Epidemiological Report

Dengue, Chikungunya and Zika Virus
Historic Series 2010 – 2021

Fernando Luiz de Lima Macedo, Francisca Leiliane de Oliveira Mota,Gilberlândio Pereira de Oliveira, Graziela Almeida da Silva, Jussara Vargas Polimanti, Maria do Carmo Rodrigues dos Santos Camis, Roseane Pôrto Medeiros, Roudom Ferreira Moura, Vivian Ailt

Division of Dengue, Chikungunya and Zika Diseases
Epidemiological Surveillance Center “Prof. Alexandre Vranjac”
Disease Control Coordination
Sao Paulo State Health Department

DOI: https://doi.org/10.57148/bepa.2022.v.19.37861
VOL. 20 • **Nº** 219 • **YEAR** 2023 • **ISSN** 1806-4272

Correspondence
E-mail: dengue@cve.saude.sp.gov.br
Institution: CVE|CCD/SES-SP
Address: Av. Dr. Arnaldo, 351 - 6th floor. CEP: 01246-000. Sao Paulo-SP, Brazil

BRIEF HISTORY

DENGUE

Urban arboviruses (dengue, chikungunya and zika) are a major public health problem in Brazil and worldwide. Several factors contribute to the increase in cases in addition to the proliferation of mosquitoes of the *Aedes* genus (especially *A. aegypti* and in a less extent *A. albopictus)*: rapid population growth, intense and disorderly urbanization, lack of urban infrastructure, increased production of waste, lack of basic sanitation, weakness of public health services and campaigns, as well as the unpreparedness of health agents and the population for disease control. These aspects, among others, make these diseases a major challenge for managers and society, and the participation of all those involved is essential, requiring a restructuring of actions to minimize transmission and improve the care of suspected cases.[1,2]

According to the Centers for Disease Control and Prevention (CDC), in the United States, half of the world's population, about 4 billion people, live in areas at risk of disease transmission; and each year 400 million are infected by the virus, 100 million become ill and 40 thousand can progress to death from severe dengue. Epidemics occur in the Americas, Africa, Asia and the Pacific Islands.[3] In the Americas, in addition to the circulation of the four dengue virus serotypes (DENV-1, DENV-2, DENV-3, DENV-4), there was an increase in cases, from 1.5 million in the 1980s to 16.2 million between 2010-2019.[4]

In Brazil, the first documented dengue epidemic was recorded in Roraima (1981-1982), caused by the DENV-1 and DENV-4 serotypes, with approximately 11,000 cases, and since then it has been occurring in all regions of the country in the endemic form and with epidemics, generally associated with circulation in unaffected areas or alteration of circulating DENV, occurring more sharply in hot and rainy periods, when mosquito proliferation increases.[1,2]

The transmission of the disease was first observed in the state of São Paulo (SSP) in 1987, in the municipalities of Guararapes and Araçatuba. In the summer of 1990/1991, a major epidemic was recorded, starting in Ribeirão Preto, which quickly expanded to neighboring municipalities and other regions. Since then, dengue transmission has occurred every year in São Paulo. Between 1987 and 2013, the epidemiological pattern of the disease presented periods of low transmission (inter-epidemic periods), interspersed with the occurrence of epidemics (epidemic periods), these are often associated with the introduction of a new serotype or the change in the predominant serotype.[1,2,5]

CHIKUNGUNYA

Chikungunya, in the language spoken by the Makonde ethnicity, means “the one who bends”, in allusion to the stooped appearance of people with intense arthralgia, the main characteristic of the condition.[6] The disease-causing virus (CHIKV) was first described in an epidemic in Tanzania in 1952 and identified in African and European countries, India and the Pacific Islands. As of 2013, transmission was reported in the Americas, being identified in the Caribbean islands, where it caused epidemics.[6]

In Brazil, autochthonous transmission of CHIKV was confirmed in the second half of 2014, primarily in the states of Amapá and Bahia. Since then, autochthonous cases have been recorded in several regions of the country. In affected communities, the hallmark is epidemics with high attack rates, ranging from 31% to 75%.[7-9]

In the SSP, initially cases were imported and detected at the end of 2014. In the following year, 2015, the first autochthonous case was identified and some municipalities began to register cases of the disease sporadically. In 2021, there was a record in São Paulo of the first chikungunya epidemic, in Baixada Santista.[10]

ZIKA VIRUS

Zika virus (ZIKV) was identified in 1947 in the Zika forest in Uganda, Central Africa, after scientists conducted surveillance for yellow fever in rhesus macaques; and in 1948, in the same area, the virus was found in *Aedes* africanus mosquitoes. The first human cases were detected in this same region in 1952.[11]

The first ZIKV epidemic was reported only in 2007, on Yap Island, Micronesia (Oceania), with a subsequent episode in French Polynesia, in 2013, and in other countries in the Pacific region, being associated with 80% of asymptomatic infections. After being considered to have a benign course, there was evidence of a link between ZIKV infection and the development of Guillain-Barré syndrome, also related to cases of microcephaly. This scenario led to the issuing of an international alert by the World Health Organization (WHO).[12-16]

In 2015, Brazil reported to the WHO the association between ZIKV infection and microcephaly.[2,11-14] The first confirmation of autochthonous contagion by ZIKV in the territory of São Paulo was verified in May 2015, due to probable transfusional transmission.[15]

ETIOLOGICAL AGENTS

Dengue and Zika are caused by RNA viruses, genus *Flavivirus* that belongs to the family *Flaviviridae*. DENV has four known serotypes: DENV 1, DENV 2, DENV 3 and DENV 4. All of them have already circulated in the SSP, the most frequent being DENV 1. In the case of ZIKV, two lineages are described, one African and the other Asian.[13,17,18]

Chikungunya has as its etiological agent the virus that belongs to the *Alphavirus* genus of the family *Togaviridae*. It has four genotypes: Asian, Indian Ocean, West African and East-Central-South African (ECSA). The West African one is endemic in Africa and the Asian one circulates in Southeast Asia; the first two are responsible for epidemics on islands in the Indian Ocean and in Asia. In Brazil, the ECSA genotypes were identified, probably coming from Angola to Bahia, and the Asian, from the Caribbean epidemic to Amapá.[19-21]

A mutation that occurred in the West African genotype allowed the adaptation of CHIKV to *Aedes albopictus*, present mainly in peri-urban areas with a milder climate, facilitating the spread of the disease in Europe. It is possible that the same mutation, if acquired by ECSA, may favor its expansion to colder regions Brazil.[20]

TRANSMISSION MODE

Urban arboviruses can be transmitted to the host by the bite of a female mosquito of the genus *Aedes* (*A. aegypti* and *A. albopicuts*) infected with the virus, which remains transmitting throughout its life to several human hosts. *A. albopictus* can be found in peri-urban and rural areas and in milder climates, also feeding on mammals, birds, and humans. *A. aegypti*, on the other hand, lives in urban areas and in warmer climates, being the main vector of diseases in the Americas and Brazil. In addition to vector transmission, other forms of transmission can occur:[3,4,6,7,10,15,16]

- DENGUE: vertical (pregnant woman – baby), transfusion;
- CHIKUNGUNYA: Vertical transmission can occur at the time of delivery of viremia pregnant women and often result in severe neonatal infection. Transmission by blood transfusion may occur; and
- ZIKA: vertical (pregnant woman – baby), sexual and possibility of transfusion transmission. During pregnancy, the virus can lead to several fetal malformations, especially microcephaly.[14]

EPIDEMIOLOGICAL SITUATION

1. DENGUE

In the period from 2010 to 2021, there was greater and lesser transmission, maintaining the characteristic of epidemic and interepidemic years. In 2015, the highest incidence coefficient (IC) was observed (1,597.16 cases per 100,000 inhabitants, with 709,084 cases).

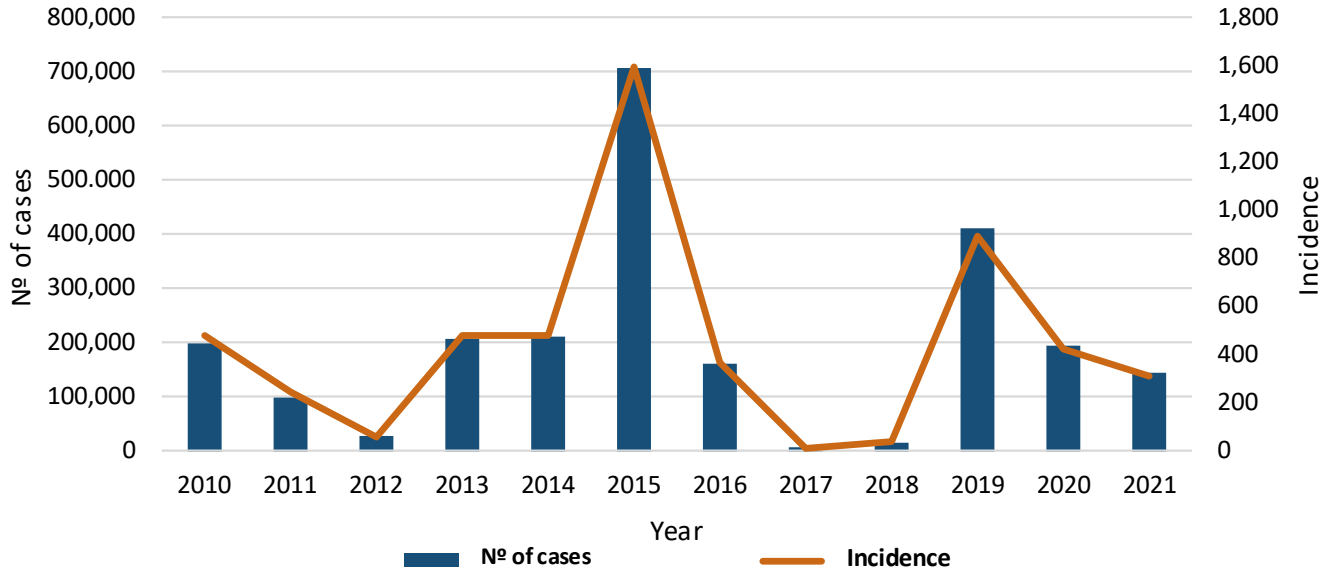
The year 2019 was the second with the highest transmission (411,654 cases and an IC of 896.48 cases per 100,000 inhabitants). The years with the lowest IC were 2012 (61.98 cases per 100,000 inhabitants and 25,970 cases), 2017 (IC of 14.29 cases per 100,000 inhabitants and 6,443 cases) and 2018 (IC of 34.71 cases per 100,000 inhabitants and 15,805 cases), as shown in Table 1 and Graph 1.

Table 1. Number of confirmed cases, IC (cases per 100,000 population), number and percentage of municipalities with dengue transmission, by year of symptoms, ESP, 2010 – 2021.*

Year	Dengue cases	IC*	Number of municipalities	%
2010	197,999	479.86	475	74%
2011	100,398	241.42	419	65%
2012	25,970	61.98	326	51%
2013	208,260	476.96	536	83%
2014	209,933	476.74	514	80%
2015	709,084	1,597.16	612	95%
2016	162,788	363.77	553	86%
2017	6,443	14.29	341	53%
2018	15,805	34.71	400	62%
2019	411,654	896.48	594	92%
2020	195,935	423.28	574	89%
2021	146,028	313.03	565	88%
Total municipalities in the SSP	**-**	**-**	**645**	**100%**

Source: Sinan Online. *Data extracted on May 30, 2022.

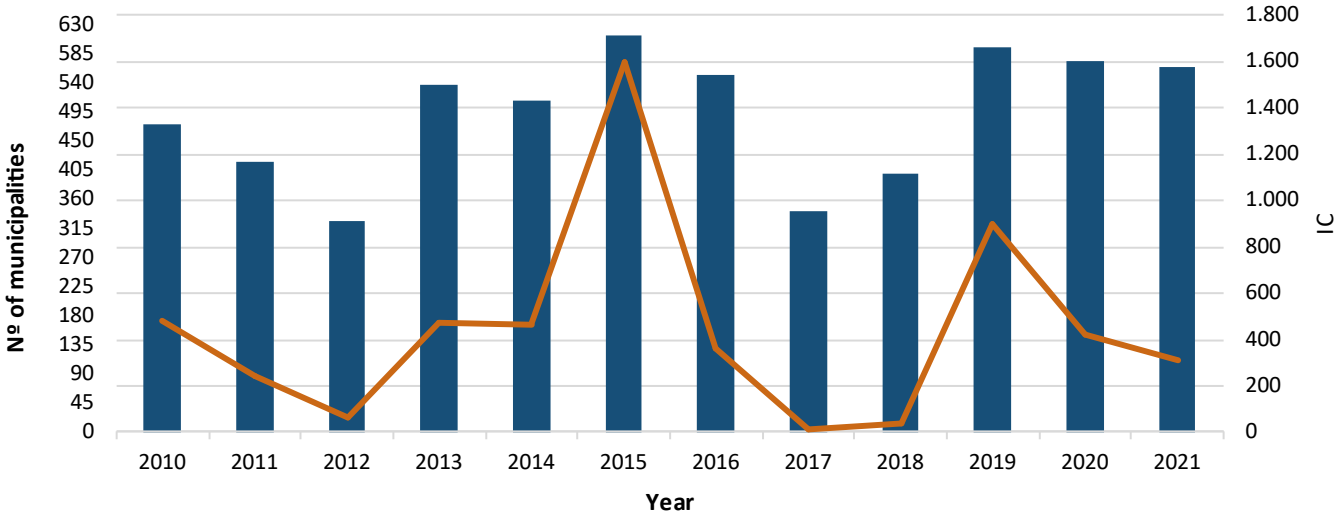
Graph 1. Number of confirmed cases of dengue and IC (cases per 100,000 population), according to year of onset of symptoms, SSP, 2010 – 2021.*



Source: Sinan Online. *Data extracted on May 30, 2022.

São Paulo has 645 municipalities, divided into 63 Health Regions (HR), in all the disease is present, with a progressive increase in cases and it has affected cities since its introduction in the state. In 2015, the largest epidemic occurred, reaching 95% of the municipalities, followed by 2019, with 92% (Table 1 and Graph 2). In the analyzed period, more than 50% of all municipalities in São Paulo were affected every year, ranging from 51% (326 cities) in 2012 and 95% (613) in 2015.

Graph 2. Municipalities with dengue transmission and IC (cases per 100,000 inhabitants) by year of onset of symptoms, SSP, 2010 – 2021.*



Source: Sinan Online. *Data extracted on May 30, 2022.

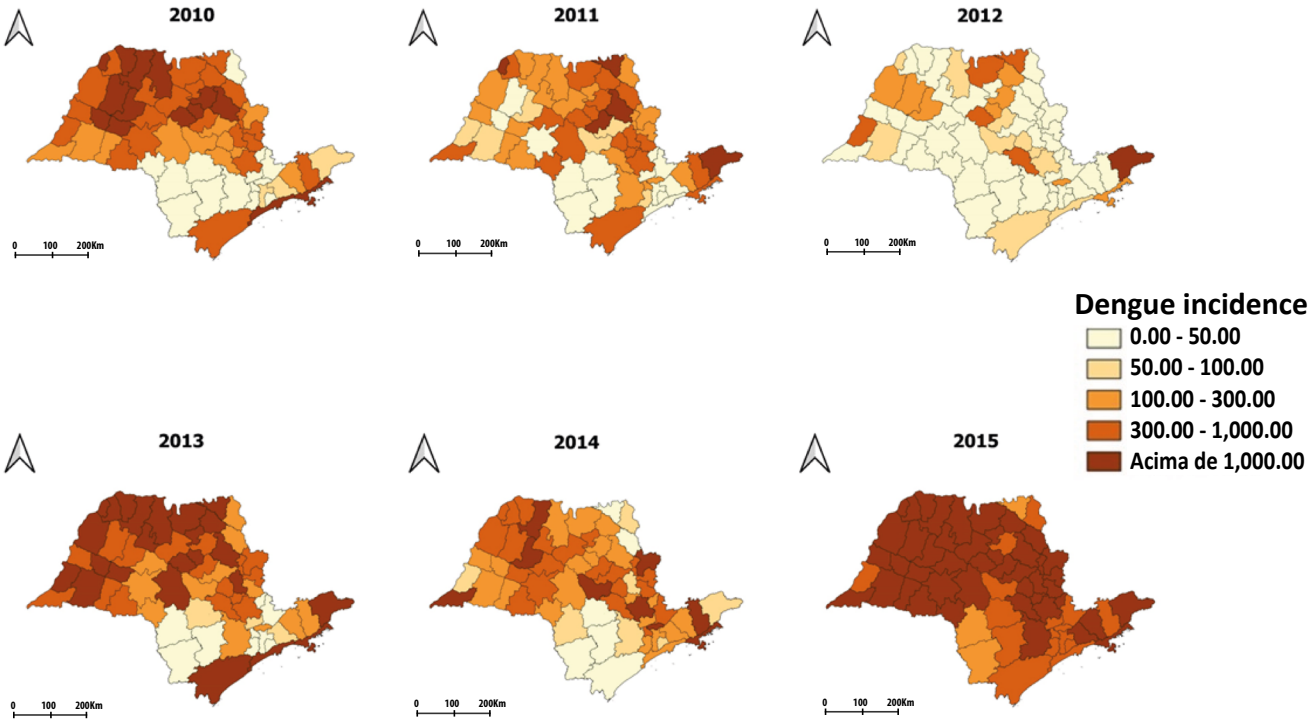
The occurrence of dengue in the SSP varied by year and by health region, as we can see in Table 2, which shows the IC by ranges, and Figures 1 and 2, the incidence coefficient per year and HR affected. In 2015, the year with the highest IC (1,597.16 cases per 100,000 inhabitants) of dengue, no HR had an IC below 100 cases per 100,000 inhabitants and 70% (44) of the 63 HRs had an IC above 1,000 cases per 100,000 inhabitants. The year 2017 had the lowest transmission, with an IC of 14.29 occurrences per 100,000 inhabitants, with 95% (60) of the HRs with an IC below 50 cases per 100,000 inhabitants in the range of 50 to 100, and only the HR of São José do Rio Preto with an IC of 131.10 incidents per 100,000 inhabitants.

Table 2. Number of Health Regions by IC range by year of symptoms, SSP, 2010-2021.*

IC (cases 100 thousand inhab.)	Year of onset of symptoms											
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
< 50	14	14	39	9	6	0	5	60	43	3	11	17
50 to 100	3	6	10	3	7	0	14	2	8	3	5	10
101 to 300	11	19	8	12	21	3	18	1	9	11	10	12
301 to 1000	21	19	5	15	20	16	11	0	2	8	11	12
> 1,000	14	5	1	24	9	44	15	0	1	38	26	12

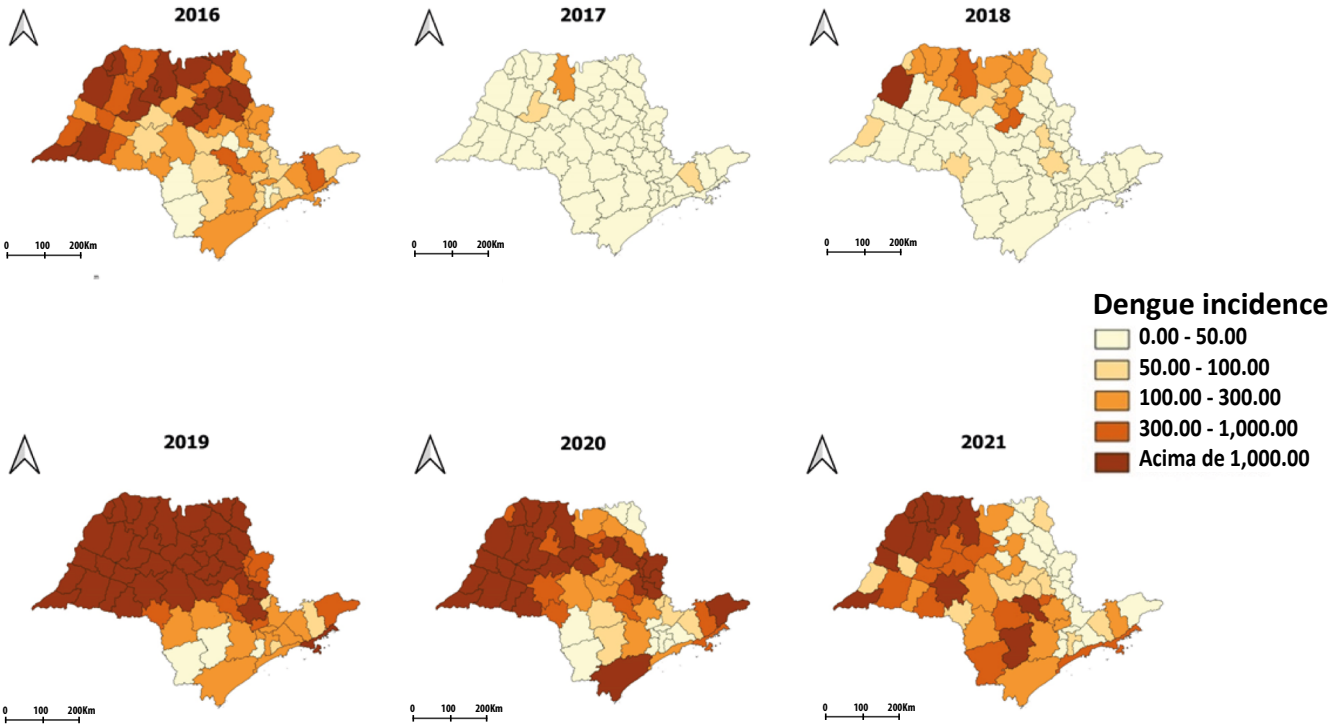
Source: Sinan Online. *Data extracted on May 30, 2022.

Figure 1. Distribution of the dengue incidence coefficient (cases per 100,000 inhabitants), according to HR, SSP, 2010 -2015.*



Source: Sinan Online. *Data extracted on May 30, 2022.

Figure 2. Distribution of the dengue incidence coefficient, according to HR, SSP, 2016 – 2021.*



Source: Sinan Online. *Data extracted on May 30, 2022.

In the period, the Lagos HR, Guarani Aquifer, Santa Fé do Sul, São José do Rio Preto and Votuporanga had an IC above 1,000 cases per 100,000 inhabitants in seven of the 12 years studied.

The HR of Lagos and of São José do Rio Preto and Votuporanga maintained IC above 1,000 cases per 100,000 inhabitants in the last three years, as well as the HR of Central; Pontal do Paranapanema; Jales and Fernandópolis; and Alta Paulista. These regions draw attention for the persistence of important transmission over the years.

The HR of Alto do Tietê had an IC greater than 1,000 cases per 100,000 inhabitants in 2015, but the other years of the period had an IC of less than 300 cases per 100,000 inhabitants. The HR of Grande ABC and Circuito das Águas presented IC of 314.67 cases per 100,000 inhabitants in 2015, while in the other years below 100 cases per 100,000 inhabitants. Other regions with lower transmission were Vale do Jurumirim, which showed the highest coefficient in 2015 (290.51 cases per 100,000 inhabitants) and Itapeva, with an IC of less than 100 cases per 100,000 inhabitants in ten years of historical series (2010-2021), with the highest IC in the years 2015 and 2021.

Table 3 and Graph 3 show the seasonal behavior of dengue. Around 84% of cases occur between February and May, representing a significant burden, in a short period of time, for care services, laboratories, surveillance teams, needs for supplies and beds, especially in the year's epidemic.

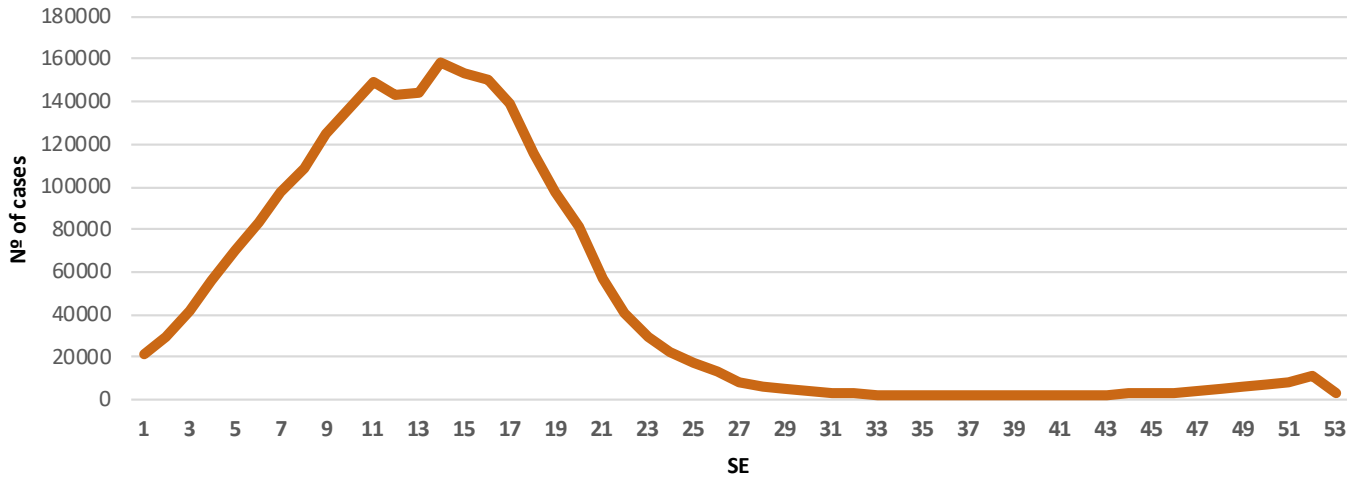
The impact can be better managed with timely and adequate planning, according to different levels of transmission. From November/December, the number of cases may increase, especially if the following year is epidemic. One should be alert if there is a growth in these months.

Table 3. Distribution of confirmed dengue cases, second month of onset of symptoms, SSP, 2010 - 2021.*

Month of onset of symptoms	Cases	%
Jan	172,554	7.2
Feb	376,422	15.7
Mar	629,265	26.3
Apr	648,501	27.1
May	364,558	15.2
Jun	94,994	4.0
Jul	24,804	1.0
Aug	10,510	0.4
Sept	8,214	0.3
Oct	9,794	0.4
Nov	15,894	0.7
Dec	35,948	1.5
Total	**2,391,458**	**100**

Source: Sinan Online. *Data extracted on May 30, 2022.

Graph 3. Distribution of confirmed dengue cases, according to symptom onset of symptoms SE, SSP, 2010-2021.*



Source: Sinan Online. *Data extracted on May 30, 2022.

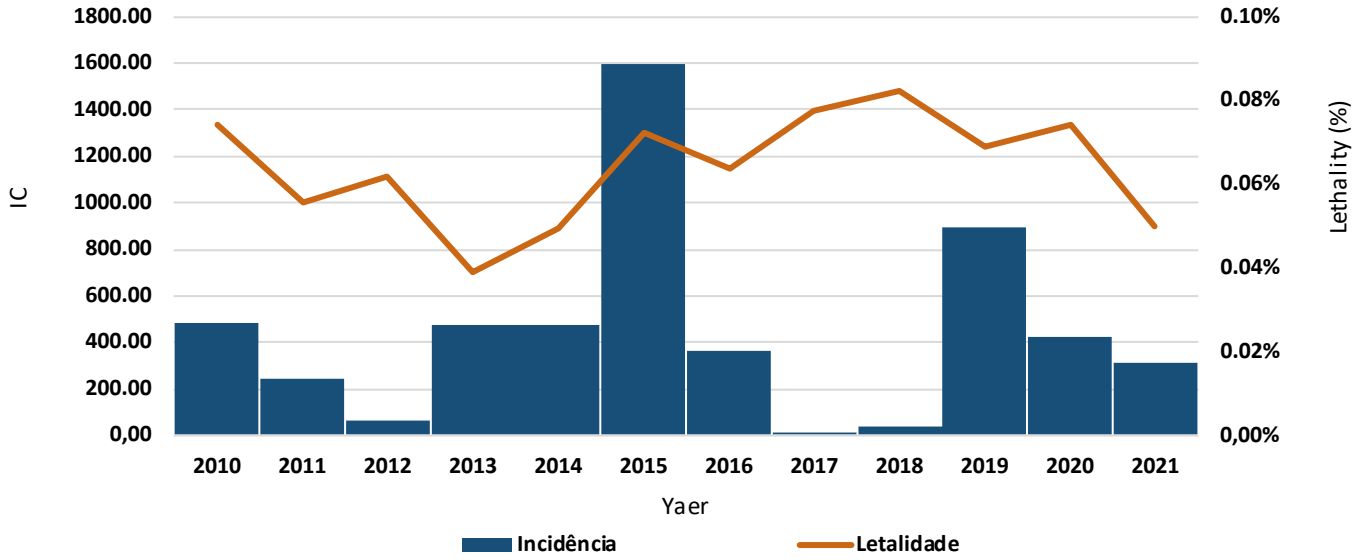
In Table 4 and Graph 4, the case fatality rate ranged from 0.04% to 0.08%, a level below that recommended by the WHO, which is 1%.[4] In 2015, the year with the highest number of cases, there were 514 deaths (0.07% lethality) from dengue.

Table 4. Number of deaths, case fatality rate, confirmed cases and IC (cases per 100,000 inhabitants) of dengue, according to year of symptoms, SSP, 2010-2021.*

Year	Nº of deaths	Lethality* (%)	Cases	IC
2010	147	0.07	197,999	479.86
2011	56	0.06	100,398	241.42
2012	16	0.06	25,970	61.98
2013	81	0.04	208,260	476.96
2014	104	0.05	209,933	476.74
2015	514	0.07	709,084	1,597.16
2016	104	0.06	162,788	363.77
2017	5	0.08	6,443	14.29
2018	13	0.08	15,805	34.71
2019	283	0.07	411,654	896.48
2020	145	0.07	195,935	423.28
2021	73	0.05	146.,028	313.03

Source: Sinan Online. *Data extracted on May 30, 2022.

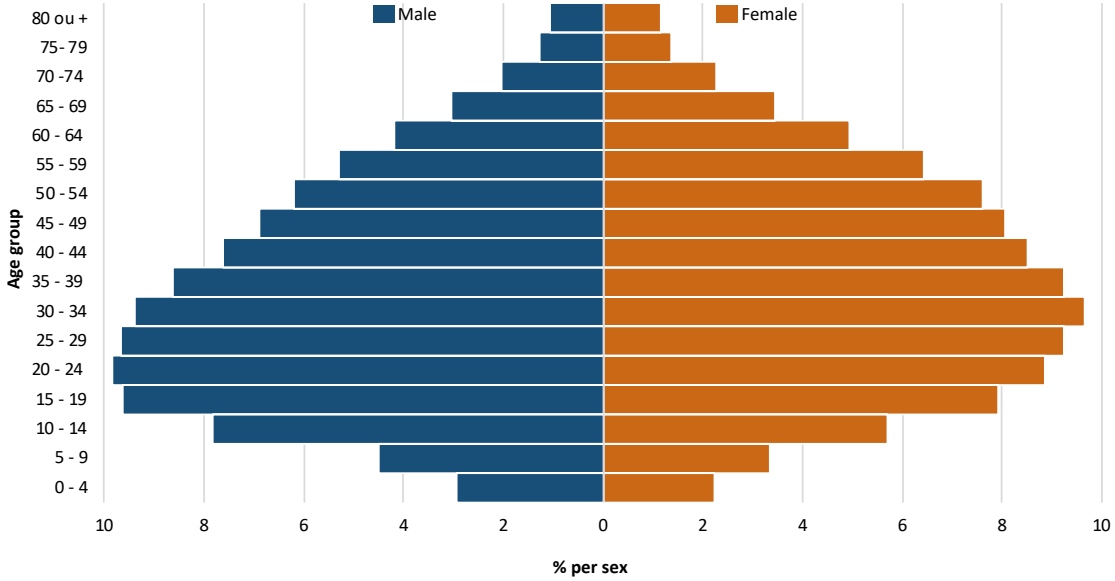
Graph 4. Distribution of IC (cases per 100,000 population) and dengue case fatality rate by year of onset of symptoms, SSP, 2010-2021.*



Source: Sinan Online. *Data extracted on May 30, 2022.

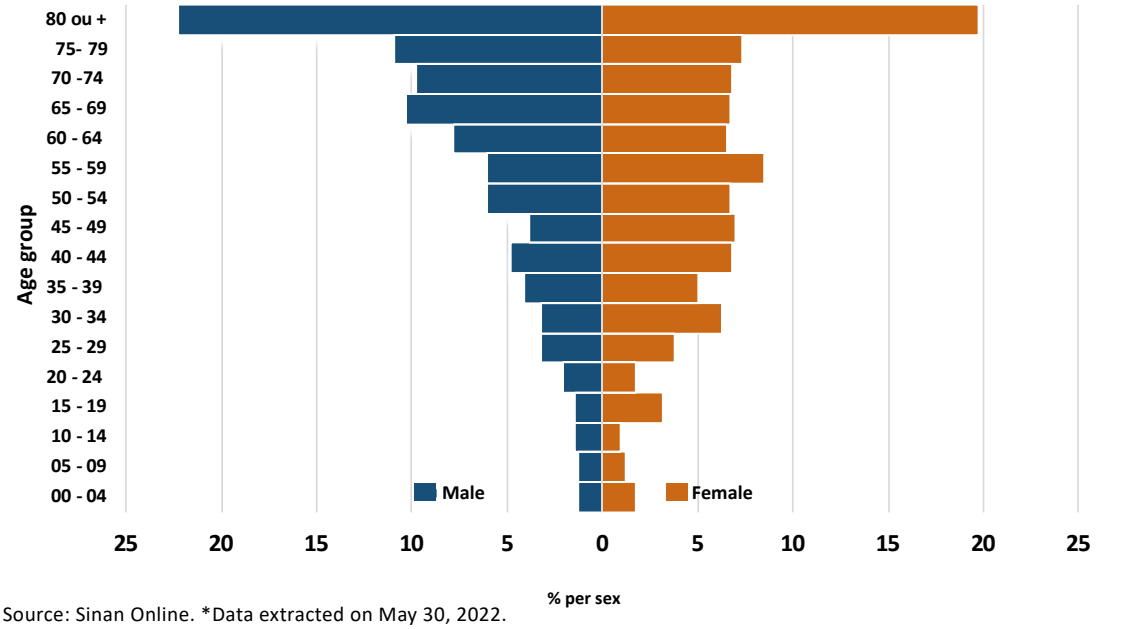
In Graphs 5 and 6, it is possible to observe the distribution of dengue cases and deaths by sex and age group, from 2010 to 2021. Regarding sex, 45.1% of the sick people were men and 54.9% were women, while 52.4% of deaths occurred among males and 47.6% among females.

Graph 5. Proportional distribution of dengue cases by sex and age group, SSP, 2010-2021.*



Source: Sinan Online. *Data extracted on May 30, 2022.

Graph 6. Proportional distribution of death from dengue according to sex and age group, SSP, 2010-2021.*



Source: Sinan Online. *Data extracted on May 30, 2022.

Regarding the age group, the predominance of cases occurred between 20 and 44 years of age (45.4%), 7.9% in those over 65 years of age and 1.1% over 80 years of age. In Graph 6, we observe that deaths predominated in patients over 65 years of age (47.7%), with 21.1% over 80 years of age. It is important that health services are aware of cases of individuals over 65 years of age and the risk of severe forms and deaths.

The DENV 1 serotype circulated in all years of the period considered (Table 5), being predominant from 2010 to 2017 and in 2021. DENV 2 circulated from 2018 to 2020. DENV 4 represented about 40% of identifications from 2012 and 2013, not being identified in 2017, 2018 and 2021. From 2010 to 2021, DENV 3 was identified in 37 (0.3%) cases with DENV identified.

Table 5. Distribution of dengue virus serotypes identified by year, SSP, 2010-2021.*

Serotype	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total	%
DENV 1	608	901	357	932	1,079	1,471	349	18	104	251	201	491	6,762	57.7
DENV 2	104	22	62	20	12	24	50	11	259	1,963	1,005	202	3,734	31.9
DENV 3	19	3	1	0	0	4	0	6	1	2	1	0	37	0.3
DENV 4	5	22	269	660	67	140	8	0	0	4	2	0	1,177	10.1
Total	**736**	**948**	**689**	**1,612**	**1,158**	**1,639**	**407**	**35**	**364**	**2,220**	**1,209**	**693**	**11,710**	**100.0**

*Data extracted on May 30, 2022. Source: Sinan Online.

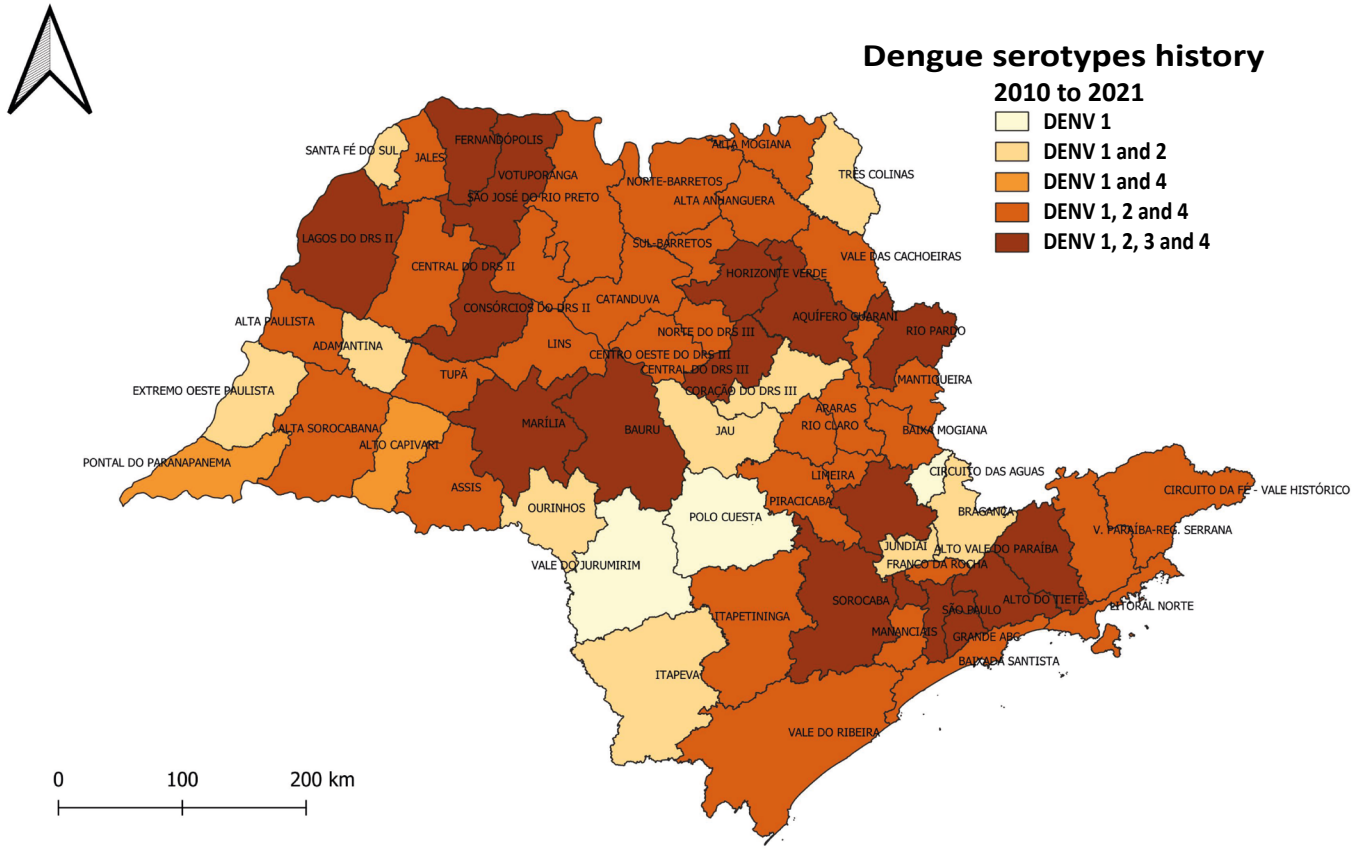
Regarding the distribution of serotype circulation, DENV 1 was identified in all HRs (Table 6 and Figure 3), while DENV 2 in 59 (93.7%), DENV 3 in 17 (27.0%) and DENV 4 in 31 (49.2%).

Table 6. Dengue virus serotypes identified by HR number, SSP, 2010-2021.*

Serotype	HR Nº	HR %
DENV 1	63	100.0
DENV 2	59	93.7
DENV 3	17	27.0
DENV 4	31	49.2

Source: Sinan Online. *Data extracted on May 30, 2022.

Figure 3. Serotypes identified by HR, SSP, 2010-2021.*



*Provisional data until 05/30/2022. Source: Sinan Online.

Table 7 shows that in 3 HR (4.8%) only the DENV 1 serotype was identified, while in 17 (27.0%) all four serotypes occurred.

Table 7. Distribution of dengue virus serotypes according to HR number, SSP, 2010-2021.*

Serotype	HR Nº	HR %
DENV 1	3	4.8
DENV 1 and 2	10	15.9
DENV 1 and 4	2	3.2
DENV 1, 2 and 4	31	49.2
DENV 1, 2, 3, 4	17	27.0
TOTAL	**63**	**100.0**

Source: Sinan Online. *Data extracted on May 30, 2022.

2. CHIKUNGUNYA

Chikungunya was introduced in the SSP in 2014, with the appearance of the first imported cases, and from 2015 onwards it began to be identified with sporadic local transmission. Since then, several regions have recorded occurrences of transmission of the disease, with few records, except for the region of Baixada Santista, in 2021, which had the most significant transmission.[10]

In Table 8, the IC of confirmed cases in the SSP ranged between 0.07 and 32.30 per 100,000 inhabitants, remaining between 0.07 and 1.56 until 2021, when it had the highest IC of 32.30 per 100,000 inhabitants.

Table 8. Number of cases, IC, number and percentage of municipalities with chikungunya transmission, according to year of onset of symptoms, SSP, 2014-2021.*

Year	N º of cases	IC (cases per 100,000 inhabitants)	No. of municipalities with transmission	% of municipalities with transmission
2014	32	0.07	0	0
2015	80	0.18	9	1%
2016	699	1.56	74	11%
2017	633	1.40	101	16%
2018	405	0.89	89	14%
2019	343	0.75	66	10%
2020	294	0.64	24	3%
2021	15,068	32.30	68	10%

Source: Sinan Online. *Data extracted on May 30, 2022.

The number of affected municipalities in São Paulo ranged from 0 to 101, and in 2017 16% (101) of them had registered cases, however, with a low incidence rate (1.4 per 100,000 inhabitants). In that year, 41.5% of the cases (263) were imported, that is, acquired outside the municipality considered (Table 9). In 2021, in 10% of the cities in the SSP there was transmission of the disease, a lower proportion than from 2016 to 2018, but the incidence coefficient was significantly higher (32.30 cases per 100,000 inhabitants), and 98.4% of records were considered autochthonous.

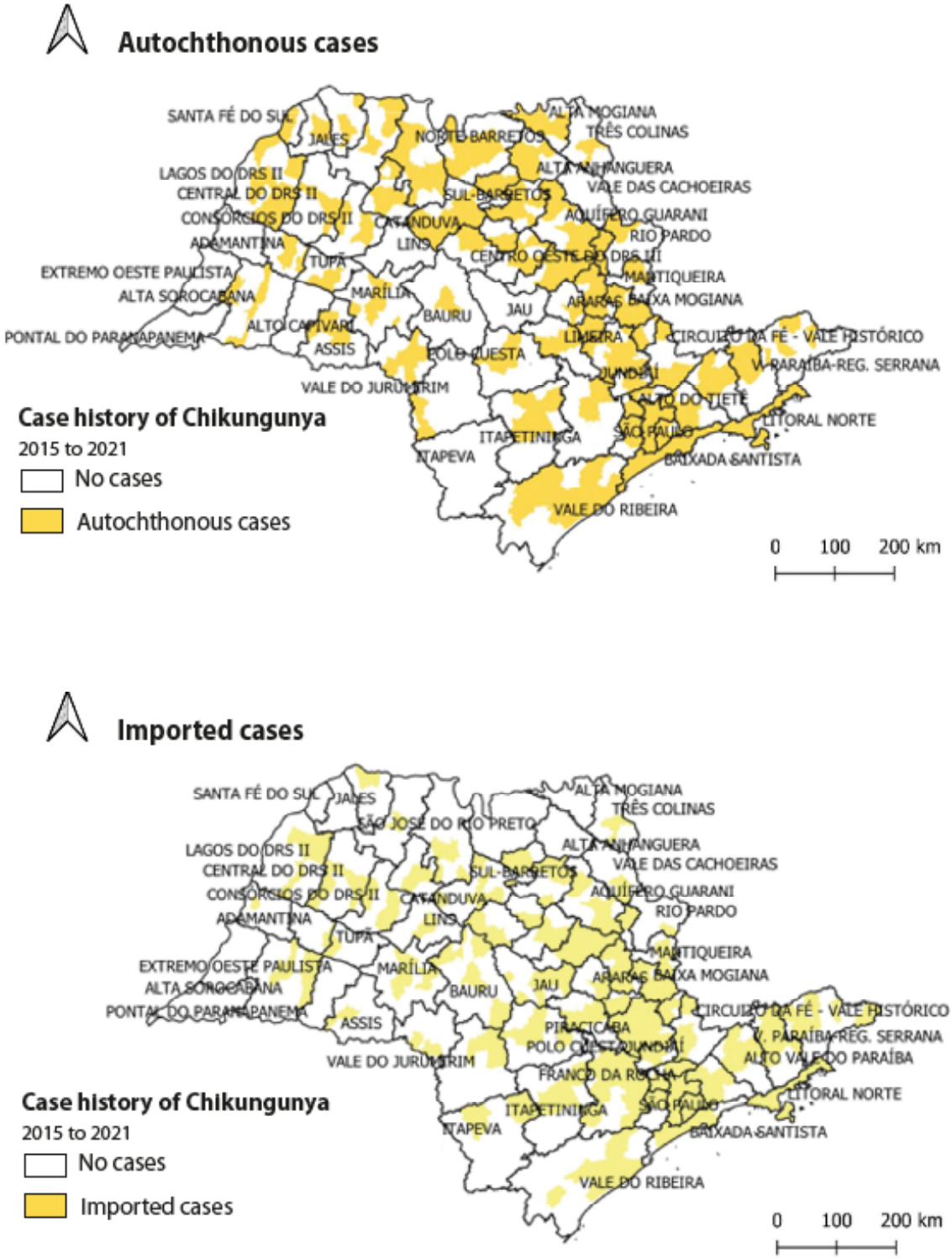
Table 9 and Figure 4 show a decrease in the proportion of imported cases over the course of the historical series, that is, the introduction of transmission of the disease in the SSP. In 2014, all occurrences (100%) were imported, in other years there was a decrease from 81.3% to 1.6% in 2021, a year in which there was high transmission in the HR of Baixada Santista. In the 2014-2021 historical series, some regions had no cases of local transmission, however, there were records of imported cases in the municipalities of Jaú, Lins and Itapeva (Figure 4). The SSP is vulnerable to the disease, as a large part of the population is susceptible to the disease, several municipalities have not yet had cases of local transmission, and those that did, they were few.

Table 9. Number and percentage of confirmed autochthonous and imported chikungunya cases, by year of symptoms, SSP, 2014-2021.*

Year	Autochthonous	% of Autochthonous	Imported	% of imported	Total confirmed cases
2014	0	0.0	32	100.0	**32**
2015	15	18.8	65	81.3	**80**
2016	170	24.3	529	75.7	**699**
2017	370	58.5	263	41.5	**633**
2018	307	75.8	98	24.2	**405**
2019	233	67.9	110	32.1	**343**
2020	256	87.1	38	12.9	**294**
2021	14,830	98.4	238	1.6	**15,068**

Source: Sinan Online. *Data extracted on May 30, 2022.

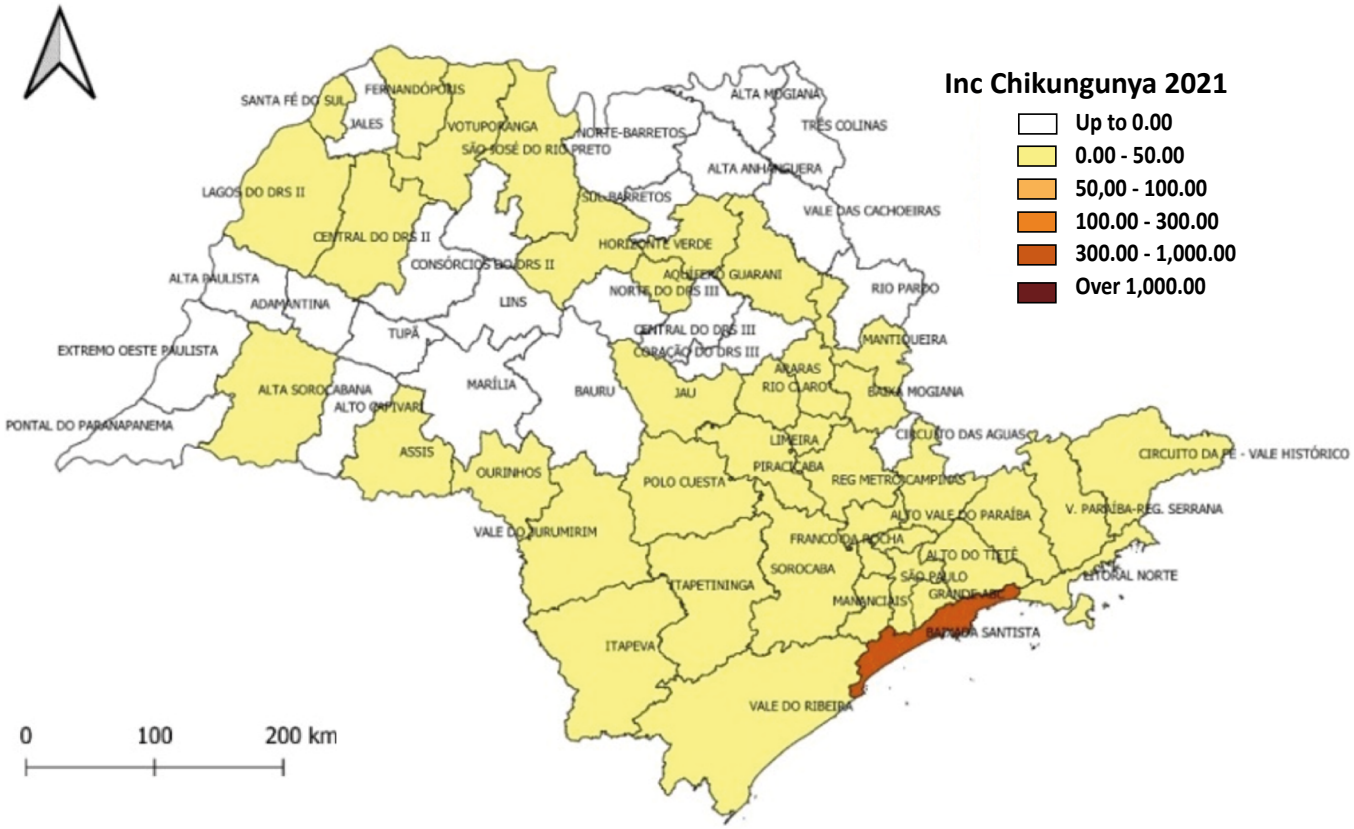
Figure 4. Distribution of confirmed autochthonous and imported chikungunya cases according to municipality and HR of residence, SSP, 2014-2021.*



Source: Sinan Online. *Data extracted on May 30, 2022.

In 2021, we had the highest transmission in the historical series, with an IC of 32.3 cases per 100,000 inhabitants (15,068 records), of which 98% (14,830) were local transmission, with 10% of the municipalities in São Paulo affected. HR Baixada Santista recorded 97% (14,680) of confirmations of the disease, with an incidence of 773.63 cases per 100,000 inhabitants (14,680), being above the SSP IC, which was 32.5 per 100,000 inhabitants (15,068), according to Figure 5. The other health regions maintained an incidence lower than 50 cases per 100,000 inhabitants, of which 23 of these did not register the disease.

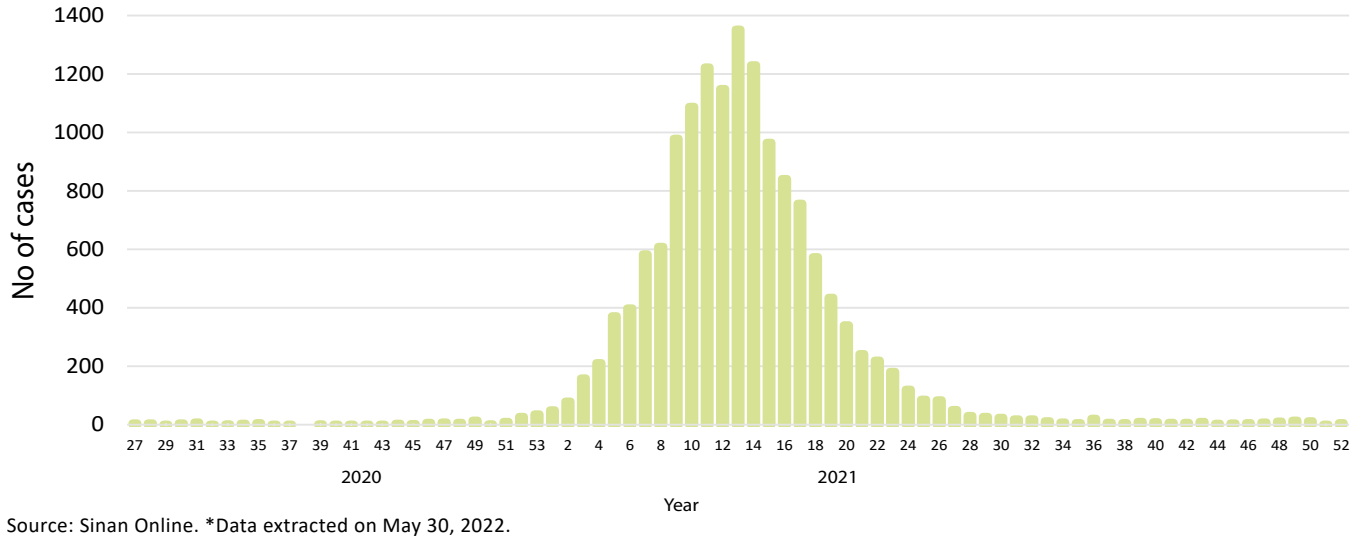
Figure 5. Incidence of chikungunya cases according to HR of residence, SSP, 2021.*



Source: Sinan Online. *Data extracted on May 30, 2022.

This was the first major transmission in the state, in which the majority of cases (97%) were recorded between epidemiological weeks 1 and 27 of 2021 (Graph 7). Of this total, 60% occurred between SE 09 and 16 (02/28/21 to 04/24/21). An increase in cases can be observed from the last weeks of 2020. There was marked transmission in the hottest and wettest months of 2021, which represent good conditions for the proliferation of *A. aegypti*, with a drop in the second semester.

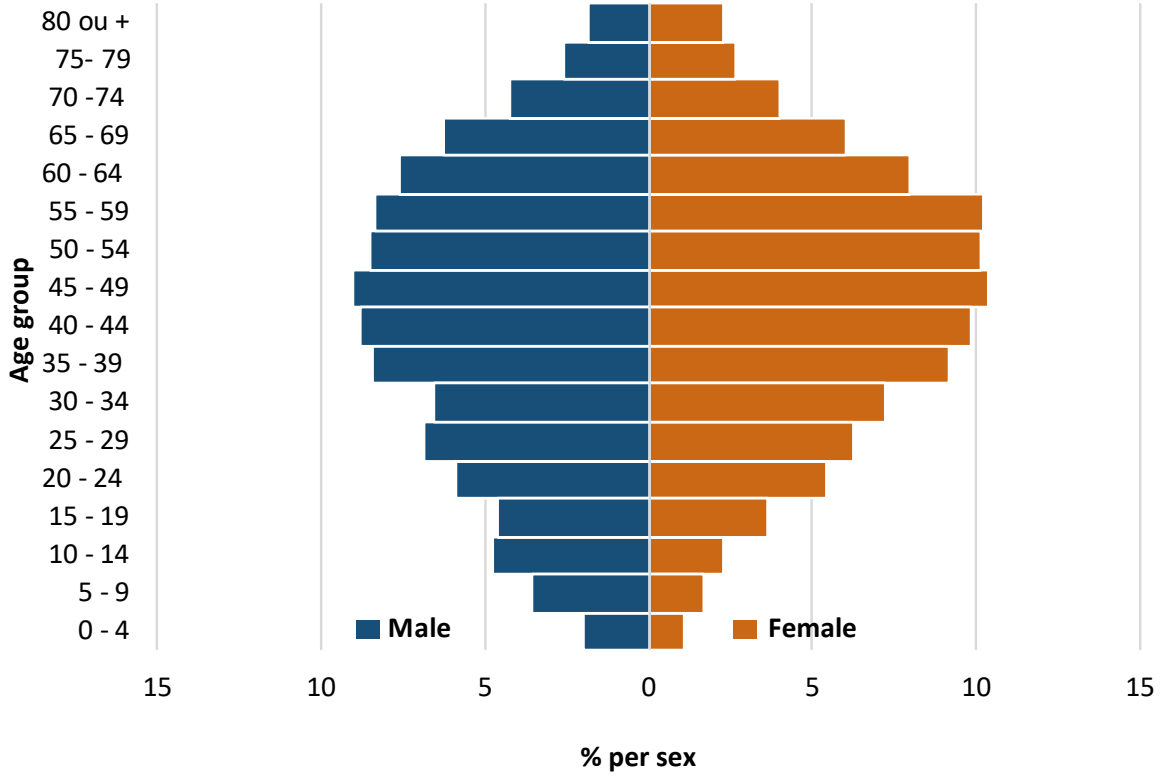
Graph 7. Distribution of chikungunya cases by onset of symptoms SE HR Baixada SSP, 2020-2021.*



Source: Sinan Online. *Data extracted on May 30, 2022.

In the period from 2014 to 2021, as shown in Graph 8, the most affected age group was 30 to 59 years old, with 54% of cases, followed by those over 65 years old, with 13%; the female sex was the most affected, with 64% of the cases, against 36% of the male sex.

Graph 8. Proportional distribution of chikungunya cases by sex and age group, SSP, 2014-2021.*



Source: Sinan Online. *Data extracted on May 30, 2022.

During the historical series from 2014 to 2021, there were eight deaths from the disease, 5 were male, aged between 38 and 89 years, and 4 were people over 80 years of age. Of the female sex, three cases were between 22 and 94 years of age and 2 were more than 74 years of age. Of the 8 reported deaths, 7 occurred in 2021, between SE 6 and 15, in the Baixada Santista region, which had a lethality rate of 0.05%.

3. ZIKA VIRUS

In the second half of 2014, suspicions of ZIKV were registered in some cities in the Brazilian Northeast, confirmed by the Ministry of Health, in May 2015, as autochthonous transmission.[22,23]

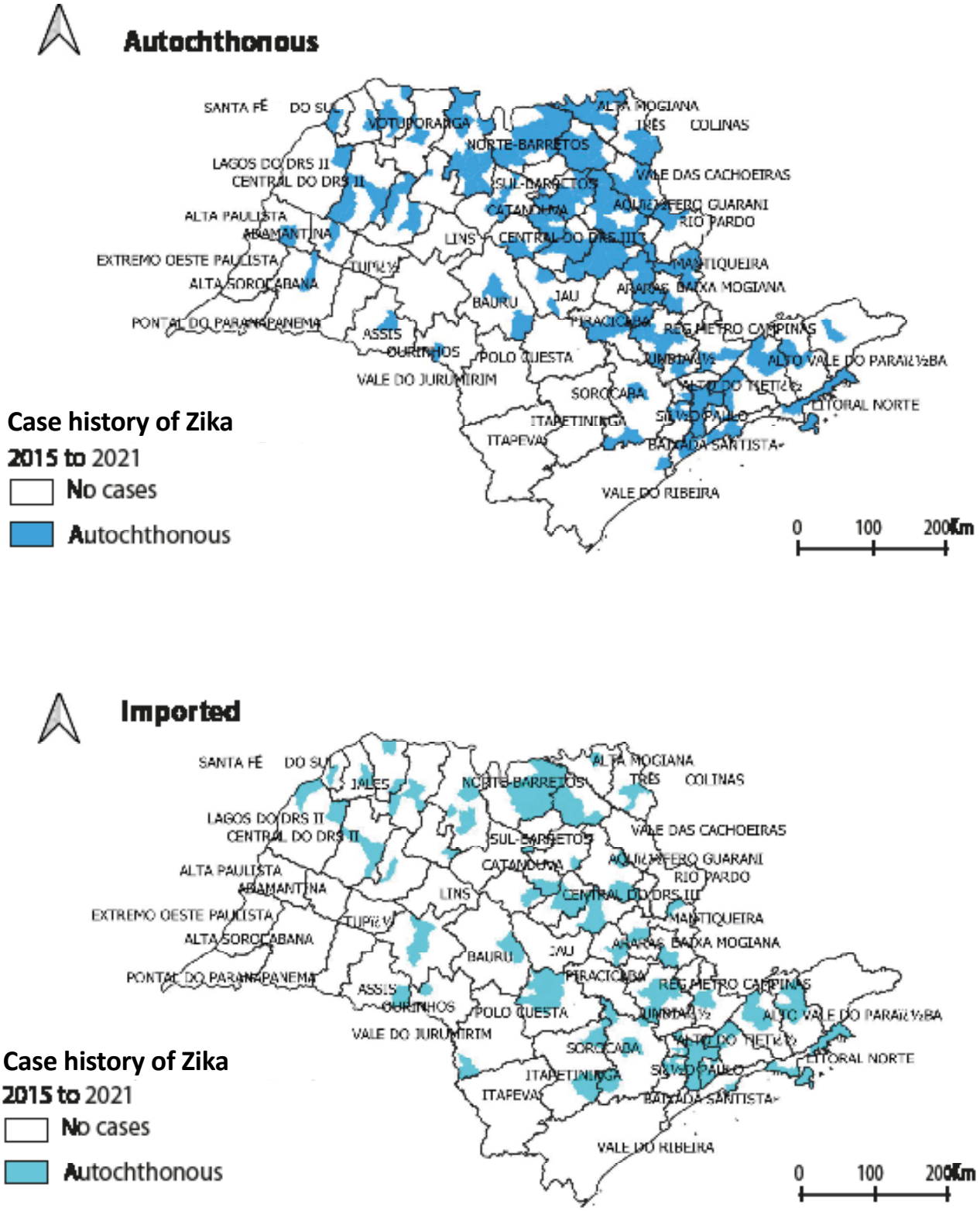
This virus was identified in São Paulo from 2015 onwards, through probable transfusional transmission, and then spread across the state.[2,15] Since then, 50 of the 63 Health Regions (79%) have identified transmission sporadically, while in HR Franco da Rocha, Vale do Jurumirim, Polo Cuesta, Marília, Rio Claro and Itapetininga, so far, there have been few detections. imported cases and no local transmission was identified, as shown in Figure 6.

The year with the highest incidence rate of zika virus was 2016, with 10 cases per 100,000 inhabitants (4,531 confirmations), 96% of which with local transmission, reaching 112 municipalities, 17% of the total in the SSP. Since then, cases of the disease have been falling, with an incidence between 0.03 and 0.17 per 100,000 inhabitants (Table 10).

From 2015-2021, 144 (22.3%) of the 645 municipalities in São Paulo reported Zika transmission, ranging from 141 in 2016, with 4,323 confirmed cases, to 8 in 2021, with 15. This was the highest number of cases in the period, in which no death from the disease was recorded.

Graph 9 shows the distribution of cases by sex and age group, from 2015 to 2021, 73% of which were female and 27% were male. Regarding age, the predominance was in people between 20 and 49 years old (62%), 4% of them over 65 years old. The distribution of Zika by sex was different from the other diseases (dengue and chikungunya). Of the female cases, 47% were between 20 and 39 years old, therefore, they were of childbearing age. One hypothesis for greater attention to these women is that, although zika is a viral disease of benign evolution, most of the time the infection can cause microcephaly in newborns, in addition to Guilan-Barré syndrome and death.

Figure 6. Distribution of confirmed autochthonous and imported Zika cases by municipality and HR of residence, SSP, 2015-2021.*



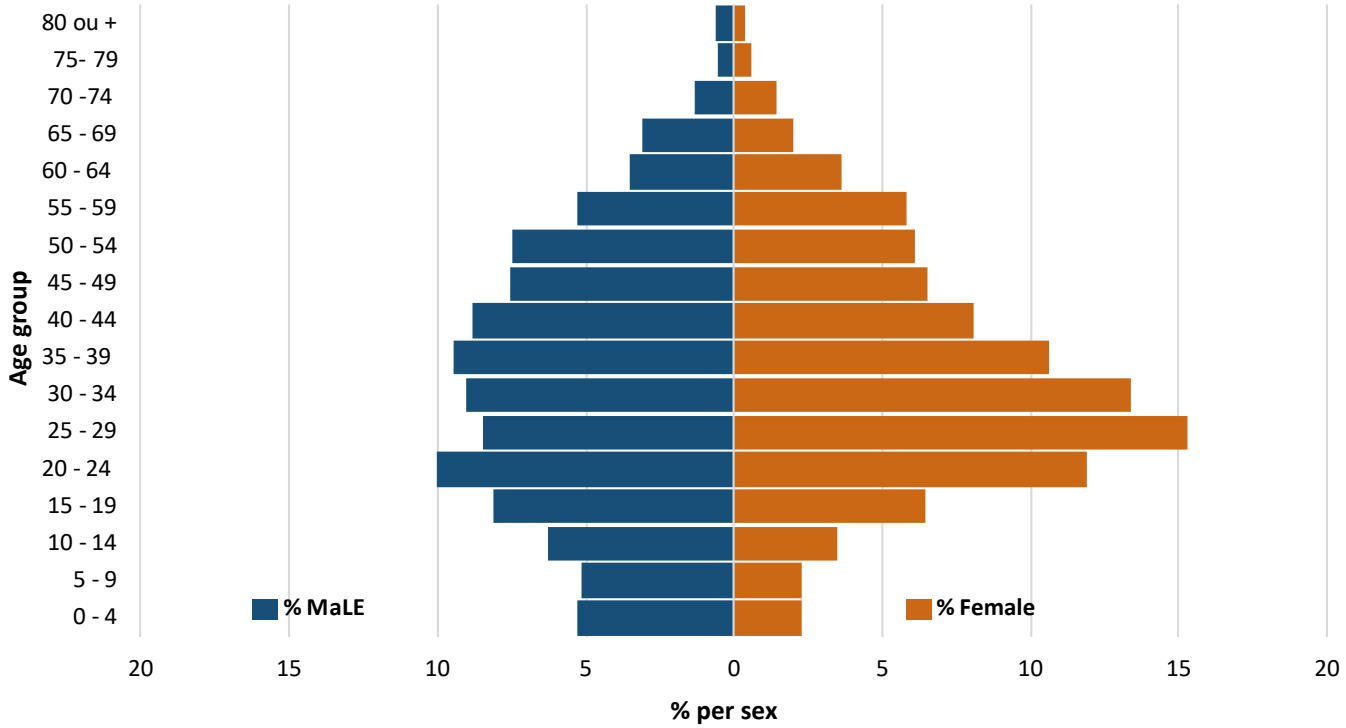
Source: Sinan Online. *Data extracted on May 30, 2022.

Table 10. Incidence coefficient and number of confirmed cases of ZIKV; number and proportion of autochthonous and imported cases; number and proportion of municipalities with ZIKV transmission, SSP, 2014-2021.*

Year	Autochthonous	% of Autochthonous	Imported	% of imported	Nº of municipalities with transmission	% of municipalities with transmission	Total confirmed cases	IC
2015	52	63%	30	37%	10	2%	**82**	0.18
2016	4,323	96%	190	4%	112	17%	**4,513**	10.08
2017	123	92%	11	8%	27	4%	**134**	0.30
2018	126	92%	11	8%	15	2%	**137**	0.30
2019	77	97%	2	3%	27	4%	**79**	0.17
2020	13	100%	0	0%	11	2%	**13**	0.03
2021	15	94%	1	6%	7	1%	**16**	0.03
Total	**4,729**	**95%**	**245**	**5%**	**144**	**22%**	**4,974**	-

Source: Sinan Online. *Data extracted on May 30, 2022.

Graph 9. Proportional distribution of Zika cases by sex and age group, SSP, 2015-2021.*



Source: Sinan Online. *Data extracted on May 30, 2022.

REFERENCES

1. Mendonça FA, Souza AV, Dutra DA. Saúde pública, urbanização e dengue no Brasil [internet]. Sociedade & Natureza. 2009;21(3):257-69 [acesso em 3 jun 2022]. Disponível em: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1982-45132009000300003&lng=pt&tlng=pt

2. Secretaria da Saúde de São Paulo (estado). Divisão Dengue [internet]. BEPA. 2017;14(167-8):65-77.

3. Centers for Disease Control and Prevention. National Center for Emerging and Zoonotic Infectious Diseases. Division of Vector-Borne Diseases. About dengue: what you need to know. Atlanta (USA); Sept 23, 2021 [acesso em 12 jun 2022]. Disponível em: https://www.cdc.gov/dengue/about/index.html

4. Organização Pan-Americana da Saúde. Dengue [internet]. Washington (DC); [2020?] (acesso em 4 jun 2022]. Disponível em: https://www.paho.org/pt/topicos/dengue

5. Secretaria da Saúde de São Paulo (estado). Dengue: distribuição dos casos de dengue notificados e confirmados (autóctones e importados) no estado de São Paulo, segundo o município de residência, por mês de início de sintomas [internet]. São Paulo: Centro de Vigilância Epidemiológica "Prof. Alexandre Vranjac"; 2020 [acesso em 4 jun 2022]. Disponível em: http://www.saude.sp.gov.br/resources/cve-centro-de-vigilancia-epidemiologica/areas-de-vigilancia/doencas-de-transmissao-por-vetores-e-zoonoses/dados/dengue/2019/dengue19_import_autoc_res.htm

6. Organização Pan-Americana da Saúde. Chikungunyua. Washington (DC); [2010-2020?] [acesso em 8 jun 2022]. Disponível em: https://www.paho.org/es/temas/chikungunya

7. Ministério da Saúde (Brasil). Secretaria de Vigilância em Saúde. Departamento de Vigilância das Doenças Transmissíveis. Chikungunya: manejo clínico. Brasília: Ministério da Saúde; 2017.

8. Hennessey MJ, Ellis EM, Delorey MJ, Panella AJ, Kosoy OI, Kirking HL, et al. Seroprevalence and symptomatic attack rate of chikungunya virus infection, United States Virgin Islands, 2014–2015. Am. J. Trop. Med. Hyg. 2018;99(5):1321-6.

9. Sergon K, Yahaya AA, Brown J, Bedja Sa, Dmlindasse M, Agata N, et al. Seroprevalence of Chikungunya virus infection on Grande Comore Island, union of the Comoros, 2005. Am. J. Trop. Med. Hyg. 2007;76(6):1189-93.

10. Secretaria da Saúde de São Paulo (estado). Coordenadoria de Controle de Doenças. Protocolo de manejo clínico de chikungunya no estado de São Paulo [internet]. São Paulo: Secretaria da Saúde; 2021 [acesso em 7 jun 2022]. Disponível em: https://www.cosemssp.org.br/wp-content/uploads/2021/12/PROTOCOLO-DE-MANEJO-CLINICO-DE-CHIKUNGUNYA-NO-ESTADO-DE-SAO-PAULO.pdf

11. Organização Pan-Americana da Saúde. Zika vírus [internet]. Washington (DC); 2017 [acesso em 8 jun 2022]. Disponível em: https://www.paho.org/pt/topicos/zika

12. Duffy MR, Chen TH, Hancock WT, Powers AM, Kool JL, Lanciotti RS et al. Zika virus outbreak on Yap Island, Federated States of Micronesia. N Engl J Med. 2009;360(24):2536-43.

13. Organização Pan-Americana da Saúde. Epidemiological alert – Neurological syndrome, congenital malformations, and zika virus infection. Implications for public health in the Americas [internet]. Washington (DC); 2015 [acesso em 7 jul 2022]. Disponível em: https://www.paho.org/hq/dmdocuments/2015/2015-dec-1-cha-epi-alert-zika-neuro-syndrome.pdf

14. Mlakar J, Korva M, Tul N, Popović M, Poljšak-Prijatelj M, Mraz J, et al. Zika virus associated with microcephaly. N Engl J Med. 2016;374(10):951-8.

15. Barjas-Castro ML, Angerami RN, Cunha MS, Suzuki A, Nogueira JS, Rocco IM et al. Probable transfusion-transmitted Zika virus in Brazil. Transfusion. 2016;56(7):1684-8.

16. Musso D, Nhan T, Robin E, Roche C, Bierlaire D, Zisou K et al. Potential for zika virus transmission through blood transfusion demonstrated during an outbreak in French Polynesia, November 2013 to February 2014. Euro Surveill. 2014;19(14):20761.

17. Ross TM. Denguevirus. Clin Lab Med. 2010;30(1):149-60.

18. Secretaria da Saúde de São Paulo (estado). Grupo Técnico de Arboviroses e Grupo Técnico de Vigilância em Saúde. Diretrizes para a prevenção e o controle das arboviroses urbanas no estado de São Paulo [internet]. São Paulo; 2017 [acesso em 7 jul 2022]. Disponível em: http://www.saude.sp.gov.br/ resources/cve-centro-de-vigilancia-epidemiologica/publicacoes/diretrizes2017_ arboviroses_esp.pdf

19. Chiu CY, Bres V, Yu G, Krysztof D, Naccache SN, Lee D, et al. Genomic assays for identification of chikungunya virus in blood donors, Puerto Rico, 2014. Emerg Infect Dis. 2015;21(8): 1409-13.

20. Delatte H, Dehecq JS, Thiria J, Domerg C, Paupy C, Fontenille Geographic distribution and developmental sites of *Aedes albopictus* (Diptera: *Culicidae*) during a chikungunya epidemic event. Vector Borne Zoonotic Dis. 2008;8(1):35-4.

21. 21. Nunes MRT, Faria NR, de Vasconcelos JM, Golding N, Kraemer MUG, de Oliveira LF et al. Emergence and potential for spread of chikungunya virus in Brazil. BMC Med. 2015;13(1):102.

22. Proença-Modena JL, Milanez GP, Costa ML, Judice CC. Zika virus: lessons learned in Brazil. Microbes Infect. 2018;20(11-12):661-9.

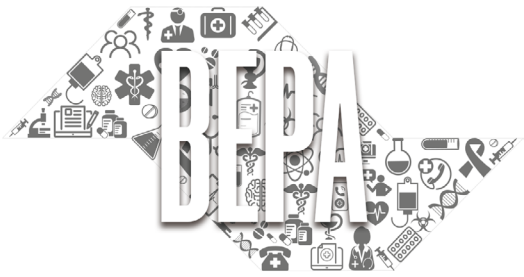
23. Campos GS, Bandeira AC, Sardi SI. Zika virus outbreak, Bahia, Brazil. Emerg Infect Dis. 2015;21(10):1885-6.

Publication
May 2023

Open access

How to cite

Macedo FLL, Mota FLO, Oliveira GP, Silva GA, Polimanti JV, Camis MCRS, Medeiros RP, Moura RF, Ailt V. Epidemiological report of the surveillance of dengue, chikungunya and zika virus. Bepa [Internet]. 2023 Mar 1 ;19:1-25.
Available in: https://periodicos.saude.sp.gov.br/BEPA182/article/view/37861



CVE CENTRO DE VIGILÂNCIA EPIDEMIOLÓGICA
CCD COORDENADORIA DE CONTROLE DE DOENÇAS
GOVERNO DO ESTADO DE SÃO PAULO
Secretaria da Saúde