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Autochthonous arbovirus infections in children in Europe, 2007–2024: A systematic review of the **Italian Society of Pediatric Infectious Disease**

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ABSTRACT

Background: Imported and autochthonous cases of arboviral infections constitute an emerging and current public health threat in Europe. The aim of this work is to analyse epidemiological characteristics of pediatric autochthonous cases of Dengue (DENV), Chikungunya (CHIKV), West Nile (WNV) and Zika (ZIKV) virus in mainland Europe to help develop surveillance systems tailored to the pediatric population.

Methods: A systematic review of the articles reporting autochthonous pediatric arboviral infections by Dengue, Chikungunya, West Nile and Zika in continental Europe from 2007 to 2024 was performed. Studies were identified through PUBMED, EMBASE, and official epidemiological reports.

Findings: Pediatric autochthonous infections were uncommon and generally mild. Dengue represented the most frequently reported arbovirus, with pediatric cases identified in France, Italy, Spain and Croatia. Pediatric CHIKV cases were described during the 2007 and 2017 Italian outbreaks and in France in 2010. Although WNV is now endemic in Europe, children accounted for <1% of confirmed cases, with no fatal outcomes. Autochthonous ZIKV transmission was exceptional, and no pediatric cases were reported.

Conclusion: Autochthonous arboviral infections in European children remain rare but may increase with the ongoing spread of Aedes vectors. Strengthening pediatric surveillance, improving diagnostic awareness and implementing rapid vector control measures are essential to prevent sustained transmission and mitigate future outbreaks in the pediatric population.

1. Introduction

Arboviral infections constitute a broad group of infectious diseases caused by viruses transmitted by hematophagous arthropods, mainly ticks and mosquitoes, and belonging to various viral families, including *Flaviviridae* (e.g. Dengue, Zika, West Nile viruses), *Togaviridae* (e.g. Chikungunya), and *Bunyaviridae*. Transmission typically occurs through the bite of competent vectors, which, after acquiring the virus from a viremic host, inoculate it into a new individual during a blood meal.[1]

From a clinical perspective, the manifestations of these viral infections are highly variable. Although most cases are asymptomatic or cause nonspecific flu-like symptoms, in some instances they can cause severe conditions such as hemorrhagic syndromes or neurological complications.[1] Fig. 1.

Arboviruses are widespread globally, and their geographic distribution is closely linked to the presence of competent vectors. In recent decades, increasing international mobility and climate change have favoured the expansion of vectors into new geographic areas and the adaptation of certain invasive species, which has favoured the spread of these viruses, such as *Aedes albopictus*, once confined to tropical and subtropical regions, even into non-endemic areas. Since the early 2000s, the transmission of arboviruses by mosquitoes of the *Aedes* genus has gained growing relevance in continental Europe, where an increasing number of imported cases have occasionally led to clusters of

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autochthonous transmission. The increased frequency of these outbreaks is due to multiple factors: the establishment of *Aedes albopictus* across vast areas of the continent, climatic conditions that extend the period of activity of this species, and the constant introduction of imported cases from endemic or epidemic regions.[2] For these reasons, combined with the challenges of timely diagnosis (due to often nonspecific clinical manifestations and/or the lack of rapid diagnostic tests), arboviral infections represent an emerging public health issue, highlighting the need for effective surveillance and vector control systems.

In detail, Dengue virus (DENV) comprises four antigenically distinct serotypes (DENV-1–4) and is transmitted primarily by Aedes aegypti and, to a lesser extent, Aedes albopictus. In children, most infections are asymptomatic or mild, yet atypical features may occur and secondary infections confer increased risk of plasma leakage via antibody-dependent enhancement.[3] Although dengue is not endemic in Europe, climatic suitability for vectors and travel-related importations have enabled sporadic autochthonous transmission; diagnosis is clinical supported by RT-PCR or NS1 antigen detection in the first 5–7 days and by DENV-specific IgM/IgG thereafter, ideally using paired sera and interpreting results cautiously due to flavivirus cross-reactivity.

Chikungunya virus (CHIKV), though not endemic in Europe, has shown a growing number of travel-associated cases in recent years, alongside sporadic autochthonous outbreaks in mainland regions.[1] The virus is transmitted by *Aedes albopictus* and *Aedes aegypti* and includes three major genotypes—West African, East/Central/South African (ECSA), and Asian—characterized by outbreak-associated mutations.[4] In pediatric populations, CHIKV infection may involve severe organ manifestations. However, lower seroprevalence compared to adults has been reported, possibly due to reduced vector exposure and improved access to healthcare.[5]

West Nile virus (WNV) has become endemic across much of continental Europe. The virus is mainly transmitted by *Culex pipiens* and *Culex modestus*, with birds serving as amplifying hosts and humans as incidental dead-end hosts. Human infections are mostly asymptomatic; about 20% present with a mild febrile illness, while fewer than 1% develop neuroinvasive disease (WNND), primarily affecting older adults or immunocompromised individuals.[6,7] Although WNV can affect all ages, pediatric cases are rare and generally mild, with severe forms infrequently reported in Europe.[8]

Zika virus (ZIKV) is another Aedes-borne *Flavivirus*. The outbreak in Micronesia in 2007 and subsequent outbreaks in French Polynesia (2013–2014) and South America (2015–2016) brought the World Health Organization to declare a Public Health Emergency of International Concern in February 2016. In the same year, the European Centre for Disease Prevention and Control (ECDC) reinforced surveillance systems by including ZIKV among the notifiable diseases with the aim of early detection of imported cases and reducing the risk of local transmission.[9] These events highlighted two crucial aspects: first, the ability of ZIKV to spread rapidly in areas with competent vectors such as mosquitoes belonging to the *Aedes aegypti* and *Aedes albopictus* species[2]; second, its association with severe neurological complications, such as Guillain–Barré syndrome, and with congenital malformations resulting from vertical transmission during pregnancy. The latter includes congenital Zika syndrome, a condition characterised by microcephaly, intracranial calcifications and profound neurodevelopmental impairment.[10] Up to 80% of ZIKV infections are asymptomatic. When symptoms occur, the typical presentation consists of a mild febrile illness accompanied by maculopapular rash, arthralgia, myalgia, headache, and non-purulent conjunctivitis,[1] with a generally self-limiting course of 2–7 days.[2]

A recent systematic review, focused on adult cases, documented 56 clusters of local transmission in continental Europe between 2007 and 2023, identifying France and Italy as the countries most affected by such episodes.[11]

However, data on pediatric cases remain scarce and fragmented, with limited systematic analyses available.

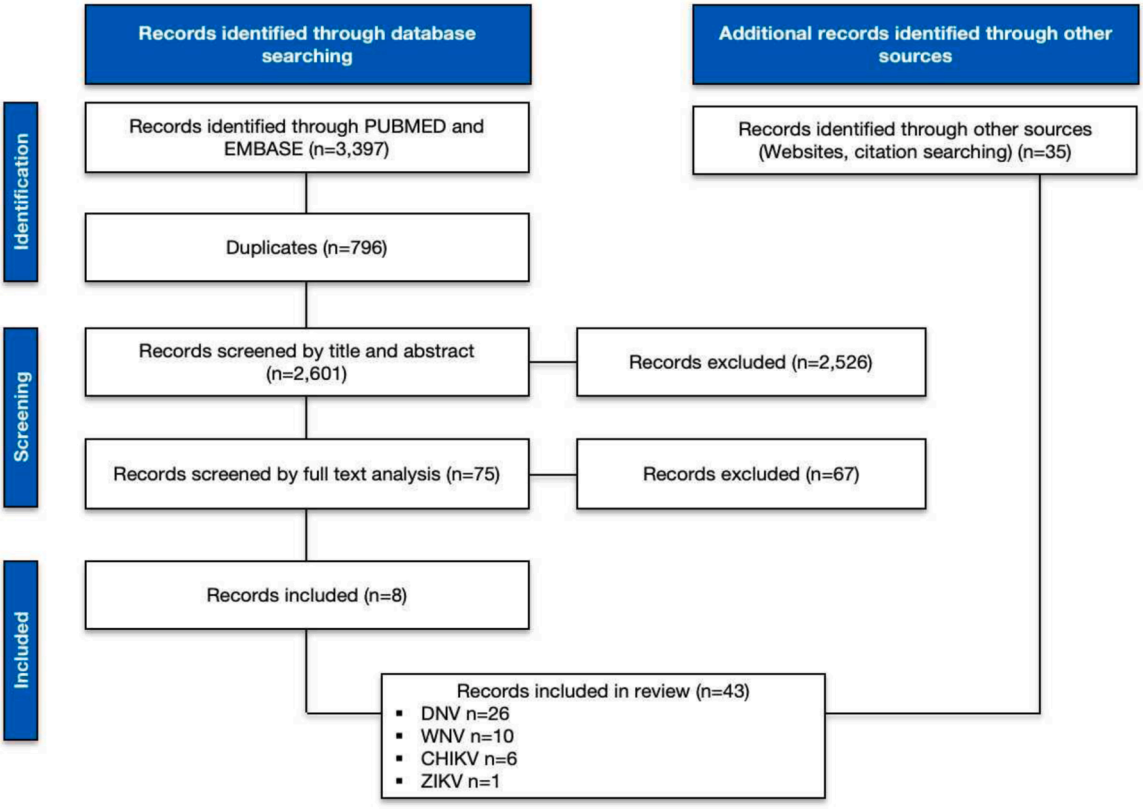

Fig. 1. PRISMA flow diagram.

The present study aims to describe the epidemiological characteristics of autochthonous Dengue virus (DENV), West Nile virus (WNV), Chikungunya virus (CHIKV), and Zika virus (ZIKV) cases in children in mainland Europe between 2007 and 2024, to provide an updated overview of pediatric autochthonous arboviral infections in Europe and to contribute to the development of surveillance and response strategies tailored to the specific needs of the pediatric population.

2. Material and methods

We conducted a systematic review of the literature on autochthonous arboviral infections in the pediatric population that occurred in continental Europe between 2007 and 2024. Details of the search string and strategy are provided in the Supplementary Material. For more comprehensive and up-to-date information on ongoing clusters, given the absence of published articles, official reports from the European Centre for Disease Prevention and Control (ECDC) and from national official epidemiological websites were consulted, and data are presented in our results. The review focused on four arboviruses: Dengue virus (DENV), West Nile virus (WNV), Chikungunya virus (CHIKV), and Zika virus (ZIKV). The manuscript adheres to the PRISMA 2020 reporting guidelines.

2.1. Aim of the study

The primary objective of this review was to summarize the epidemiological characteristics of autochthonous DENV, WNV, CHIKV, and ZIKV cases in children (age 0–14 years) in mainland Europe between 2007 and 2024.

2.2. Search strategies

We included studies published between January 1, 2007, and May 20, 2025, reporting epidemiological and clinical data on autochthonous pediatric cases of DENV, WNV, CHIKV, or ZIKV occurring in mainland Europe. The pediatric population was defined as individuals aged 0–18 years, and all studies reporting cases within this age range were included in the analysis. An event was classified as autochthonous if the infection was vector-borne and occurred in individuals who, in the two weeks preceding symptom onset, had no history of travel to endemic areas, nor any history of blood exposure with infected individuals. The literature search was conducted using PUBMED and EMBASE, covering all relevant publications indexed during the study period. Reports from the ECDC and from national epidemiological websites were also consulted for additional data. In particular, epidemiological data published after 2024 and identified through official datasets were integrated and discussed alongside the findings of the systematic review. Firstly, all records were independently screened by two reviewers (A.C. and G.C.) by title and abstract. Disagreements were discussed and resolved with other authors (D.Z. and V.G.). All the articles were then subsequently screened by full text by all the reviewers (A.C., G.C., R.C., R.D.T.). Rayyan Systems Inc. software was used to organise search results, record screening decisions, and perform manual deduplication.

2.3. Inclusion and exclusion criteria

We excluded systematic reviews, meta-analyses, editorials, studies lacking epidemiological data, and those focusing on pregnancy, congenital infections, or adult populations. Studies published before 2007 or reporting cases diagnosed in territories and islands outside of continental Europe were excluded after articles screening process.

2.4. Data collection and analysis

For each included study, the following data were extracted: DENV, WNV, CHIKV, ZIKV infection; viral serotype; country and specific location of infection; month and year of cases occurrence; total number of confirmed autochthonous pediatric cases identified. After extracting data from the included papers, the data were merged into an Excel file to provide a comprehensive description of each local event for each virus considered.

3. Results

3.1. Dengue

From 2010 to 2024, various episodes of autochthonous dengue transmission were documented in continental Europe, with a clear increase in frequency and geographic spread. The first locally acquired infections were detected in France (Nice) and Croatia in 2010.[12,13] The earliest pediatric autochthony was reported during the 2010 cluster on the Pelješac peninsula, Croatia, where adolescents were among those affected, though ages were not systematically recorded. Clinical presentation included high fever, rash, headache, and limb myalgia/arthralgia; all pediatric patients recovered uneventfully without complications. The local transmission window was inferred from a symptomatic household resident whose DENV-specific IgM/IgG seroconversion confirmed infection; she was admitted on day six and had recovered by day nineteen from symptom onset.[12]

In subsequent years, DENV demonstrated its ability to establish limited transmission chains under favorable conditions. In mainland Europe, France has reported the highest number and frequency of autochthonous dengue events since 2010, with recurrent clusters in the southern departments—particularly Var, Bouches-du-Rhône, and Gard—caused by DENV-1 and DENV-2.[14–17] One pediatric case was recorded in Toulon (Var) in 2014: the child presented with high fever, asthenia, and limb arthralgia/myalgia, requiring five days of hospitalization for mild thrombocytopenia. The patient was discharged in good condition with no hemorrhagic manifestations or severe disease progression.[14] France subsequently detected six foci with 13 autochthonous cases in 2020[18], three further events in 2021—one associated with a transplant rather than vector transmission[19]—and an expansion to 65 locally acquired infections across nine foci in 2022, including the first detection of DENV-3.[20] Transmission continued to rise as of surveillance reports, with 83 local infections in 2024, the highest annual total recorded.[21]

In Spain, autochthonous transmission was first detected in Andalusia and Murcia in 2018, involving familial DENV-1 clusters with five confirmed cases, including at least one adolescent and one younger child. Pediatric presentations mirrored the adult pattern, with acute fever, generalized myalgia/arthralgia, and maculopapular rash; all recovered without complications.[22] Additional local infections were recorded in Catalonia and the Valencian Community in 2019.[23,24] Further pediatric involvement occurred in 2022 in the Ibiza (Balearic Islands) clusters, where children became symptomatic within family groups linked to an imported adult. In one family, a 14-month-old girl developed low-grade fever and rhinorrhea on the same day as her mother's dengue-compatible illness (NS1 and IgM positive, IgG negative); although untested, her symptoms were considered clinically compatible and self-limited. In another family, a 9-year-old boy developed fever, mild malaise, and headache one day before his mother's confirmed DENV-1 infection; both recovered fully within a few days without laboratory confirmation or hospitalization.[25] A resurgence occurred in 2024, when Catalonia reported new autochthonous infections linked to travelers from Costa Rica and Brazil, affecting mostly adults with mild disease.[26]

In Italy, the first recognized local transmission occurred in Vicenza (Veneto) in August 2020, within a family cluster of DENV-1 infections seeded by a traveler returning from Indonesia. Among the five locally acquired infections, a preschool child developed high fever (up to 39 °C) and fatigue simultaneously with adult family members between 16 and 18 August. The child's symptoms were mild and resolved within four

days, without hemorrhagic signs or hospitalization; all family members recovered fully.[27] In August 2023, Lombardy reported its first local dengue cluster in Castiglione d'Adda (Lodi Province), which included a pediatric female resident hospitalized at Lodi Hospital in non-severe condition; adult cases were detected concurrently in the same municipality.[28,29] The following year, the Marche region experienced Italy's largest dengue outbreak to date, centered in Fano, with 199 DENV-2 cases, an estimated R_0 of 2.66, and around 24% hospitalization rate; no pediatric patients developed severe dengue or warning signs.[30]

Overall, adult infections predominate among reported events, but pediatric dengue—typically mild and self-limited—recurrently occurs within household clusters (e.g. Croatia 2010; France 2014; Spain 2018 and 2022; Italy 2020 and 2023). Across all documented pediatric cases, clinical courses were benign, without hemorrhagic manifestations, plasma leakage, or fatalities. The growing circulation of multiple serotypes (DENV-1, DENV-2, DENV-3) and the pattern of household co-infections highlight the importance of pediatric-inclusive surveillance, timely vector control, and early diagnostic capacity to prevent wider community transmission Table 1.

3.2. Chikungunya

The first autochthonous CHIKV epidemic in Europe was reported in 2007 in the Italian region of Emilia-Romagna. During this initial

Table 1
Reported cases of autochthonous Dengue infection in Europe (2007–2024).

Year	Country (Location)	Total Cases	No. of Pediatric Cases	Age(s) Reported (Peds)	Serotype	Diagnostic Method	Notes
201,0[13]	France (Nice, Alpes-Maritimes)	2	0 (NR)	NR	DENV-1	RT-PCR / serology (index/contacts)	First autochthonous dengue in mainland France; localized transmission; suspected travel-related introduction.
201,0[12]	Croatia (Pelješac Peninsula)	2 confirmed (+ probable)	≥1 (adolescents)	Adolescents (exact ages not available)	NR	PCR/serology within cluster	Household/neighbor clusters; serosurvey suggested wider exposure; mild clinical course.
201,3[15]	France (Bouches-du-Rhône)	1	0 (NR)	NR	DENV-2	RT-PCR	Isolated autochthonous case; local vector activity.
201,4[14]	France (Var & Bouches-du-Rhône)	4	1	Child (age not available)	DENV-1 & DENV-2	RT-PCR / serology	Independent introductions in Var; pediatric case hospitalized 5 days for thrombocytopenia; full recovery.
201,5[16]	France (Nîmes, Gard)	7	NR	NR	DENV-1	RT-PCR/serology; serosurvey	Outbreak with active case finding; serosurvey indicated wider circulation.
201,8[22]	Spain (Murcia & Andalusia)	5	≥2	Adolescent; younger child (age not available)	DENV-1	PCR and/or IgM	Family clusters with adult index; household transmission; mild disease.
201,9[23,24]	Spain (Catalonia & Valencian Community)	≥3 (public-health confirmed)	0 (NR)	—	DENV-1	Public health case definitions; RT-PCR/ serology	Multiple autochthonous events; suspected importations from Philippines and Cuba; Aedes albopictus active.
202,0[31]	France (multiple departments; 6 foci)	13	NR	not available	Predominantly DENV-1	RT-PCR/serology; enhanced surveillance	Seasonal local transmission during vector activity period.
202,0[27]	Italy (Vicenza, Veneto)	5	1	Preschool child (age not available)	DENV-1	RT-PCR	Household cluster; imported traveler in household suspected as index; all recovered.
202,1[19]	France (isolated events)	3	0 (NR)	—	NR	RT-PCR/serology	Two mosquito-borne singletons; one likely post-transplant, non-vector transmission.
202,2[20]	France (9 foci)	65	NR	NR	DENV-3 majority; DENV-1 also detected	RT-PCR/serology; national surveillance	Largest annual count to date; first detection of DENV-3 in France.
202,2[25]	Spain (Ibiza, Balearic Islands)	4 (2 adults + 2 pediatric compatible)	2	14 months; 9 years	DENV-1 (cluster context)	Adults: NS1+/IgM+ (confirmed) or IgM+ (probable); children untested (compatible)	Family clusters linked to returning traveler from Mexico (Aug) and a probable adult case (Oct); all mild.
202,3[28,29]	Italy (Castiglione d'Adda, Lodi Province)	≥3 (local cluster)	1	Girl (age not available)	DENV-1	RT-PCR (regional reference lab)	First Lombardy autochthonous detections; established Aedes albopictus; child hospitalized non-severe.
2024[26]	Spain (Catalonia; multiple municipalities)	Public-health confirmed cluster (s)	NR	NR	Likely DENV-1	Public health investigation; RT-PCR/serology	Linked to travelers returning from Costa Rica and Brazil; adult cases predominated; no severe outcomes in updates.
202,4[21]	France (11 foci)	83	NR	NR	NR	RT-PCR/serology; national surveillance	Highest annual autochthonous count recorded; broader geographic spread.
202,4[30]	Italy (Fano, Marche)	199	NR	NR	DENV-2	RT-PCR/serology; outbreak investigation	Largest Italian outbreak; R_0≈2.66; ≈24% hospitalized; no severe pediatric outcomes.

NR = not reported.

outbreak, which affected the towns of Castiglione di Cervia and Castiglione di Ravenna in the province of Ravenna, after retrospective age categorization, 12 cases were reported among individuals aged 0–19 years, out of a total of 205 confirmed cases. However, owing to the lack of detailed age-specific data—also absent from the official epidemiological reports of the ECDC—the exact number of pediatric cases under 18 years cannot be determined.[32]

Two autochthonous pediatric cases were identified during the 2010 outbreak in southeastern France, in the city of Fréjus. Both cases were confirmed by serological and molecular (RT-PCR) testing and were associated with the ECSA clade. The index case was a 7-year-old girl who had returned from Rajasthan, India; she lived within 2.5 km of the secondary case, who developed symptoms approximately three weeks later.[33] No pediatric cases were reported during the other French outbreaks, including the one in Le Cannet-des-Maures (2010) and in Montpellier (2014).

In 2017, during the second Italian outbreak in the municipality of Anzio (Lazio region), one pediatric case was reported: a 3-year-old girl residing in the Rome area who had been infected along with her parents while visiting Anzio. The diagnosis was confirmed through positive serological testing.[34] Later the same year, another local outbreak occurred in Guardavalle Marina (Calabria, southern Italy). Although detailed age data for the affected individuals are lacking, it was reported that five of the confirmed cases were between 0 and 19 years of age.[35] Table 2.

3.3. West nile

The first large human outbreak of WNV infection in Europe occurred in Romania in 1996, with 393 confirmed neuroinvasive cases and 17 deaths.[8]

Subsequent autochthonous outbreaks were reported in Hungary (2004), Italy (2008), and Greece (2010), the latter involving a total of 197 patients with neuroinvasive disease were reported, of whom 33 (17%) died.[37–39]

Since 2010, autochthonous transmission has been documented annually in several European countries—mainly Italy, Greece, and Romania—signalling the virus establishment in local mosquito populations.[40,41]

Across these early outbreaks, pediatric infections were reported only sporadically and represented a small minority of total cases. Most pediatric patients presented with non-neuroinvasive illness or mild febrile syndromes, while neuroinvasive forms were exceedingly rare.[8]

Between 2015 and 2019, autochthonous WNV transmission was consistently detected in southern and eastern Europe. In 2015, 122 locally acquired (n = 104 confirmed) human cases were identified across seven EU/EEA countries, mostly from Italy (n = 61), Romania (n = 19), and Hungary (n = 15).[42]

In 2016, 224 locally acquired (n = 192 confirmed) infections were reported in seven countries, mainly from Romania and Italy, with a significant increase compared to the previous season and the first human case ever detected in Cyprus.[43]

In 2017, eight EU/EEA countries reported 201 locally acquired cases (n = 147 confirmed), with Romania (n = 66) and Italy (n = 53) accounting for most infections; Greece re-emerged after two consecutive years of epidemiological silence.[44]

The 2018 transmission season represented a turning point, with 2083 total human infections, including 1548 locally acquired cases (n = 1311 confirmed) across eleven EU/EEA countries—a 7.7-fold increase compared with 2017. Italy (n = 610), Greece (n = 195), and Romania (n = 267) accounted for 46.5%, 14.9%, and 20.4% of all EU confirmed cases, respectively, with 166 deaths overall.[45]

The 2019 season showed a decline in incidence, with 425 locally acquired infections reported (n = 271 confirmed) by eleven EU/EEA countries, mainly from Greece (n = 227), Romania (n = 67), and Italy (n = 54), and the first autochthonous case in Slovakia.[46]

Age-stratified surveillance data from TESSy and national sources indicate that children aged 0–14 years generally accounted for <1% of total reported infections, and no pediatric deaths have been documented.

From 2020 to 2024, Europe continued to report autochthonous WNV circulation with fluctuating intensity and progressive geographic expansion.

In 2020, 336 locally acquired cases were documented in eight EU/EEA countries, mainly from Greece (n = 143), Spain (n = 77), and Italy (n = 66), with 38 deaths.[47]

In 2021, a total of 139 human infections locally acquired were reported across seven EU/EEA states, with Greece and Italy again most affected.[48]

The 2022 season saw a resurgence, with 1108 locally acquired cases (including 104 deaths), the highest number since 2018; Italy (n = 723), Greece (n = 283), and Romania (n = 47) were the main contributors.[49]

In 2023, 709 locally acquired cases were reported by nine EU/EEA countries, predominantly Italy (n = 336), Greece (n = 162), and Romania (n = 103), This season recorded the highest number of locally acquired cases since the previous peak years of 2018 (n = 1548) and 2022 (n = 1108).[50]

The 2024 transmission season involved 1436 locally acquired human cases across nineteen European countries, with Italy (n = 455) and Greece (n = 217) again at the forefront; notably, Albania experienced its largest-ever outbreak, and Poland reported its first probable autochthonous case.[51]

Across all years, surveillance datasets show that children accounted for <1% of total confirmed infections, with no pediatric deaths reported. No specific pediatric clusters or transmission chains were documented. Pediatric infections were scattered within community outbreaks and primarily presented as mild febrile illness, in contrast with adult neuroinvasive cases Table 3.

Table 2
Reported pediatric cases of autochthonous CHIKV infection in Europe (2007–2024).

Year	Country (Location)	No. of Pediatric Cases	Age(s) Reported	Diagnostic Method	Notes
200,7[36]	Italy (Castiglione di Cervia / Ravenna)	12* (total of 205 cases)	0–19 (exact ages not available)	Not specified	12 cases among 205 total; excluded due to missing age-specific data
201,0[33]	France (Frejus)	1	age not specified	Serology + RT-PCR (ECSA clade)	Index case returning from India; secondary transmission within 2.5 km
2010	France (Le Cannet-des-Maures)	0	NR	NR	No pediatric cases reported
2014	France (Montpellier)	0	NR	NR	No pediatric cases reported
201,7[34]	Italy (Anzio, Lazio)	1	3 years	Serology	Child infected with parents while visiting Anzio
201,7[35]	Italy (Guardavalle Marina, Calabria)	5* (total of 100 cases)	0–19 (exact ages not available)	Not specified	5 pediatric cases reported; age details not provided

* = age not specified; ECSA = East/Central/South African genotype.

Table 3
Reported pediatric cases of autochthonous West Nile infection in Europe (2007–2024).

Year	Countries involved	Total locally acquired cases	Main affected regions	Pediatric cases (0–14 y)	Deaths	Notes
201,5[41]	Italy, Romania, Hungary, Austria, Bulgaria, France, Portugal	122 (#104)	Po Valley (Italy), Bucharest (Romania), Vienna (Austria)	Not specified (<1%)	2	First re-emergence after low 2014 activity
201,6[42]	Romania, Italy, Hungary, Cyprus	224 (#192)	Central Romania, Northern Italy	Not specified (<1%)	–	First human case in Cyprus
201,7[43]	Romania, Italy, Greece, Hungary, Austria, Croatia	201 (#147)	Danube Delta, Emilia-Romagna, Thessaly	Not specified (<1%)	25	Greece reintroduced local transmission
201,8[44]	Italy, Greece, Romania, Hungary, France, Austria, Bulgaria, Croatia, Slovenia, Czech Rep.	1548 (#1311)	Po Valley, Central Greece, Bucharest area	NR	166	Largest outbreak on record (+7.2 × vs 2017)
201,9[45]	Greece, Italy, Romania, Hungary, Cyprus, Bulgaria, Germany, Slovakia	425 (#271)	Central Macedonia, Veneto, Attica	NR	50	First local cases in Germany and Slovakia
202,0[46]	Greece, Spain, Italy, Germany, Netherlands, Romania, Hungary, Bulgaria	336	Thessaly, Andalusia, Emilia-Romagna	Not specified (<1%)	38	First local cases in the Netherlands
202,1[47]	Greece, Italy, Hungary, Romania, Spain, Germany, Austria	139	Thessaly, Veneto, Attica	Not specified (<1%)	10	Decline after COVID-related underreporting
202,2[48]	Italy, Greece, Romania, Germany, Hungary, Croatia, Austria, France, Spain, Slovakia	1108	Po Valley, Central Greece, Danube basin	NR	92	Second largest outbreak after 2018
202,3[49]	Italy, Greece, Romania, France, Hungary, Spain, Germany, Croatia, Cyprus	709	Lazio, Central Macedonia, Wallonia	Not specified (<1%)	67	Moderate resurgence; spread to new regions
202,4[50]	Italy, Greece, Spain, Hungary, Romania, France, Austria, Germany, Croatia, Bulgaria, Slovakia, Slovenia, Cyprus, Albania, Czech Rep., Serbia, Turkey, Kosovo*, N. Macedonia	1436	Po Valley, Attica, Andalusia, Pannonian Basin	Not specified (<1%)	125	Largest outbreak since 2018; first probable case in Poland

confirmed cases – where specified.

3.4. Zika virus

The first three cases of likely vector-borne autochthonous transmission in continental Europe were confirmed only in 2019, in Hyères (Var department, France). None of these involved children.[53] These are the only locally acquired cases identified in the region, underscoring that autochthonous transmission of ZIKV remains exceptional compared to DENV and CHIKV.

To date, almost all (99%) ZIKV confirmed cases in Europe have been travel-related, with the remaining cases linked to sexual transmission or, more rarely, to vertical transmission.[9] Nevertheless, the risk of future outbreaks is concrete, given the widespread establishment of *Aedes albopictus* across much of the continent, and the presence of *Aedes aegypti* in certain island territories, such as Madeira, the Canary Islands and Cyprus Table 4.

4. Discussion

This systematic review provides a comprehensive overview of autochthonous arboviral infections in the pediatric population across continental Europe between 2007 and 2024. Despite the progressive expansion of competent vectors—*Aedes albopictus, Aedes aegypti* and *Culex pipiens*—and recurrent outbreaks among adults, pediatric autochthonous cases remain rare, sporadic, and mostly mild; most often seeded by an adult index case within the same community—more commonly within the same household.

Among the arboviruses reviewed, autochthonous outbreaks reported in Europe between 2007 and 2024 most frequently involved dengue, as supported by the breadth of available literature, although the largest pediatric cluster occurred during Italy's 2007 Chikungunya outbreak.[32] The European pediatric risk profile for ZIKV differs fundamentally from DENV and CHIKV: nearly all European cases have been imported, and the only confirmed autochthonous transmissions (France, 2019) did not involve children. Surveillance enhancements introduced in 2016 improved detection of imported infections but have not revealed sustained local transmission chains in continental Europe, positioning ZIKV as a latent rather than active pediatric threat at present. In contrast, WNV is endemic across large portions of continental Europe with yearly transmission and episodic surges (notably 2018 and 2022); children consistently represent a very small proportion (<1%) of confirmed infections, and no pediatric fatalities were reported.[6,7]

Table 4
Reported cases of autochthonous ZIKV infection in Europe (2007–2024).

Year	Country (Location)	No. of autochthonous Cases	No. of Pediatric Cases	Notes
201,9[53]	France (Hyères, Var department)	3	0	To date, the only confirmed autochthonous cases of ZIKV in mainland Europe

Preliminary 2025 national surveillance for dengue indicates continued sporadic local transmission in northern Italy, particularly in Lombardy, involving DENV-1 and DENV-2 and likely seeded by imported cases.[56]

With regard to the most recent data on CHIKV, from the beginning of 2025 up to 10 September 2025, the ECDC reported cases in two European countries. In France, 383 autochthonous cases were confirmed across 37 cluster.[57] Italy reported 167 cases distributed across three clusters: the largest cluster was in the province of Modena (Emilia-Romagna region) with 133 cases, followed by the province of Verona (Veneto region) with 33 cases, and a smaller cluster in the province of Bologna (Emilia-Romagna region). A sporadic case was observed in the city of Piacenza (Emilia-Romagna region), without resulting in a local cluster. Age stratification in Italy revealed a total of 2 cases in the 0–9 year age group and 10 cases in the 10–19 year age group.[29]

West Nile virus (WNV) remains the only endemic arbovirus in Europe, with annual transmission and periodic surges. As of 3 October 2025, thirteen European countries reported 989 locally acquired infections and 63 deaths, most of them in Italy (n = 714). Although the total case count exceeded the ten-year average, it remained below previous peak years, confirming ongoing geographic expansion across the continent. No pediatric cases were reported, and available data on children remain scarce and insufficiently detailed, limiting the accuracy and interpretability of age-specific estimates.[2,52,54]

To date, no data is available regarding autochthonous cases of Zika virus in Europe in 2025.

As expected, pediatric autochthonous cases have been considerably less frequent than adult cases across outbreaks. The low count is likely

multifactorial. Reduced exposure to mosquito bites among children (e.g., caregiver use of repellents, less time outdoors during peak biting hours) may contribute, and underdiagnosis remains a concern because pediatric infections often present with mild or nonspecific symptoms that limit clinical suspicion. Notably, no severe pediatric disease or congenital forms were reported in Europe.[1,11] However, the lack of detailed age-specific data constrains accurate assessment of the pediatric burden.

Continued expansion of autochthonous Aedes-borne transmission is plausible, driven by climatic and ecological changes that extend vector activity, ongoing adaptation of *Aedes albopictus* to temperate areas and increasing international travel that seeds imported cases.[2] *Aedes aegypti* is the principal vector in tropical regions,[55] but from a European perspective the key concern is *Aedes albopictus*, whose global range has expanded dramatically over the past four decades. Leveraging global trade, *Aedes albopictus* spread to temperate zones in the late 1970s,[16] was first detected in Europe in 1979, and is now established in France and at least 14 other Mediterranean countries. Its consolidation in southern France underscores the substantial potential for local emergence of DENV, CHIKV, and ZIKV.[16] Within this landscape, Italy stands out for the magnitude and persistence of outbreaks, whereas France reports the highest number of independent transmission events.[2]

In children, underdiagnosis remains a major limitation—reflecting frequent asymptomatic or nonspecific presentations and the paucity of age-stratified surveillance. Diagnostic delays can permit multiple transmission cycles, reinforcing the need for timely case detection and early alert systems. Strengthening pediatric surveillance should therefore be a public health priority. Enhanced vector management, harmonized containment protocols, and improved clinician awareness—especially for febrile children during vector season—are essential to limit onward transmission.

Three priorities emerge. First, age-stratified, timely diagnostics for febrile children during vector season—particularly DENV NS1/RT-PCR—should be embedded in frontline pediatric pathways to reduce diagnostic lag and interrupt household chains. Second, rapid, focal vector control around pediatric and adult index cases remains decisive for containment of Aedes-borne outbreaks. Third, integrated entomological–clinical–laboratory notification loops, aligned with ECDC guidance, are needed as *Aedes albopictus* expands and seasonal risk windows widen across Europe.

The principal limitation is that evidence is uneven: national reporting is inconsistent, pediatric data are thin (few age bands/comorbidity details; primary vs. secondary DENV often unknown), and many signals come from public or grey sources. This likely underestimates the true pediatric burden. Even so, the picture is consistent: in Europe, pediatric DENV shows up mostly as mild, short, household clusters; pediatric CHIKV/ZIKV are rare; and pediatric WNV, despite endemic circulation, is usually non-severe. Overall, autochthonous pediatric arboviral disease is uncommon and typically mild, but will be detected more often as vectors expand and adult outbreaks grow—hence the need for age-aware surveillance and fast, targeted local control.

In conclusion, although autochthonous arboviral infections in European children remain infrequent and generally mild, their rising frequency and geographic spread warrant sustained vigilance. A coordinated, multidisciplinary approach—combining clinical awareness, rapid diagnostics, entomological surveillance, and community education—will be crucial to mitigate the future impact of arboviral outbreaks in Europe's pediatric population.[11,2]

CRediT authorship contribution statement

Daniele Zama: Validation, Supervision, Formal analysis, Data curation, Conceptualization. **Arianna Catelli:** Writing – review & editing, Writing – original draft, Data curation, Conceptualization. **Raffaella Di Tonno:** Writing – review & editing, Writing – original draft, Data curation, Conceptualization. **Roberta Caiazzo:** Writing – review & editing, Writing – original draft, Data curation, Conceptualization. **Giacomo Campodipietro:** Writing – review & editing, Writing – original draft, Data curation, Conceptualization. **Federico Gobbi:** Validation, Supervision. **Andrea Lo Vecchio:** Validation, Supervision. **Vania Giacomet:** Validation, Supervision, Formal analysis, Data curation, Conceptualization.

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.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.gpeds.2026.100356.

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