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 NNDRS 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.
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 Cases | Morbidity (1/100,000) | Laboratory Confirmed Proportion (%) | The Average of 2015-2017 Cases | Morbidity (1/100,000) | Laboratory Confirmed Proportion (%) | Compared with the Average of 2015-2017 | 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    | 3,836,152  | 276.1616              | 12.55                              | 3,398,466                     | 247.8769              | 13.16                              | 11.41                              | -4.64                                |                                       |
| Transmitted Diseases         | 1,956,719  | 140.8627              | 25.58                              | 1,472,774                     | 107.4210              | 18.34                              | 31.13                              | 39.48                                |                                       |
| Respiratory Transmitted      | 65,865     | 4.7415                | 81.07                              | 68,082                        | 6.2786                | 71.41                              | -24.48                             | 13.53                                |                                       |
| Diseases                     | 1,911,909  | 137.6368              | 93.04                              | 1,790,671                     | 130.6077              | 92.65                              | 5.38                               | 0.42                                 |                                       |
| Zoonotic/Vector-Borne        |            |                       |                                    |                               |                       |                                    |                                    |                                      |                                       |
| Diseases                     | 655,819    | 46.3850               | 75.01                              | 655,819                       | 46.3850               | 75.01                              | 0.00                               | 0.00                                 |                                       |
| Blood-Borne/Sexually         |            |                       |                                    |                               |                       |                                    |                                    |                                      |                                       |
| Transmitted Diseases         | 8,062      | 0.5789                | 54.17                              | 13,057                        | 0.9523                | 25.70                              | -39.21                             | 110.78                               |                                       |

**Pathogen**

| Classes          | 2018 Cases | Morbidity (1/100,000) | Laboratory Confirmed Proportion (%) | The Average of 2015-2017 | Morbidity (1/100,000) | Laboratory Confirmed Proportion (%) | Compared with the Average of 2015-2017 | Percent Change in Morbidity (%) | Percent Change in Laboratory Confirmation (%) |
|------------------|------------|-----------------------|------------------------------------|----------------------------|-----------------------|------------------------------------|------------------------------------|--------------------------------------|---------------------------------------|
| 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                               |                                       |
| Disease                         | 2018 Cases | 2018 Morbidity (1/100,000) | Laboratory Confirmed Proportion (%) | The Average of 2015-2017 Cases | 2017 Morbidity (1/100,000) | Laboratory Confirmed Proportion (%) | Compared with the Average of 2015-2017 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                             | 0.67                         |
| 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                        |
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 an increase 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
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, especially 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
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 occurred 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 development 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.

Conflict of interest statement: The authors who have taken part in this study declared that they do not have any other potential conflicts of interest.

Financial support statement: This study was funded by grants from the National Science and Technology...
Major Project of China (No. 2018ZX10713001-001) and National Natural Science Foundation of China (No. 91846302).

Authors’ contributions: Shuaibing Dong and Xiang Ren contributed equally to this work. Zhongjie Li, Liping Wang, and Lijie Zhang designed and supervised this study; Shuaibing Dong and Xiang Ren wrote the manuscript; Cuihong Zhang, Mengjie Geng, Yuliang Zhu, and Lusha Shi prepared and cleaned the data; Shuaibing Dong, Xiang Ren, and Cuihong Zhang carried out the analysis; All authors interpreted the data and critically revised the manuscript for important intellectual content.

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Submitted: October 29, 2019; Accepted: December 16, 2019

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TABLE S1. Different classifications for the 39 notifiable diseases.

| Classification Index | 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, Meningococcal meningitis. |
|                      | Class C: Influenza, Mumps, Rubella, Acute hemorrhagic conjunctivitis, Leptospirosis, Epidemic typhus, Kala-azar, Echinoococcosis, 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 conjunctivitis, Infectious diarrhea, HFMD); Respiratory transmitted diseases (SARS, Measles, Mumps, Tuberculosis, Influenza, Rubella, Leptospirosis, 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, Echinoococcosis, 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, Leptospirosis, 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) |