Vital Surveillances

Notified Vector-Borne Diseases — China, 2005–2024

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ABSTRACT

Introduction: Vector-borne diseases (VBDs) represent a significant category of infectious diseases. Analyzing the epidemiological characteristics of VBDs in China, including their temporal and spatial distributions, provides essential evidence for developing effective prevention and control strategies.

Methods: Data for 14 types of VBDs from 2005 to 2024 were obtained from the China National Infectious Disease Surveillance System. These diseases were categorized as mosquito-borne, tick-borne, rodent-borne, and other VBDs. Using the Mann-Kendall trend test, we analyzed demographic characteristics, spatial distribution, temporal trends, and seasonal patterns of notified cases over the 20-year period.

Results: From 2005 to 2024, a total of 1,129,736 VBD cases were reported in China. Scrub typhus (28.17%), malaria (20.8%), hemorrhagic fever with renal syndrome (HFRS, 18.4%), dengue (12.61%), and schistosomiasis (8.42%) collectively accounted for 88.4% of all cases. Over a 20-year period, mosquito-borne and rodent-borne diseases indicated significant declining trends (P<0.05), while tick-borne and other VBDs demonstrated significant increasing trends (P<0.05). Dengue, scrub typhus, and severe fever with thrombocytopenia syndrome (SFTS) expanded geographically, with annual increases of 10.89, 12.37, and 7.07 reporting cities, respectively. Although diseases such as plague, malaria, and schistosomiasis have been effectively controlled, the incidence of scrub typhus, dengue, HFRS, and SFTS has remained high in recent years.

Conclusions: The burden of VBDs in China remains substantial, with an increasing trend observed over the past 5 years. The rising incidence and geographic expansion of scrub typhus, dengue, and SFTS warrant particular attention from public health authorities.

Vector-borne diseases (VBDs) are caused by bacteria, viruses, or parasites transmitted through vectors such as mosquitoes, ticks, fleas, and rodents (*1*). According to the World Health Organization, 80% of the global population is at risk of at least one VBD, collectively accounting for 17% of the global infectious disease burden (*2*). VBDs cause approximately 700,000 deaths annually, representing a significant global public health threat. China, with its vast territory of approximately 9.6 million square kilometers and population of 1.4 billion, encompasses multiple climate zones and ecological regions that support high biodiversity. This ecological diversity has facilitated the proliferation of numerous disease vectors, resulting in a wide spectrum of VBDs and creating substantial challenges for disease prevention and control efforts (*3*).

Globalization, climate change, and urbanization have substantially altered vector habitats, potentially expanding or shifting their geographical distribution (*4*). These environmental changes facilitate pathogen transmission to human populations, increasing the risk of emerging and reemerging infectious diseases, including VBDs. Over the past two decades, China has identified new VBDs such as severe fever with thrombocytopenia syndrome (SFTS) and Zika virus disease, while established diseases like dengue and hemorrhagic fever with renal syndrome (HFRS) have caused recurrent outbreaks (*5*–*6*). These infectious diseases pose significant threats to social stability, economic development, and public health in China. Therefore, exploring disease patterns and transmission trends is essential for implementing effective VBD control and prevention strategies.

METHODS

This study analyzed data from 14 VBDs recorded in the China national infectious disease surveillance system from 2005 to 2024. We categorized these diseases into four groups: mosquito-borne diseases (dengue, malaria, Japanese encephalitis, Zika virus disease, and filariasis), tick-borne diseases [severe fever

with thrombocytopenia syndrome (SFTS) and tick-borne encephalitis], rodent-borne diseases [hemorrhagic fever with renal syndrome (HFRS), leptospirosis, and plague], and others (scrub typhus, schistosomiasis, typhus group rickettsiosis, and leishmaniasis). After excluding 32,102 suspected cases, we analyzed the spatial distribution, temporal trends, and demographic characteristics of these four VBD categories over the 20-year period. We used analysis of variance to examine differences in continuous variables between groups, Chi-square tests to analyze differences in categorical variables, and the Mann-Kendall trend test to evaluate temporal trends in disease incidence. All data processing and statistical analyses were performed using R (version 4.2.2; The R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

From 2005 to 2024, China reported a total of 1,129,736 cases of VBDs (annual incidence rate of 4.13 per 100,000), with 6,096 deaths (Table 1). Scrub typhus accounted for the highest number of cases (318,258), followed by malaria (235,033), HFRS (207,850), and dengue (142,422). Tick-borne diseases exhibited the highest cumulative fatality rate (4.33%) during this period. Among individual diseases, plague had the highest case fatality rate (38.33%), followed by Japanese encephalitis (4.9%) and SFTS (4.79%). The mean age of all VBD cases was 43.85 years (SD: 20.04), with tick-borne disease cases having the highest mean age of 61.51 years (SD: 13.66). Males comprised a higher proportion of cases in all disease categories except tick-borne diseases. Across all VBD types, farmers represented a significantly higher proportion of cases compared to individuals in other occupations (Table 2, all $P<0.05$).

Mosquito-borne diseases, primarily malaria (56.39%) and dengue (34.17%), are predominantly distributed in the southern regions of China (Figure 1). Tick-borne diseases, mainly SFTS (89.07%), are concentrated in Central and Eastern China. Rodent-borne diseases, predominantly HFRS (95.53%), are primarily found in Northeast China and along the middle and lower reaches of the Yangtze and Yellow Rivers. Other vector-borne diseases, chiefly scrub typhus (69.63%), are mainly distributed across Southwest and South China regions. Notably, dengue,

TABLE 1. The incidence and fatality of VBDs in China from 2005 to 2024.

Disease	Cases (No.)	Cumulative incidence (per 100,000)	Death (No.)	Fatality rate (%)
VBD	1,129,736	82.60	6,096	0.54
Mosquito-borne disease	416,813	30.47	2,292	0.55
Dengue	142,422	10.41	14	0.01
Malaria	235,033	17.18	350	0.15
Japanese encephalitis	39,303	2.87	1,927	4.90
Zika virus disease	39	–	0	0.00
Filariasis	16	–	1	6.25
Tick-borne disease	38,241	2.80	1,656	4.33
SFTS	34,063	2.49	1,631	4.79
Tick-borne encephalitis	4,178	0.31	25	0.60
Rodent-borne diseases	217,579	15.91	2,001	0.92
HFRS	207,850	15.20	1,806	0.87
Leptospirosis	9,669	0.71	172	1.78
Plague	60	–	23	38.33
Others	457,103	33.42	147	0.03
Scrub typhus	318,258	23.27	108	0.03
Schistosomias	95,093	6.95	14	0.01
Typhus group rickettsiosis	37,673	2.75	6	0.02
Leishmaniasis	6,079	0.44	19	0.31

Abbreviation: VBD=vector-borne disease; No.=number; HFRS=hemorrhagic fever with renal syndrome; SFTS=severe fever with thrombocytopenia syndrome.

TABLE 2. The Characteristics of cases with VBDs in China from 2005 to 2024.

Characteristics	Mosquito-borne disease	Tick-borne disease	Rodent-borne diseases	Others	*P*
Age [mean (SD)]	36.24 (20.02)	61.51 (13.66)	45.31 (15.80)	48.61 (19.75)	<0.001
Gender (%)					
Female	152,948 (36.69)	19,385 (50.69)	56,169 (25.82)	224,737 (49.17)	<0.001
Male	263,865 (63.31)	18,856 (49.31)	161,410 (74.18)	232,366 (50.83)	
Occupation (%)					
Children	33,522 (8.04)	71 (0.19)	884 (0.41)	26,912 (5.89)	<0.001
Service industry	25,318 (6.07)	187 (0.49)	4,689 (2.16)	4,240 (0.93)	
Farmer	165,919 (39.81)	29,944 (78.30)	147,420 (67.75)	339,774 (74.33)	
Unemployed	33,686 (8.08)	4,039 (10.56)	16,332 (7.51)	21,626 (4.73)	
Pupil	51,199 (12.28)	157 (0.41)	9,734 (4.47)	22,496 (4.92)	
Staff of public institutions	12,364 (2.97)	323 (0.84)	5,845 (2.69)	6,474 (1.42)	
Others	94,805 (22.75)	3,520 (9.20)	32,675 (15.02)	35,581 (7.78)	

Abbreviation: VBD=vector-borne disease; SD=standard deviation.

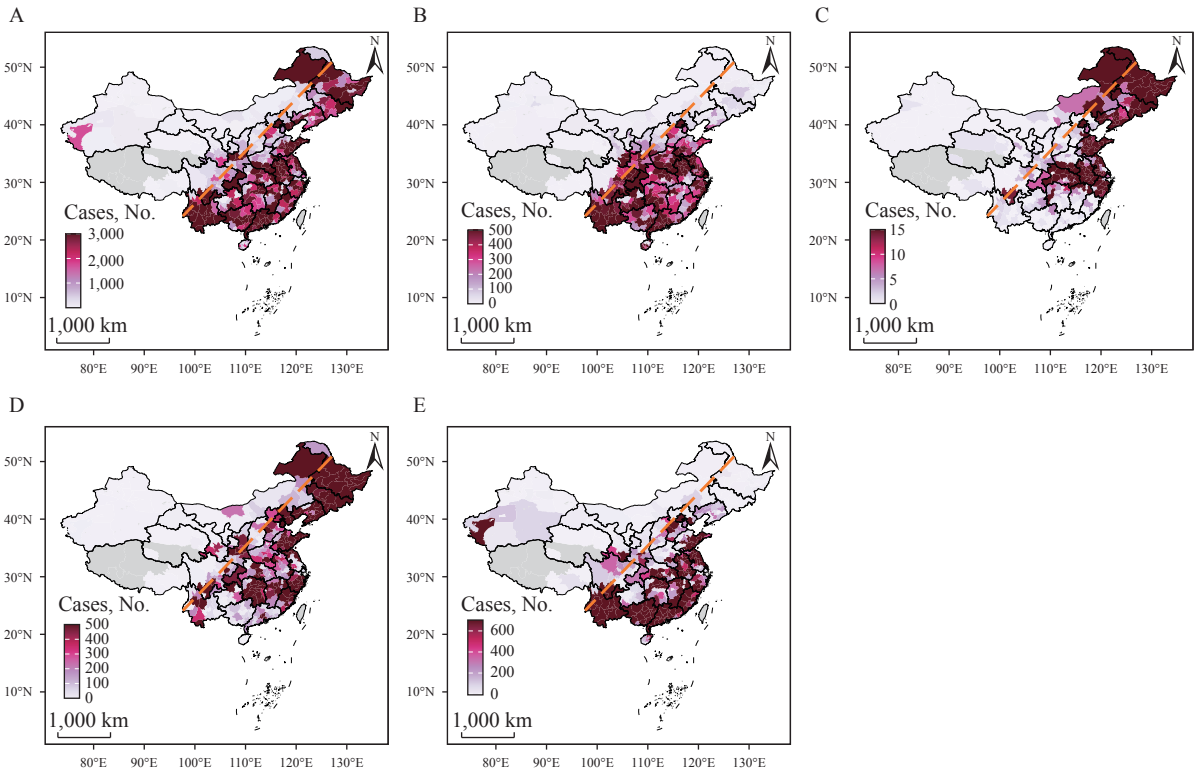

FIGURE 1. Spatial distribution of VBDs in China from 2005 to 2024. (A) VBDs; (B) Mosquito-borne diseases; (C) Tick-borne diseases; (D) Rodent-borne disease; (E) Other diseases.
Abbreviation: VBD=vector-borne disease; No.=number.
Map approval number: GS 京 (2025)0996 号.

scrub typhus, and SFTS have demonstrated annual increases in geographic spread, with reported cases expanding to 10.89, 12.37, and 7.07 more cities each year, respectively (Supplementary Figures S1–S3, available at https://weekly.chinacdc.cn/).

From 2005 to 2024, the incidence of VBDs in China has exhibited a fluctuating pattern with three distinct peaks occurring in 2006, 2014, and 2024 (P=0.721, Figures 2A and 2C). Mosquito-borne and rodent-borne diseases showed significant declining trends, while tick-borne diseases and other VBDs demonstrated significant increasing trends (all P<0.05).

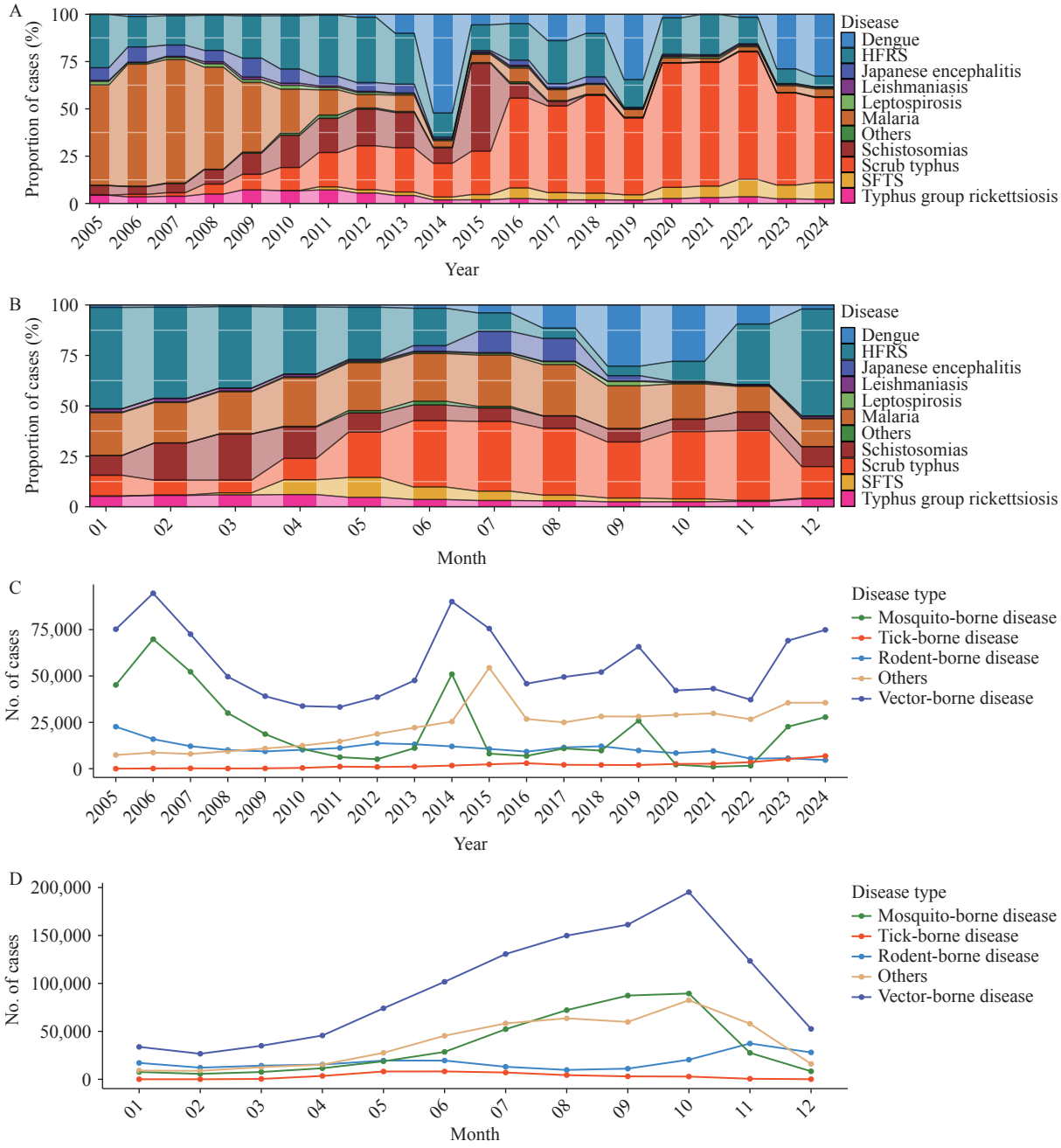

FIGURE 2. The trends in incidence and seasonal characteristics of VBDs in Mainland China from 2005 to 2024. (A) Annual case distribution (%) of vector-borne diseases by disease; (B) Monthly case distribution (%) of vector-borne diseases by disease; (C) Annual reported cases of VBDs by vector category; (D) Monthly reported cases of vector-borne diseases by vector category.
Abbreviation: VBD=vector-borne disease; No.=number; HFRS=hemorrhagic fever with renal syndrome; SFTS=severe fever with thrombocytopenia syndrome.

The first two peaks were primarily attributed to outbreaks of malaria and dengue, while the 2024 peak resulted mainly from increased scrub typhus and dengue cases. From 2004 to 2014, malaria and HFRS cases constituted a higher proportion of VBDs in China, whereas from 2014 to 2024, dengue, SFTS, and scrub typhus became more prevalent. Mann-Kendall trend analysis revealed that rodent-borne diseases (HFRS, leptospirosis), malaria, Japanese encephalitis, schistosomiasis, and typhus group rickettsiosis have shown significant declining trends, while SFTS, dengue, and scrub typhus have demonstrated significant increasing trends (all $P<0.05$). Additionally, VBDs exhibit distinct seasonal

distribution patterns (Figure 2B and 2D). HFRS displays bimodal annual incidence peaks, dengue cases peak from June to October, and SFTS cases peak from May to August. Scrub typhus shows a higher proportion of cases from June to November.

DISCUSSION

From 2005 to 2024, VBDs in China exhibited a fluctuating trend, with previous studies documenting a fluctuating decline from 2005 to 2020 (*1*), followed by a notable increase in recent years. This recent upward trend necessitates strengthened preventive measures to mitigate further case increases in 2025. Over the past two decades, high-threat diseases such as plague, HFRS, malaria, and Japanese encephalitis have been generally controlled. However, dengue has emerged as a significant mosquito-borne disease, replacing malaria and Japanese encephalitis as a major public health threat in China. Additionally, SFTS, a newly emerging tick-borne disease, presents a high fatality rate that warrants urgent attention. While rodent-borne diseases have generally been controlled, HFRS cases remain at concerning levels. Therefore, China should intensify measures to prevent the spread of dengue and SFTS, while also focusing on the prevention of key VBDs and emerging infectious diseases to avoid outbreaks.

In the context of global warming and urbanization, preventing mosquito-borne disease outbreaks and controlling their northward spread should be prioritized (*7*). SFTS, as an emerging infectious disease, is spreading rapidly, necessitating enhanced research and prevention efforts to identify factors driving its spread and prevent further expansion (*8*). Scrub typhus, which has become a major VBD in recent years in China, is primarily prevalent in southern regions and manifests a trend of further geographical expansion (*9*). Simultaneously, flea monitoring should be strengthened to prevent potential plague outbreaks in endemic areas. In high-risk regions, vaccination efforts should be intensified to prevent HFRS outbreaks, with particular attention to outbreaks triggered by extreme events such as floods (*10*). Additionally, prevention and control measures for dengue and scrub typhus should be strengthened before summer and autumn, while HFRS prevention should be enhanced before winter and spring. Currently, the epidemiological trends of VBDs in China pose a significant health threat to the population, especially among elderly farmers who are particularly vulnerable due to their poor health status and low economic resources. Tailored interventions should be developed, including community health education, free vaccination programs, and early warning systems to reduce social inequities.

In summary, a substantial gap remains between China's current VBD control efforts and the goals proposed by the World Health Organization. Therefore, intensified efforts are needed to prevent the continued increase in VBD cases in and beyond 2025, especially for the control and prevention of dengue, scrub typhus, and SFTS. Additionally, we need to strengthen monitoring and prevention of outbreaks of emerging infectious diseases and those not legally required to be reported. We should also promote patriotic health campaigns, implement integrated vector management, and ensure sustainable vector control to effectively mitigate VBD risks (*11*). This study has several limitations. First, some VBDs, such as Yellow Fever, Lyme disease, and bartonellosis, were not included in the disease notification system and therefore were not analyzed. Second, there may be cases where individuals did not seek medical treatment and thus were not reported, potentially resulting in a higher actual disease burden than reflected in this study. Finally, the 20-year epidemic trend of VBDs may have been influenced by monitoring capabilities, the COVID-19 pandemic, and various natural social policy events.

Conflicts of interest: No conflicts of interest.

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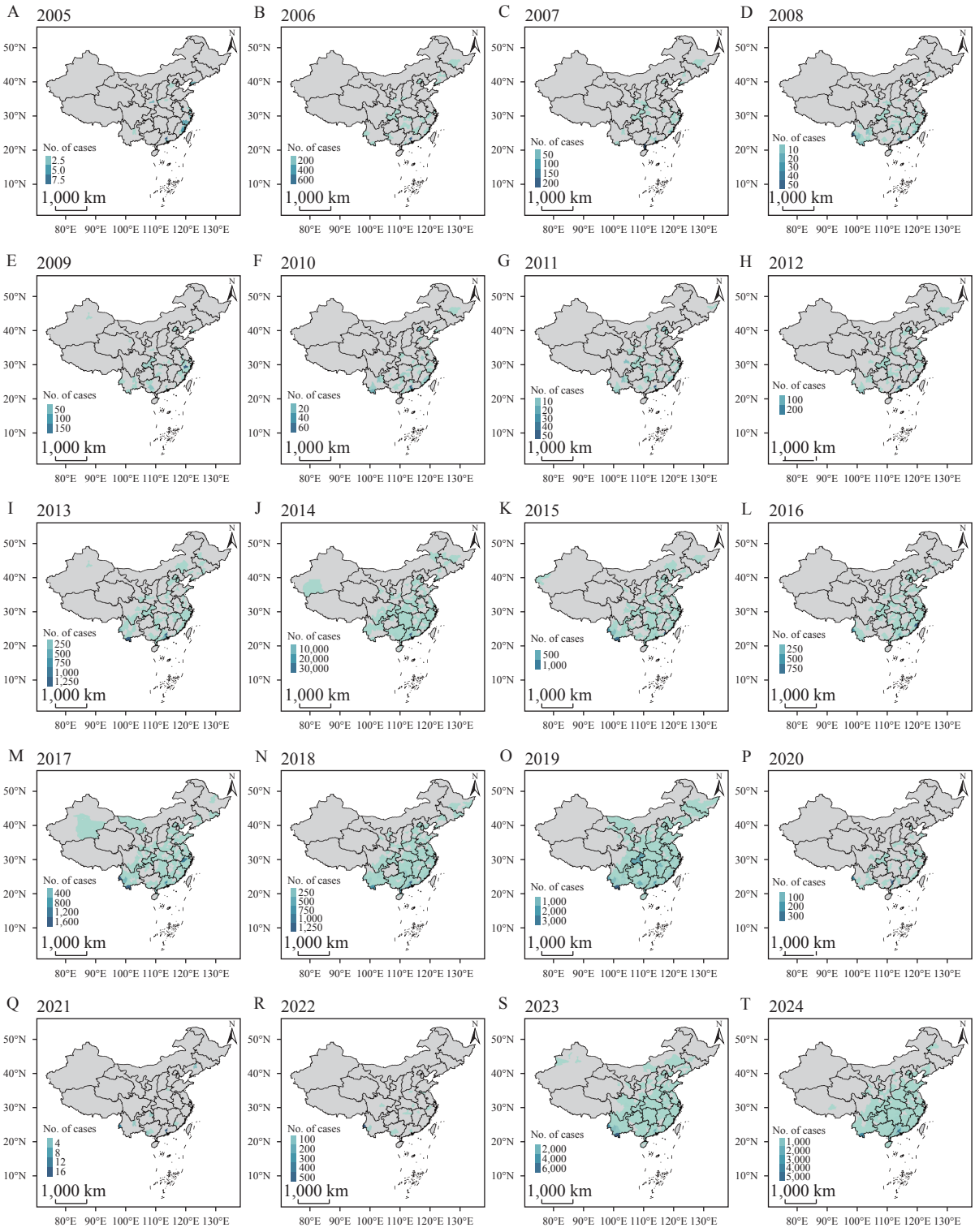
SUPPLEMENTARY MATERIAL



SUPPLEMENTARY FIGURE S1. The spatial diffusion pattern of dengue in China from 2005 to 2024. (A)–(T) 2005–2024.
Abbreviation: No.=number.
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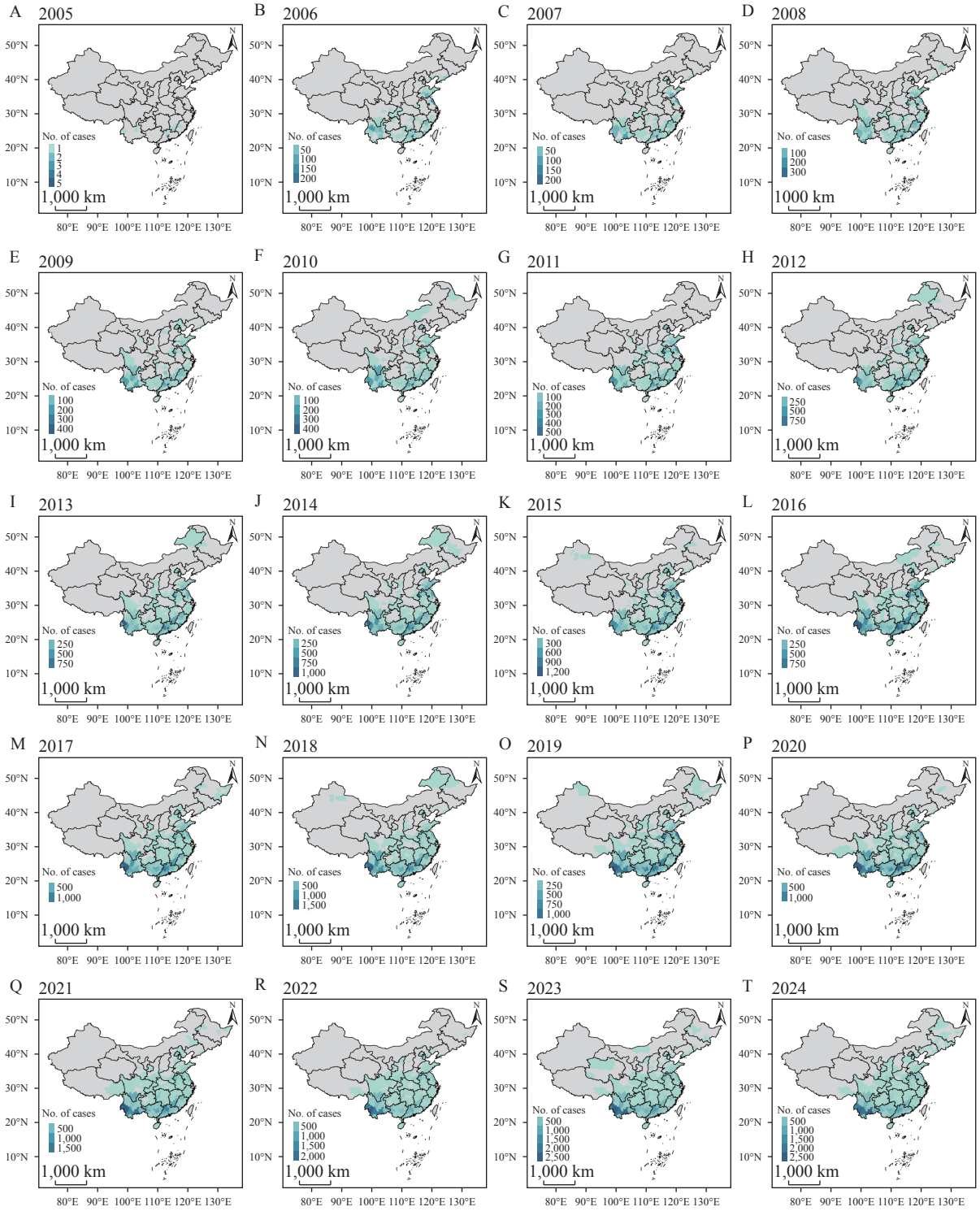

SUPPLEMENTARY FIGURE S2. The spatial diffusion pattern of scrub typhus in China from 2005 to 2024. (A)−(T) 2005−2024.
Abbreviation: No.=number.
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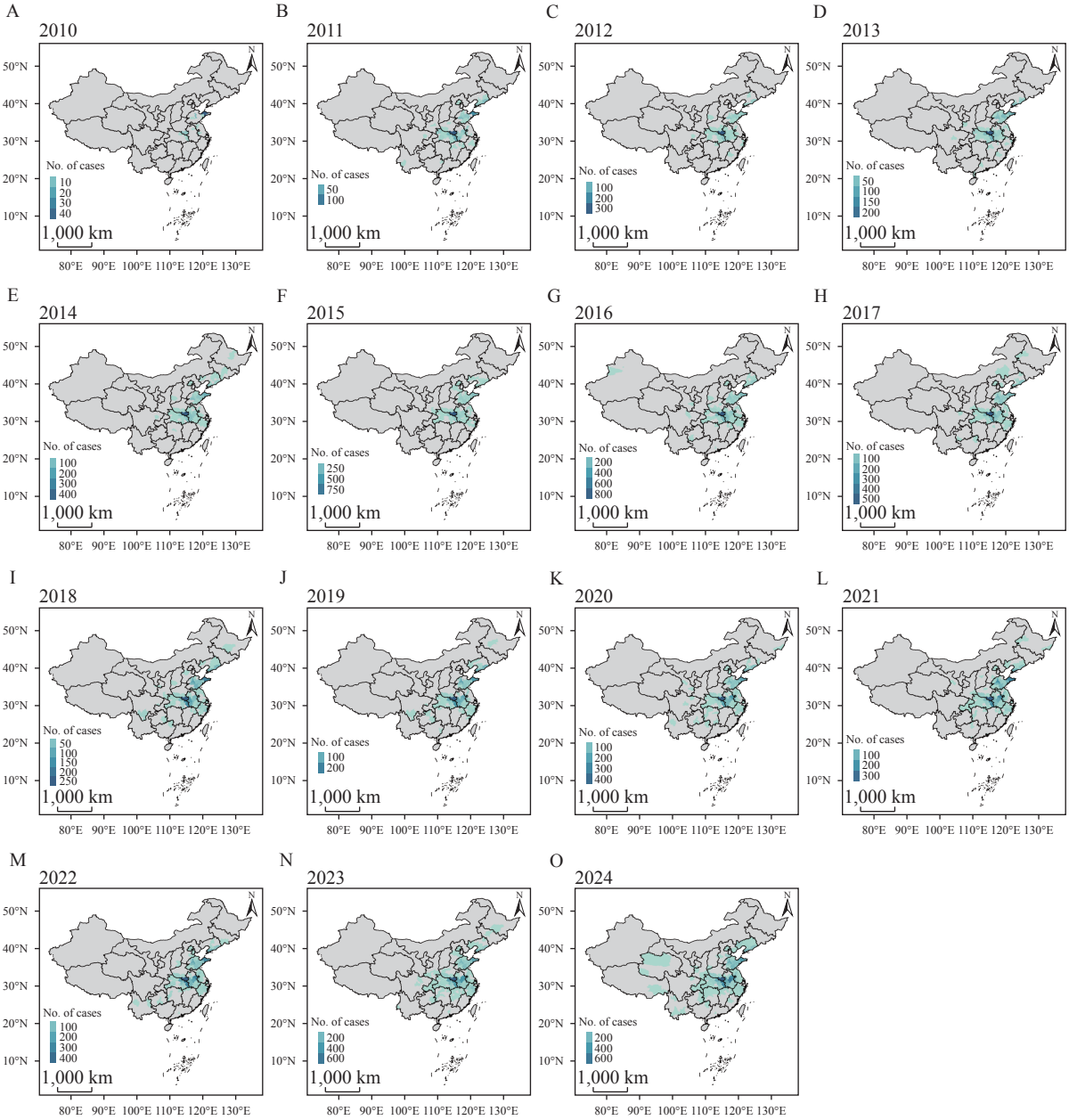

SUPPLEMENTARY FIGURE S3. The spatial diffusion pattern of SFTS in China from 2010 to 2024. (A)−(T) 2010–2024.
Abbreviation: No.=number; SFTS=severe fever with thrombocytopenia syndrome.
Map approval number: GS 京 (2025)0996 号.