all evaluated years, a higher frequency of infections was observed in men, approximately three times higher than in women. In international migrants, men represented between 75 % and 83 %, whereas in Chileans, this range fluctuated between 83.3 % and 89.1 % of new infections.

Regarding age, in 8 out of the 10 years under study, the highest percentage of new infections among international migrants was recorded for the 30 to 44 age group (between 44 % and 51.1 % of new infections), whereas among Chileans, the highest percentage was registered for the 15 to 29 age group (between 35.4 % and 48.3 % of new infections). Concerning the laboratory origin of the sample, the Metropolitan Region presented the highest percentage throughout the entire period, however, there was a decrease in both international migrants (from 73.7 % to 64.6 %) and Chileans (from 56.6 % to 43.4 %) (Table 1).

International migrants registered the highest crude and adjusted rates of new HIV infections in the year 2018, with 199.4 new infections per 100,000 population (95 % CI: 191.7 - 207.1) and 123.9 new infections per 100,000 population (95 % CI: 118.6 - 129.3), respectively. Chileans presented a crude and adjusted rate of 24.9 new HIV infections per 100,000 population (95 % CI: 24.2 - 25.6) and 25.4 new infections per 100,000 population (95 % CI: 24.6 - 26.2) in the same year, respectively. The rate ratio between both groups was 8.0 (95 % CI: 7.6 - 8.4) for crude rates and 4.9 (95 % CI: 4.7 - 5.1) for adjusted rates (Table 2).

Generally, higher rates were observed in international migrants compared to Chileans during the study period. However, it is important to note that during the years of the COVID-19 pandemic, a decrease in incidence rates was observed (Fig. 2). Between the years 2013 and 2022, rates in international migrants increased approximately 5 times, ranging from 35.6 to 175.1 new HIV infections per 100,000 population in crude rates and from 22.6 to 115.6 in adjusted rates (see Table 2 and Fig. 2).

4. Discussion

This study contributes to generating evidence regarding the epidemiological situation of new HIV infections in international migrants. It highlights the reporting of higher incidence rates of HIV infection among international migrants compared to the resident population in Chile. This is the first study in Chile that estimates and compares the magnitude of new HIV infections between international migrants and Chileans in terms of crude and adjusted incidence rates. When comparing adjusted incidence rates by age and sex, this study revealed that during the years 2013 to 2022, new HIV infections in international migrants showed an increase, reaching rates 7.6 times higher compared to the rates in Chileans.

These findings align with other international publications. Hoffman et al. (Hoffman et al., 2012), using HIV/AIDS surveillance data from 2006 to 2007 in New York City, compared HIV diagnosis rates, among West Indian-born Blacks; immigrants from Haiti and Dominican Republic; and US-born Blacks and Whites. This study determined that the age-adjusted rate of new HIV infections reported for West Indian-born Blacks was 43.2 per 100,000 population (95 % CI: 38.9 - 49.1), a higher rate than among US-born Whites (20.0 new HIV infections per 100,000 population; 95 % CI: 18.6 - 21.4) and Dominican immigrants but lower than among US-born Blacks (109.5 new HIV infections per 100,000 population; 95 % CI: 105.0 - 114.1) and Haitian immigrants.

Similarly, Ashton et al. (Ashton et al., 2012) compared rates of newly diagnosed infections of HIV/AIDS in Utah between 2000 and 2009 among US-born Blacks and Black individuals born in Africa, where US-born Whites had the lowest annual rates (4 new HIV infections per 100,000 population) while Black individuals born in Africa and in the United States had the highest rates, with 162 and 24 new HIV infections per 100,000 population, respectively. In Europe, Deen et al. (Deen et al., 2018) revealed a higher incidence of HIV diagnoses and late presentation between the years 1993 and 2010 among migrants compared to individuals born in Denmark. The study estimated that both refugee migrants (Hazard Ratio [HR]: 5.6; 95 % CI: 4.4 - 7.1) and family-reunified migrants (HR: 10.5; 95 % CI: 8.9 - 12.4) showed a higher incidence of HIV diagnoses compared to individuals born in Denmark. Furthermore, late presentation was more common among refugees (Odds Ratio [OR]: 1.9; 95 % CI: 1.1 - 3.3) and migrants reunified with family (OR: 2.3; 95 % CI: 1.5 - 3.5) compared to those born in Denmark. Incidence rate differences presented in these studies is relevant, given that the effect of this health measure subsequently influences the population prevalence rates of the disease. In a recent study conducted in Australia, Santoso et al. (Santoso et al., 2022) performed a systematic review with meta-analysis, ranging from 2010 to 2022. This study incorporated evidence from various regions worldwide (Africa, Asia, Europe, Middle East, Oceania, North and South America) and consequently estimated prevalence rates of HIV in international migrants compared to native populations. Reported pooled prevalence ratio for any migrant born abroad was 1.7 (95 % CI: 1.1 - 2.6), 2.4 (95 % CI: 0.3 - 17.0) for refugees, 4.0 (95 % CI: 0.1 - 143.0) for undocumented individuals, and 54.8 (95 % CI: 17.2 - 174.2) for asylum seekers.

There are some limitations to our study. First, it did not include additional relevant risk factors that might affect the probability of acquiring HIV, such as belonging to a specific population group (e.g., pregnant women or men who have sex with men [MSM]), educational level, socioeconomic status, or health coverage (Finnerty et al., 2019; Dailey et al., 2022; Gant et al., 2023). These variables could have provided better insights into health status, accessibility to healthcare, prevention strategies, control, and treatment for this infection, among other conditions. Second, this study does not imply causality between international migrant status and HIV infection, recognizing the complexity in determining the risk of acquiring HIV considering social determinants of health, such as those previously mentioned. Therefore, this study emphasizes the importance of continuing to thoroughly explore the circumstances that explain the risk of contracting HIV in international

Table 1
Number and percentage of new HIV infections confirmed by ISP in international migrants and Chilean population, by sex, age, and region. Chile, 2013–2022¹.

Characteristics	2013 (n = 3999)				2014 (n = 4071)				2015 (n = 4258)				2016 (n = 4883)				2017 (n = 5798)				2018 (n = 6935)				2019 (n = 6710)				2020 (n = 4441)				2021 (n = 5027)				2022 (n = 5391)			
	IM		CL		IM		CL		IM		CL		IM		CL		IM		CL		IM		CL		IM		CL		IM		CL		IM		CL		IM		CL	
	n = 137		n = 3862		n = 216		n = 3855		n = 406		n = 3852		n = 812		n = 4071		n = 1485		n = 4313		n = 2591		n = 4344		n = 2685		n = 4025		n = 1786		n = 2655		n = 2183		n = 2844		n = 2635		n = 2756	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Sex																																								
Male	108	78.8	3336	86.4	171	79.2	3302	85.7	329	81.0	3405	88.4	644	79.3	3629	89.1	1163	78.3	3828	88.8	1943	75.0	3794	87.3	2175	81.0	3434	85.3	1443	80.8	2259	85.1	1812	83.0	2448	86.1	2138	81.1	2297	83.3
Female	29	21.2	526	13.6	45	20.8	553	14.3	77	19.0	447	11.6	168	20.7	442	10.9	322	21.7	485	11.2	648	25.0	550	12.7	510	19.0	591	14.7	343	19.2	396	14.9	371	17.0	396	13.9	497	18.9	459	16.7
Age (years)																																								
<14	1	0.7	8	0.2	2	0.9	16	0.4	3	0.7	13	0.3	1	0.1	11	0.3	2	0.1	11	0.3	4	0.2	15	0.3	5	0.2	12	0.3	1	0.1	7	0.3	3	0.1	7	0.2	7	0.3	10	0.4
15–29	54	39.4	1746	45.2	99	45.8	1724	44.7	189	46.6	1794	46.6	351	43.2	1957	48.1	646	43.5	2082	48.3	1110	42.8	2012	46.3	1137	42.3	1771	44.0	726	40.6	1079	40.6	905	41.5	1069	37.6	1086	41.2	976	35.4
30–44	70	51.1	1369	35.4	95	44.0	1354	35.1	183	45.1	1296	33.6	394	48.5	1378	33.8	735	49.5	1409	32.7	1257	48.5	1461	33.6	1303	48.5	1429	35.5	880	49.3	966	36.4	1073	49.2	1094	38.5	1243	47.2	1101	39.9
45–64	12	8.8	669	17.3	20	9.3	684	17.7	31	7.6	676	17.5	64	7.9	665	16.3	100	6.7	717	16.6	209	8.1	763	17.6	229	8.5	730	18.1	175	9.8	532	20.0	196	9.0	597	21.0	287	10.9	582	21.1
>64	0	0.0	70	1.8	0	0.0	77	2.0	0	0.0	73	1.9	2	0.2	60	1.5	2	0.1	94	2.2	11	0.4	93	2.1	11	0.4	83	2.1	4	0.2	71	2.7	6	0.3	77	2.7	12	0.5	87	3.2
Region																																								
Arica y Parinacota	2	1.5	84	2.2	6	2.8	70	1.8	9	2.2	98	2.5	15	1.8	92	2.3	24	1.6	101	2.3	33	1.3	121	2.8	31	1.2	96	2.4	25	1.4	54	2.0	61	2.8	74	2.6	55	2.1	83	3.0
Tarapacá	10	7.3	88	2.3	9	4.2	96	2.5	21	5.2	109	2.8	39	4.8	99	2.4	41	2.8	100	2.3	78	3.0	106	2.4	96	3.6	99	2.5	52	2.9	73	2.7	91	4.2	78	2.7	117	4.4	78	2.8
Antofagasta	16	11.7	135	3.5	13	6.0	146	3.8	51	12.6	118	3.1	58	7.1	169	4.2	84	5.7	196	4.5	117	4.5	195	4.5	128	4.8	175	4.3	96	5.4	129	4.9	111	5.1	150	5.3	173	6.6	122	4.4
Atacama	1	0.7	43	1.1	4	1.9	53	1.4	5	1.2	51	1.3	8	1.0	66	1.6	11	0.7	59	1.4	13	0.5	55	1.3	26	1.0	66	1.6	24	1.3	49	1.8	19	0.9	63	2.2	39	1.5	56	2.0
Coquimbo	3	2.2	120	3.1	0	0.0	141	3.7	7	1.7	140	3.6	13	1.6	133	3.3	26	1.8	120	2.8	56	2.2	157	3.6	52	1.9	155	3.9	37	2.1	103	3.9	56	2.6	128	4.5	60	2.3	137	5.0
Valparaíso	1	0.7	346	9.0	3	1.4	371	9.6	4	1.0	375	9.7	17	2.1	391	9.6	75	5.1	418	9.7	168	6.5	395	9.1	167	6.2	401	10.0	105	5.9	271	10.2	107	4.9	273	9.6	156	5.9	283	10.3
Metropolitana	101	73.7	2185	56.6	175	81.0	2224	57.7	302	74.4	2040	53.0	647	79.7	2163	53.1	1129	76.0	2238	51.9	1747	67.4	2225	51.2	1841	68.6	1968	48.9	1212	67.9	1213	45.7	1466	67.2	1260	44.3	1701	64.6	1196	43.4
O'Higgins	0	0.0	97	2.5	0	0.0	96	2.5	1	0.2	95	2.5	1	0.1	125	3.1	33	2.2	127	2.9	95	3.7	130	3.0	68	2.5	134	3.3	50	2.8	85	3.2	72	3.3	93	3.3	114	4.3	104	3.8
Maule	0	0.0	117	3.0	1	0.5	91	2.4	1	0.2	114	3.0	2	0.2	115	2.8	14	0.9	157	3.6	78	3.0	141	3.2	75	2.8	182	4.5	57	3.2	106	4.0	51	2.3	116	4.1	66	2.5	116	4.2
Ñuble	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	17	0.6	63	1.6	13	0.7	38	1.4	13	0.6	40	1.4	14	0.5	37	1.3
Biobío	1	0.7	294	7.6	2	0.9	258	6.7	1	0.2	296	7.7	4	0.5	318	7.8	19	1.3	314	7.3	87	3.4	337	7.8	66	2.5	234	5.8	41	2.3	206	7.8	54	2.5	199	7.0	59	2.2	183	6.6
La Araucanía	0	0.0	83	2.1	1	0.5	65	1.7	1	0.2	118	3.1	3	0.4	113	2.8	11	0.7	125	2.9	45	1.7	145	3.3	33	1.2	125	3.1	25	1.4	81	3.1	30	1.4	98	3.4	17	0.6	99	3.6
Los Ríos	0	0.0	38	1.0	1	0.5	42	1.1	0	0.0	55	1.4	0	0.0	48	1.2	1	0.1	78	1.8	18	0.7	62	1.4	8	0.3	60	1.5	4	0.2	43	1.6	8	0.4	54	1.9	12	0.5	50	1.8
Los Lagos	2	1.5	175	4.5	0	0.0	142	3.7	2	0.5	181	4.7	3	0.4	194	4.8	10	0.7	214	5.0	43	1.7	209	4.8	53	2.0	206	5.1	32	1.8	157	5.9	27	1.2	162	5.7	43	1.6	163	5.9
Aysén	0	0.0	14	0.4	0	0.0	14	0.4	0	0.0	16	0.4	0	0.0	11	0.3	1	0.1	19	0.4	1	0.0	20	0.5	3	0.1	19	0.5	5	0.3	13	0.5	3	0.1	16	0.6	3	0.1	19	0.7
Magallanes	0	0.0	43	1.1	1	0.5	46	1.2	1	0.2	46	1.2	2	0.2	34	0.8	6	0.4	47	1.1	12	0.5	46	1.1	21	0.8	42	1.0	8	0.4	34	1.3	14	0.6	40	1.4	6	0.2	30	1.1

¹ IM: International migrants; CL: Chilean. Until the year 2018 (inclusive), new infections from the Ñuble Region were included in the Biobío region.

Table 2
Crude rates, adjusted rates, and rate ratio of new HIV infections, by international migrants and Chilean population. Chile, 2013–2022.

Confirmed year	International migrants		Chilean population		Rate Ratio ²	
	Crude rate 95 % CI ³	Adjusted rate ¹ 95 % CI	Crude rate 95 % CI	Adjusted rate 95 % CI	Crude rate 95 % CI	Adjusted rate 95 % CI
2013	35.6 (29.7 - 41.6)	22.6 (18.3 - 27.0)	22.4 (21.7 - 23.1)	22.3 (21.6 - 23.0)	1.6 (1.3 - 1.9)	1.0 (0.9 - 1.2)
2014	52.6 (45.6 - 59.6)	36.4 (30.7 - 42.2)	22.2 (21.5 - 22.9)	22.0 (21.3 - 22.7)	2.4 (2.1 - 2.7)	1.7 (1.4 - 1.9)
2015	64.1 (58.0 - 70.4)	41.6 (37.0 - 46.3)	22.2 (21.5 - 22.9)	22.2 (21.5 - 22.9)	2.9 (2.6 - 3.2)	1.9 (1.7 - 2.1)
2016	95.0 (88.4 - 101.5)	58.5 (54.0 - 63.0)	23.5 (22.8 - 24.2)	23.8 (23.1 - 24.5)	4.0 (3.8 - 4.4)	2.5 (2.3 - 2.7)
2017	137.9 (130.9 - 144.9)	83.7 (79.0 - 88.4)	24.9 (24.1 - 25.6)	25.3 (24.5 - 26.0)	5.5 (5.2 - 5.9)	3.3 (3.1 - 3.5)
2018	199.4 (191.7 - 207.1)	123.9 (118.6 - 129.3)	24.9 (24.2 - 25.6)	25.4 (24.6 - 26.2)	8.0 (7.6 - 8.4)	4.9 (4.7 - 5.1)
2019	185.4 (178.4 - 192.4)	116.9 (111.9 - 122.0)	22.8 (22.1 - 23.5)	23.2 (22.5 - 23.9)	8.1 (7.5 - 8.5)	5.0 (4.8 - 5.3)
2020	122.3 (116.7 - 128.0)	76.9 (72.9 - 81.0)	14.8 (14.2 - 15.3)	14.8 (14.2 - 15.4)	8.3 (7.8 - 8.8)	5.2 (4.9 - 5.5)
2021	147.3 (141.1 - 153.5)	91.4 (87.1 - 95.7)	15.6 (15.1 - 16.2)	15.7 (15.1 - 16.3)	9.4 (8.9 - 10.0)	5.8 (5.5 - 6.2)
2022	175.1 (168.5 - 181.8)	115.6 (110.5 - 120.7)	15.0 (14.5 - 15.6)	15.2 (14.7 - 15.8)	11.6 (11.0 - 12.3)	7.6 (7.2 - 8.0)

¹ Adjusted rates by age and sex using the direct adjustment method, based on the estimated population in Chile in 2002 according to the 2017 Census by INE. Rates per 100,000 population.

² Rate Ratio calculated as division between international migrant and Chilean population rates.

³ Confidence Intervals (CI) were calculated as mentioned in Betty R. Kirkwood and Jonathan A. C. Sterne (Kirkwood and Sterne, 2010).

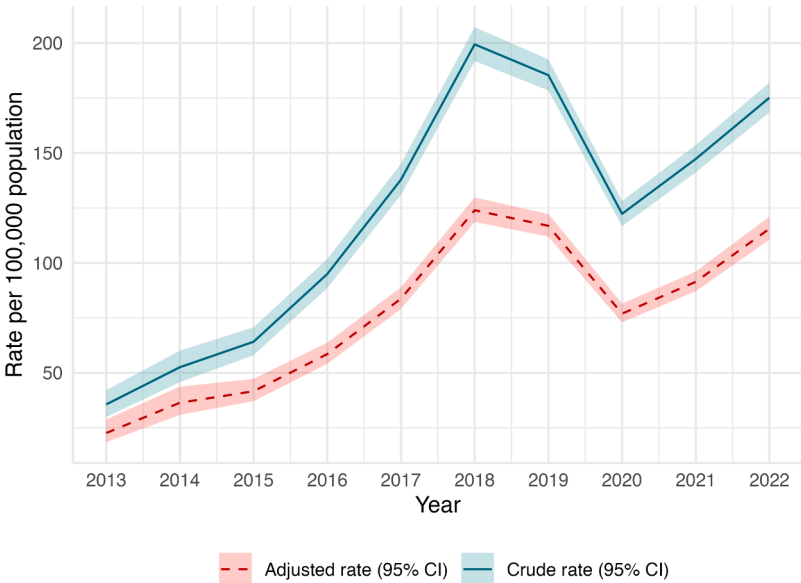


Fig. 2. Crude and adjusted rates with 95 % confidence intervals of new HIV infections in international migrants. Chile, 2013–2022. Crude and adjusted rates of new HIV infections among international migrants in Chile from 2013 to 2022, with 95 % confidence intervals. The figure highlights the annual trends and offers a visual comparison between the crude and adjusted rates, indicating variations and patterns over the specified years.

migrant communities in Chile. Third, this study did not include additional epidemiological information about the country of origin, likely country of infection, or HIV infection status before, during, and after migration to Chile. An interesting approach was proposed by Schousboe et al. (Santoso et al., 2022), where they assessed the prevalence of HIV in migrant groups and contrasted it with estimates within their countries of origin by constructing a ratio. A similar framework could be adapted in terms of incidence rate; however, country of origin would not be presented and an overall informative metric would be reported (Schousboe and Wejse, 2021). Fourth, the time elapsed from arrival in Chile to the confirmation of HIV infection was not considered, making it interesting to study the moment and the mechanism by which this infection was acquired in the international migrant population.

The findings in this study suggest the necessity to focus on and ensure HIV prevention and treatment interventions in the international migrant community. This is particularly relevant considering their high rates of HIV infection, and they also constitute a large and increasing population group in Chile (Instituto Nacional de Estadísticas de Chile 2022; Departamento de Extranjería y Migración 2016; Instituto Nacional de Estadísticas de Chile 2021). This phenomenon was particularly relevant during the initial years of the COVID-19 pandemic. The reported increase in migrant arrivals in Chile (Colmenares and Abarca, 2022) coincided with other factors, such as the disruption of timely HIV screening strategies and confinement measures. These factors have been attributed to the reduction in the rate of new reported HIV infections at the onset of the pandemic (Mude et al., 2023; Soriano et al., 2023;

Centers for Disease Control and Prevention 2021). Consequently, there might be a significant number of undiagnosed infections that, if not timely screened, could progress to more severe stages of infection and maintain the risk of transmission, potentially explaining an increase in HIV diagnoses and other sexually transmitted infections (STIs) in later stages after the COVID-19 pandemic (Soriano et al., 2023; Centers for Disease Control and Prevention 2022; Jenness et al., 2021). Therefore, it is essential to consider that an increase in new HIV infection rates in the coming years may not necessarily reflect an increase in the incidence of infections (i.e., new infection occurrence) since they could correspond to infections not diagnosed during the COVID-19 pandemic, occurring beforehand.

5. Conclusions

The rates of new HIV infections among international migrants were higher compared to the Chilean resident population and showed an increase during the analyzed period. It is necessary to focus on diagnostic, preventive, and control strategies for HIV among international migrants in Chile. Furthermore, HIV persists as a significant public health challenge in Chile, urging a comprehensive approach that considers social determinants of health, with migration being a prominent factor among them.

Statement of intent

The authors have made their best effort not to perpetuate racism or other forms of oppression. However, language, knowledge, interpretation, and understanding are dynamic. This communication reflects best efforts at the time of publication (Joint United Nations Programme on HIV/AIDS (UNAIDS) 2024; Lebow-Skelley, 2023).

CRedit authorship contribution statement

Rodrigo Puentes: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization. **María Alejandra Dünner:** Writing – review & editing, Supervision, Investigation, Conceptualization. **Natalia T. Santis-Alay:** Writing – review & editing, Writing – original draft, Visualization, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Mario E. Soto-Marchant:** Writing – review & editing, Writing – original draft, Visualization, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Cecilia Canales:** Project administration, Funding acquisition. **Janepsy Díaz:** Project administration, Funding acquisition.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jmh.2024.100297.

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