

Epidemiological Characteristics and Changes in the Trends of Other Infectious Diarrhoeal Diseases in Zhoushan, China, from 2016 to 2025

Sihui Liang

395601641@qq.com

Zhoushan Center for Disease Control and Prevention

Yaxin Dai

Zhoushan Center for Disease Control and Prevention

Yuzhe Hua

Zhoushan Center for Disease Control and Prevention

Wenjie Wu

Zhoushan Center for Disease Control and Prevention

Research Article

Keywords: Other infectious diarrhoeal diseases, Epidemiological characteristics, Analysis of changes in the trend, Incidence rate, Zhoushan

Posted Date: October 4th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-10977852/v1>

License:   This work is licensed under a Creative Commons Attribution 4.0 International License. [Read Full License](#)

Additional Declarations: No competing interests reported.

Abstract

Background

This study aims to investigate the epidemiological characteristics and changes in the trends of other infectious diarrhoeal diseases in Zhoushan from 2016 to 2025 to provide evidence for the optimization of disease prevention and control strategies.

Methods

The population distributions of cases of other infectious diarrhoeal diseases were acquired from the China National Infectious Disease Network Direct Reporting System (CNIDNDRS). A descriptive epidemiological framework was applied to characterize incidence, seasonality, and demographic distribution, while Joinpoint regression analysis was employed to detect significant inflection points in the secular trend, adjusting for the 2020 pandemic interference.

Results:

A total of 15,493 cases of other infectious diarrhoeal diseases were reported during the study period, with an average annual incidence rate of 132.78 per 100,000 population. No fatal cases were reported. Seasonal peaks occurred in winter (December–February) and summer (July–September). The male-to-female sex ratio was 1.24:1. The highest number of cases occurred in the 0–4-year-old group (10,584 cases, 68.31%), predominantly among children living in household settings (9,282 cases, 59.91%). Aetiological agents were identified in 25.99% of the reported cases. Viruses and bacteria accounted for 96.35% and 3.65% of the confirmed pathogens, respectively. Rotavirus was the leading viral pathogen (3,067 cases, 79.05%), while Salmonella was the predominant bacterial pathogen (130 cases, 88.44%). A total of 23 clustered outbreaks were reported, mostly caused by norovirus (20 outbreaks, 86.96%), with all the clusters occurring in schools or childcare facilities. Joinpoint regression analysis revealed a three-phase trend in the overall incidence: an increase from 2016 to 2018 (APC = 17.54%, $P = 0.01$), followed by a decrease from 2018 to 2023 (APC = -12.50%, $P < 0.001$), and a rapid increase from 2023 to 2025 (APC = 32.19%, $P < 0.001$).

Conclusions

According to the results of Joinpoint regression, other infectious diarrhea cases in Zhoushan, China, exhibit obvious seasonal characteristics, and show an upward trend. To better prevent and control the situation, it is necessary that prevention and control efforts should prioritize outbreaks in schools and childcare settings, promote rotavirus vaccination, and increase laboratory diagnostic capacity in local medical institutions. The results established a critical evidence base for tailored enteric disease control in island and coastal populations globally.

1 Introduction

Other infectious diarrhoea refers to infectious diarrhoea excluding cholera, dysentery, typhoid and paratyphoid, which is caused mainly by pathogenic microorganisms, their products or parasites^[1]. This type of diarrhoea is classified as a Category C infectious disease under the Law of the People's Republic of China on the Prevention and Treatment of Infectious Diseases and has a wide epidemic range and high incidence^[2]. Infectious diarrhoea

causes approximately 760,000 child deaths globally every year and is a major cause of child malnutrition^[3]. In China, the incidence of this disease has long ranked among the top 3 diseases in national notifiable infectious disease reports^[4–5].

While existing national and provincial-level studies have described broad temporal patterns of other infectious diarrhoea across inland settings, there remains a distinct knowledge gap regarding its long-term epidemic trajectory in geographically isolated island regions. The unique subtropical monsoon climate, closed population mobility dynamics, and marine-associated exposure pathways in island areas create epidemiological profiles that differ substantially from those observed in inland urban contexts, yet few long-term trend analyses have accounted for the disruptive impact of the COVID-19 pandemic on routine surveillance data.

The Zhoushan Archipelago, located in northeastern Zhejiang Province, is a typical coastal island region surrounded by the East China Sea. Local surveillance data show that the annual average reported number of other infectious diarrhoea cases reached 1429 during 2021–2025, ranking second among all notifiable infectious diseases in the city. Prior local descriptive reports have not systematically adjusted for the non-specific public health interventions implemented in 2020, and the true secular trend of the disease over the past decade remains uncharacterized. This study therefore aims to reconstruct the unbiased 10-year temporal trends of other infectious diarrhoea in Zhoushan using Joinpoint regression with explicit control for the 2020 pandemic interference, and further identify heterogeneous epidemic patterns across gender and age subgroups, to fill the local evidence gap and support targeted island-specific prevention and control strategies.

2 Materials and Methods

2.1 Data Sources

The data used in this study were collected from all clinically diagnosed and confirmed cases of other infectious diarrhoea with onset dates from January 1, 2016, to December 31, 2025, and a current residential address in Zhoushan; all such cases were recorded in the China Information System for Disease Control and Prevention. Cases with a definite aetiology were included in the aetiological analysis. The population data for the period from 2016 to 2024 were all directly taken from the official publicly published "Zhoushan Statistical Yearbook". These figures were calculated by the Zhoushan Municipal Bureau of Statistics based on annual population change sampling surveys. In 2024, the sampling survey selected a total of 89 village (community) samples, and the actual survey covered approximately 90,000 people. The data is highly reliable. The 2025 permanent population data is derived from the annual main population data bulletin released by the Zhoushan Municipal Bureau of Statistics. This data is calculated based on a 1% population change sampling survey covering 197 villages (communities) and nearly 23,000 actual surveyed individuals.

The diagnosis of the case is based on the definition of infectious diarrhea provided by the World Health Organization (WHO), which states that "the frequency of defecation is ≥ 3 times per day, and the fecal characteristics are abnormal (such as loose stools, watery stools, mucus stools, pus-blood stools or bloody stools)." At the same time, the case diagnostic criteria refer to the Diagnostic Criteria for Infectious Diarrhea (WS271–2007)^[6]. Inclusion criteria: (1) Clinical manifestations of infectious diarrhea as defined by WHO and WS271–2007; (2) Clear pathogen detected in stool specimens by PCR or culture; (3) Age ≥ 6 months, without immunosuppressive conditions (such as HIV positive, undergoing chemotherapy). Exclusion criteria: (1) Legal Class A and B infectious diseases (such as cholera, bacterial dysentery, typhoid/paratyphoid); (2) Non-infectious

diarrhea (such as drug-induced, allergic, inflammatory bowel disease); (3) Antibiotics were used within 48 hours before specimen collection and no pathogen detection record was available.

2.2 Methods

Excel 2013 was used to clean and organize the data from cases of other infectious diarrhoea in Zhoushan from 2016 to 2025 into a database. SPSS 25.0 software was used to analyse the onset characteristics. Joinpoint Regression Program 5.4.0 was used for joinpoint regression, with the test level α set at 0.05.

3 Results

3.1 General Epidemic Situation

A total of 15,493 cases of other infectious diarrhoea were reported in Zhoushan from 2016 to 2025, with an average annual incidence rate of 132.78 cases/100,000 population and no fatal cases. The annual numbers of reported cases were 1,452, 1,958, 1,996, 1,968, 976, 1,393, 1,309, 1,142, 1,282 and 2,017, and the reported incidence rates were 126.04 cases/100,000 population, 169.09 cases/100,000 population, 170.89 cases/100,000 population, 167.78 cases/100,000 population, 82.99 cases/100,000 population, 120.31 cases/100,000 population, 112.27 cases/100,000 population, 97.62 cases/100,000 population, 109.30 cases/100,000 population and 171.52 cases/100,000 population, respectively.

3.2 Temporal Distribution

Other infectious diarrhoea cases were reported every month in Zhoushan from 2016 to 2025, with seasonal peaks. Before 2018, the number of reported cases mostly began to increase in November, peaked from December to January of the following year, and then gradually decreased. After 2018, the onset peak gradually shifted to February–March of the following year. In 2020, owing to the impact of COVID-19, the onset peak was not obvious. Excluding the influence of special factors such as the COVID-19 pandemic, the overall reported incidence showed a bimodal distribution, which was concentrated mainly in the winter and spring, with a small peak in the summer. (Fig. 1)

3.3 Regional Distribution

Other infectious diarrhoea cases were reported in all 4 counties (cities and districts) of Zhoushan from 2016 to 2025. The number of reported cases in descending order was as follows: Dinghai District (10,313 cases), Putuo District (3,048 cases), Daishan County (1,814 cases) and Shengsi County (318 cases). The average annual incidence rates were 205.21 cases/100,000 population in Dinghai District, 86.61 cases/100,000 population in Daishan County, 79.49 cases/100,000 population in Putuo District, and 46.07 cases/100,000 population in Shengsi County.

3.4 Sex and Age Distribution

Among the 15,493 reported cases of other infectious diarrhoea in Zhoushan from 2016 to 2025, 8,590 cases (55.44%) occurred in males, and 6,903 cases (44.56%) occurred in females, with a sex ratio of 1.24:1. In terms of age distribution, cases were reported in all age groups. The 0 ~ 4-year-old group had the greatest number of cases, with 10,584 reported cases, accounting for 68.31% of the total reported cases, which might be on account of the relatively weak immunity of preschool children, and the likelihood of experiencing diarrhea would be higher after

pathogens entering the body. Therefore, our focus of prevention and control lied in this age group, and health education for parents had become a key point. (Table 1)

Table 1
Distribution of Reported Other Infectious
Diarrhoea Cases by Age and Sex in
Zhoushan, 2016–2025

Age (years)	Male	Female	Total
0	1634	1197	2831
1	2070	1635	3705
2	1068	829	1897
3	771	562	1333
4	464	354	818
5–9	858	666	1524
10–19	457	274	731
20–29	236	193	429
30–39	236	238	474
40–49	139	142	281
50–59	212	270	482
≥ 60	445	543	988
Total	8590	6903	15493

3.5 Socio-occupational Distribution

The top 5 socio-occupational groups with the greatest number of reported cases in Zhoushan from 2016 to 2025 were children living in household settings (9,282 cases, 59.91%), preschool children (2,123 cases, 13.70%), students (1,475 cases, 9.52%), housewives and unemployed people (886 cases, 5.72%) and administrative staff (353 cases, 2.28%). The reported cases of these 5 socio-occupational groups (14,119 cases) accounted for 91.13% of the total reported cases. The proportion of scattered children is higher than that of children in kindergartens, which might be on account of that scattered children had more outdoor activities, thereby increasing the risk of bacterial and viral entry. Therefore, it is extremely important for school-age children to receive health education on hand hygiene, etc. However, attention should also be paid to the occurrence of clustered outbreaks in childcare institutions.

3.6 Aetiological Characteristics

Among all reported cases of other infectious diarrhoea in Zhoushan from 2016 to 2025, 25.99% (4027/15493) had confirmed aetiological agents. Viruses and bacteria accounted for 96.35% (3880/4027) and 3.65% (147/4027) of the confirmed pathogens, respectively. The viral pathogens included mainly rotavirus, norovirus, adenovirus, and sapovirus. Among the reported cases, there were 3,067 rotavirus cases, accounting for 79.05% of the total viral cases, followed by 839 adenovirus cases, accounting for 21.62%. The predominant bacterial pathogen was Salmonella, with 130 cases, accounting for 88.44% of the cases. The highest-incidence season for

rotavirus infection was winter, and the number of rotavirus infection cases reported from December to February of the following year accounted for 52.20% (1684/3067) of the total reported cases. The highest-incidence season for Salmonella infection was from summer to early autumn, and the number of Salmonella infection cases reported from July to October accounted for 61.53% (80/130) of the total reported cases.

3.7 Outbreak Surveillance

A total of 23 clustered outbreaks of other types of infectious diarrhoea were reported in Zhoushan from 2016 to 2025. The pathogens included norovirus (20 outbreaks), sapovirus (1 outbreak), *Campylobacter jejuni* (1 outbreak) and enteroaggregative *Escherichia coli* (1 outbreak), all of which occurred in schools or childcare facilities, with a total of 402 reported cases.

3.8 Analysis of Onset Trends

The year 2020 constituted a special outlier point, and its data heterogeneity was well-grounded in public health practice. During the COVID-19 pandemic, comprehensive non-pharmaceutical interventions including population-level social distancing, improved hand hygiene practices, and increased frequency of environmental disinfection exerted a discontinuous strong inhibitory effect on the reported incidence of enterically transmitted infectious diseases. Data from this year represented a typical "biased sample". After excluding observations from the time series and re-estimating the model, the resulting trend estimates were more consistent with the natural epidemic trajectory of other infectious diarrhea cases in this region.

From 2016 to 2025, the reported incidence showed a slow decreasing trend, but the trend was not statistically significant (APC=-1.85%, $P = 0.603$). Since the COVID-19 pandemic in 2020 strongly affected the reported incidence of other types of infectious diarrhoea, the data from 2020 were excluded, and a joinpoint regression analysis was performed. The results revealed that the incidence tended to increase from 2016 to 2018 (APC = 17.541%, $P = 0.01$), to decrease from 2018 to 2023 (APC=-12.503%, $P < 0.001$), and to increase rapidly from 2023 to 2025 (APC = 32.190%, $P < 0.001$).

When performing the analysis by sex without excluding the data from 2020, the incidence in the male group tended to decrease slowly, but the trend was not statistically significant (APC=-1.97%, $P = 0.579$), which was consistent with the overall onset trend when the data from 2020 were not excluded; however, the trend in the female group was consistent with the overall onset trend after the 2020 data were excluded. After excluding the data from 2020, the data of the two sex groups were reanalysed, and the results revealed that the incidence of both the male and female groups presented a three-stage fluctuating trend.

After excluding the data for 2020, there was consistency among the gender groups. After correcting for confounding variables, the incidence rates of both the male and female subgroups showed a complete three-stage fluctuation trend, and there was no gender-based prevalence bias. This proved that the segmented trend conclusion for the entire population was not affected by the gender structure, and the results were reliable and robust. (Table 2)

Table 2
Joinpoint Regression Analysis of the Diarrhoea in Zhoushan by Sex, 2016–2025

Sex	Data from 2020 has not been excluded				Data from 2020 has been excluded			
	Year	APC(%) [95%CI]	T value	P value	Year	APC(%) [95%CI]	T value	P value
Male	2016–2025	-1.97(-11.72–7.37)	-0.707	0.579	2016–2018	14.42(0.11–35.16)	1.610	0.048
					2018–2023	-11.95(-19.45–8.38)	-4.616	< 0.001
					2023–2025	31.59(11.06–52.24)	3.157	< 0.001
Female	2016–2018	19.54(-0.43–55.28)	0.512	0.057	2016–2018	23.75(8.43–39.35)	3.134	< 0.001
	2018–2023	-13.11(-28.64–8.92)	-1.275	0.003	2018–2023	-13.29(-18.62–10.79)	-6.573	< 0.001
	2023–2025	37.84(6.87–72.30)	0.936	0.001	2023–2025	34.39(19.04–48.46)	4.419	< 0.001

When analysed by age group, the reported incidence in the 0-, 1-year and 2-year-old groups tended to decrease from 2016 to 2025, and the changes in the 0-and 1-year-old groups were statistically significant (APC=-11.67%, $P = 0.004$; APC=-13.95%, $P = 0.003$), whereas the change in the 2-year-old group was not statistically significant (APC=-2.81%, $P = 0.353$). The reported incidence in the 5- and 10-year-old groups both tended to increase from 2016 to 2025 (APC = 16.74%, $P < 0.001$; APC = 16.16%, $P < 0.001$, respectively). The annual reported incidence of the 20 + year age group tended to change across three stages: it increased from 2016 to 2019 (APC = 35.67%, $P < 0.001$), decreased from 2019 to 2022 (APC=-20.82%, $P = 0.003$), and increased from 2022 to 2025 (APC = 57.17%, $P < 0.001$). Trend analysis was also carried out on the data excluding the data from 2020, and the results revealed that the reported incidence of the 0-year group tended to decrease from 2016 to 2025 (APC=-11.54%, $P = 0.015$); the reported incidence of the 5- and 10-year-old groups tended to increase from 2016 to 2025, which was consistent with the results before exclusion (APC = 15.92%, $P < 0.002$; APC = 15.70%, $P < 0.003$); the 2-year group tended to increase from 2016 to 2019 and decrease from 2019 to 2025, but neither was statistically significant (APC = 13.46%, $P = 0.180$; APC=-8.49%, $P = 0.111$); and the 1- and 20 + year groups presented “up-down-up” trends, but the stages were not statistically significant.

This age-stratified analysis further clarified the current priority for the prevention and control of other infectious diarrhea. The existing prevention and control system for young infants had achieved stable results and did not require significant adjustments. Resources should be redirected towards the 5- to 10-year-old school-age children group, with a particular focus on the clustered epidemic risks in schools and kindergartens. At the same time, we must be highly vigilant about the rapid rebound exceeding the previous levels among the 20 + adult group since 2022, and provided targeted health education and intervention in workplaces and public places to prevent the further escalation of the epidemic intensity across the entire population. (Table 3)

Table 3
Joinpoint Regression Analysis of the Diarrhoea in Zhoushan by Age, 2016–2025

Age	Data from 2020 has not been excluded				Data from 2020 has been excluded			
	Year	APC(%) [95%CI]	T value	P value	Year	APC(%) [95%CI]	T value	P value
0-	2016	-11.67(-21.09–4.39)	-4.116	0.004	2016	-11.53(-23.06–2.84)	-4.053	0.015
	– 2025				– 2025			
1-	2016	-13.95(-25.63–5.49)	-4.176	0.004	2016	11.10(-4.40–30.21)	0.929	0.208
	– 2025				– 2018			
					2018	-13.29(-18.62–10.79)	-5.937	< 0.001
					– 2023			
					2023	34.39(19.04–48.46)	0.945	0.156
					– 2025			
2-	2016	-2.81(-9.27–3.58)	-0.949	0.353	2016	13.46(-9.59–74.82)	0.995	0.180
	– 2025				– 2019			
					2019	-8.49(-39.60–5.67)	-1.554	0.111
					– 2025			
5-	2016	16.74(6.78–31.51)	5.459	< 0.001	2016	15.92(7.08–29.72)	6.038	0.002
	– 2025				– 2025			
10-	2016	16.16(6.48–30.72)	3.169	< 0.001	2016	15.70(5.63–31.70)	2.882	0.003
	– 2025				– 2025			
20-	2016	35.67(21.13–87.74)	2.236	< 0.001	2016	32.04(15.14–123.41)	1.889	0.007
	– 2019				– 2019			
	2019				2019			
	– 2022				– 2023			
	2022	57.17(38.39–111.98)	2.498	< 0.001	2023	80.11(40.23–137.62)	3.159	< 0.001
	– 2025				– 2025			

4 Discussion

This study systematically reconstructed the epidemiological trend of other infectious diarrhea in Zhoushan from 2016 to 2025 using the Joinpoint regression model, which eliminated bias caused by the COVID-19 pandemic in 2020. The results showed that the disease did not follow the previously observed long-term gradual decline trend, but instead underwent a three-phase dynamic change: "accumulation of natural epidemic intensity—rapid decline under non-specific interventions—strong rebound after relaxation of control measures." With an average annual

increase rate of 32.19% since 2023, the findings indicated that local epidemic risk had returned to its highest level in nearly a decade.

Despite the improvement in living standards and sanitary conditions, other infectious diarrhoea is still among the notifiable infectious diseases with the highest incidence in Zhoushan, other cities in Zhejiang Province^[7] and other provinces across China^[8-9], and it imposes a high disease burden on the population, especially children^[10]. The annual number of other infectious diarrhoea cases was generally stable from 2016 to 2017. After a small peak in incidence in 2018, the number of cases decreased in 2019 and 2020, with the number of cases in 2020 reaching the lowest level in recent years. From 2021 to 2024, the number of cases returned to the pre-COVID-19 level, and a small peak appeared in 2025. The possible reasons for the fluctuation of the onset trend are as follows: First, other infectious diarrhoeal diseases are a group of infectious diseases with diarrhoea as the main symptom and are caused by a large variety of pathogens with similar clinical symptoms. The lack of specific detection capabilities for viral diarrhoea in primary laboratories leads to some cases being classified as nonspecific diagnoses, such as “acute gastroenteritis”. The decrease in the number of reported cases and incidence rate in 2020 may be related to the reduced population contact, decreased outpatient volume of intestinal clinics, and the government’s strong promotion of healthy behaviours such as handwashing and mask-wearing during the COVID-19 pandemic prevention and control period. On the one hand, the pandemic restricted population mobility and reduced the transmission probability of intestinal diseases; on the other hand, the government strengthened personal hygiene habits through multichannel health communication, prompting the public to actively reduce nonessential medical visits, which jointly led to a significant reduction in cases of other infectious diarrhoeal diseases^[11-12].

Overall, the onset of other infectious diarrhoea in Zhoushan presents obvious seasonal alternating characteristics, with relatively high incidences in winter and spring and a small peak in autumn, which is consistent with the epidemiological characteristics of Shanghai^[13] and Yunnan Province^[14] but quite different from that of Heze city^[15], Shandong Province. This may be related to differences in regional climatic environments, population structures, individual hygiene habits, health education, and seasonal epidemic characteristics of pathogens^[16-17].

In terms of population distribution, the incidence in males is greater than that in females; the 0 ~ 4-year-old group had the greatest number of cases, and children living in household settings accounted for the greatest proportion of cases, which is similar to the situation in Xicheng District of Beijing^[18], Jiangxi Province^[19] and other places. The possible reasons are as follows: On the one hand, the immune system of infants and young children is not yet fully developed, and the breastfeeding rate after birth is relatively low^[20], so the unique flora and antibodies in breast milk cannot protect infants and young children; guardians in some rural areas have relatively weak health awareness, which may increase the risk of onset for infants and young children. On the other hand, children living in household settings engage in more outdoor activities, leading to a higher risk of bacteria and viruses entering the body. In addition, boys are more active and restless than girls are, and their symptoms after infection with infectious diarrhoea are more severe than those of adults, resulting in higher medical consultation rates and higher reported proportions^[21].

Joinpoint regression analysis of the trends of onset of other types of infectious diarrhoea in Zhoushan from 2016 to 2025 revealed that after the effect of the COVID-19 pandemic on onset was excluded, the overall trend presented a three-stage pattern of “rise-fall-rise”, which was consistent with the results of sex grouping but different from the results of age grouping. According to the results, the trend obtained without excluding the 2020

data was statistically significant. The incidence in the low-age group under 5 years old tended to decrease, while that in the 5–20-year-old children and adolescents tends to increase, and that in individuals over 20 years old also tended to increase in recent years. These findings suggest that more attention should be given to the prevention and control of other types of infectious diarrhoea among school-aged children and adults.

This study presented several well-defined limitations and methodological boundaries. First, the data source was the notifiable infectious disease reporting surveillance system, which inevitably introduced inherent biases associated with underreporting and delayed case notification. Mild symptomatic cases that did not access clinical care were not captured in the routine surveillance statistics, leading to a marginal deviation between the reported incidence and the true population-level infection rate. Second, the Joinpoint regression model exhibited limited statistical sensitivity for inflection point detection at the distal end of the time series. Since the rapid upward trend spanning 2023 to 2025 was supported by only three consecutive monitoring years, extrapolation of this trend to longer time horizons carried non-negligible statistical uncertainty. Third, the study population was restricted to the local island residents of Zhoushan, where demographic composition, geographical context, and exposure scenarios were highly geographically specific. As such, direct generalization of these findings to non-island settings was not warranted without careful contextual adaptation.

Notwithstanding these limitations, none exerted a substantial confounding effect on the validity of the core study conclusions. All segmented temporal trends identified in this analysis met stringent statistical significance criteria, and the magnitude of underreporting bias remained relatively stable across the 10-year surveillance period, which did not alter the directional inference of a resurgent epidemic trajectory. Future research activities, including supplementary community-based seroepidemiological sampling, extension of continuous surveillance for an additional 3–5 years, and multi-site cross-island comparative analyses, would enable further bias calibration and robust validation of trend stability, ultimately reinforcing the evidence base for the epidemiological patterns of other infectious diarrhea in this region.

In summary, other infectious diarrhoeal diseases in Zhoushan have obvious seasonal characteristics, and the incidence rate may increase in the next few years. It is necessary to strengthen public awareness, health education and personal protection in the winter and spring; focus on preventing and controlling outbreaks of other infectious diarrhoeal diseases in schools and childcare institutions; promote vaccination against rotavirus among infants and young children to improve the immune protection barrier; and strengthen the laboratory diagnostic capabilities of local medical institutions to improve the aetiological diagnosis rate to lay a foundation for the subsequent monitoring and prevention and control of this disease.

5 Conclusion

This study applied Joinpoint regression analysis to a 10-year notifiable disease surveillance dataset spanning 2016 to 2025, with explicit adjustment for the disruptive non-pharmaceutical interventions during the COVID-19 pandemic in 2020, to characterize the true long-term temporal trends of other infectious diarrhea in the island setting of Zhoushan, China. The analysis identified a three-phase dynamic trajectory of disease incidence that had been masked in unadjusted full-period models, alongside distinct heterogeneous trend patterns across gender and age subgroups. The core novel findings — the post-pandemic rapid resurgence of incidence and the shift of high-risk populations from infants to school-aged children and working adults—provided robust, context-specific epidemiological evidence that directly refuted the prior empirical assumption of a sustained long-term decline in disease burden. These results carry broad public health implications for geographically isolated island

populations, offering actionable evidence to reorient local surveillance priorities, reallocate targeted intervention resources, and prevent large-scale clustered outbreaks. This work also establishes a standardized analytical baseline for future research, upon which subsequent seroepidemiological investigations, multi-site comparative studies, and dynamic trend prediction modeling can be built to further refine the prevention and control framework for enteric infectious diseases in island and coastal settings.

Declarations

Ethics approval and consent to participate This study was a retrospective epidemiological analysis using fully anonymized routine public health surveillance data, which did not involve any identifiable personal information or human biological samples. The study protocol was reviewed and exempted from the requirement for individual informed consent by the Ethics Committee of Zhoushan Center for Disease Control and Prevention, and all procedures complied with the national ethical requirements for public health surveillance research.

Consent for publication All data used in this retrospective epidemiological analysis were fully anonymized and de-identified before the authors accessed the dataset. No identifiable personal information that could be traced to any specific individual is included in this manuscript, and the requirement for separate consent for publication was waived by the institutional ethics committee.

Availability of data and materials The de-identified datasets generated and analyzed during this study are available from the corresponding author upon reasonable request. The raw data are not publicly available due to the requirements of local public health data confidentiality regulations and ethical restrictions to protect personal privacy of the notified cases.

Competing Interests The authors declare no competing interests.

Funding This work was supported by the Zhoushan City Medical and Health Science and Technology Planning Project (2023YB09).

Authors' contributions SL has made substantial contributions to the acquisition, analysis, and interpretation of data for the work. YD has made contributions to the analysis of data for the work. YH has revised it critically for important intellectual content. WW has contributed to the drafting of the article .

Acknowledgements The authors would like to thank research assistants Jienan Liu and Jiayan Jiang for their assistance with data collection and preliminary analysis.

References

1. Yang W, Zhang HD, Long J, et al. Spatiotemporal Cluster Analysis of Other Infectious Diarrhea in Chongqing from 2005 to 2020. *Journal of Preventive Medicine Information*, 2022, 38(8): 1041-1046.
2. Ren JH, Wang R. Epidemiological Characteristics of Public Health Emergencies Caused by Other Infectious Diarrhea in China from 2017 to 2023. *Tropical Disease and Parasitology*, 2023, 21(1): 1-6.
3. Kelly P. Infectious diarrhoea. *Medicine*, 2019, 47(6): 341-346.
4. National Notifiable Infectious Disease Epidemic Profile in 2021.
<http://www.nhc.gov.cn/jkj/s3578/202204/4fd88a291d914abf8f7a91f6333567e1.shtml>

5. National Notifiable Infectious Disease Epidemic Profile in 2020.
<http://www.nhc.gov.cn/jkj/s3578/202103/f1a448b7df7d4760976fea6d55834966.shtml>
6. Ministry of Health of the People's Republic of China. Diagnostic Criteria for Infectious Diarrhea: WS 271-2007[S]. 2007.
7. Gu MM, Liang HB, Hu YF, et al. Epidemiological Characteristics and Long-term Trend Analysis of Other Infectious Diarrhea in Taizhou City, Zhejiang Province from 2012 to 2022. *Disease Surveillance*, 2023, 38(12): 1530-1534.
8. Zhao JH, Wang WJ, Wang XW, et al. Etiology and Epidemiological Characteristics of Other Infectious Diarrhea in Qinghai Province from 2010 to 2020. *Modern Preventive Medicine*, 2021, 48(17): 3073-3076.
9. Hao CX, Liu YQ, Liao XC, et al. Epidemiological Characteristics and Etiological Analysis of Other Infectious Diarrhea in Sichuan Province from 2019 to 2020. *Journal of Preventive Medicine Information*, 2022, 38(8): 1054-1060.
10. Liang D, Che RF, Shi QP, et al. Research Progress on the Disease Burden of Infectious Diarrhea and the Change of Its Pathogen Spectrum. *Chinese Journal of Public Health*, 2020, 36(11): 1651-1654.
11. WANG L P, HAN J Y, ZHOU S X, et al. The changing pattern of enteric pathogen infections in China during the COVID-19 pandemic—A nation-wide observational study. *Lancet Reg Health West Pac*, 2021(16): 100268.
12. Tao JJ, Qi JW, Diao ZM, et al. Investigation on the Status of Nosocomial Infections in a Tertiary Hospital in Jiangxi Province during the Prevention and Control Period of COVID-19. *Chinese Journal of Nosocomiology*, 2021, 31(24): 3695-3698.
13. Li M, Qiao XF, Lv XH, et al. Epidemiological Characteristics of Other Infectious Diarrhea in Songjiang District of Shanghai from 2017 to 2020. *Occupational and Health*, 2023, 39(4): 492-496.
14. Huang L, Chen TM, Fu XQ, et al. Epidemiological Analysis of Other Infectious Diarrhea in Yunnan Province from 2005 to 2019. *Modern Preventive Medicine*, 2022, 49(10): 1741-1746.
15. Zhang WQ, Zhang DD, Liu D. Epidemiological Analysis of Other Infectious Diarrhea in Heze City, Shandong Province from 2012 to 2021. *Forum of Preventive Medicine*, 2022, 28(9): 675-678.
16. Wang HT, Liu ZD, Lao JH, et al. Lag Effect and Influencing Factors of Temperature on Other Infectious Diarrhea in Zhejiang Province. *Chinese Journal of Epidemiology*, 2019, 40(8): 960-964.
17. Liu ZD. Study on Comprehensive Risk Assessment and Early Warning Model for Other Infectious Diarrhea Caused by Meteorological Factors. Jinan: Shandong University, 2020.
18. Huang YH, Kong QZ, Liu XX, et al. Epidemiological Characteristics and Spatiotemporal Aggregation Analysis of Other Infectious Diarrhea in Xicheng District of Beijing from 2013 to 2018. *Medical Animal Control*, 2021, 37(2): 128-131.
19. Jin Y, Zeng ZL, Ding XX, et al. Epidemiological Analysis of Other Infectious Diarrhea in Jiangxi Province from 2008 to 2017. *Modern Preventive Medicine*, 2020, 47(13): 2319-2321, 2327.
20. Fang H, Wu YJ, Sun MX, et al. A Longitudinal Qualitative Study on the Breastfeeding Experience of Primiparas during Lactation. *Chinese Maternal and Child Health Care*, 2025, 40(24): 4571-4575.
21. Long QZ, He L, Hu SX, et al. Analysis of Etiological Monitoring Results of Other Infectious Diarrhea in Zhuzhou City, Hunan Province from 2015 to 2018. *Disease Surveillance*, 2019, 34(9): 789-794.

Figures

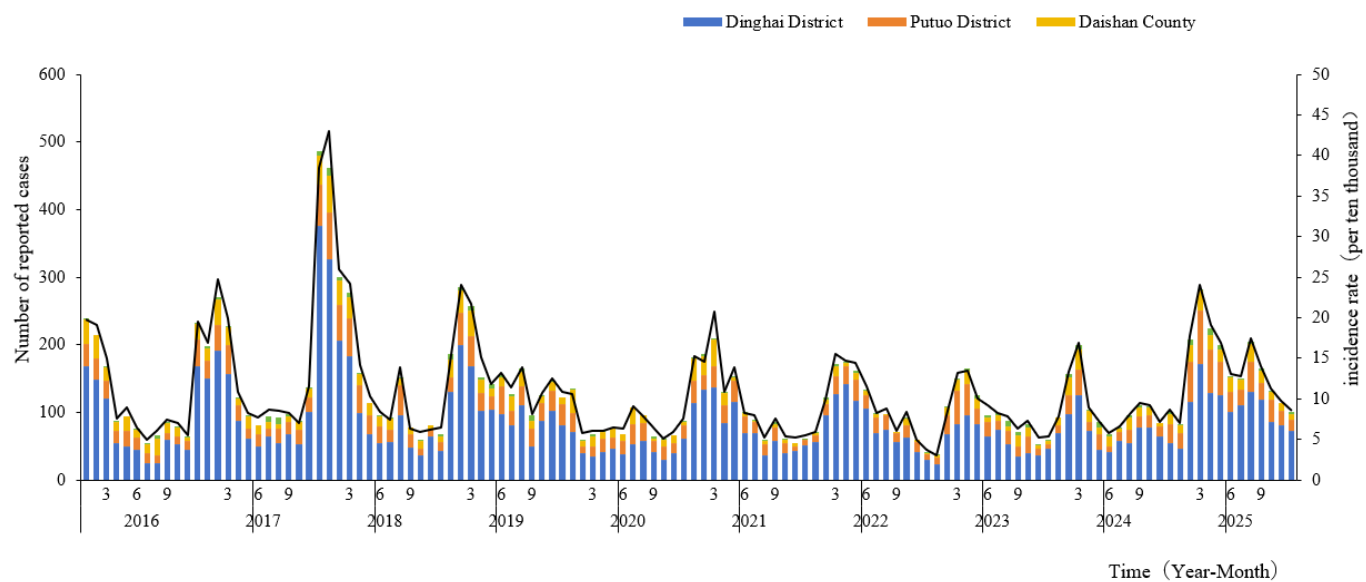


Figure 1

Monthly distribution of other infectious diarrhea cases and incidence rates in Zhoushan from 2016 to 2025