Vital Surveillances

Morbidity Analysis of the Notifiable Infectious Diseases in China, 2018

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Summary

What is already known about this topic?

Annual morbidity analysis reports that summarized trends and changing epidemiology for notifiable diseases were published in 2013 and 2015 (*1*,*2*).

What is added by this report?

In 2018, the morbidity of national notifiable diseases was 559.41 per 100,000 population, an increase of 12.88% compared with the average rate between 2015–2017. The five notifiable diseases with the highest reported morbidity were hand, foot, and mouth disease (HFMD), infectious diarrhea, hepatitis B, tuberculosis, and influenza. The five regions with the highest reported morbidity of infectious diseases were Zhejiang Province, Guangxi Autonomous Region, Guangdong Province, Beijing Municipality, and Xinjiang Autonomous Region.

What are the implications for public health practice?

Evidence on notifiable disease morbidity trends and changing epidemiology should help disease control and prevention agencies and medical institutions direct their response and prevention efforts. In addition, this report demonstrates the continued need for surveillance systems and high-quality data to identify focal points for disease control.

Abstract

Introduction Notifiable infectious disease surveillance is important for understanding the trends in morbidity for certain diseases, especially detection of acute infectious disease outbreaks and changing epidemiology. A web-based reporting system was deployed in January 2004, which has improved data collection and speed tremendously. This report provides an updated analysis for reports published in 2013 and 2015.

Methods Data from the National Notifiable Disease Reporting System (NNDRS) was used. The NNRDS shows data from 39 notifiable diseases split into three categories (A, B, and C) based on severity and importance. A descriptive analysis was conducted to analyze the morbidity of notifiable diseases in China.

Results In 2018, the morbidity of national notifiable diseases was 559.41 per 100,000 population, an increase of 12.88% compared with the average of 2015–2017. The proportion of laboratory confirmed cases was 36.22%, which decreased 4.03% compared with the average of that in the recent three years. Diseases transmitted by direct contact/fecal–oral transmission accounted for the largest proportion, 49.37% of the total reported cases, followed by the respiratory transmitted diseases, blood-borne/sexually transmitted diseases, and the zoonotic and vector-borne diseases with a proportion of 25.18%, 24.60%, and 0.85%, respectively. Pathogenic descriptive analysis showed that the viral-infected cases accounted for 73.78% of the totals, followed by the bacterial-infected and parasitic diseases.

Conclusion The national morbidity of notifiable infectious diseases showed increases in 2018, mostly due to higher morbidity of category C diseases, such as HFMD, infectious diarrhea, and influenza, and these diseases need to be further prioritized in disease control and prevention efforts. Laboratory confirmed cases remain low and need to be improved to improve data quality.

Introduction

The National Notifiable Disease Reporting System (NNDRS) in China was established in the 1950s, and since 2004, compulsory guidelines mandate that medical and health institutions at all levels must report infectious diseases to the NNDRS in real time (*3*). The NNDRS is the most important infectious disease

surveillance system in China and has played an important role in infectious disease prevention and control. Timely analysis of outbreak surveillance data and understanding the relevant trends and characteristics are the foundation for the prevention and control of infectious diseases (*4*). Therefore, a descriptive analysis of notifiable diseases in 2018 based on data from NNDRS is invaluable to Chinese public health efforts.

Methods

Data on clinical and laboratory diagnoses between January 1 and December 31 in 2018 were collected from NNDRS. Data from certain regions of China (Taiwan, Hong Kong, and Macau) and cases of foreign travelers are not included in the analysis. A total of 39 notifiable diseases (shown in Supplementary Table S1, available in http://weekly.chinacdc.cn/) are required to be reported under the regulations and management of the Law of the People's Republic of China on the Prevention and Treatment of Infectious Diseases (*5*), These diseases are divided into three categories: Class A, B, and C. Descriptive analysis was conducted by Microsoft Excel 2010, and ArcGIS 10.2 was used for geo-analysis.

Results

Overall, 7,770,749 notifiable diseases cases were reported through the NNDRS, and the morbidity of notifiable diseases was 559.41 cases per 100,000 population, with an increase of 12.88% compared with the average of the recent three years. There were no cases of plague, severe acute respiratory syndrome associated coronavirus disease (SARS), poliomyelitis, avian influenza (H5N1), diphtheria, and filariasis reported in China in 2018. The morbidity of Class A and B notifiable diseases was 220.51 cases per 100,000 population, which was relatively stable in the recent years with only 0.03% higher than that of the recent three years. However, the morbidity of Class C was 338.90 cases per 100,000 population, with a remarkable increase of 23.18% compared with the recent three-year average. The top five notifiable diseases with the highest reported morbidity were HFMD, infectious diarrhea, hepatitis B, tuberculosis, and influenza, accounting for 80.10% of the total morbidity and HFMD alone accounting for 30.28%. Compared to the average of 2015-2017, the diseases with the highest increase in reported morbidity were pertussis, influenza, and Japanese encephalitis, while the diseases with the highest decline in morbidity were human infection with H7N9, schistosomiasis, and measles (Table 1).

TABLE 1. The morbidity of notifiable diseases and the proportion of laboratory confirmation proportion in China, 2018 and 2015-2017.

Disease	2018			The Average of 2015-2017			Compared with the Average of 2015-2017	
	Cases	Morbidity (1/100,000)	Laboratory Confirmed Proportion (%)	Cases	Morbidity (1/100,000)	Laboratory Confirmed Proportion (%)	Percent Change in Morbidity (%)	Percent Change in Laboratory Confirmation (%)
Classifications								
Class A, B, and C	7,770,749	559.4101	36.22	6,794,496	495.5761	37.74	12.88	−4.03
Class A and B	3,063,049	220.5065	71.28	3,022,320	220.4416	68.34	0.03	4.30
Class C	4,707,700	338.9036	13.41	3,772,176	275.1345	13.23	23.18	1.36
Transmission routes								
Direct Contact/Fecal-oral Transmitted Diseases	3,836,152	276.1616	12.55	3,398,466	247.8769	13.16	11.41	−4.64
Respiratory Transmitted Diseases	1,956,719	140.8627	25.58	1,472,774	107.4210	18.34	31.13	39.48
Zoonotic/Vector-Borne Diseases	65,865	4.7415	81.07	86,082	6.2786	71.41	−24.48	13.53
Blood-Borne/Sexually Transmitted Diseases	1,911,909	137.6368	93.04	1,790,671	130.6077	92.65	5.38	0.42
Pathogen								
Viruses	4,787,198	344.6264	32.15	4,021,239	293.3007	35.16	17.50	−8.56
Bacteria	1,693,219	121.8928	57.26	1,671,194	121.8933	52.95	0	8.14
Parasitic	8,062	0.5789	54.17	13,057	0.9523	25.70	−39.21	110.78

TABLE 1 (continued)

Disease	2018			The Average of 2015-2017			Compared with the Average of 2015-2017	
	Cases	Morbidity (1/100,000)	Laboratory Confirmed Proportion (%)	Cases	Morbidity (1/100,000)	Laboratory Confirmed Proportion (%)	Percent Change in Morbidity (%)	Percent Change in Laboratory Confirmation (%)
Single notifiable infectious disease								
Plague	0	0	–	1	0	100.00	−100.00	–
Cholera	28	0.0020	100.00	18	0.0013	100.00	53.85	0
SARS-CoV	0	0	–	0	0	–	–	–
Acquired Immune Deficiency Syndrome (AIDS)	64,170	4.6195	99.86	53,961	3.9358	99.64	17.37	0.22
Viral Hepatitis	1,280,015	92.1473	88.14	1,241,316	90.5390	87.55	1.78	0.67
Hepatitis A	16,196	1.1659	79.81	20,942	1.5275	83.52	−23.67	−4.44
Hepatitis B	999,985	71.9881	96.13	959,478	69.9823	94.48	2.87	1.75
Hepatitis C	219,375	15.7926	57.06	209,584	15.2866	62.56	3.31	−8.79
Hepatitis D	356	0.0256	81.18	262	0.0191	77.48	34.03	4.78
Hepatitis E	28,603	2.0591	86.55	28,035	2.0448	89.20	0.70	−2.97
Hepatitis, Unspecified	15,500	1.1158	24.28	23,014	1.6786	28.04	−33.53	−13.41
Poliomyelitis	0	0	–	0	0	–	–	–
Human Infection with H5N1 Virus	0	0	–	2	0.0001	100.00	−100.00	–
Measles	3,940	0.2836	97.08	24,374	1.7778	95.28	−84.05	1.89
Epidemic Hemorrhagic Fever	11,966	0.8614	77.90	10,143	0.7398	80.24	16.44	−2.92
Rabies	422	0.0304	11.61	654	0.0477	7.04	−36.27	64.91
Japanese Encephalitis	1,800	0.1296	92.83	1,003	0.0731	89.73	77.29	3.45
Dengue	5,136	0.3697	76.67	3,934	0.2869	93.42	28.86	−17.93
Anthrax	336	0.0242	16.37	327	0.0238	15.92	1.68	2.83
Dysentery	91,152	6.5620	12.52	123,856	9.0338	15.34	−27.36	−18.38
Tuberculosis	823,342	59.2717	34.01	845,148	61.6433	28.89	−3.85	17.72
Typhoid & Paratyphoid Fever	10,843	0.7806	40.63	11,109	0.8103	45.28	−3.67	−10.27
Meningococcal Meningitis	104	0.0075	68.27	108	0.0079	53.54	−5.06	27.51
Pertussis	22,057	1.5879	35.18	7,544	0.5502	30.02	188.60	17.19
Diphtheria	0	0	–	0	0	–	–	–
Neonatal Tetanus*	83	0.0052	1.20	192	0.0140	1.04	−62.86	15.38
Scarlet Fever	78,864	5.6774	4.22	67,300	4.9087	4.47	15.66	−5.59
Brucellosis	37,947	2.7318	91.32	47,561	3.4690	92.11	−21.25	−0.86
Gonorrhea	133,156	9.5858	100.00	118,041	8.6097	100.00	11.34	0
Syphilis	494,867	35.6251	100.00	449,344	32.7742	100.00	8.70	0
Leptospirosis	157	0.0113	47.77	303	0.0221	62.64	−48.87	−23.74
Schistosomiasis	144	0.0104	10.42	12,751	0.9300	3.69	−98.88	182.38
Malaria	2,518	0.1813	99.56	2,981	0.2174	99.24	−16.61	0.32
Human Infection with H7N9 Virus	2	0.0001	100.00	350	0.0255	100.00	−99.61	0
Influenza	765,186	55.0851	25.90	319,708	23.3188	36.43	136.23	−28.90
Mumps	259,071	18.6503	1.50	203,525	14.8447	1.18	25.64	27.12
Rubella	3,930	0.2829	88.52	4,758	0.3470	79.36	−18.47	11.54

TABLE 1 (continued)

Disease	2018			The Average of 2015-2017			Compared with the Average of 2015-2017	
	Cases	Morbidity (1/100,000)	Laboratory Confirmed Proportion (%)	Cases	Morbidity (1/100,000)	Laboratory Confirmed Proportion (%)	Percent Change in Morbidity (%)	Percent Change in Laboratory Confirmation (%)
Acute Hemorrhagic Conjunctivitis	38,250	2.7536	0.73	34,494	2.5159	0.61	9.45	19.67
Leprosy	225	0.0162	80.89	310	0.0226	77.72	−28.32	4.08
Typhus	971	0.0699	16.68	1,183	0.0863	34.73	−19.00	−51.97
Visceral Leishmaniasis	160	0.0115	65.00	331	0.0242	43.06	−52.48	50.95
Echinococcosis	4,327	0.3115	26.21	4,560	0.3326	27.13	−6.34	−3.39
Filariasis	0	0	−	0	0	−	−	−
Infectious Diarrhea†	1,282,270	92.3096	23.53	1,080,288	78.7939	24.05	17.15	−2.16
Hand, Foot, and Mouth Disease	2,353,310	169.4129	5.19	2,123,020	154.8486	5.38	9.41	−3.53

* The unit of the morbidity of neonatal tetanus is 1/1,000.
† Infectious diarrhea excludes cholera, dysentery, typhoid fever, and paratyphoid fever.
− Denotes the number cannot be counted.

In 2018, 73.78% of all national notifiable disease cases were attributable to viral diseases. The morbidity of viral infectious diseases was 344.63 cases per 100,000 population with an increase of 17.50% compared with the average of 2015–2017. Bacterial pathogens were responsible for 26.10% of all national notifiable disease cases. The morbidity of bacterial diseases was 121.89 cases per 100,000 population, which was nearly same as that of the recent three years. Parasitosis represented 0.12% of the total cases, and the corresponding morbidity was 0.58 cases per 100,000 population, which was a decrease of 39.21% compared with average of 2015–2017. The reported morbidity of schistosomiasis and visceral leishmaniasis has significantly decreased.

The morbidity analysis by the main route of transmission and the reservoir of the organism showed that diseases transmitted by direct contact/fecal–oral transmission are the largest proportion 49.37% of the total cases, and the related morbidity was 276.16 cases per 100,000 population, which was an increase of 11.41% compared with the average of 2015–2017. The major contributors were HFMD and infectious diarrhea.

Respiratory transmitted diseases contributed 25.18% of total cases, and the morbidity of respiratory transmitted diseases was 140.86 cases per 100,000 population, which was an increase of 31.13% compared with 3-year average. The largest contributors in this category were tuberculosis and influenza.

Blood-borne/sexually transmitted diseases accounted for 24.60% of the totals, and the morbidity was 137.64 cases per 100,000 population, which was an increase of 5.38% compared with the 3-year average. Hepatitis B and syphilis were the major contributors.

The smallest contributor for total cases was zoonotic and vector-borne diseases, which accounted for 0.85%, and the morbidity was 4.74 cases per 100,000 population, which was a decrease of 24.48% compared with the 3-year average. These diseases include brucellosis and epidemic hemorrhagic fever (Table 1, Figure 1).

Zhejiang Province, Guangxi Autonomous Region, Guangdong Province, Beijing Municipality, and Xinjiang Autonomous Region are the five regions with the highest reported morbidity of infectious diseases, and the morbidities were 986.47, 981.61, 932.64, 840.72, and 813.49 cases per 100,000 population, respectively. For the top four regions, the leading diseases were mainly HFMD, infectious diarrhea, influenza, all of which belong to Class C. However, hepatitis B, syphilis, and infectious diarrhea were the three leading diseases in Xinjiang Autonomous Region of western China. Combining the regional distribution of infectious diseases with different transmission routes, Guangxi Autonomous Region and Zhejiang Province had higher morbidity of direct contact/fecal-oral transmitted diseases than other regions in China including HFMD and infectious diarrhea diseases. Beijing Municipality, Xinjiang Autonomous Region, and Tibet Autonomous Region reported more morbidity of respiratory infectious diseases like tuberculosis and influenza than other provinces. The morbidity of zoonotic infectious diseases was higher in

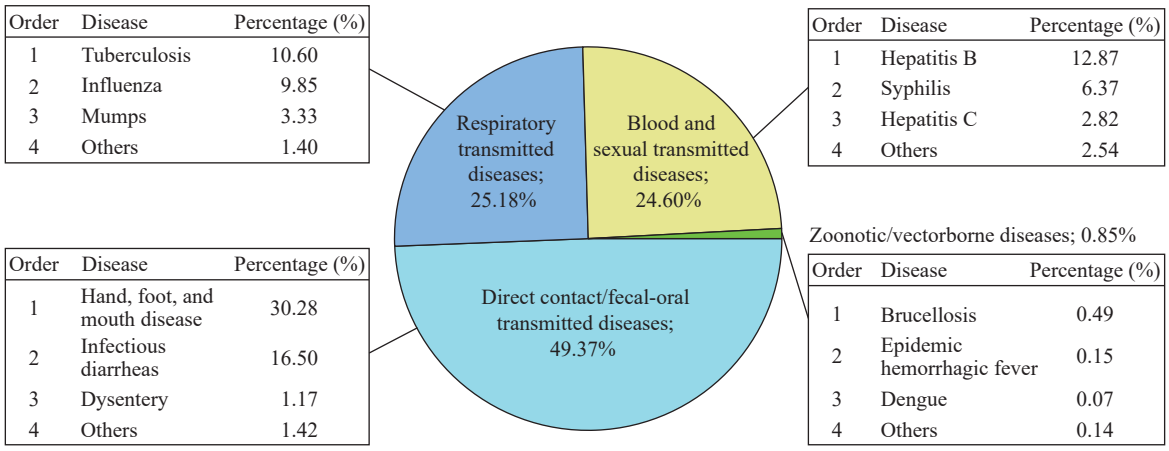

FIGURE 1. The morbidity analysis by the main route of transmission and the reservoir of the organism in China, 2018.

northern regions, including Inner Mongolia Autonomous Region, Ningxia Autonomous Region, and Xinjiang Autonomous Region, than other regions. These diseases include brucellosis and epidemic hemorrhagic fever. Xinjiang Autonomous Region, Hainan Province, and Qinghai Province reported more morbidity of blood and sexually transmitted diseases, including hepatitis B and syphilis (Figure 2).

In 2018, 36.22% of national notifiable disease cases were laboratory diagnosed, 4.03% lower than the average rate between 2015–2017. The proportion of bacterial pathogens with laboratory confirmation was 57.26%, an increase of 8.14% compared to the 3-year average. However, the proportion of viral disease cases with laboratory confirmation was 32.15%, a decrease of 8.56% compared with the average of 2015–2017. The proportion of parasitic cases with laboratory confirmation was 54.17%, an increase of 110.78% compared with the average of 2015–2017. All cases of cholera, H7N9, gonorrhea, and syphilis were laboratory confirmed, but the proportions of scarlet fever, neonatal tetanus, mumps, and acute hemorrhagic conjunctivitis with laboratory confirmation were less than 5% (Table 1).

Discussion

The national morbidity of notifiable infectious diseases showed an increase in 2018 compared with the average of 2015–2017, and all the morbidities of direct contact/fecal-oral transmitted diseases, respiratory transmitted diseases, and blood-borne/sexually transmitted diseases increased, which can be attributed primarily to the higher morbidity of category C diseases, such as HFMD, infectious diarrhea, and influenza. There was 2,353,310 HFMD cases reported in 2018, an increase over 230,000 cases compared with the average of 2015–2017, and this was the largest contributor of direct contact/fecal–oral transmission cases. The HFMD morbidity is higher in eastern and southern provinces of China, and children less than three years old should be the primary targets for interventions (*6*).

There were 1,282,270 infectious diarrhea cases reported in 2018, an increase of over 200,000 cases compared with the average of 2015–2017, becoming one of the great health threats to infants and children since the year of 2008. The seasonal influenza epidemic increased 136.23% in 2018 compared with the average of 2015–2017. Increasing recognition of influenza and increasing awareness of diagnosis and reporting by doctors, espeically in developed provinces such as Beijing, might explain this increase.

Tuberculosis morbidity was reported as 59.27 cases per 100,000 population and contributes the most to the burden of respiratory transmitted diseases. The World Health Organization (WHO) reported over 10 million new tuberculosis cases globally in 2018, and China was one of 20 countries with the highest tuberculosis burden (*7*).

Hepatitis B morbidity was reported as 71.99 cases per 100,000 population, an increase of 2.87% compared with the average of the recent three years, which accounted for the largest proportion of blood/sexually transmitted diseases. The most cost-effective way to control hepatitis B is to prevent a susceptible person from acquiring Hepatitis B virus infection by the interruption of the transmission route and by immunization of susceptible hosts (*8*).

Zoonotic and vector-borne disease morbidity decreased slightly. Brucellosis morbidity was reported

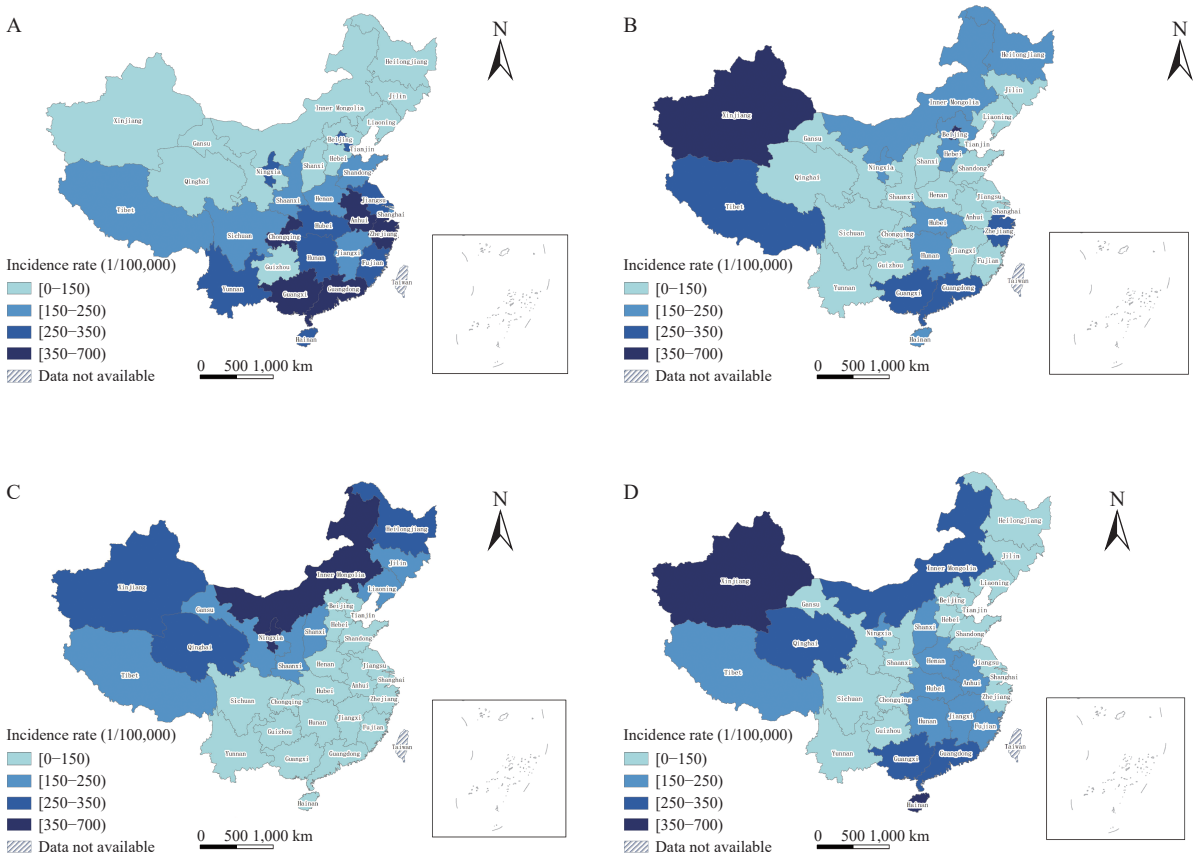

FIGURE 2. Geographical distribution of the morbidity of notifiable diseases in China, 2018. (A) Direct contact/fecal-oral transmitted diseases; (B) Respiratory transmitted diseases; (C) Zoonotic and vector-borne diseases; (D) Blood and sexual transmitted diseases.

as 2.73 cases per 100,000 population and was the leading zoonotic and vector-borne disease. Brucellosis morbidity is high in northern provinces such as Inner Mongolia Autonomous Region, Heilongjiang Province and Xinjiang Autonomous Region, and sporadic outbreaks occured in southern regions caused by infected imported animals from northern regions.

Rabies morbidity was 0.03 cases per 100,000 population and has progressively decreased since 2008. Rabies outbreaks have been effectively controlled. China has the ability to achieve the WHO global goal of eliminating rabies transmission from dog to human by 2030 (*9*).

Dengue fever morbidity increased by 28.86% in 2018, compared with the average of 2015–2017. In recent years, dengue outbreaks occurred frequently in coastal areas, such as Zhejiang Province and Guangdong Province, and most dengue cases in China were imported (*10*).

Overall, the laboratory diagnosis rate of notifiable disease decreased 4.03% compared with the average of 2015–2017. The laboratory diagnosis rate of class C infectious diseases is still lower than that of class A and B infectious diseases. Parasitic infectious diseases had a significantly higher laboratory diagnostic rate in 2018 compared with the average of 2015–2017. However, there is still a big gap in terms of laboratory evidence of pathogen diagnosis between China and western countries (*11*). Even though China has uniform diagnostic standards and reporting requirements for infectious diseases, unbalanced develpoment of laboratory diagnostic facilities and economic status within the country may limit the laboratory confirmation rates, which is reflected in the laboratory diagnosis rate of notifiable disease cases varies across the country. Thus, further strengthening the construction of infectious disease laboratory systems in China and the laboratory testing capabilities are major priorities.

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SUPPLEMENT

TABLE S1. Different classifications for the 39 notifiable diseases.

Classification Index	Items
Classes	Class A: plague, cholera Class B: SARS, AIDS, viral Hepatitis, Poliomyelitis, Human infection with H5N1 virus, Measles, Epidemic hemorrhagic fever, Rabies, Epidemic encephalitis B, Dengue fever, Anthrax, Dysentery, Tuberculosis, Typhoid fever, Pertussis, Diphtheria, Neonatal tetanus, Scarlet fever, Brucellosis, Gonorrhea, Syphilis, Leptospirosis, Schistosomiasis, Malaria, Human infection with H7N9 virus.7N9 virus, Meningococcal meningitis. Class C: Influenza, Mumps, Rubella, Acute hemorrhagic conjunctivitis, Lepriasis, Epidemic typhus, Kala-azar, Echinococcosis, Filariasis, Infectious diarrhea, HFMD
Transmission routes	Direct contact/fecal-oral transmitted diseases (cholera, Hepatitis A, Hepatitis E, Other hepatitis, poliomyelitis, Bacillary and Amebic dysentery, Typhoid and paratyphoid, Acute hemorrhagic con- junctivitis, Infectious diarrhea, HFMD); Respiratory transmitted diseases (SARS, Measles, Mumps, Tuberculosis, Influenza, Rubella, Lepriasis, Pertussis, Diphtheria, Scarlet fever, Meningococcal meningitis); Zoonotic/vector borne diseases (Plague, Human infection with H5N1 virus, Epidemic hemorrhagic fever, Rabies, Epidemic encephalitis B, Dengue fever, Anthrax, Brucellosis, Leptospirosis, Schistosomiasis, Malaria, Human infection with H7N9 virus, Epidemic and endemic typhus, Kala-azar, Echinococcosis, Filariasis, Anthrax); Blood and sexual transmitted type (AIDS, Hepatitis B, Hepatitis C, Gonorrhea, Syphilis); other infectious diseases (neonatal tetanus)
Pathogens	Bacterial diseases (Plague, Cholera, Anthrax, Bacterial dysentery, Tuberculosis, Typhoid fever and paratyphoid fever, Meningococcal meningitis, Pertussis, Diphtheria, Neonatal tetanus, Scarlet fever, Brucellosis, Gonorrhea, Syphilis, Lepriasis, Epidemic and endemic typhus, Leptospirosis); Virosis (SARS, AIDS, Viral hepatitis, Poliomyelitis, Human infection with H5N1 virus, Measles, Mumps, Epidemic hemorrhagic fever, Rabies, Epidemic encephalitis B, Dengue fever, Human infections with H7N9 virus, influenza, Rubella, Acute hemorrhagic conjunctivitis, HFMD); Parasitic diseases (Amebic dysentery, Schistosomiasis, Malaria, Filariasis, Echinococcosis, Kala-azar)