J Occup Health 2018; 60: 208-228

Journal of Occupational Health

Review

What are the new challenges, goals, and tasks of occupational health in China's Thirteenth Five-Year Plan (13th FYP) period?

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Abstract: Objective: In recent years, the Chinese government has attached great importance to occupational health under the guidance of people-oriented concept. This paper introduces the current status and future development of occupational health in China's Thirteenth Five-Year Plan (13th FYP) period (2016-2020) to promote the cooperation and exchange on occupational health between China and other countries. **Methods:** We collected statistical data about occupational diseases and information addressing occupational diseases. We included all types of official reports, guidelines, policies, and relevant laws published by the Chinese government. **Results:** China has carried out a series of strategies and measures to reduce the incidence of occupational diseases, and has made progress in occupational health protection. However, occupational health in China still faces severe conditions and challenges for occupational diseases that have not been prevented and controlled effectively. To actively promote the future development of occupational health during the 13th FYP period, China has issued a series of important policy documents (such as the Plan for a Healthy China 2030, the 13th FYP for Occupational Disease Prevention and Control, and the 13th FYP for Occupational Health Hazard Prevention and Control) in the last two years. **Conclusion:** The overall situation condition of occupational health in China is still serious. Occupational health in China's 13th FYP period faces a series of challenges, future tasks include plans to add the employer and regulatory levels of occupational health management, and occupational health education and publicity to the current technology-dominated approaches.
(J Occup Health 2018; 60: 208-228)

Received October 18, 2017; Accepted February 2, 2018
Published online in J-STAGE March 20, 2018
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doi: 10.1539/joh.2017-0275-RA

Key words: 13th FYP, China, Current status, Future development, Occupational disease, Occupational health

1. Introduction

Occupational diseases not only affect workers' health by adding a significant disease burden, but also decrease the productivity and profitability of commercial enterprises, as well as social harmony and stability[1,2)]. For example, at the 1st International Occupational Health Forum & 3rd China-US Occupational Health Symposium, held at the Beijing International Center in Beijing, China, from August 22 to August 23, 2017, about five hundred occupational health researchers and practitioners from China, the US and other countries agreed that occupational diseases have become an important factor in restricting the sustainable development of the social economy. Therefore, prevention and control of occupational disease has become an important health and social issue for countries throughout the world[3)]. Moreover, occupational health is one of the basic policies in China. Considering that many countries are facing serious situations and challenges in occupational disease prevention and control, and that workers' occupational health needs are continuously increasing, developing effective solutions for the promotion of occupational health is essential and urgent. At present, countries around the world are using various strategies and measures (e.g. scientific research, technology, legislation, administration, education and economy) to gradually reduce the incidence of occupational disease in their na-

tion.

The problem of occupational disease impacts all countries, including China[2,4,5]. For example, data from the National Health and Family Planning Commission (NHFPC) of the People's Republic of China (PRC) show that since China's reform and opening-up in 1978, more than 80 million cases of occupational disease have occurred[6]. Although China is a developing country, it has already become one of the largest global producers, the world's most populous country, and the world's second-largest economy[7]. Moreover, in recent decades, China has experienced rapid industrialization, urbanization, and economic growth, leading to a transformed industrial structure and expansion of the labor force. However, China has also become one of countries with the high incidence of occupational disease[5,8]. On April 29, 2015, the Innovation Center for Social Risk Governance in Health (ICSRGH), a research group consisting of Fudan University, Tsinghua University, Harbin Medical University, Xinjiang Medical University, the National Health and Family Planning Commission of China, and others, published a Research Report titled 'Warning and Control of Occupational Health Hazards in China'[8]. This study concluded that at present China has the highest incidence of occupational diseases in the world, as determined by cases of occupational disease, the cumulative number of deaths, and the new cases of occupational disease.

Health investment in China has increased in recent years. According to data from the National Bureau of Statistics of China, total health expenditures reached 700 billion USD in 2016 and accounted for 6.2% of the country's gross domestic product (GDP)[9]. A series of strategies and measures for occupational disease prevention and control have been successfully implemented to address issues related to occupational health, including occupational pneumoconiosis, occupational poisonings, occupational dermatoses, etc.[10,11]. Unfortunately, occupational disease remains a serious concern for the Chinese government, businesses, and individuals; and threatens workers' health and well-being, business productivity and profitability, economic development, and social stability[5,10,11]. Even with steady occupational health improvements in recent years, tens of thousands of new cases of occupational disease are found every year in China[11]. Moreover, Sun[12] suggests that there is a large gap in the overall strength of occupational disease prevention and controls between the US and China. Thus China has an urgent need to strengthen the capacity to guarantee occupational health. In 2016 and 2017, China released a series of important government documents to promote occupational disease prevention and control, including the Plan for a Healthy China 2030[13], the Thirteenth Five-Year Plan (13th FYP) for Work Safety[14], the National Plan for Occupational Disease Prevention and Control (2016-2020)[10] and the 13th FYP for Occupational Health Hazard Prevention and Control[11]. Additionally, the Law of the People's Republic of China on Occupational Disease Prevention and Control was amended and issued on July 2, 2016[15].

The 13th FYP period is a critical stage of building a uniformly prosperous society and a healthy China, so improving occupational health in the 13th FYP period is critical[10,11,13]. What are the new challenges, goals and tasks of occupational health in China's 13th FYP period? To answer this question, we discuss the major challenges and prospects for occupational disease prevention and control in China according to the latest government documents related to occupational health in China during the 13th FYP period. However, it is necessary to first analyze the current occupational health situation in China. Obviously, this study can promote the cooperation and exchange of occupational health information between China and other countries, in order to help provide evidence-based occupational health services in other countries[16]. Because several overviews of occupational health in China before 2011 have been published[1,2,4,17-19], here we have focused mainly on government documents released since 2011. Of course, based on the existing overviews on China's occupational health, a more systematic and deeper understanding of China's occupational health development can be achieved.

2. Analysis of the Current Occupational Health Status in China

2.1 Occupational disease with Chinese characteristics

According to Article 2 of the Law of PRC on Occupational Disease Prevention and Control[15,20], occupational disease refers to a disease caused by exposure to dust or radioactive substances, or by other poisonous and harmful factors that are present during work activities. According to the 'Occupational Disease Classification and Catalogue'[21], occupational diseases are classified into 10 types:

1. occupational pneumoconiosis and other occupational respiratory diseases,
2. occupational dermatoses,
3. occupational eye diseases,
4. occupational ear, nose and throat diseases,
5. occupational poisonings,
6. occupational diseases caused by physical factors,
7. occupational radiation-induced diseases,
8. occupational infectious diseases,
9. occupational tumors and
10. others ("others" as used in the 'Occupational Disease Classification and Catalogue[21] is a category that includes only specified diseases, such as metal fume fever and underground workers' bursitis).

There are 132 occupational disease subtypes. Occupational diseases are diagnosed and identified by the Regu-

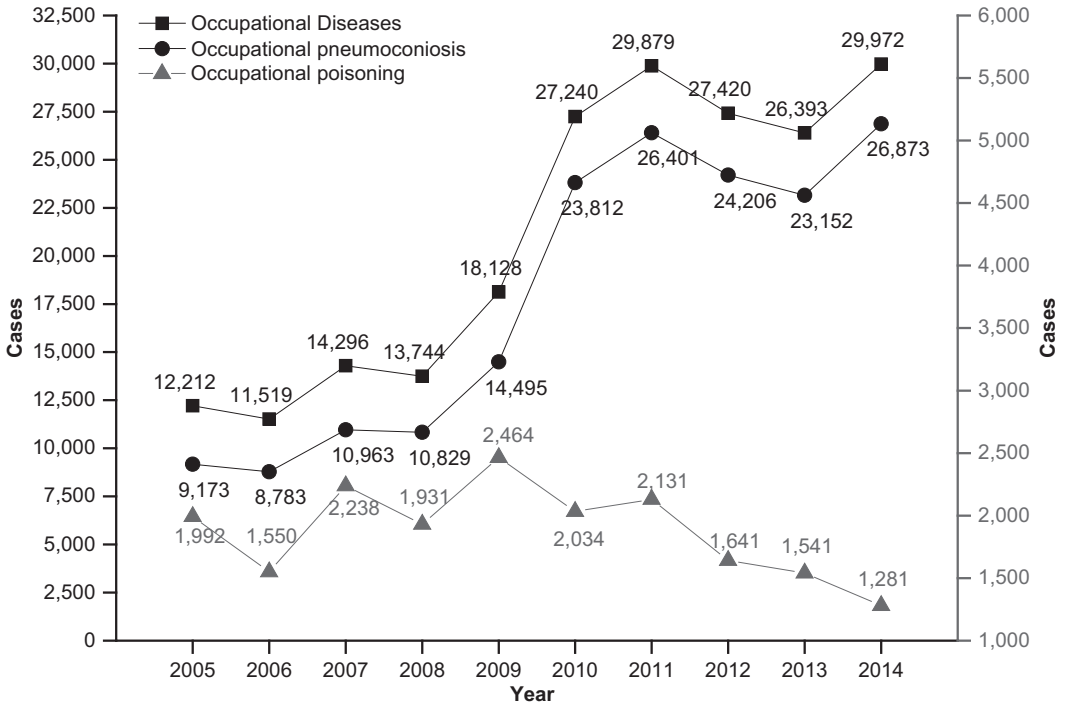

Fig. 1. Cases of occupational disease, occupational pneumoconiosis, and occupational poisoning in China from 2005-2014.

lation of the Occupational Disease Diagnosis and Identification Management Measures[22].

This section provides an overview of the state of occupational disease in China. The statistical data for occupational diseases in 30 Chinese provinces (including Anhui, Beijing, Chongqing, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hainan, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Jilin, Liaoning, Inner Mongolia, Ningxia, Qinghai, Shandong, Shanxi, Shaanxi, Shanghai, Sichuan, Tianjin, Xinjiang, Yunnan and Zhejiang) in this section comes from the NHFPC of PRC. This source is commonly used by researchers in this study area (such Ding et al.[2] and Zhang et al.[4]).

2.1.1 Distribution of occupational diseases by year

In recent years, most occupational diseases in China are occupational pneumoconiosis and occupational poisoning. Fig. 1 shows the evolution of occupational disease cases, occupational pneumoconiosis, and occupational poisoning in China between 2005 and 2014. During this period, both overall occupational disease and occupational pneumoconiosis gradually rose, with a temporary and relatively small decrease in 2011-2013, after which the numbers rose again. Cases of occupational poisoning remained relatively stable before 2009, and then began to steadily decline, with a temporary and small increase in the number of cases in 2011. As seen in Fig. 1, although the incidence of occupational poisoning has become relatively stable, the total number of occupational disease cases are still high in China, and the number of new occupational disease and occupational pneumoconiosis cases is increasing every year. This shows that occupational diseases have not been prevented and controlled effectively in China, and that the overall state of occupational health is still very serious.

There were more than 26,000 new cases of occupational disease every year between 2010 and 2014. In 2014, there were 29,972 new cases of occupational disease, an increase of 145.43% compared to 2005. Data from the NHFPC of PRC shows that since the PRC was established in 1949, there have been more than 863,634 cases of occupational disease in China. Furthermore, because the diagnosis, identification, and statistical analysis of occupational diseases are subject to rigorous procedures, occupational diseases usually have a long incubation period, and because many peasant-workers exposed to occupational health hazards lack the knowledge and consciousness to safeguard their rights, actual cases of occupational disease are higher than the number reported in the data from the NHFPC of PRC.

2.1.2 Distribution of occupational diseases by industry

In China, occupational diseases come from more than 30 industries, including traditional industries (e.g. coal mining, non-ferrous metals mining, metallurgy, machinery, construction and chemical) and new types of industries (e.g. computer and information technology, biology and medicine)[11]. Occupational diseases mainly occur in industries with high occupational health risks, such as coal mining and mining for non-ferrous metals. For ex-

Table 1. The ten leading occupational diseases in China in 2014.

No.	Illness	Cases	
		Number	Percentage
1	Coal workers' pneumoconiosis	13,846	46.20
2	Silicosis	11,471	38.27
3	Noise-induced hearing loss	825	2.75
4	Brucellosis	376	1.25
5	Chronic benzene poisoning	282	0.94
6	Chronic poisoning due to lead and its compounds (excluding tetraethyl lead)	224	0.74
7	Acute carbon monoxide poisoning	213	0.71
8	Chronic poisoning due to arsenic and its compounds	120	0.40
9	Contact dermatitis	63	0.21
10	Benzene-induced leukemia	53	0.21

ample, among the reported occupational diseases in 2010-2014, the highest percentage of occupational diseases is found in coal mining (49.16%). This is followed by non-ferrous metals mining (10.25%). In addition, there are many cases of occupational disease in the machinery and construction industries. For example, of a total of 26,393 recorded cases of occupational disease in 2013, 7.32% were found in the machinery and construction industries.

2.1.3 Distribution of occupational diseases by type

In recent years, occupational pneumoconiosis has been the most serious occupational disease in China, followed by occupational poisoning. For example, among the reported cases of occupational disease from 2010 to 2014, occupational pneumoconiosis and occupational poisoning accounted for 84.76% and 8.92% of total cases, respectively. All other disease categories put together only accounted for 6.33% of the occupational disease burden.

When we examined the data according to the 132 subtypes of occupational disease in the 'Occupational Disease Classification and Catalogue'[21], coal workers' pneumoconiosis ranked as the top cause of occupational disease, followed by silicosis and noise-induced hearing loss. For example, coal workers' pneumoconiosis contributed to the highest number of occupational disease cases (46.20% of the total cases), followed by silicosis (38.27%), and noise-induced hearing loss (2.75%) in China in 2014 (Table 1).

2.1.4 Occupational pneumoconiosis

"Pneumoconiosis" refers to a group of fibrotic lung diseases caused by the retention of dust in the lung[21]. There was a cumulative number of 178,687 confirmed pneumoconiosis cases in China between 2005 and 2014. Currently, pneumoconiosis is still a horrible monster that accounts for more than 80% of the total reported cases of occupational disease in China, which is approximately equal to the total sum of pneumoconiosis cases in all of the other countries in the world combined[8]. New pneumoconiosis cases are estimated at 23,000-26,000 annually, and new cases continue to increase (see Fig. 1). In 2014, there were 26,873 pneumoconiosis cases, an increase of 192.96% compared to 2005. This trend shows that pneumoconiosis remains frequent in China, and that current occupational health policies have not succeeded in preventing and controlling pneumoconiosis.

China's economic development is heavily dependent on energy sources like coal and oil, and China is both a major producer and consumer of coal. For example, coal production was 3,870 MT in 2014, which is 3.91 times greater than production in 2000. Coal consumption in 2013 is 3.78 times greater than that in 1990. There are about six million coal workers in China at present, and over 50% of them are peasant-workers. The coal mining industry remains one of the most high-risk industries in China, and bears the worst occupational health and safety record in the world. The highest occurrence of pneumoconiosis is found in the coal mining industry; known as coal workers' pneumoconiosis ("black lung") (see Fig. 2), this accounted for 53.65% of the total pneumoconiosis cases in China between 2010 and 2014.

Due to the large number of laborers engaged in construction, mining, and other occupations with potential exposure to silica, silicosis is a crucial occupational health problem that currently threatens about 10,000 Chinese workers each year (see Fig. 2). In 2010-2014, there was a cumulative number of 51,150 silicosis cases in China, accounting for 41.1% of total pneumoconiosis cases.

2.1.5 Occupational poisoning

From 2005 to 2014, there were 18,803 cases of occupational poisoning in China. Occupational poisoning represents a large proportion of occupational disease in China; however, the number of occupational poisonings has come down significantly since 2009 (see Fig. 1). There were a total of 1,992 reported occupational poisoning cases in 2005 versus 1,281 in 2014, a 35.7% decrease. However, accidents with high numbers of occupational

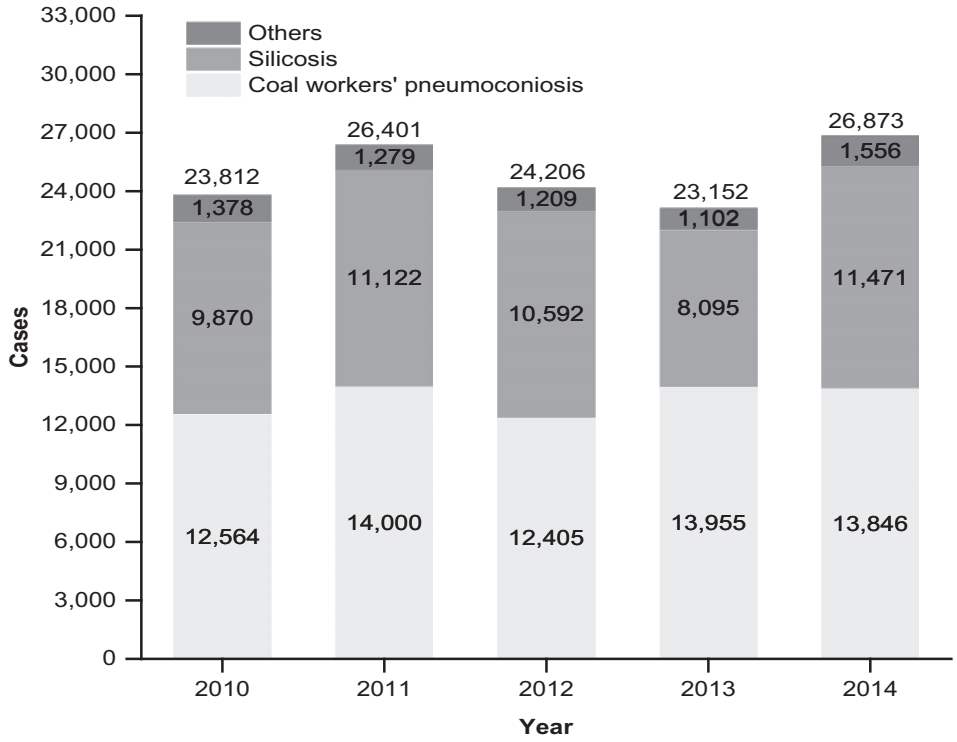

Fig. 2. Distribution of occupational pneumoconiosis cases in China for each year between 2010 and 2014.

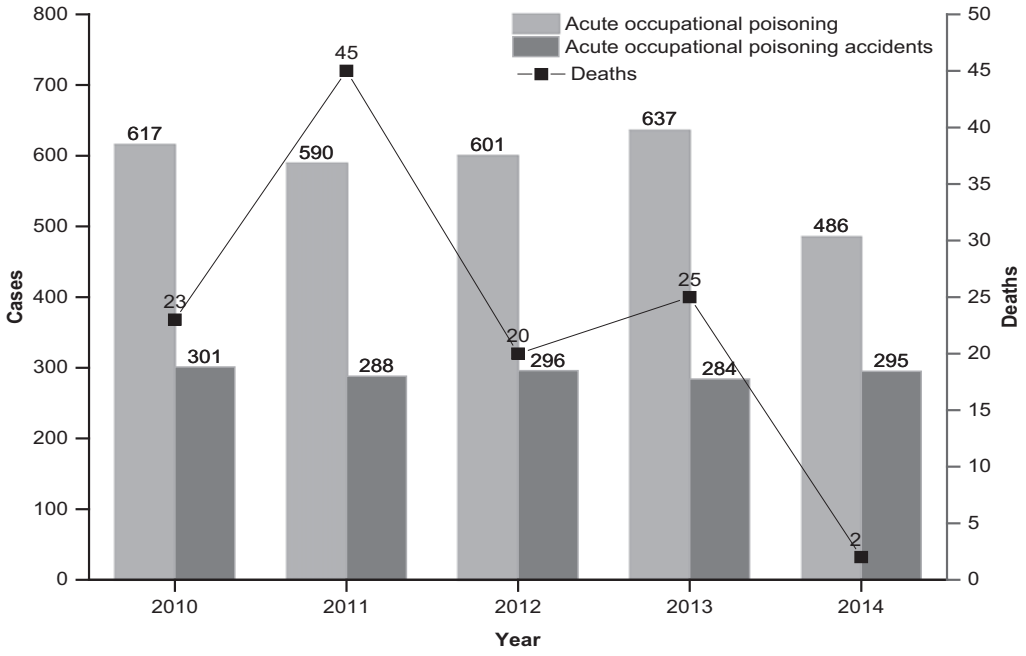

Fig. 3. Cases of acute occupational poisoning, acute occupational poisoning accidents, and deaths in China from 2005-2014.

poisoning cases and deaths still occasionally occur (e.g. the Youxian coal mine poisoning accident on May 7, 2017, in Hunan Province, which resulted in 37 poisoning cases and 18 deaths).

In 2010-2014, official statistics listed 1,464 acute occupational poisoning accidents involving 2,931 patients and 115 deaths. Fig. 3 shows the incidence of acute occupational poisoning cases, acute occupational poisoning acci-

Table 2. Serious acute occupational poisoning accidents associated with confined spaces in China (March-June 2016).

Date	Province	Location/ enterprise	Chemical	Deaths
4/3/2016	Guangdong	Shijing lime sales department	CO	4
19/3/2016	Fujian	Ocean leather company	H_2S	3
4/4/2016	Shandong	Babaoshan calcium oxide company	CO	4
12/6/2016	Gansu	Lixin petrochemical company	H_2S	3
9/7/2016	Hebei	Guangyao foundry company	N2	5
11/7/2016	Ningxia	Zhengwang agriculture and husbandry company	H_2S	4

Source: State Administration of Work Safety (SAWS).

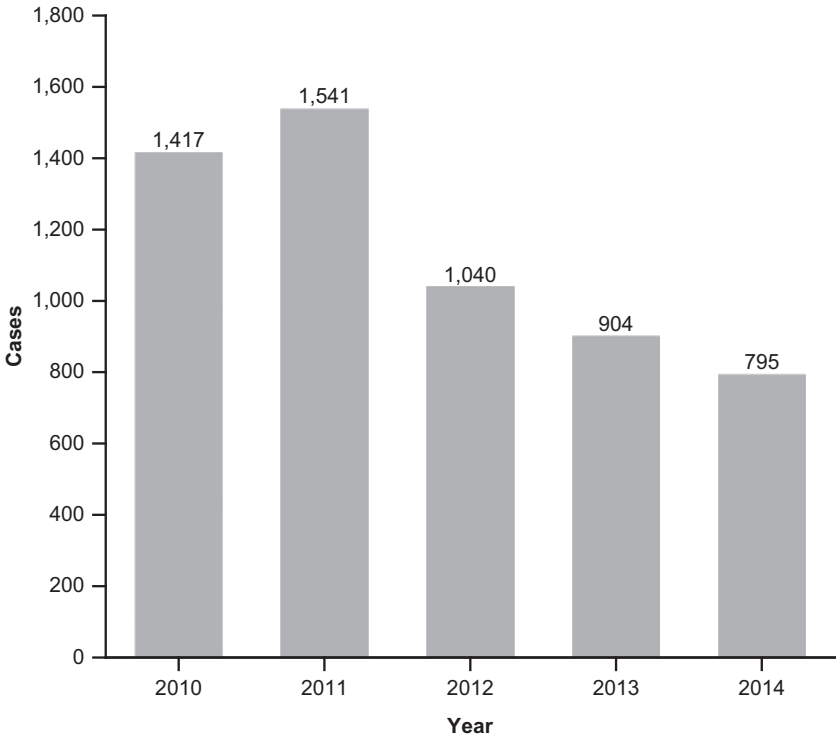

Fig. 4. Cases of chronic occupational poisoning in China from 2010-2014.

dents, and deaths in China between 2005 and 2014. During this period, the overall incidence of acute occupational poisonings and accidents remained relatively stable. There is a decreasing trend in the number of deaths, from 23 in 2010 to 2 in 2014; however, there was a dramatic increase in deaths in 2010-2011. More than 30 chemicals (e.g. carbon monoxide, hydrogen sulfide, and ammonia) are known to cause acute occupational poisoning. Carbon monoxide was ranked among the top causes, and accounted for 37.6% of the total occupational poisoning accidents and 43.8% of the total acute poisoning cases in 2014. Moreover, serious acute occupational poisoning accidents happen frequently in confined spaces in China. In China, a serious accident refers to an accident that has resulted in over 3 deaths[23], and serious acute occupational poisoning accidents frequently occur in confined spaces. In 2010-2013, there were 67 serious confined space accidents in industrial and commercial enterprises and 269 fatalities, which accounted for 41.1% and 39.9% of the total serious accidents and fatalities, respectively. Table 2 shows the serious acute occupational poisoning accidents in confined workspaces in China from March to June in the year 2016.

In 2010-2014, there were a total of 5,697 reported cases of chronic occupational poisoning. During this period, there was temporary increase in the number of chronic occupational poisoning cases in 2010-2011 with a peak in 2011, and has been decreasing ever since (see Fig. 4). In 2014, the number of chronic occupational poisoning cases was 795, a drop of 43.9% compared to 2010. Lead and its compounds (excluding tetraethyl lead) are the top causes of chronic occupational poisonings, fol-

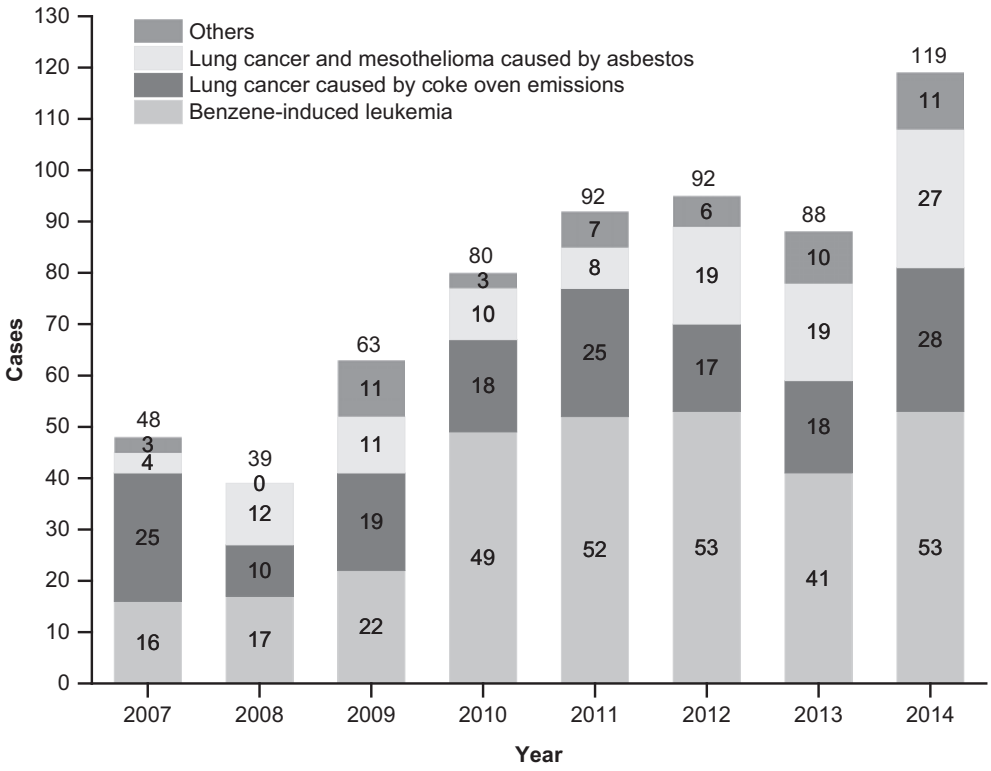

Fig. 5. Distribution of occupational tumor cases in China from 2007-2014.

lowed by benzene, accounting for 31.3% and 26.76% of the total reported cases in 2010-2014, respectively.

2.1.6 Occupational tumors

In 2007-2014, there were 624 reported cases of occupational tumors. During this period, there is a clear increasing trend in the number of occupational tumor cases, from 48 in 2007 to 119 in 2014 (Fig. 5), indicating that occupational tumors are becoming more common. Benzene-induced leukemia is the top cause of tumors, followed by lung cancer caused by coke oven emissions, and lung cancer and mesothelioma caused by asbestos, which accounted for 48.56%, 25.64% and 17.63% of the total reported cases in 2007-2014, respectively. In addition, the proportion of lung cancer and mesothelioma caused by asbestos in occupational tumors has increased significantly since 2012, as shown in Fig. 5.

2.1.7 Other occupational diseases

Besides the occupational pneumoconiosis, poisonings, and tumors described above, other common occupational diseases include occupational ear, nose, and throat diseases; occupational dermatoses; occupational diseases caused by physical factors; occupational eye diseases; and occupational diseases caused by biological factors. Fig. 6 shows the evolution of cases of occupational ear, nose and throat diseases; occupational dermatoses; occupational diseases caused by physical factors; occupational eye diseases; and occupational diseases caused by biological factors in China between 2010 and 2014. Fig. 7 and Fig. 8 show the distribution of occupational ear, nose and throat disease cases and occupational diseases caused by physical factors, respectively. Three important conclusions can be drawn from these figures:

(1) From 2010 to 2014, there was a rapid rise in new cases of occupational ear, nose and throat diseases, from 347 in 2010 to 880 in 2014 (Fig. 6). Noise-induced hearing loss represented the largest proportion of occupational ear, nose and throat diseases (Fig. 7).

(2) In 2010-2014, occupational diseases caused by biological factors showed a general rising tendency, with a temporary and relatively small decrease in 2010-2011, while occupational dermatoses and eye diseases were generally on the decline (Fig. 6).

(3) Cases of occupational diseases caused by physical factors remained stable from 2010-2013, with between 200 and 230 cases a year, but then sharply decreased in 2014 (Fig. 6), a drop of 38.63% from 2013. Currently, hand-arm vibration syndrome and sunstroke are the most serious occupational diseases caused by physical factors (see Fig. 8).

2.2 Occupational health protection at the national level in China

2.2.1 Occupational health services

In order to consistently improve the ability of occupational health services to provide employers and workers with convenient, rapid, and efficient occupational health

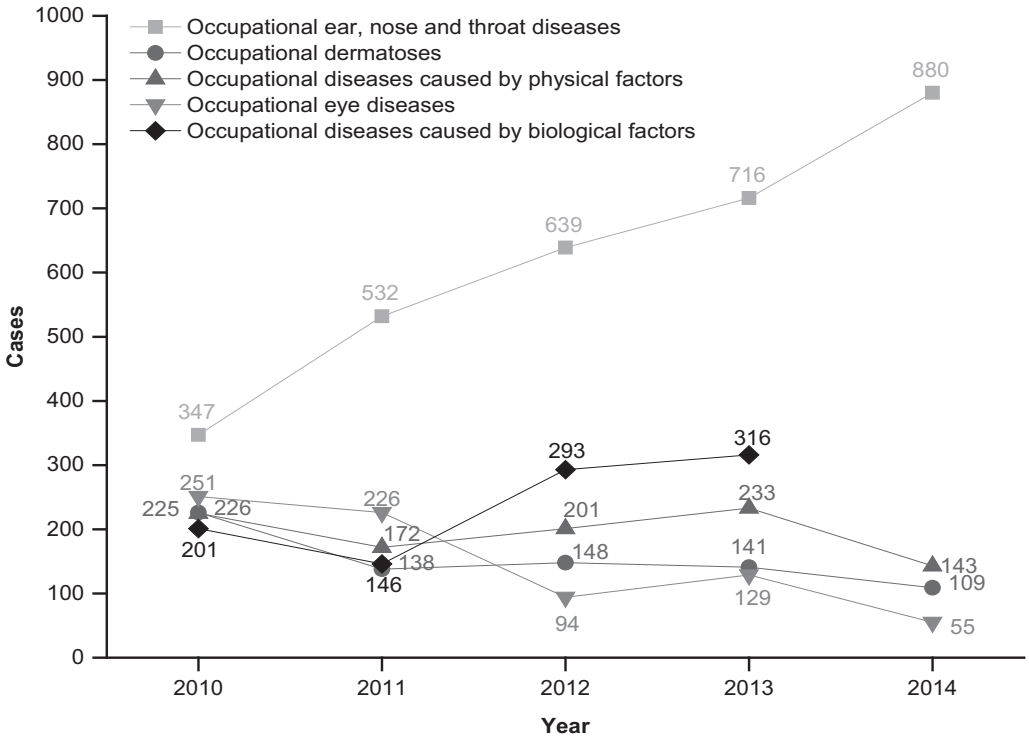

Fig. 6. Cases of occupational ear, nose and throat diseases; occupational dermatoses; occupational diseases caused by physical factors; occupational eye diseases; and occupational diseases caused by biological factors in China from 2010-2014.
Note: Cases of occupational disease caused by biological factors is not available for 2014.

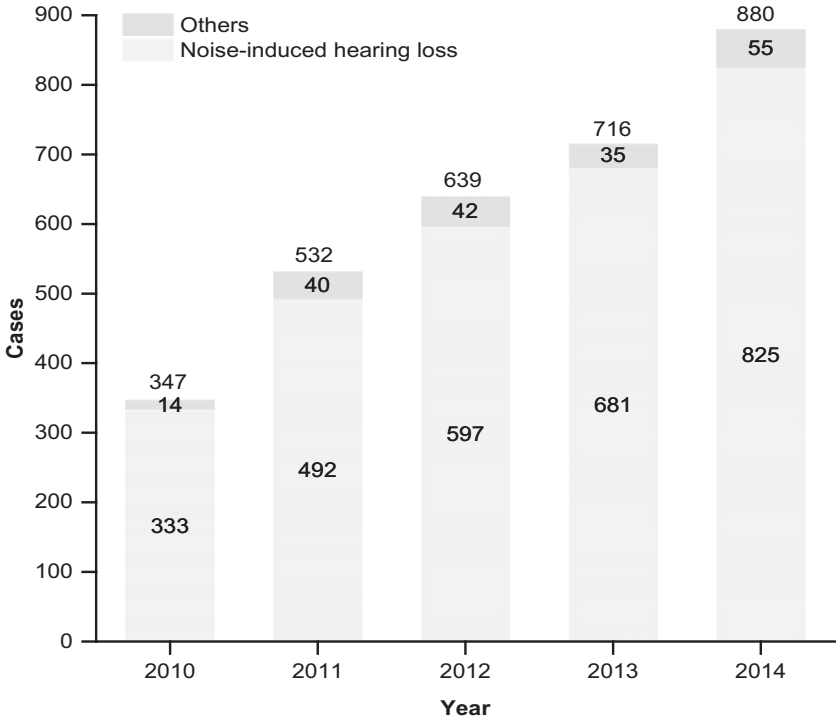

Fig. 7. Distribution of occupational ear, nose and throat disease cases in China from 2010-2014.

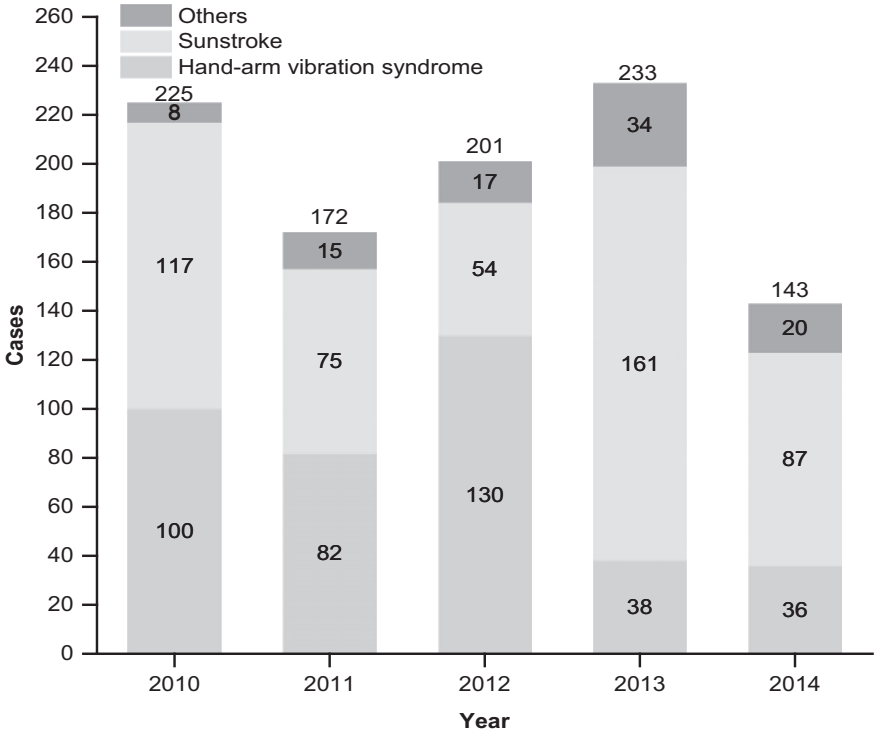

Fig. 8. Distribution of cases of occupational diseases caused by physical factors in China in each year from 2010- 2014.

services, in recent years the NHFPC has worked ceaselessly to improve the capacity of occupational health agencies and the occupational health service system, and optimized the distribution of occupational health examination and occupational disease diagnosis agencies. Meanwhile, the SAWS continuously strengthened the construction and supervision of occupational health service agencies and the training of occupational health service professionals. Fig. 9 shows the evolution of occupational health examination and occupational disease diagnosis agencies in China between 2010 and 2014. According to the licensing system of occupational health service agencies, China approved 604 occupational health examination agencies and 3,438 occupational diseases diagnosis agencies by the end of 2014, a rise of 51.32% and 22.76%, respectively, compared to 2010. According to the report 'Organizing and development of occupational health services' by Li (a senior engineer from the Occupational Hazard Institute of China Academy of Safety Science and Technology) at the 1st International Occupational Health Forum & 3rd China-US Occupational Health Symposium held at the Beijing International Center in Beijing, China from August 22 to August 23, 2017[24], there are currently 1212 qualified occupational health service agencies and 29,935 fully-trained and qualified occupational health service professionals.

Furthermore, Li[24] reported the current regional distribution of occupational health service agencies and occupational health service professionals (Fig. 10). From Fig. 10, we conclude that occupational health service agencies and professionals are clustered in more economically developed areas, such as Guangdong, Jiangsu and Shandong. This suggests that there is an imbalance in access to occupational health services in China, and that people from developed areas are more aware of occupational health services, perhaps accounting for the growing demand for occupational health services in such industrialized areas. Finally, Li[24] reported that the overall ability and quality of occupational health services has been improved through these two years of focused effort.

2.2.2 Regulatory organization of occupational health

After years of investigation and development, China has largely established an ideal regulatory organization system for occupational health. According to the State Commission Office of Public Sectors Reform (SCOPSR) guidelines adopted in 2010[25], the main occupational health regulatory agencies in the central government of China include the NHFPC of PRC (named the Ministry of Health of PRC before 2013), the SAWS, the Ministry of Human Resources and Social Security (MOHRSS) of PRC, and the All-China Federation of Trade Unions (see Table 3).

2.2.3 Some newly representative occupational health policies

In order to effectively prevent and control occupational diseases, the Chinese government has formulated and im-

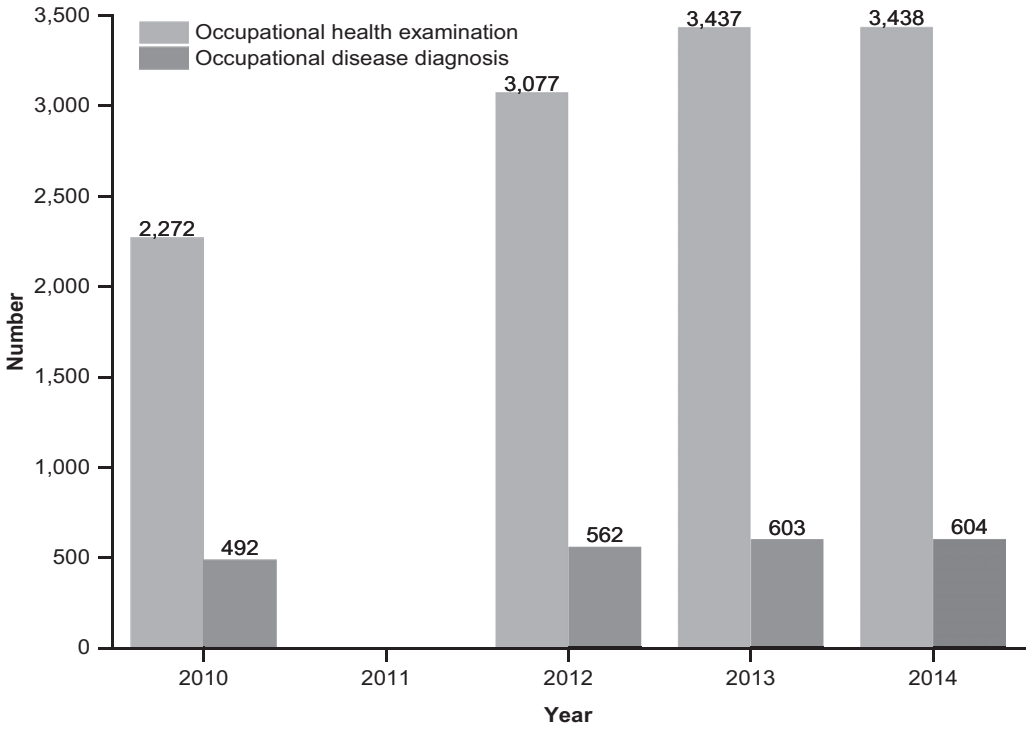

Fig. 9. The number of occupational health examination and occupational diseases diagnosis agencies from 2010-2014.
Source: National Health and Family Planning Commission (NHFPC) of PRC.
Note: The number of occupational health examination and occupational diseases diagnosis agencies in 2011 is not available.

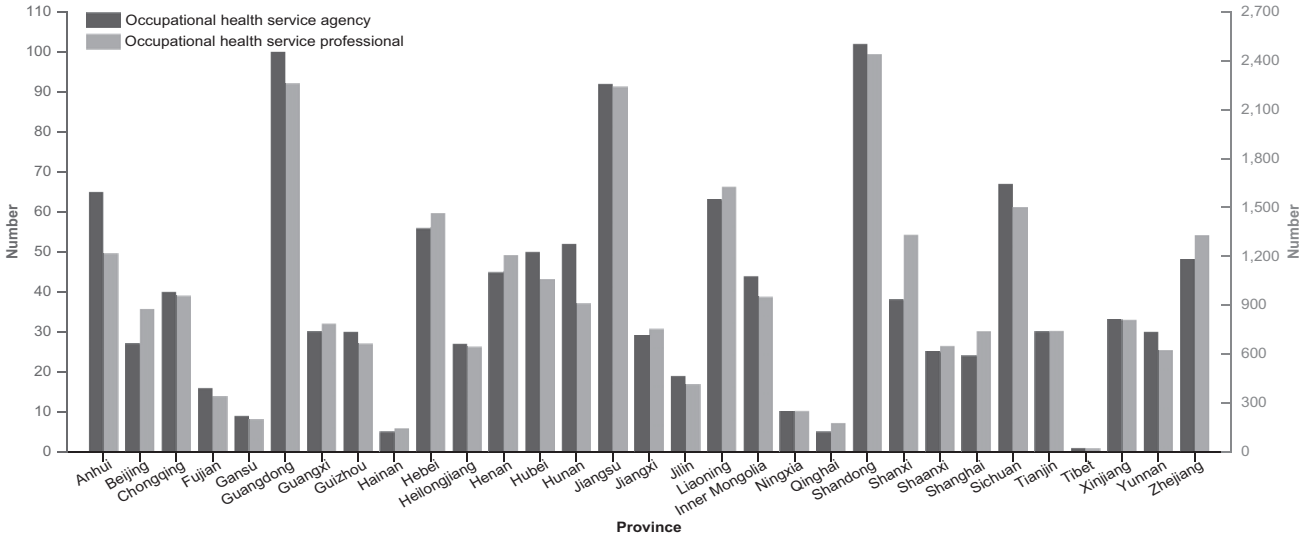

Fig. 10. Regional distribution of occupational health service agencies and occupational health service professionals.
Note: Data from Xinjiang Production and Construction Corps is included in Xinjiang.

plemented a series of occupational health policies, such as establishing and perfecting a system of accountability related to occupational health, improving the high-risk industry admittance standard, implementing occupational health "three simultaneousness" standards (i.e., the occupational health facilities of the newly built or rebuilt or expanded engineering projects of the production and business operation entities shall be designed, built and put into production and use at the same time of the principal part of the projects) in construction projects with occupa-

Table 3. The current key occupational health regulatory agencies in the central government of China.

Organization	Key responsibilities (all organizations have additional responsibilities not listed here)
National Health and Family Planning Commission (NHFPC) of PRC	1. Drafting the laws, regulations and plans for national occupational disease prevention and control, and making and publishing the national occupational health standards. 2. Supervising and managing the identification and diagnosis of occupational diseases. 3. Organizing and launching monitoring and special investigation of the major occupational diseases, and developing the occupational health risk assessment. 4. Studying and proposing strategies and measures for occupational disease prevention and control. 5. Recognizing qualifications of occupational health organizations; supervision and administration of organizations providing occupational health services (mainly including chemical toxicity evaluations, personal dose monitoring, and the testing of radiation protection equipment and radioactive products); examining, approving, supervising, and managing the medical and health institutions providing occupational health examination and disease diagnosis; strengthening the construction of occupational disease prevention and control institutions in conjunction with other relevant departments. 6. Supervising and managing radiological hazard control in medical institutions. 7. Managing and publishing the national occupational disease report, and organizing scientific research on occupational diseases prevention and control. 8. Organizing to publicize and promote education regarding the laws, regulations, and understanding occupational disease prevention and control, and occupational health promotion.
State Administration of Work Safety (SAWS)	1. Drafting laws and regulations for occupational health supervision and administration, and formulating regulations, standards and occupational health rules for employers. 2. Responsible for occupational health supervision and employer inspections, and organizing the investigation and handling of accidents caused by occupational health hazards and illegal activities. 3. Responsible for the supervision and inspection of occupational health "three simultaneousness" (designing the occupational disease protective facilities of a construction project, constructing them, and using them for production and other business operations at the same time as the main body of the project) of a new construction, expansion, or reconstruction project or a technical improvement or technology introduction project (hereinafter referred to as the "construction project") with occupational health hazards, and supervision and management of employer occupational disease hazard program reports. 4. Managing occupational health and safety permits, and responsible for supervising, administering, and validating the qualifications of organizations providing occupational health detection and evaluation services. 5. Organizing, directing, supervising, and inspecting occupational health training. 6. Supervising, inspecting, and encouraging employers to establish occupational health management systems (e.g. the system for occupational health hazard detection and evaluation, and the system for occupational health surveillance) as required by law, and providing the evidentiary documents or materials for health damages, occupational history, and occupational hazard exposure. 7. Summarizing and analyzing information related to occupational health (e.g. occupational health hazard identification and evaluation, and occupational health surveillance), and providing occupational health supervision and inspection results for some departments and institutions.
Ministry of Human Resources and Social Security (MOHRSS) of PRC	1. Supervising the implementation of labor contracts, and pressing employers to sign labor contracts according to the law. 2. Executing social security works for patients with occupational diseases according to occupational disease diagnosis results.
All-China Federation of Trade Unions	1. Participating in the investigation and handling of accidents caused by occupational health hazards. 2. Reflecting the demands for the occupational health of workers, and providing advice for promoting occupational health to protect the legitimate rights and interests of workers.

Source: State Commission Office of Public Sector Reform (SCOPSR).

tional health hazards, punishing or closing enterprises that violate occupational health laws, promoting technology development, and publicizing occupational health and education[10,11]. Here, we present selected examples of the new occupational health policies of China since 2009 (see Table 4).

2.2.4 Legal framework of occupational health

In 2001, the Law on Prevention and Control of Occu-

Table 4. Representative occupational health policies in China since 2009.

No.	Year	Issuing department	Policy	Description
1	2009	General Office of the State Council of PRC	National Plan for Occupational Diseases Prevention and Control (2009~2015)	To recognize occupational disease as a major public health challenge, and to unify plans and oversee national occupational health protection between 2009 and 2015.
2	2010	State Commission Office of Public Sectors Reform (SCOPSR)	Notice regarding the Responsibility Division of Occupational Health Supervision Department	To determine the new occupational health supervision system, and to ensure that the Responsibility Division of occupational health fully undertakes the supervision of occupational health, strengthens occupational health administrative supervision, and urges employers to assume responsibility for occupational health.
3	2011	General Office of the State Council of PRC	Twelfth Five-Year Plan for Work Safety	To offer general guidance for national safety protection (including occupational health protection) during China's Twelfth Five-Year Plan period.
4	2011	State Administration of Work Safety (SAWS)	Guidance on Strengthening Occupational Health Works	To make suggestions and requirements for implementing employers' occupational health responsibilities, standardizing employers' occupational health management behaviors, and improving occupational health supervision.
5	2011	State Administration of Work Safety (SAWS)	Guiding Opinions on Strengthening the Construction of Technical Support System for Occupational Health	To provide direction, basic principles, and the main goals and tasks for building a perfect technical support system for occupational health, to provide strong technical support for occupational hazard prevention and control, and occupational health supervision and law-enforcement.
6	2016	Central Committee of the Communist Party of China and the State Council of PRC	Plan for a Healthy China 2030	To offer guidance to promote the construction of Healthy China (including the improvement of occupational health) in the next 15 years.
7	2016	National Health and Family Planning Commission (NHFPC) of PRC, the National Development and Reform Commission of PRC, etc.	Opinions on Strengthen Occupational Pneumoconiosis Prevention and Control of Peasant-Workers	To list seven major tasks for occupational pneumoconiosis prevention and control in peasant-workers, and to effectively prevent and control peasant-workers' occupational diseases in the future, especially occupational pneumoconiosis.
8	2016	General Office of the State Council of PRC	National Plan for Occupational Disease Prevention and Control (2016~2020)	To unify, plan, and make overall arrangements (e.g. guiding ideology, goals, tasks, solutions and requirements) for national occupational health protection between 2016 and 2020.
9	2017	General Office of the State Council of PRC	13th FYP for Work Safety	To give general guidance to national occupational health protection during China's the 13th FYP period.
10	2017	State Administration of Work Safety (SAWS)	13th FYP for Occupational Health Hazard Prevention and Control	To effectively implement the National Plan for Occupational Disease Prevention and Control (2016-2020) and the 13th FYP for Work Safety to ensure effective occupational health hazard prevention and control during China's the 13th FYP period.

Source: Central People's Government of PRC, General Office of the State Council of PRC, State Commission Office of Public Sectors Reform (SCOPSR), and State Administration of Work Safety (SAWS).

pational Disease of PRC[20] was promulgated and implemented. Currently, the large number of regulations, rules and standards, and technical specifications established by the Law on Prevention and Control of Occupational Disease in PRC has been largely implemented throughout China[1,10,11]. The current legal framework of occupational health in China is divided into four levels, as shown in Table 5. Although this legal system is ideal in many

Table 5. The current legal framework for management of occupational health in China.

No.	Main law, regulation, rule and standard related to occupational health	
1	Constitution of PRC	
2	1. Labor Law of PRC	
	2. Law for Prevention and Control of Occupational Disease of PRC	
	3. Law on Work Safety of PRC	
3	1. Regulations on Insurance for Work-Related Injuries	
	2. Regulations on Labor Protection for Using Toxic Substances in Workplaces	
	3. Regulations on Prevention and Control of Occupational Pneumoconiosis	
	4. Special Provisions on Labor Protection for Female Workers	
	5. Regulations on Coping with Public Health Affairs	
	6. Regulations on Safety and Protection of Radioisotopes and Radiation Devices	
	7. Interim Provision for Promoting Industrial Structure Adjustment	
	8. Other laws, etc.	
4	Rules on Occupational Health and Safety	1. Occupational Disease Classification and Catalogue
		2. Management Measures of Occupational Health Service Institutions
		3. Management Measures of Employers' Occupational Health Surveillance
		4. Management Measures of Diagnosis and Verification of Occupation Diseases
		5. Management Measures of Occupational Health "Three Simultaneousness" of Construction Projects
		6. Management Measures of Preventing Sunstroke
		7. Management Measures of the National Occupational Health Standards
		8. Classification of Occupational Health Hazards
		9. Reporting Measures of the Projects Entailing Occupational Health Hazards
		10. Provisions on Occupational Health Supervision and Administration in Workplaces
		11. Management Measures of Classification of Construction Projects with Occupational Health Hazards
		12. Other rules, etc.
	National Occupational Health Standards	1. Hygienic Standards for the Design of Industrial Enterprises (GBZ 1—2010)
		2. Occupational Exposure Limit for Hazardous Agents in the Workplace Part 1: Chemical Hazards (GBZ 2.1—2007)
		3. Occupational Exposure Limit for Hazardous Agents in the Workplace Part 2: Physical Hazards (GBZ 2.2—2007)
		4. General Guidelines for Diagnosis of Occupational Diseases (GBZ/T 265—2014)
		5. Specifications for Individual Monitoring of Occupational External Exposure (GBZ 128—2016)
		6. Diagnosis for Occupational Radiation Injuries of the Skin (GBZ 106—2016)
		7. Classification of Occupational Hazards at Workplaces Part 4: Occupational Exposure to Noise (GBZ/T 229.4—2012)
		8. Specifications for Drafting Diagnostic of Occupational Disease (GBZ/T 267—2015)
		9. Diagnosis of Occupational Pneumoconiosis (GBZ 70—2015)
		10. Occupational Health Standard for Fire Fighter (GBZ 221—2009)
		11. Terms for Diagnosis of Occupational Disease (GBZ/T 157—2009)
		12. Terms for occupational health (GBZ/T 224—2010)
		13. Criteria for Diagnosis of Occupational Infectious Disease (GBZ 227—2010)
		14. Guidelines for Employer of Prevention and Control of Occupational Diseases (GBZ/T 225—2010)
		15. Diagnosis of Occupational Cadmium Poisoning (GBZ 17—2015)
		16. Diagnosis of Occupational Fluorine and Inorganic Compound Poisoning (GBZ 5—2016)
		17. Specification for Estimation of Cumulative Exposure to Radon's Progeny for Miners (GBZ/T 270—2016)
		18. Criteria for Use and Preparedness for a Nuclear or Radiological Emergency (GBZ/T 271—2016)
		19. Testing Criteria of Personnel Dosimetry Performance for External Exposure (GBZ 207—2016)
		20. Other standards, etc.

Source: Information Database of China's Laws and Regulations (http: //law.npc.gov.cn/FLFG/) and Standardization Administration of PRC (http: //www.sac.gov.cn/).

Table only lists some of China's main national occupational health laws, regulations, rules and standards. In China, the national occupational health standards are divided into compulsory standards (GB) and recommendatory standards (GBZ); and industry standards related to occupational health, such as General Rules for Occupational Risk assessment (AQ/T 8008—2013) and Guidelines for the Pre-Evaluation of Occupational Hazards of Construction Projects (AQ/T 8009—2013), are not included.

ways, many occupational health laws, regulations and standards still need improvement, which is discussed in detail in Section 3 and Section 4.2.9.

3. Major Challenges of Occupational Health in China

At present, occupational disease prevention and control faces a series of challenges in China. According to the analysis of China's occupational health characteristics described in Section 2, and the latest government documents promoting occupational disease prevention and control in China's 13th FYP, including the National Plan for Occupational Disease Prevention and Control (2016-2020)[10] and the 13th FYP for Occupational Health Hazard Prevention and Control[11] seen in Table 4, we identify the following as major occupational health challenges in China's 13th FYP:

・A serious occupational disease burden remains for the large number of Chinese workers who are exposed to a wide variety of occupational diseases and health hazards in a number of industries. Occupational disease morbidity is quite high, with an estimated 30,000 new cases of occupational diseases each year, and this number continues to rise. Occupational disease cases arise from more than 30 industries, with the majority of cases arising from the coal mining, non-ferrous metals mining, chemical manufacturing, and construction industries.

・The accountability of employers for occupational health is not fully established. Because legal awareness remains poor among the major supervisors of some employers, the occupational health investments in improving work environments, providing workers with personal protective equipment, and implementing occupational health examinations to guarantee the occupational health of peasant- and dispatched workers is inadequate. Some enterprises still do not implement the occupational health "three simultaneousness" in construction projects, report occupational health hazards, or provide regular occupational health examinations, services, or training for workers exposed to hazardous conditions in accordance with the applicable laws.

・Occupational health supervision capacities are inadequate, and the supervising system is imperfect. First, there is a serious discrepancy between the lack of supervision and the numerous occupational health hazards. In some areas, there is an extreme lack of highly skilled occupational health supervision teams. Secondly, the responsibilities of government and industry management departments in the supervision and inspection of occupational health is not fully realized, and there is lax supervision of occupational safety and health supervision departments.

・New occupational health problems are constantly emerging, and coexist with traditional occupational health challenges. Long-standing occupational health problems (e.g. occupational pneumoconiosis and poisoning) have not been fully controlled, and new causal factors of occupational diseases are continually emerging as a result of new technologies, processes, equipment, materials, industries, environmental pollution, and other problems. For example, new chemicals such as quaternary ammonium compounds present new occupational health hazards. In summary, traditional and emerging occupational health hazards coexist in China, which makes occupational disease prevention and control more difficult.

・The transfer of occupational health hazards increases the difficulty of occupational disease prevention and control. Occupational health hazards have begun to spread from traditional industries (e.g. coal and non-ferrous metal mining) to new industries (e.g. computer and information technology, biology and medicine), from cities to the countryside, and from large enterprises to small and medium-sized enterprises. Firstly, the recent rise of new occupational diseases, such as carpal tunnel syndrome, cervical spondylosis, lumbar vertebrae disease, etc. are emerging with the rapid development of new industries. Secondly, this spread of occupational diseases towards rural and poor regions and small and medium sized enterprises poses difficult problems in consistently implementing occupational health standards.

・Peasant-workers are the primary group exposed to occupational health hazards. As a disadvantaged social group, peasant-workers are unlikely to receive adequate support to prevent occupational diseases. With the accelerating pace of urbanization in China, more and more peasants are seeking jobs in cities. According to relevant surveys, the number of peasant-workers in China reached 282 million by the end of 2016, an increase of 4.24 million from 2015[26], and about 60% of this population is employed in industries with high occupational health hazards[27]. In recent years, peasant-workers accounted for more than 80% of total occupational disease cases[27].

・Occupational diseases have become the major challenge for economic development and social harmony and stability. The International Labor Organization (ILO) pointed out that global economic losses caused by occupational diseases cost up to 1.25 trillion USD, accounting for about 4% of global GDP[27]. In 2016, China's GDP was the second highest in the world at approximately 11.33 trillion USD[28]. According to these ILO reports, China's economic losses due to occupational disease were 0.452 trillion USD in 2016, which is 11.6 times the GDP of Qinghai Province of China (0.0392 trillion USD) in 2016[29]. In addition, Chinese experts have estimated that occupational disease causes 100 billion RMB (Renminbi) in direct economic losses and 200 billion RMB in indirect economic losses each year[27]. This data demonstrates that occupational disease seriously damages China's economic development. Additionally, according to a study by Wang and Li[1], there is no doubt that occupational disease is becoming a prominent public health problem that

impacts social harmony and stability.

・The overall foundation of occupational health hazard prevention and control is currently weak. Collection of occupational health hazard information is incomplete, the framework of standards, regulations, scientific research, and technical support for occupational health requires optimization, the capacity to monitor occupational diseases and health hazards is insufficient, and there is a severe lack of occupational health professionals.

・There is a lack of occupational health awareness in China. Some local governments and enterprises do not fully understand the importance and urgency of occupational disease prevention and control, and there is insufficient investment in occupational health. Many employees, especially peasant-workers, are unaware of available resources for occupational disease prevention and control, and thus are unable to adequately protect their health and rights.

・At present, there is insufficient research and technical support for occupational health. The development and arrangement of health service institutions is not balanced, and China urgently needs to improve the availability and quality of occupational health services.

4. Goals and Tasks of Occupational Health in China

Maintaining occupational health is an important and inevitable task for constructing a harmonious, prosperous, and healthy society. China published the Plan for a Healthy China 2030 in 2016[13], which aims to provide health services to every citizen by 2030. Life expectancy is targeted to reach 79 years old, meeting the standard of high-income countries. Additionally, the plan clearly proposed that China should strengthen industry self-regulation, improve occupational health supervision, firmly establish employers' responsibilities, and focus on addressing the source of occupational hazards in order to effectively prevent and control occupational diseases.

In 2016 and 2017, China disseminated a series of important government documents to promote occupational disease prevention and control (shown in Table 4), including the National Plan for Occupational Disease Prevention and Control (2016-2020)[10] and the 13th FYP for Occupational Health Hazard Prevention and Control[11]. This section briefly introduces the occupational health goals and future tasks necessary to address economic and social development demands and meet the emerging occupational health concerns and suggestions in the latest government documents during China's 13th FYP period.

4.1 Main goals

The National Plan for Occupational Disease Prevention and Control (2016-2020)[10] and the 13th FYP for Occupational Health Hazard Prevention and Control[11] aims to significantly improve the capability of employers to prevent and control occupational health hazards and provide occupational health supervision by 2020. The performance targets to be reached by the end of 2020 are given in Table 6.

4.2 Future tasks

Future tasks according to The National Plan for Occupational Disease Prevention and Control (2016-2020)[10], the 13th FYP for Occupational Health Hazard Prevention and Control[11], and the 13th FYP for Work Safety[14] will cover the following topics, which include plans to add employer and regulatory levels of occupational health management to current technology-dominated approaches.

4.2.1 Focus on the control of occupational diseases at the hazard source

China will need to focus on the control of occupational diseases at the source. Viable strategies to achieve this goal include:

(1) Conducting a nation-wide investigation of occupational health hazards to acquire fundamental information about employers, areas, industries, jobs, and social groups exposed to occupational health hazards.

(2) Establishing management systems to eliminate or limit the use of outdated technologies, archaic techniques, and obsolete equipment or materials that present serious occupational health hazards in favor of new and safer technologies, materials, techniques, and equipment.

(3) Implementing special occupational disease prevention and control measures by focusing on occupational pneumoconiosis and poisoning in high-risk industries such as coal mining, non-ferrous metal mining, metallurgy, construction, and chemical manufacturing.

(4) Strictly addressing occupational health hazards the source, and promoting technological upgrades of employers with serious hazards.

(5) Strengthening the prevention and control of occupational health hazards in the workplace, including the strategic targeting of high-risk dusts and highly toxic substances (described in Table 7).

(6) Taking actions to assist and support occupational disease prevention and control, including exploring ways to provide a public welfare platform to help micro, small, and medium-sized employers prevent and control occupational diseases.

(7) Strengthening the identification, evaluation, and control of new occupational health hazards.

4.2.2 Strengthen employer responsibility for occupational health

Countermeasures to increase employers' occupational health responsibilities need to be established and implemented, and include the following:

(1) Supervising, inspecting, and pushing employers with serious occupational health hazards to establish a responsibility system for occupational disease prevention

Table 6. 13th FYP goals for occupational health in China.

No.	Goal	Specific target
1	To implement employers' occupational health responsibilities	• The report rate of projects with occupational health hazards will reach more than 85% of employers in main industries. • The coverage rate of occupational health supervision and employer inspections in main industries will reach more than 80%. • The regular detection rate of occupational hazards in workplaces will reach more than 80%. • The occupational health examination rate of workers exposed to occupational hazards will reach more than 90%. • The occupational health training rate of the major supervisors and occupational health of employers will reach more than 95%. • The personal dose monitoring rate of radiation workers in medical and health institutions will reach more than 90%.
2	To build a sound system for occupational disease prevention and control	• To set up a perfect joint meeting system of occupational disease prevention and control at province, city, and county levels. • There is at least one medical and health institution undertaking the work of occupational disease diagnosis in a city with subordinate districts. • There is at least one medical and health institution undertaking the work of occupational disease diagnosis in a county. • To build the perfect occupational health service network and the perfect occupational health supervision network. • To train all occupational health supervision personnel.
3	To improve the capability of occupational disease monitoring	• To perfect the occupational disease monitoring network. • The coverage rate of the county and district carrying out the monitoring of main occupational diseases will reach 90%. • To improve the quality of occupational disease reports. • The reporting rate of occupational disease diagnosis institutions will reach 90%. • To preliminarily establish an occupational disease prevention and control information system. • To achieve occupational health information sharing among occupational health management departments.
4	To protect the health rights and health interests of workers	• The coverage rate of workers with industrial injury insurance will reach more than 80%. • To assure the effective coordination between occupational injury insurance and basic medical insurance, critical illness insurance, and medical assistance to reduce the medical expenditures of patients with occupational disease and their families.
5	To accomplish six major national projects related to occupational health	• Thorough investigation of the basic information on occupational health hazards. • A training project for occupational safety and health supervision. • Creation of a pilot project for prevention and control of dusts and poisonous substances. • The project for comprehensive prevention and control of coal dust. • The research and development project for technology and equipment to improve occupational health hazard prevention and control in labor-intensive industrial enterprises. • The comprehensive platform construction project for the prevention and control of occupational health hazards.

Table 7. Focuses of the future prevention and control of occupational health hazards in China.

Focus	Specific focus
Main industries	Mining, chemical, metal smelting, ceramic production, refractory materials and electronic manufacturing.
Main operations	Mining, crushing, burnishing, welding, spraying, brushing and plating.
Main factors	Coal dust, rock dust, asbestos dust, silica dust, benzene, n-hexane and dichloroethane.

Source: 13th FYP for Work Safety (General Office of the State Council of PRC, 2017).

and control.

(2) Promoting the establishment of occupational health management departments in private enterprises, and ensuring these full- or part-time occupational health managers and professionals are trained and equipped to meet the standards of the new laws.

(3) Providing guidance to employers to enable them to occupy the primary role in occupational disease prevention and control, and to fulfill their legal obligations to guarantee workers' health through the exchange of occupational health experiences, the creation of occupational health demonstration resources, or other means.

(4) Helping employers carry out targeted occupational health training, and improving the occupational health awareness of supervisors, managers, and workers.

(5) Supervising, inspecting, and urging employers to implement the system of occupational health "three simultaneousness" of construction projects, and strengthening pre-evaluation of occupational health hazards and evaluation of the effects of health hazard control through occupational health protection facilities in the project construction.

(6) Improving the work environment, reporting, daily monitoring, and regular detection of occupational health hazards in workplaces and the management of personal protective equipment. This includes strictly implementing protocols for announcing detection results and protection measures for occupational health hazards, and displaying warning signs and messages in workplaces with serious hazards.

(7) Guiding employers in incorporating the occupational health infrastructure into standardized work safety protocols, establishing or perfecting occupational health surveillance systems, organizing and arranging occupational health examinations for workers, and actively cooperating with government departments to provide occupational disease diagnoses and appraisals.

(8) Helping enterprises optimize systems for occupational health surveillance and records management, and promoting adoption of the occupational health supervisor system in enterprises in main industries.

4.2.3 Strengthen occupational health supervision and law-enforcement

China will need to increase the intensity of regulatory supervision, administration, and law-enforcement related to occupational health. To achieve this goal, the following strategies are proposed:

(1) Strengthening the construction of occupational health supervision and administration frameworks, and improving the overall quality of occupational health supervision teams.

(2) Vigorously improving primary occupational health supervision, especially in counties and townships.

(3) Performing occupational health supervision duties according to the law, and urging employers to strengthen occupational health management for groups at high risk for occupational disease, such as peasant- and dispatched workers.

(4) Expanding the coverage of occupational health supervision and inspection. This includes strengthening the supervision and inspection of industries, enterprises, and construction projects with serious occupational health hazards; and increasing access to institutions providing occupational health services, disease diagnoses, and examinations.

(5) Ceasing or closing high-risk operations in accordance with the law.

(6) Establishing a "blacklist" for employers and occupational health service institutions that fail to meet safety guidelines, and regularly report it to the public and notify the relevant departments.

(7) Emphasizing the key role of industry organizations in occupational health supervision.

4.2.4 Improve occupational health services

In order to effectively improve occupational health services, the following strategies are proposed:

(1) Perfecting the occupational health service network by improving the occupational health infrastructure according to the principle of proper distribution of occupational health services, and defining the distribution, scale, function, and number of occupational health service institutions.

(2) Effectively involve disease control and prevention agencies, occupational health research institutes, general hospitals, and specialized hospitals in occupational disease prevention and control (such as occupational health examinations, and disease diagnosis, monitoring and evaluation) with the goal of establishing mechanisms for cooperative participation in occupational health services.

(3) Gradually guiding all medical institutions to participate in occupational health management and occupational health promotion.

(4) Using the reduction of occupational pneumoconiosis in peasant-workers as an opportunity to simplify occupational disease diagnosis procedures, optimize occupational health service flow-charts, and improve the quality of occupational health services.

(5) Increasing investment in occupational health, with a focus on improving the level of emergency treatment for occupational poisonings and nuclear radiation.

(6) Attempting to meet the varied occupational health service demands of workers and employers at all levels through positively mobilizing social participation in occupational health services, increasing the supply of services, and innovation.

(7) Establishing a public information system to grade occupational health service agencies and provide information about occupational health services. The goal of this system is to provide a mechanism to evaluate, award, and punish the performance of occupational health service

agencies, and promote the construction of an occupational health service credit system.

(8) Cultivating of inter-disciplinary approaches related to the clinical and public health.

4.2.5 Implement measures related to occupational health assistance and care

To provide effective occupational health assistance and patient care, China will need to take measures which include:

(1) Standardizing employer management of labor and employees and development of labor contracts according to relevant laws, and using appropriate supervision to encourage employers to define occupational health concerns such as worker protection, working conditions, and the prevention and control of occupational health hazards.

(2) Implementing a system of equal consultation and collective contracts related to occupational safety and health in key industries, and using appropriate supervision to encourage both employees and employers to earnestly implement their occupational health responsibilities, especially in private enterprises.

(3) Supervising and urging employers to pay occupational injury insurance premiums on schedule and in full, and establishing and implementing a system of floating industrial injury insurance rates according to the severity of occupational health hazards.

(4) Ensuring effective coordination between occupational injury insurance, basic medical insurance, critical illness insurance, medical assistance, social charity and commercial insurance; and ensuring that qualified patients with occupational diseases have timely access to treatment through critical illness insurance and medical assistance programs to reduce their medical expenditures in accordance with regulations.

(5) Providing qualified families of patients with occupational disease (e.g. occupational pneumoconiosis) with the minimum living standard guarantee, and giving timely assistance to patients and their families experiencing difficulties in their life as stipulated by the relevant laws.

4.2.6 Promote the capacity for information exchange in occupational health management

To improve the capacity for information exchange in occupational health management China will need to make efforts in these seven areas:

(1) Improving occupational health hazard program reports, and constructing a systematic and highly efficient mechanism for the supervision and management of occupational health information to promote openness and transparency.

(2) Building a complete network for monitoring, reporting, and managing the main occupational diseases and health hazards, including a national big data platform for occupational health.

(3) Continuously and systematically collect information related to the main occupational diseases and health hazards through health monitoring and investigation.

(4) Standardizing information management in occupational disease reports to collect occupational health information more quickly, accurately and completely.

(5) Recognizing characteristics and trends of the main occupational diseases and high-risk industries through frequent health risk assessments.

(6) Encouraging the sharing and use of information among different occupational health management departments, and promoting the timely exchange of occupational health information with employers.

(7) Incorporating occupational health into the national health protection information exchange project, and making full use of new information management technologies (e.g. Internet, big data, cloud computing) in occupational disease prevention and control.

4.2.7 Strengthen occupational health education and publicity

In order to improve the social awareness of occupational disease prevention and control, China will need to take measures to strengthen and publicize occupational health education, which include:

(1) Making full use of the authority and influence of the mainstream media (e.g. TV, newspapers) and the convenience of the new media (e.g. WeChat) to mobilize national participation in occupational health education and promotion programs, and widely disseminate the laws, regulations, and standards related to occupational health and education.

(2) Actively using the Law on Prevention and Control of Occupational Disease national publicity week (the last week of April each year) to develop activities to promote occupational health information and education, and improving the pertinence and effectiveness of occupational health publicity programs.

(3) Supervising and urging employers to pay attention to the occupational health education and training at workplaces.

(4) Developing a cultural atmosphere and environment conducive to occupational health by conducting pilot projects for promoting occupational health and building new health enterprises.

(5) Updating occupational health promotion materials to address emerging occupational health problems due to industrial transformation and technological progress.

4.2.8 Attach importance to occupational health research and its application

Improving occupational health research and its application is another strategy to prevent and control occupational hazards. The following strategies should be implemented to achieve this goal:

(1) Encouraging and supporting basic research on occupational diseases (e.g. the pathogenesis of occupational diseases, early occupational health effects, new occupational hazards, the occupational disease burden, or epide-

miological investigations of specific social groups and industries) in order to develop effective occupational health policies.

(2) Developing technologies to prevent and control occupational pneumoconiosis, occupational poisoning, noise-induced hearing loss, and occupational radiation-induced diseases; and technologies to rapidly detect dust and hazardous chemicals.

(3) Accelerating the application of research achievements related in occupational health, and encouraging the rapid adoption of new technologies, techniques, equipment, and materials that improve occupational health.

(4) Strengthening international cooperation to promote occupational health, and incorporating advances in science and technology and successful intervention programs from around the world.

(5) Promoting institutions of higher education to strengthen the occupational health discipline, and cultivate the necessary talent to meet the demands of occupational health services.

4.2.9 Improve and refine the laws, regulations and standards related to occupational health

China will need to promote the legal framework of occupational health. To achieve this goal, the following important tasks will need to be completed:

(1) Further optimizing the laws and regulations addressing occupational health, especially for operations with high-risk dust and highly toxic substances, and developing legal systems for occupational risk assessment, occupational health examination, and disease diagnosis and appraisal.

(2) Establishing norms and standards for occupational disease reporting and health management.

(3) Perfecting the technical protocols for monitoring the main occupational diseases, occupational radiation-induced diseases, and risk assessment.

(4) Improving the national occupational health standards and guidelines for employer prevention and control of occupational health hazards, the occupational health protections for individuals, occupational health surveillance, occupational disease diagnosis, etc.

(5) Exploring the possibility of a registered occupational health engineer system, bringing occupational health into the region's economic and social development plans, developing a joint occupational health meeting system, and improving the accountability system for occupational health.

4.2.10 Strengthen occupational pneumoconiosis prevention and control in peasant-workers

Peasant-workers have become the main group of industrial workers in China, and make enormous contributions to economic and social development. The Chinese government has always attached great importance to the occupational health of peasant-workers; however, occupational diseases, especially occupational pneumoconiosis, are not being effectively prevented and controlled in this population. This could be due to employers failing to fulfill their occupational health responsibilities, inadequate occupational health surveillance, and poor awareness of the occupational protections and rights of among peasant-workers. In order to effectively address the occupational health problems of peasant-workers, ten ministries (including the NHFPC of PRC, the National Development and Reform Commission of PRC, and SAWS) jointly issued the Opinions on Strengthening Occupational Pneumoconiosis Prevention and Control in Peasant-Workers[30] on January 8th, 2016. This document listed seven major tasks for occupational pneumoconiosis prevention and control of peasant-workers in the future, which are as follows:

(1) Focusing on occupational pneumoconiosis control in peasant-workers at the hazard source (e.g. fulfilling employers' responsibility of dust prevention and control);

(2) Vigorously promoting occupational health examinations of peasant-workers;

(3) Effectively diagnosing, identifying, and treating occupational pneumoconiosis;

(4) Guaranteeing that peasant-workers can access injury insurance benefits;

(5) Effectively addressing the medical and life problems of extremely poor peasant-workers with occupational pneumoconiosis;

(6) Harnessing all available resources to safeguard the occupational health rights and interests of peasant-workers with occupational pneumoconiosis; and

(7) Comprehensively strengthening the government's responsibility for the occupational health of peasant-workers (e.g. putting occupational pneumoconiosis prevention and control in peasant-workers into local economic and social development plans, and plans for local occupational disease prevention and control).

4.2.11 Actively implement and propagate the latest Law of PRC on Occupational Disease Prevention and Control

The Law of PRC on Occupational Disease Prevention and Control was issued in 2001, and amended in 2011. Five years later, the second amendment were adopted in 2016. There are four remarkable changes in the second revised edition compared to the first revised edition. The first is the classification of construction projects. Construction projects are divided into two categories, comprising general construction projects, and construction of medical institutions that may cause radioactive occupational disease hazards. The second change is the decentralization or cancellation of administrative examination and approval, causing different projects to be treated differently. The third change is the increased supervision of occupational hazards in construction projects. The forth change is the strengthening of occupational health management, such as the further optimization of the occupational health supervision system, and the increase in em-

ployers' responsibility for occupational health. The new Law of PRC on Occupational Disease Prevention and Control signifies the Chinese government's commitment to improving the workplace environment and eradicating preventable occupational diseases. However, the effectiveness of the new regulations will depend not only on implementation but also on communication and education. Therefore, actively implementing and publicizing the new law is an important occupational health task for the future.

Acknowledgments: This study is supported by the Key Project of the National Natural Science Foundation of China (No. 51534008) and Fundamental Research Funds for the Central Universities of Central South University. 2018 Graduate Student Research Innovation Project of Hunan Province.

Conflict of interest: None.

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