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The 18th National Publicity Week of Occupational Disease Prevention and Control — April 25 to May 1, 2020

The 18th Publicity Week of the Law on Prevention and Control of Occupational Disease will be held from April 25 to May 1 of this year and has been held since 2003.

China has the largest working population in the world with about 776 million workers with most of them spending at least half their lives working (1). Globalization and industry revolution bring the coexistence of traditional and modern occupational hazards and present both current and future challenges in occupational health.

To fully implement national deployments of occupational disease prevention and control and protect workers’ health, the National Health Commission of China has launched a series of activities during the Publicity Week themed with “Occupational Health Protection, Time to Act.”

Focused on the Occupational Health Protection Campaign and the Action Plan for Prevention and Control of Pneumoconiosis, primary activities during this week include promoting knowledge and awareness of occupational health in businesses, providing occupational health management training, conducting questionnaire surveys about awareness of core knowledge on occupational health, and showcasing excellent publicizing portfolios of occupational health.

The publicity week is a comprehensive strategy to prevent and control occupational diseases and to promote work on occupational health, aiming to disseminate knowledge of occupational health, improve workers’ awareness, and integrate the resources of the government, employers, workers, and other stakeholders to prioritize occupational health protection.

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Investigation on Work-Related Musculoskeletal Disorders — China, 2018–2019

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Summary

What is already known about this topic?
Work-related musculoskeletal disorders (WMSDs) have a high prevalence and seriously harmful, which has attracted extensive attention in various countries in the world. Currently, the occurrence and rules of WMSDs in key industries are not known in China.

What is added by this report?
The prevalence of WMSDs is relatively high among professional populations in key industries in China, with the most commonly affected body parts concentrated in neck, shoulders, and low back and increasing with age and working years.

What are the implications for public health practice?
This study determined the prevalence and distribution characteristics of WMSDs in key industries in China and provided scientific evidence to recommend for inclusion of WMSDs in the new revision of the list of occupational diseases in China.

Recent research indicates that an estimated 20% of lower back and neck pain in adults is attributable to occupation exposure worldwide (1). These work-related musculoskeletal disorders (WMSDs) result from many adverse ergonomic factors in the workplace, such as heavy physical load operation, repetitive work, awkward working posture, occupational stress, bad working organization, and other problems. Workers exposed to these adverse ergonomics factors for a long time are easy to cause part muscle fatigue. Such long-term chronic accumulation may eventually lead to WMSDs.
In recent decades, WMSDs have become increasingly prominent and affect all parts of an individual’s life. In 2002, the International Labour Organization (ILO) explicitly added musculoskeletal diseases to the list of international occupational diseases (Recommendation 194). Musculoskeletal diseases are further detailed in the latest occupational disease list that was approved and went into effect by the ILO in 2010 (2). Since the 1990s, China has been paying attention to WMSDs and has carried out related research on its epidemiological characteristics, risk factors, and occurrence mechanism. So far, much of the existing research has focused on local areas or enterprises, and these results can only reflect the occurrence of WMSDs in a certain working populations and lack the occurrence and rules of WMSDs in key industries nationwide. Therefore, this study conducted a large-scale epidemiological survey on key industries in different regions to investigate the prevalence and distribution characteristics of WMSDs in key industries in China and to explore the epidemiological characteristics. An epidemiological cross-sectional survey was conducted to investigate the occurrence of WMSDs among the above-mentioned subjects using the electronic questionnaire system of “Chinese Version of Musculoskeletal Disorders Questionnaire,” which has been the standard for such surveys so far (3).

The case definition most commonly employed by the National Institute of Occupational Safety and Health (NIOSH) required satisfaction of all of the following criteria (4):

Discomfort within the past year.
Discomfort began after employment in the current job.
No prior accident or sudden injury (affecting focal area of discomfort).
Episodes of discomfort occur monthly or, if not every month, at least exceeding a weeklong period of discomfort.

After the survey data were exported from the background, SPSS 20.0 statistical software (version 20.0, SPSS Inc, Chicago, IL, USA) was used to statistically process the data. Patients with congenital spinal deformity and musculoskeletal diseases caused by non-work related factors such as trauma, infectious diseases, malignant tumors, etc. were excluded. So far, 41,310 valid questionnaires have been received covering seven regions of China’s northern region, eastern region, central region, southern region, southwestern region, northwestern region, and northeastern region, and involved 14 industries or working groups including automobile manufacturing, footwear manufacturing, bio-pharmaceutical manufacturing, electronic equipment manufacturing, shipbuilding and related equipment manufacturing, petrochemical industry, construction industry, coal mining and washing and dressing industry, animal husbandry, medical staff, 4S automobile store*, vegetable greenhouses, flight attendants, toy manufacturing, etc. The prevalence rate of WMSDs (a WMSD in any body part is listed as a case) among the total working population was 42.9%, and the prevalence of WMSDs in each body part fluctuates between 7.5% and 27.0% with the highest three body parts being the neck (27.0%), shoulders (22.4%), and lower back (17.6%) (Table 1). The prevalence of WMSDs in different regions of China was significantly different ($p<0.05$), and the prevalence of WMSDs in each region ranked from highest to lowest was the central region (51.4%), northwestern region (51.2%), northeastern region (49.8%), northern region (48.6%), southwestern region (42.9%), southern region (42.3%), and eastern region (37.9%) (Figure 1). There were statistical differences in the prevalence of WMSDs among occupational groups in different industries ($p<0.05$), and the three industries with the highest prevalence of WMSDs were biopharmaceutical manufacturing (66.4%), vegetable greenhouse (60.5%), and medical staff (55.6%).

The difference of prevalence of WMSDs between age groups and working age groups was statistically significant ($p<0.05$) as the prevalence rate of WMSDs gradually increased and then decreased as age increased. The prevalence of WMSDs increased first, then decreased and then increased with the length of service (Figure 2). The prevalence of female WMSDs (48.5%) was significantly higher than that of male (38.4%) ($p<0.05$).

**DISCUSSION**

This study is the first large survey on the occurrence of WMSDs in key industries or working population in China. According to the survey, the prevalence of WMSDs in key industries or working groups in China was relatively high in the past year, and the prevalence of WMSDs was 42.9% (for any body part), with the most common parts are neck, shoulders, and waist. A

* 4S means sales, service, spare parts, and surveys.
| Industry                                      | Number (n) | Any body part | Neck | Shoulders | Upper back | Lower back | Elbows | Wrists/Hands | Hips/Thighs | Knees | Ankles/Feet |
|----------------------------------------------|------------|---------------|------|-----------|------------|------------|--------|--------------|-------------|-------|-------------|
| Shipbuilding and related equipment manufacturing | 3,515      | 1,439 40.9    | 788  22.4 | 673  19.1 | 494  14.1  | 664  18.9  | 326  9.3 | 455 12.9     | 419  11.9   | 489  13.9 | 414  11.8    |
| Electronic equipment manufacturing           | 8,284      | 3,236 39.1    | 2,116 25.5 | 1,808 21.8 | 1,184 14.3 | 1,151 13.9 | 527  6.4 | 907 10.9     | 721  8.7    | 588  7.1 | 816  9.9    |
| Construction industry                        | 1,245      | 258 20.7      | 106  8.5  | 104  8.4   | 79   6.3   | 111  8.9   | 49   3.9 | 63  5.1       | 60  4.8    | 48   3.9 | 52   4.2    |
| Coal mining and washing industry             | 722        | 328 45.4      | 197  27.3 | 179  24.8   | 134  18.6  | 150  20.8  | 68   9.4 | 83  11.5      | 109 15.1    | 137  19.0 | 104 14.4    |
| Flight attendants                            | 1,362      | 697 51.2      | 505  37.1 | 387 28.4    | 204 15.0  | 276 20.3   | 52  3.8  | 98  7.2       | 122 9.0     | 143 10.5 | 157 11.5    |
| 4S automobile store*                         | 544        | 177 32.5      | 88   16.2 | 78   14.3   | 70  12.9   | 92  16.9   | 27  5.0  | 50  9.2       | 47  8.6     | 50  9.2  | 61  11.2    |
| Automobile manufacturing                     | 10,942     | 4,773 43.6    | 2,700 24.7 | 2,261 20.7  | 1,760 16.1 | 1,942 17.7 | 971  8.9 | 1,862 17.0    | 1,292 11.8  | 1,404 12.8 | 2,003 18.3  |
| Biopharmaceutical manufacturing             | 286        | 190 66.4      | 131  45.8 | 95  33.2    | 82  28.7  | 74  25.9  | 18  6.3  | 51  17.8      | 51  17.8    | 42  14.7 | 81  28.3    |
| Petrochemical industry                       | 286        | 80 28.0       | 49   17.1 | 37  12.9    | 26  9.1   | 38  13.3  | 15  5.2  | 20  7.0       | 21  7.3     | 23  8.0  | 11  3.8     |
| Vegetable greenhouse                         | 243        | 147 60.5      | 51   21.0 | 43  17.7    | 16  6.6   | 79  32.5  | 5  2.1   | 16  6.6       | 30 12.3     | 57  23.5 | 13  5.3     |
| Toy manufacturing                            | 314        | 163 51.9      | 117  37.3 | 112 35.7    | 83  26.4  | 88  28.0  | 69  22.0 | 95  30.3      | 53  16.9    | 61  19.4 | 62  19.7    |
| Animal husbandry                             | 246        | 96  39.0      | 62   25.2 | 41  16.7    | 20  8.1   | 64  26.0  | 19  7.7  | 47  19.1      | 23  9.3     | 35  14.2 | 15  6.1     |
| Medical staff                                | 6,323      | 3,517 55.6    | 2,535 40.1 | 2,049 32.4  | 1,386 21.9 | 1,602 25.3 | 440  7.0 | 723 11.4      | 1,051 16.6  | 878 13.9 | 1,018 16.1  |
| Footwear industry                            | 6,998      | 2,608 37.3    | 1,696 24.2 | 1,395 19.9  | 872 12.5  | 954 13.6  | 508  7.3 | 1,075 15.4    | 600  8.6    | 552  7.9 | 599  8.6    |
| Total                                        | 41,310     | 17,709 42.9   | 11,141 27.0 | 9,262 22.4  | 6,410 15.5 | 7,285 17.6 | 3,094 7.5 | 5,545 13.4    | 4,599 11.1  | 4,507 10.9 | 5,406 13.1  |
| Chi-square test                              |            |               |       |           |            |            |        |              |            |       |             |
| p value                                       |            |               |       |           |            |            |        |              |            |       |             |

* Sales, service, spare parts, and surveys (customer feedback).
epidemiological survey in European countries showed that nearly a quarter of adults report suffering from some kind of “arthritis or rheumatism” (5), but there were great differences between different countries, ranging from 16.6% in Sweden to 38.2% in Portugal (6). A epidemiological survey of more than 3,000 occupational groups in New Zealand showed that the prevalence of WMSDs in any body part was 92%, and the most commonly affected body parts were the lower back (54%), neck (43%), and shoulders (42%) (7). The prevalence and most commonly affected body part of WMSDs in China are similar to research results found in other studies.

WMSDs are widely prevalent throughout society. WMSDs occur differently due to different labor intensity, working conditions, and working methods. The results indicated that the prevalence of WMSDs in the biopharmaceutical manufacturing industry was the highest in this survey, and other industries or occupational groups with a prevalence of more than 50% were vegetable greenhouses (60.5%), medical staff (55.6%), toy manufacturing (51.9%), and flight attendants (51.2%). The characteristics of occupational activities determined which body part was most likely to have a WMSD. For example, the biopharmaceutical manufacturing industry adopts assembly line work, with hours seated as high as 12 hours per day. Workers need to repeat highly monotonous actions (such as lifting, pushing, and pulling with one or both hands) during the operation process and maintaining a working posture of bending forward and bending down for a long time so that the most commonly affected body parts are concentrated in the neck, shoulders, and upper back.

The results of this study show that sociodemographic factors such as age, length of service, and gender are closely related to the occurrence of WMSDs. The prevalence of WMSDs increased linearly with age under 40 years. This can be explained by cumulative effects as with an increase of age, the body’s musculoskeletal system showed a tendency of degeneration, and the longer the period of service, the

FIGURE 1. Regional distribution of work-related musculoskeletal disorders (WMSDs) among key industries or occupational groups in China, 2018–2019.

FIGURE 2. Prevalence of work-related musculoskeletal disorders (WMSDs) in different age and working years in key industries or occupational groups in China, 2018–2019.
longer the exposure time to risk factors. After the age of 40 years, the prevalence of WMSDs decreased. On-site investigations found that the management of many enterprises will adjust the working positions of front-line workers according to their age, i.e. the front-line workers will be adjusted to auxiliary positions with lighter loads or promoted to management positions such as team leaders. This may also be a reason for the decline in the prevalence of WMSDs.

In addition, the study also found that the prevalence of WMSDs in women was higher than that in men. Women were more likely to have WMSDs in the neck, shoulders, upper back, lower back, and legs. Men were more likely to have WMSDs in the knees and feet. There were three possible reasons for gender differences. First, the division of labor between male and female workers in industrial and mining enterprises is different. Men were more engaged in heavy manual work, while women are more engaged in manual manufacturing with lower physical loads, such as bio-pharmaceutical manufacturing, footwear manufacturing, and electronic equipment manufacturing. Most of these industries required workers to sit down for long periods of time to work, so the prevalence of neck WMSDs was relatively high (8). Second, women were smaller and their spine was less able to bear the load than men. Therefore, even in the same job, women were more likely to suffer from chronic musculoskeletal disorders (9). Third, women were more sensitive to pain than men or were more willing to report pain (10).

This study has the following limitations. First, the survey data do not cover all provincial-level administrative divisions (PLADs) in China, so there are still some key industries related to WMSDs that have not been surveyed, and the extrapolation of results has certain limitations. Second, WMSDs were collected through a self-reported questionnaire, which is affected by recall bias and reporting bias.

In conclusion, the prevalence rate of WMSDs was relatively high among the occupational groups in the key industries in China. The most common parts of WMSDs were concentrated in the neck, shoulder, and lower back and increased with age and length of service. The prevalence of WMSDs in women was higher than that in men. The biopharmaceutical manufacturing industry, vegetable greenhouses, and medical staff were the top three industries with the highest prevalence of WMSDs. In view of this, we can set up a population list in selected key industries of China, take relevant measures to reduce the impact of WMSDs on the occupational population of our country, develop standard WMSD-risk assessment systems, comprehensive assessment methods, and technical regulations suitable for the occupational population and economic development of China, and consider including the WMSDs of key industries into our country’s legal occupational disease catalogue in the immediate future.

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Preplanned Studies

Distribution of Asbestos Enterprises and Asbestosis Cases — China, 1997–2019

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Summary

What is already known on this topic?
Asbestos is classified as a Class I Carcinogen by the International Agency for Research on Cancer (IARC) because exposure causes mesothelioma and lung cancer in addition to asbestosis and plaques. So far, asbestos has been banned in 67 countries, but chrysotile, a commonly encountered form of asbestos, is still widely used in China and most developing countries. Most asbestos-caused cancers are not reported, recorded, and compensated in many countries.

What is added by this report?
Enterprises manufacturing asbestos products have been migrating from economically developed Eastern China to relatively underdeveloped central and western regions between 2010 and 2019. Asbestosis cases reported in Tianjin, Beijing, Shandong, Xinjiang, Gansu, Qinghai, and Sichuan accounted for a large proportion of the total cases in China, which was inconsistent with the distribution of asbestos-related enterprises (AREs). The reported asbestosis cases versus total pneumoconiosis cases declined from 2.81% to 0.39% from 2006–2017, and this proportion reached 0.69% in 2018.

What are the implications for public health practice?
Robust occupational and environmental health assessments and reporting are needed to define the epidemiology of asbestos-related lung diseases. Management of using asbestos and existing products containing asbestos need strengthening and follow-up. Furthermore, the latest estimate of the global number of asbestosis deaths from the Global Burden of Disease estimate 2016 is 3,495 (2). Epidemiological studies indicate that lung cancer accounts for 54%–75% of all occupational cancers, and asbestos accounts for 55%–85% of these lung cancers while causing other cancers and other asbestos-related diseases today (5). In 2006, the International Labor Office (ILO) officially affirmed that “all forms of asbestos, including chrysotile, are considered as known human carcinogens” (6). International Agency for Research on Cancer (IARC) announced asbestos as a Class I carcinogen (7). So far, asbestos is completely banned in 67 countries, including the United Kingdom, the European Union, and Japan (8), but chrysotile, a commonly encountered form of asbestos, is still widely used in China and most developing countries. An estimated 2,030,000 tons were consumed annually according to the latest available consumption data. Every 20 tons of asbestos produced...
and consumed kills a person somewhere in the world. The present asbestos consumption and exposure will cause negative outcomes 30–50 years later (3). China started to ban the production, import, and use of amphibole asbestos in 2002, but chrysotile products are allowed to be safely produced and consumed in compliance with occupational health standards. Currently, China not only has the third-largest asbestos reserve but also is the second-largest producer and consumer of asbestos products in the world.

Both the incidence of asbestosis and the number of employees, the business scope, type and regional distribution of AREs in the mainland of China were analyzed in this study. The number of employees in AREs was missing in 2019. The inclusion criteria were enterprises whose business scope involved raw materials or products involving asbestos. The raw materials category involved mining or trading asbestos and using asbestos to manufacture primary products. The products category included products involving asbestos such as vinyl asbestos tiles, asbestos cement, asbestos roofing felt, asbestos reinforced plastics, asbestos adhesives, sealants, asbestos cloth, and coatings. All statistical analyses used the R software package (version 3.6.2, 2019 The R Foundation for Statistical Computing).

The distribution of AREs in 2010 and 2019 was shown in Figure 1. There were 1,611 and 1,936 AREs registered in mainland China, respectively. In 2010, AREs were mainly concentrated in the coastal areas of Eastern China and a few central regions with 188,739 employees in all at an average of 117 per enterprise. AREs were mainly concentrated in Hebei, Jiangsu, Zhejiang, and the other 10 provincial-level administrative divisions (PLADs), accounting for 82.9% of the total. Among them, 289 enterprises located in Dacheng County, Hejian City, Yuyao City, Cixi City, and Jiangyan City, accounting for 17.9% of all AREs. Fewer enterprises were located in asbestos deposit and mining areas. There were only 73 asbestos enterprises in Qinghai, Xinjiang, Sichuan, Gansu, and Shaanxi, accounting for 4.5% of the total. In 2019, 68.6% of AREs migrated from Eastern China to central and western regions, mainly Gansu, Yunnan, Xinjiang, and Guizhou. Among these, Dacheng County, Guangzhou City, Hejian City, Jiuquan City, and Lingshou County were the most concentrated areas of AREs, accounting for 498 (25.7%). There were 46 asbestos mining enterprises located in Gansu, Xinjiang, Qinghai, Yunnan, Sichuan, and other PLADs, which represented a significant increase and a clustering tendency in asbestos mining areas. The number of AREs in Zhejiang, Jiangsu, Shanghai, Henan, Beijing, and other regions decreased significantly when compared to 2010, especially in Zhejiang where the number was reduced to 85.1%. The distribution of AREs exhibited a concentrating pattern in 2010 and a scattering pattern in 2019. The AREs in Zhejiang, Jiangsu, and Shanghai decreased significantly.

The business types of AREs were shown in Table 1. In 2010, The primary business types were private enterprises, sole proprietorship, and limited liability companies, accounting for 86.1% of the total. The 44 joint-venture companies that mainly located in Zhejiang, Shanghai, and Shandong were invested from Hong Kong, Macao, and Taiwan of China and foreign countries. Sole proprietors accounted for a relatively large proportion in Hebei (27.3%) and Zhejiang (15.6%). Because these enterprises were

FIGURE 1. Distribution of asbestos enterprises in mainland China in 2010 (A) and in 2019 (B).
TABLE 1. Distribution and changes of asbestos-related enterprises in different business types and regions in mainland China in 2010 and 2019.

| Business types                      | Number of Enterprises in 2010 (%) | Number of Enterprises in 2019 (%) |
|-------------------------------------|----------------------------------|----------------------------------|
|                                     | Eastern | Central | Western | Total   | Eastern | Central | Western | Total   |
| Private                             | 507(31.5) | 94(5.8) | 52(3.2) | 653(40.5) | 11(0.6) | 6(0.3)  | 10(0.5) | 27(1.4) |
| Sole proprietorship                 | 292(18.1) | 39(2.4) | 45(2.8) | 376(23.3) | 174(9.0) | 53(2.7) | 136(7.0) | 363(18.8) |
| Limited liability                   | 291(15.6) | 50(3.1) | 19(1.8) | 360(22.3) | 879(45.4) | 238(12.3) | 299(15.4) | 1,416(73.1) |
| Corporation                         | 58(3.6)  | 10(0.6) | 7(0.4)  | 75(4.7)   | 14(0.7)  | 4(0.2)  | 4(0.2)  | 22(1.1)  |
| Collective                          | 33(2.0)  | 10(0.6) | 2(0.1)  | 45(2.8)   | 45(2.3)  | 33(1.7) | 25(1.3) | 103(5.3) |
| Foreign-invested                    | 31(1.9)  | 3(0.2)  | 0(0.0)  | 34(2.1)   | 2(0.1)   | 0(0.0)  | 2(0.1)  | 4(0.2)   |
| Hong Kong, Macao, and Taiwan-invested | 10(0.6)  | 0(0.0)  | 0(0.0)  | 10(0.6)   | 0(0.0)   | 0(0.0)  | 0(0.0)  | 0(0.0)   |
| Others                              | 41(2.5)  | 13(0.8) | 4(0.2)  | 58(3.6)   | 0(0.0)   | 0(0.0)  | 1(0.0)  | 0(0.0)   |
| Total                               | 1,263(78.4) | 219(13.6) | 129(8.0) | 1,611(100.0) | 1,125(58.1) | 334(17.3) | 477(24.6) | 1,936(100.0) |

mainly in Eastern China (78.4%), those in Western China only accounted for 8.0%. The business scope of most enterprises included processing raw materials and manufacturing primary products of asbestos, but a majority of these products such as vinyl asbestos tiles, asbestos cement, asbestos roofing felt, asbestos reinforced plastics, asbestos adhesives, sealants, asbestos cloth, and coatings were discontinued. Some companies used asbestos insulation in steam engines, piping, and locomotives, while others used it in boilers, gaskets, cement, roofing materials, and automotive brake pads. In 2019, AREs were mainly limited liability companies, sole proprietorship, and collective enterprises, accounting for 96.5%. The four enterprises receiving foreign-investment were in Zhejiang, Chongqing, Liaoning, and Xinjiang. AREs in Eastern China decreased by 10.9% when compared to 2010, while the number in Western China increased by 269.8%, approximately 3.7 times as much as in 2010. Especially in relatively underdeveloped regions such as Xinjiang, Guizhou, Gansu, and Yunnan (increased from 2.2% to 14.5% in the 4 PLADs), several safer substitutes such as polyurethane foam, amorphous silica fabric, thermostet plastic powder, and cellulose fiber became available. Although asbestos products were only part of the business, cement tiles were the primary asbestos products, especially in Western China, and the proportion increased from 4.0% to 16.2%.

The distribution of 3,831 asbestosis cases reported between 1997 and 2018 was shown in Figure 2. Among them, 1,470 and 2,361 cases were reported in 1997–2007 and 2008–2018, respectively (increased by 60.6%). In particular, the number of cases reported in Tianjin increased from 187 to 1,175 (increased by 528.3%), while significant increases were also observed in Gansu, Xinjiang, and Jilin. The cases in reported Tianjin, Beijing, Shandong, Xinjiang, Gansu, Qinghai, Sichuan, Zhejiang, and Jiangsu accounted for 90.7% of the total. Nevertheless, the number of cases in Beijing, Qinghai, Sichuan, Zhejiang, and Jiangsu decreased significantly, especially in Beijing where the reported cases decreased by 68.3% (from 394 to 125). No cases were reported in Guizhou, Hainan, and Tibet. The reported asbestosis cases showed a downward trend in 1998–2017 (from 294 to 89 cases). The decline was steeper in 2009–2011 (from 244 to 102 cases). The proportion of reported pneumoconiosis cases also exhibited a downward trend from 3.55% in 1998 to 0.39% in 2017. This proportion continued to decline in 2006–2017 (from 2.81% to 0.39%) and reached 0.69% in 2018.

**DISCUSSION**

In contrast with the distribution of asbestos mines, asbestos manufacturing enterprises were mainly located in coastal areas of Eastern China in 2010. AREs flourished in economically developed regions due to the large demand for asbestos products. Despite the asbestos abundance, few AREs selected underdeveloped regions due to poor transportation infrastructure among many other reasons. Henan and Hubei became transit areas of asbestos materials and finished products for their central geographic location and convenient transportation. Many AREs selected Hebei Laiyuan Asbestos Mine, Shandong Rizhao Asbestos Mine, and Liaoning Chaoyang Asbestos Mine based on resource location and economic demands.

Based on the available data of 2010 and 2019, AREs gradually migrated from economically developed...
coastal regions of Eastern China to relatively underdeveloped western and central regions. This trend may be ascribed to China’s developmental strategy, investment, and policy to promote the development of western regions. The tightened environmental control in large Eastern Chinese cities may also play a role.

For more than a decade, the transportation infrastructure in Western China has improved significantly. Local economic development increased the demand for asbestos products. Particularly, the construction of roads and buildings greatly increased the demands for asbestos cement products. In response to extensive market demands, AREs were concentrated in selected regions across China.

Nonetheless, AREs were still characterized by miniaturization, individualization, and cooperation. Many enterprises somewhat concealed the health hazards of asbestos. The word “asbestos” was used in corporate names only by 114 (9.8%) of the 1,611 enterprises in 2010 and by 182 (9.4%) of 1,936 enterprises in 2019, respectively. Some of the enterprises used finished product names such as construction materials company and sealing materials factory. Asbestos business nature was difficult to determine by corporate names. Meanwhile, most AREs also handle a variety of products other than asbestos. Only 12.5% (202/1,611) in 2010 and 25.9% (502/1,936) in 2019 of these enterprises specialized in or mainly handled asbestos products.

Asbestosis cases were mainly found in Tianjin, Beijing, Shandong, and Xinjiang, which was inconsistent with the distribution of AREs. In particular, AREs operating in Hebei ranked first in China in 2010 (348/1,611) and 2019 (470/1,936), but only 26 asbestosis cases were reported in two decades from 1997 to 2018. In contrast, there were 67 AREs in Tianjin in 2010 and 2019 (67/3,547), but 1,362 asbestosis cases were reported. Despite the obvious presence of AREs, few asbestosis cases were reported in Guangdong, Guizhou, and Hunan. More strikingly, zero asbestosis cases were reported in Guizhou in the past two decades. This may be ascribed to several factors such as the limited diagnostic capability and clinical experience of local occupational health institutions. The histopathologic diagnosis of asbestosis requires the presence of uncoated or coated asbestos fibers (asbestos bodies) in association with interstitial pulmonary fibrosis that is similar in appearance to usual interstitial pneumonitis (UIP) (9), so it can be easily misdiagnosed as other lung diseases. Moreover, serious under-diagnosing or non-diagnosing is a major

![FIGURE 2. Distribution of reported asbestosis cases in mainland China from 1997 to 2007 (A) and from 2008 to 2018 (B); Number of asbestosis cases and the percentage of total pneumoconiosis cases reported in mainland China, 1997~2018 (C).](image-url)
source of error for recording cases (3). Other influencing factors include inadequate reporting, off-site reporting of relevant cases, and feeble regulations. Especially 188,739 employees totally in 2010. Therefore, there may be a large number of asbestosis patients that have not been found, and its harm is seriously underestimated.

Asbestosis cases showed a downward trend, which was closely related to banning amphibole asbestos in China in 2002. Studies have confirmed that asbestos exposure causes a variety of diseases such as asbestosis and malignant mesothelioma with a latency period of up to 10–15 years, and the highest risk of asbestosis is observed 40–60 years after first exposure (3,9). Notwithstanding, the policy incentives for asbestos substitutes encourage asbestos enterprises to switch raw materials, and the reduced asbestos exposure has decreased the incidence of asbestosis.

This study was subject to at least a few limitations. Due to the limited information we collected, we cannot provide asbestos exposure information, which is critical in occupational health. In addition, we cannot evaluate reported asbestosis cases in various regions for authenticity, comprehensiveness, and preciseness, and this may have an impact on the regional distribution of reported asbestosis cases.

The distribution of AREs and asbestosis cases highlight the importance of a sounding occupational health strategy on asbestosis management. Based on the study findings, several targeted strategies can be implemented. First, the supervision of AREs can be centralized according to the distribution patterns in key provinces and municipalities; meanwhile, information and incentives on safer asbestos substitutes should be provided to encourage improved behavior. Second, fragmented contracting, on-site supervision, and demonstrative promotion can be adopted according to cooperative miniaturization and private individualization. To resolve the concealment of business nature, to incorporate naming, and to strengthen the declaration of occupational hazards, an information database of asbestos enterprises can be established through cooperation with the Departments of Commerce, Fire, and Security. Finally, early diagnosis, treatment, and rehabilitation of asbestos-related diseases can be improved, especially in areas with insufficient diagnostic capacity. Robust occupational and environmental health assessments and reporting are needed to define the epidemiology of asbestos-related lung diseases.

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On May 1, 2002, a law on the prevention and control of occupational diseases has been approved by the National People’s Congress Standing Committee to protect worker’s health in China. Since 2003, April 25 to May 1 of each year is dedicated to a week long campaign to publicize the law on prevention and control of occupational diseases. The “National Plan on Prevention and Control of Occupational Diseases (2016–2020)” and the “Healthy China 2030” plan clearly outlines indicators and roadmaps to protect worker’s health. A series of national action plans provide comprehensive strategies and guidelines to improve occupational health, which will address present and future challenges.

**INTRODUCTION**

China has a population of 1.39 billion people with 776 million workers, and the working population already accounts for 55% of the total population (1). Most people in China spend almost half their life in working, and with rapid socioeconomic development and the emergence of new technologies and new materials that have been extensively applied in industry, new and unidentified hazardous risks have threatened workers at their workplace. In 2015, the classification and catalogue of occupational hazards has been revised again by increasing the number of occupational hazards to 459 in 6 classifications (2). Data from the National Occupational Disease Reporting System reports a total of 23,476 new cases of occupational diseases in 2018 (3).

One occupational disease, occupational pneumoconiosis, is caused by exposure to dust in the workplace and accounted for more than 83% of total disease (Figure 1). Chemicals provide immense benefits to mankind, but many have significant negative health impacts, primarily due to their inherent chemistry and toxicity and can contribute to cancers, developmental malformations, and hereditary disease. With the rapid development of the industry, an estimated 100,000 new chemicals were produced annually around world. Although new cases of chemical poisoning reported in 2018 significantly declined to almost 50% when compared to the highest number of cases reported in 2009 (3), there is an urgent need to strengthen the capacities of monitoring, surveillance, and emergency response to chemical poisoning because of various levels of widespread exposure to chemicals, along with the occurrence of occupational and non-occupational hazards in the emergence of chemical poisonings.

In 2018, the World Health Organization (WHO) released new estimates on magnitude of disabling hearing loss, there are 466 million persons in the world with disabling hearing loss, and 91% (424 million) of these are adults (4). Occupational factors such as noise, chemical solvents, and lead contribute almost 50% of the cumulative risk assessment for hearing loss. The number of noise-induced deafness reported dramatically increased by 20% and 37% compared with data reported in 2016 and 2015, respectively, but there was a huge gap between cases of noise-induced deafness diagnosed and reported and the widespread of noise exposure at workplaces that endangered workers’ health including disabling hearing loss and cardiovascular disease (3).

The International Labour Organization (ILO) estimates that 1,000 workers die every day from work accidents and 6,500 die a day from a wide range of work-related diseases in the world. Every year, 2.78 million workers die from work-related accidents and work-related diseases, and of these, 2.4 million workers die from work-related diseases and another 3.74 million workers suffer from non-fatal work-related diseases occur annually (5). Circulatory diseases (31%), occupational cancers (26%), and respiratory diseases (17%) accounted for almost 3 out of every 4 work-related deaths (Figure 2).

The patterns of work-related diseases and injury are changing around the world. The ILO published the first international list of occupational diseases in 1925 beginning with 3 diseases, and the revision of the international list of occupational diseases has been continuously revised with the most recent update in 2010 (6). This new revision of international list of occupational diseases contains 106 diseases including 9
open items in 4 classifications. The ILO international list of occupational diseases includes a range of occupational diseases recognized internationally from illnesses caused by chemical, physical, and biological agents to respiratory and skin diseases, musculoskeletal disorders, and occupational cancer, and mental and behavioral disorders have been included for first time in the ILO international list. In China, the list of occupational diseases was first published in 1956 beginning with 14 occupational diseases recognized officially, and the latest revision of the list was in 2013 (7). The new list of occupational diseases in China contains a total 132 diseases in 10 classifications, and in the structure of the list, classification from 1 to 4 are
occupational diseases in target organs, 5 to 8 are occupational disease caused by exposed to hazards, 9 is occupational cancer, and 10 is other occupational diseases. The list of occupational diseases in China focused on the prevention and control of traditional occupational diseases such as pneumoconiosis and chemical poisoning. With industry revolution and behavioral change, some well-known occupational diseases such as pneumoconiosis and chemical poisoning are still widespread in China, but some new occupational diseases, such as work-related stress and musculoskeletal disorders (MSDs), are emerging as common threats worldwide.

PERSPECTIVES

Globalization and industrial revolution have led to incremental or revolutionary changes in occupational health. With widespread exposure of traditional hazards in the workplaces and remarkable changes in the nature of work, we are facing a double burden from “old” and relatively “new” occupational diseases in China. Widespread traditional hazards and the numbers of traditional occupational diseases are becoming more serious, but psychosocial risk factors, work-related stress, and non-communicable diseases are also a growing concern for workers across the world.

In 2019, China implemented a series of national action plans to prevent and control occupational diseases and protect worker’s health. The Healthy China 2030 Planning Outline clearly states the importance of fortifying self-discipline, supervising management responsibilities among industries, promoting corporate responsibility, and further controlling the sources of occupational diseases to prevent and control the occurrence of occupational diseases (8). Occupational Health Protection Campaign is 1 of 15 special actions of Health China 2030 Planning, and it is a long-term comprehensive strategy to integrate considerable resources from governments, employers, workers, and other stakeholders to promote a healthy lifestyle and continuously improve healthy environments and conditions for workers.

The Action Plan for Prevention and Control of Pneumoconiosis is a short-term comprehensive plan to implement five specific and concrete tasks to control and reduce the dust in workplaces such as quartz sand processing, asbestos mining and asbestos-product manufacturing, and ceramics and refractory-material production, to improve and enlarge the monitoring system of workers exposed to dust, and to implement follow-up and management of pneumoconiosis patients (9). The purpose is to control and reduce widespread exposure to dusts and high prevalence of occupational pneumoconiosis.

The WHO has been published a healthy workplace model in 2011 (10), and the 4 key elements of WHO healthy workplace model include (i) health and safety concerns in the physical environment; (ii) health, safety, and well-being concerns in the psychosocial work environment including organization of work and workplace culture; (iii) personal health resources in the workplace (support & encouragement of healthy lifestyles by the employer); and (iv) ways of participating in the community to improve the health of workers, their families, and members of the community. The “Healthy Enterprise Action Plan” in China references the WHO healthy workplace model and emphasizes performing relevant statutory liabilities and obligations in preventing and controlling occupational diseases, and it engages managers and workers to jointly build a healthy, safe, harmonious, and sustainable working environment and effectively safeguard employees’ health and well-being (11). Healthy enterprise is a concrete practice in the field of occupational health by implementing the concept and strategy of healthy China.

The concerns of traditional occupational health focus on the identification and assessment of hazards in the workplace, the diagnosis and treatment of occupational diseases, and the introduction of new concepts of occupational health to shift provision of occupational health services to cover workers’ lifecycles. New challenges will necessitate competence and capacity of occupational health.

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Overview

An occupational disease reporting system has been developed starting from a paper-based reporting system to a network-based direct reporting system. The reporting system has been linked with more than 43,300 users from 25,000 agencies at the national, provincial, municipal, and county levels in a unified vision to report individual cases of occupational diseases and chemical poisonings. Following the establishment of the reporting system of occupational diseases, the list of occupational diseases has been published since the 1950s, beginning with 14 diseases and revised by recognition and establishment of more occupational diseases in accordance with scientific advancements in medical science. The list of occupational diseases represents increasing knowledge on the development of medical sciences and disease diagnosis technologies and it plays a dual role in prevention and compensation of occupational diseases.

Definition of occupational disease

According to the “Law on Prevention and Control of Occupational Disease” modified in 2018, the term “occupational diseases” has been defined as diseases caused by exposure to dust, radioactive substances, and other poisonous and dangerous substances during occupational activities (1). There are two critical prerequisites to define an occupational disease: 1) a causal relationship can be established between exposure to a specific hazard during occupational activities and a specific disease; and 2) the concentration or intensity of exposure to a specific hazard is sufficient to cause a specific disease.

Chronology of the Reporting System of Occupational Diseases in China

Surveillance data is crucially important to guide policy development and public health practice, and the reporting system of occupational diseases has been gone through three stages in China including the initial stage, rebuilding stage, and development stage.

In the initial stage (1956–1970s), the State Council issued the “Guideline on Reporting of Death and Occupational Accidents of Workers and Employers” in 1956, and this official document normalized investigations, registrations, and reporting of acute chemical poisoning accidents. Following the guideline, a paper-based reporting system was established to investigate, register, and report acute poisoning accidents.

In the rebuild stage (mid 1970s–mid 1980s), the Ministry of Health and the State Bureau of Labor jointly published the “Regulation on Reporting of Chemical Poisoning and Occupational Disease” in 1982 (2). In 1985, the Ministry of Health issued a notice on the establishment of an annual reporting system for the prevention and control of occupational diseases including statistical reports of the hazard measurement in the workplace and medical examinations of workers exposed to hazards in the workplace. This built a foundation for the standardization and institutionalization on management of occupational disease reporting in China with indicators of occupational disease prevention, management, and effect evaluation.

In the development stage (mid 1980s–now), with the rapid technological development of informatics, a computer-based national reporting system was established in 1997 to electronically report individual cases of occupational diseases and pesticide poisoning. The database of occupational diseases had been established at the national and provincial levels for data analysis.

Since 2006, a network-based direct reporting system has been developed, which is a subsystem of the national information system of disease control and prevention managed by China CDC. In the current reporting system, based on the “Occupational Disease Classification and Catalogue” revised in 2013 (3), a total of 121 diseases in 9 categories were reported including 19 classified as occupational pneumoconiosis and other respiratory diseases, 9 as occupational dermatoses, 3 as occupational eye diseases, 4 as...
occupational otolaryngologic and oral diseases, 60 as occupational chemical poisoning, 7 as occupational diseases caused by exposure to physical factors, 5 as occupational infectious diseases, 11 as occupational tumors, and 3 as other occupational diseases; 11 occupational radioactive diseases are reported separately.

The contents reported in the document contain 1) occupational pneumoconiosis; 2) occupational diseases without occupational pneumoconiosis and radioactive diseases; 3) occupational disease diagnostic information; 4) occupational health examination information; 5) suspected occupational diseases; and 6) pesticide poisoning. The reporting agencies include occupational disease diagnostic agencies, occupational health examination agencies, and other medical agencies at different levels.

Over past 60 years, there have been remarkable changes in the nature of work, such as the demographics of workers, and efforts have been made to improve and modernize the reporting system to achieve a better and more intelligent system. Under the management of the National Health Commission (the successor to China’s Ministry of Health), monthly, quarterly, and annual reports are prepared by China CDC, and a national report of occupational diseases is published annually by the National Health Commission.

**Historical Development of the List of Occupational Diseases in China**

The list of occupational disease is a collection of diseases caused by exposure to hazardous risks during occupational activities. It reflects the increasing knowledge and cognition for changes in the types of work and rapid advancements of medical sciences and diagnostic technology of diseases. It plays a critical role in both of prevention and compensation of occupational diseases.

Following the “Regulation on Scope of Occupational Diseases and Treatment of Occupational Disease Patients” first released in 1957 (4), the list of occupational diseases was first published with 14 occupational diseases (Table 1). Over the past 30 years, there have been remarkable changes in the types of work and the demographics of the workforce in China. The list of occupational diseases was revised in 1987 by adding occupational diseases from 14 to 99 in 9 classifications (5). A significant change was the increase in the number of diseases and the classification of diseases.

On May 1, 2002, the “Law on Prevention and Control of Occupational Disease” was approved by the National People’s Congress Standing Committee, and the “Regulation on the Scope of Occupational Diseases and Treatment of Occupational Disease Patient” was jointly revised by the Ministry of Health and the Ministry of Labour. Meanwhile, the “Occupational Disease Classification and Catalogue” was revised again, and the list of occupational diseases was also revised again by increasing occupational diseases from 99 in 9 classifications to 115 in 10 classifications including the separation of the classification of radioactive diseases.

With rapid socioeconomic development and extensive applications of new technology and new materials in industry, some new and unidentified hazardous risks could incur new occupational diseases, so the “Occupational Diseases Classification and Catalogue” has been revised again in 2013 to meet the changing needs of prevention and control of occupational disease (3). In this new revision, the changes added 18 occupational diseases and expanded the scope of occupational diseases. The number of occupational diseases was increased from 115 to 132 including 4 open items (Table 2). In the new revision’s structure, these 132 diseases were divided into 10 classifications with classifications 1 through 4 being occupational diseases in target organs; 5 to 8 being occupational disease caused by exposed to hazards including chemical, physical, radioactive, and biological hazardous risks; 9 being occupational cancer; and 10 being other occupational diseases.

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**TABLE 1. The list of occupational diseases published in 1957.**

| No. | Name of Occupational Diseases                  |
|-----|-----------------------------------------------|
| 1   | Occupational poisoning                         |
| 2   | Occupational pneumoconiosis                    |
| 3   | Occupational heat stroke and heat cramp         |
| 4   | Occupational sunstroke                         |
| 5   | Occupational dermatoses                        |
| 6   | Electric ophthalmia                            |
| 7   | Occupational deafness                          |
| 8   | Occupational cataract                          |
| 9   | Decompression sickness                         |
| 10  | Mountain sickness and Aerial sickness           |
| 11  | Vibration disease                              |
| 12  | Occupational radiation-induced diseases         |
| 13  | Occupational anthrax                           |
| 14  | Occupational forest encephalitis               |

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The list of occupational diseases was first published in 1957, the list of occupational diseases was revised again in 2013 to meet the changing needs of prevention and control of occupational disease. In this new revision, the changes added 18 occupational diseases and expanded the scope of occupational diseases. The number of occupational diseases was increased from 115 to 132 including 4 open items. In the new revision’s structure, these 132 diseases were divided into 10 classifications with classifications 1 through 4 being occupational diseases in target organs; 5 to 8 being occupational disease caused by exposed to hazards including chemical, physical, radioactive, and biological hazardous risks; 9 being occupational cancer; and 10 being other occupational diseases.
The increasing number of potential hazards have contributed to the increase of occupational diseases. It is estimated that occupational exposure may contribute to approximately 15% of chronic obstructive pulmonary disease (COPD) (6). In the new revision, COPD caused by irritant chemicals, pneumoconiosis caused by exposed to metal dusts (tin, iron, antimony, and barium), and hard metal lung disease were recognized and added to the list. Cancer is also becoming a family of common chronic and non-communicable diseases in the world as 3.8 million of new cases of malignant tumors were reported in 2014 in China (7).

Occupational cancers can arise because of extensive and continuous exposure to well-known and suspected occupational carcinogens. Lung cancer and malignant mesothelioma are likely caused by occupational exposure to asbestos, an estimated 9% of lung cancer and 2% of leukemia were related to exposure to occupational carcinogens in 2000 (8). In the new revision, additions to the list included lung tumor and mesothelioma caused by exposed to erionite; skin cancer caused by exposed to coal tar, coal tar bitumen and petroleum bitumen; and bladder tumor caused by exposed to β-naphthylamine.

With widespread occupational and non-occupational exposure to chemicals, it is critically important to identify exposure to unknown or unidentified chemicals and to register and report potential chemical poisonings. In new revision, 5 diseases were added to the list including poisoning caused by exposed to indium and related compounds; poisoning caused by exposed to bromopropane; poisoning caused by exposed to iodine methane; and poisoning caused by exposed to chloroacetic acid and ethylene oxide.

**Comments**

The reporting system of occupational diseases plays an important role on the collection effective data of occupational disease diagnosis and medical examination of workers exposed to hazards in the workplace. The current reporting system is not a full-process reporting system as it lacks information on medical examinations of workers on pre-employment and post-employment and information on the follow-up of suspected patients and patients. At the request of the Information System for Prevention and Control of Disease, a full-process reporting system including hazard measurement in the workplace, medical examinations of workers exposed to hazards on pre-employment, during employment, and post-employment, diagnosis of occupational diseases, and follow-up of suspected patients and current patients will be developed for the needs of occupational disease reporting in the future.

The list of occupational diseases includes a wide range of occupational diseases officially recognized and represents knowledge on the prevention and treatment of diseases caused by exposure to hazards during occupational activities. It plays a critical role in both the prevention and compensation of occupational diseases. The International Labour Organization (ILO)

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**TABLE 2. Occupational disease classification and catalogue as revised in 2013.**

| Classification | Number of occupational diseases | Number of open items | Total |
|----------------|---------------------------------|----------------------|-------|
| 1 Occupational pneumoconiosis and other occupational respiratory diseases | 18 | 1 | 19 |
| 1.1 Occupational pneumoconiosis | 12 | 1 | 13 |
| 1.2 Other occupational respiratory diseases | 6 | 6 |
| 2 Occupational dermatoses | 8 | 9 |
| 3 Occupational eye diseases | 3 | 3 |
| 4 Occupational otolaryngologic and oral diseases | 4 | 4 |
| 5 Occupational chemical poisonings | 59 | 1 | 60 |
| 6 Occupational diseases caused by physical factors | 7 | 7 |
| 7 Occupational radiation-induced diseases | 10 | 1 | 11 |
| 8 Occupational infectious diseases | 5 | 5 |
| 9 Occupational tumors | 11 | 11 |
| 10 Others* | 3 | 3 |
| Total | 128 | 4 | 132 |

*"others" as used in the "Occupational Disease Classification and Catalogue" is a category that includes only specified diseases, such as metal fume fever and underground workers’ bursitis.
TABLE 3. International Labour Organization (ILO) international list of occupational diseases as revised in 2010.

| Classification | Number of occupational diseases | Number of open items | Total |
|----------------|---------------------------------|----------------------|-------|
| 1 Occupational diseases caused by exposure to agents arising from work activities | | | |
| 1.1 Diseases caused by chemical agents | 40 | 1 | 41 |
| 1.2 Diseases caused by physical agents | 6 | 1 | 7 |
| 1.3 Biological agents and infectious or parasitic diseases | 8 | 1 | 9 |
| 2 Occupational diseases by target organ systems | | | |
| 2.1 Respiratory diseases | 11 | 1 | 12 |
| 2.2 Skin diseases | 0 | 4 | 4 |
| 2.3 Musculoskeletal disorders | 7 | 1 | 8 |
| 2.4 Mental and behavioral disorders | 1 | 1 | 2 |
| 3 Occupational cancer | 20 | 1 | 21 |
| 4 Other diseases | 1 | 1 | 2 |
| Total | 94 | 12 | 106 |

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| Diseases                                      | Cases  | Deaths |
|----------------------------------------------|--------|--------|
| Plague                                       | 0      | 0      |
| Cholera                                      | 0      | 0      |
| SARS-CoV                                     | 0      | 0      |
| Acquired immune deficiency syndrome          | 4,808  | 1,418  |
| Hepatitis                                    | 108,657| 39     |
| Hepatitis A                                  | 1,529  | 0      |
| Hepatitis B                                  | 88,150 | 31     |
| Hepatitis C                                  | 16,718 | 6      |
| Hepatitis D                                  | 12     | 0      |
| Hepatitis E                                  | 1,641  | 1      |
| Other hepatitis                              | 607    | 1      |
| Poliomyelitis                                | 0      | 0      |
| Human infection with H5N1 virus              | 0      | 0      |
| Measles                                      | 69     | 0      |
| Epidemic hemorrhagic fever                   | 433    | 2      |
| Rabies                                       | 15     | 9      |
| Japanese encephalitis                        | 3      | 2      |
| Dengue                                       | 16     | 0      |
| Anthrax                                      | 9      | 0      |
| Dysentery                                    | 2,892  | 0      |
| Tuberculosis                                 | 73,427 | 97     |
| Typhoid fever and paratyphoid fever          | 360    | 1      |
| Meningococcal meningitis                     | 3      | 0      |
| Pertussis                                    | 874    | 0      |
| Diphtheria                                   | 0      | 0      |
| Neonatal tetanus                             | 2      | 0      |
| Scarlet fever                                | 444    | 0      |
| Brucellosis                                  | 3,508  | 0      |
| Gonorrhea                                    | 4,661  | 0      |
| Syphilis                                     | 41,154 | 8      |
| Leptospirosis                                | 1      | 0      |
| Schistosomiasis                              | 7      | 0      |
| Malaria                                      | 92     | 1      |
| Human infection with H7N9 virus              | 0      | 0      |
| COVID-19\*                                   | 1,730  | 442    |
| Influenza                                    | 21,696 | 4      |
| Mumps                                        | 6,028  | 0      |
| Diseases                      | Cases | Deaths |
|-------------------------------|-------|--------|
| Rubella                       | 197   | 0      |
| Acute hemorrhagic conjunctivitis | 2,011 | 0      |
| Leprosy                       | 41    | 0      |
| Typhus                        | 29    | 0      |
| Kala azar                     | 27    | 0      |
| Echinococcosis                | 249   | 0      |
| Filariasis                    | 0     | 0      |
| Infectious diarrhea†          | 48,491| 1      |
| Hand, foot and mouth disease  | 2,869 | 0      |
| **Total**                     | 324,803 | 2,024 |

*The data were from the website of the National Health Commission of the People's Republic of China.
† Infectious diarrhea excludes cholera, dysentery, typhoid fever and paratyphoid fever.

The number of cases and cause-specific deaths refer to data recorded in National Notifiable Disease Reporting System in China, which includes both clinically-diagnosed cases and laboratory-confirmed cases. Only reported cases of the 31 provincial-level administrative divisions in Mainland China are included in the table, whereas data of Hong Kong Special Administrative Region, Macau Special Administrative Region, and Taiwan are not included. Monthly statistics are calculated without annual verification, which were usually conducted in February of the next year for de-duplication and verification of reported cases in annual statistics. Therefore, 12-month cases could not be added together directly to calculate the cumulative cases because the individual information might be verified via National Notifiable Disease Reporting System according to information verification or field investigations by local CDCs.

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