

Field Study

Basic Occupational Health Services in Baoan, China

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Abstract: Basic Occupational Health Services in Baoan, China: Yongwen CHEN, et al. Center for Disease Control and Prevention of Baoan, P.R. China—Objectives: The aim of the study was to develop a model of basic occupational health services (BOHS) in Baoan, which could provide occupational health services (OHS) universally for workers and control occupational hazards. **Methods:** Steps involved in the BOHS strategy included construction of the BOHS system, capacity building, health training and education, surveillance of workplaces and the health of workers, risk assessment, control and evaluation processes. **Results:** This model provided BOHS to employees universally, especially migrant workers in small- and medium-sized enterprises (SMEs) who had been underserved. It expanded the coverage of OHS and improved their content. The knowledge and recognition rate of occupational diseases, the coverage rates of working places and workers rose significantly after three years development. Furthermore, BOHS were cost-effective and accepted by both employers and employees. **Conclusions:** Our experience suggests that a BOHS strategy might be a feasible and effective way of protecting the health of workers confronted with occupational hazards.

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Key words: Basic occupational health services, Migrant workers, Occupational health, Small- and medium-sized enterprises, Surveillance

Along with economic globalization, occupational health services (OHS) have become more diverse and more difficult to organize, because workplaces and jobs have become more unstable. Over 80% of workers

worldwide have no access to OHS. The coverage of OHS is diminishing due to insufficient human resources and finances, even though the need for services has increased rather than declined. The concept of basic occupational health services (BOHS) was proposed as a strategy for expanding substantially the global coverage of services by the World Health Organization and the International Labor Office in 2003¹⁾. BOHS are essential services for the health of workers, and they aim to provide services for all workers regardless of the size of the factory and the type of economy^{2,3)}. The services are mainly provided for small- and medium-sized enterprises (SMEs) and workers in the informal sector, as well as self-employed persons, through a primary health care approach.

Baoan is a district of Guangdong Province in Southern China. In the last 30 yr of economic reform and modernization, it has undergone a dramatic transformation from a rural village to an industrialized city, which is home to more than ten thousand factories employing millions of migrant workers. Most of the factories are SMEs, which are characterized in China as hiring less than 2,000 workers with annual revenue lower than 300 million RMB or total assets lower than 400 million RMB (1 RMB=0.146 USD). The transformation has led to a tremendous growth in the challenges presented by occupational health problems, such as large numbers of hazardous industries and unsafe workplaces. Few workers in Baoan had access to OHS at the beginning of the 2000s.

To protect the health of workers and maintain the harmony of society, Baoan has explored a model of BOHS in the last three years with the support of the Ministry of Health of the People's Republic of China. This paper reports on how the BOHS program was developed and implemented in Baoan, and shows the feasibility and effectiveness of the program. This paper might contribute to the development of the theory and practice of BOHS, by demonstrating how the concept of BOHS has been implemented in real life.

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Table 1. Baoan's gross domestic product by sector, 2005–2007*

Sector	2005 (USD billions)	2006 (USD billions)	2007 (USD billions)
Agriculture	0.07	0.05	0.04
Manufacturing	10.05	14.41	17.29
Construction	0.35	0.45	0.56
Services	6.56	7.34	8.90
Total	17.04	22.25	26.79

*: The data came from the Baoan government.

Table 2. Summary of the leading occupational hazards in Baoan

Occupational hazards	Number of factories	Number of workers	Number of exposed workers
Toluene	2,323	596,552	58,102
Noise	1,731	392,297	50,723
Dust	977	146,575	21,559
<i>n</i> -Hexane	934	282,788	14,602
Lead and its compounds	674	196,947	16,214
Trichloroethylene	410	71,416	1,616
Xylene	307	130,075	8,404
Benzene	107	30,789	972
Trichloromethane	58	15,318	297
Dichloroethane	9	3,113	67

Subjects and Methods

The basic conditions of OHS in Baoan

By the end of 2008, there were 2.3 million workers in Baoan, most of them were migrant workers who were employed by 11,200 factories. The gross domestic product by sector from 2005 up to 2007 is summarized in Table 1. The share of manufacturing accounted for more than a half of total gross domestic product in Baoan. The major products were electrical machinery and equipment and parts, sound recorders and clothes. The main occupations were machine operators and product line operators. As shown in Table 2, the most frequent occupational hazards in these factories were organic solvents, noise and dust. The most common organic solvents were toluene and *n*-hexane.

There are about 250 million migrant workers in China, who were originally farmers. Most of the migrant workers are employed by SMEs. Workers engaged in SMEs and the informal sector have few chances to receive OHS. According to Chinese government data, 13,744 cases of occupational diseases were reported in 2008, and more than a half of these cases worked in SMEs. To protect the health of the workers and develop models of OHS, Baoan, a district with almost 2.3 million migrant workers, was supported by the Ministry of Health to launch a pilot

study of BOHS.

In the last ten years, the need for OHS in Baoan has increased dramatically, as more and more factories were built and a large amount of migrant workers came to Baoan. However, the coverage of OHS reached just 12.3% in 2001 according to our survey, which was low, as in other areas in China^{4, 5}. The reasons for the low coverage were fourfold. The first was that the managers and workers of factories were originally farmers who were little educated and unaware of the occupational hazards of the materials they used. Second, it was impossible for the factories to provide OHS for the workers by themselves. Because most factories were SMEs, they could not provide in-company OHS like big companies. Third, the government could not offer the services to all workers due to a lack of professional staff and finances. Fourth, there was a large informal sector in Baoan, and the informal sector workers were exposed to occupational hazards without access to OHS.

The BOHS system in Baoan

To achieve a wide coverage of BOHS, we developed a three-level occupational health system which provided services through the primary health care approach. This system was led by a government group. The group members included the district governor, leaders of the

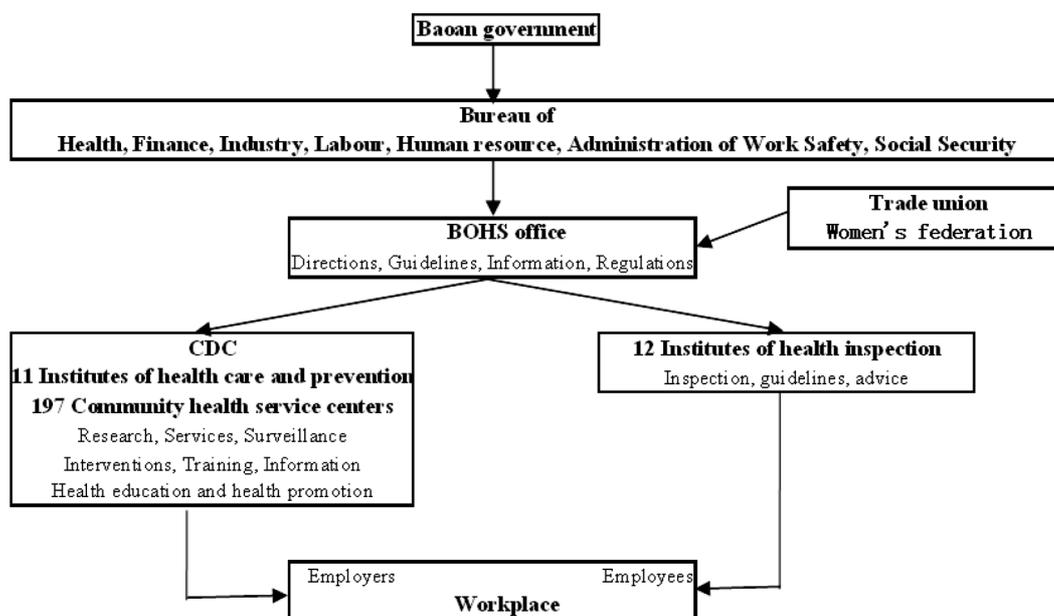


Fig. 1. The BOHS system in Baoan, integrated in the primary health care system.

Table 3. Target groups and contents of services of the BOHS three-level system

Administrative level	Target group	Content
Upper	Workers exposed to serious occupational hazards	Occupational health examination, surveillance of the working environment, dealing with the major occupational health accidents, risk control and assessment
Intermediate	Workers not exposed to serious occupational hazards	Occupational health examination, general health examination, surveillance of the working environment, health training and education
Lowest	All workers	General health examination, first aid services, health training and education

Bureau of Health and other government offices, such as the Bureau of Finance and the Bureau of Industry. The primary function of this group was to make arrangements to secure the health of people at work. The group was also responsible for ensuring enough human resources and financial support to guarantee the BOHS system was running smoothly. The BOHS office advised and assisted the government group in its functions (Fig. 1).

Baoan district was divided into towns, and the towns were subdivided into communities. In our primary health care system, the Baoan district had a Center for Disease Control and Prevention (CDC), every town had an institute of health care and prevention and every community had at least one health service center. By the end of 2008, there were altogether 1 CDC, 11 institutes of health care and prevention and 167 community health service centers in Baoan. To integrate with the primary health care system, the BOHS three-level system has a

similar structure to the district CDC, town institutes of health care and prevention and community health service centers. The target groups and contents of services of the three-level system are summarized in Table 3. The system's upper administrative level is the CDC of Baoan district. The main function of this system is to deal with major occupational health accidents and provide BOHS for workers in workplaces with serious occupational hazards, such as lead and benzene, which are defined by the regulation⁶⁾. It also has a duty to provide information, advice and training for BOHS personnel.

The intermediate administrative level is made up of the institutes of health care and prevention in the towns of Baoan. The responsibilities of these institutes include surveillance of the work environment and the health of workers, proposing prevention and control actions for the elimination of health hazards, record keeping and health training for workers.

The lowest administrative level consists of community health service centers. These centers are mainly responsible for providing first aid services, general health services, occupational health education and health promotion. The physicians and nurses of these centers also work as sentinels for the detection and control of occupational diseases. They always check on sick workers earliest, whether the workers are suffering from occupational diseases or not. When they judge that the symptoms of the sick workers might be associated with work, they report to the institutes of health care and prevention as soon as possible. Then the institutes of health care and prevention investigate these cases to decide whether the cases are caused by the work environment.

Occupational health training and education

To promote the awareness of occupational health, much attention was paid to training and educating employers and employees. They were trained and educated at least once a year. We first brought together the employers or the managers of the factories at a meeting. At this meeting, they were trained in BOHS principles. These principles included the following aspects:

1. Employers are responsible for the occupational health of the workplace.
2. Employers must educate workers about occupational hazards at work.
3. Workplaces should be monitored and evaluated for occupational hazards once a year. Workers should have legally prescribed health examinations.

After the meeting, the occupational health staff went to the factories one by one to promote health education. In the factories, we mainly trained the employers or the managers on ways to educate workers on healthy work practices. They were also handed flipcharts and other visual aids to improve their occupational health skills.

The employers and employees were told about information on occupational hazards related to their production processes and skills for protecting themselves from these hazards. Warning boards were posted at every hazardous workplace. The content of the boards included the name, dangers and preventive methods of the specific hazard existing in the workplace. For instance, the warning board posted at a noisy workplace highlighted that noise could cause hearing loss and that workers should wear earplugs at work. During our educational program, workers were notified that they had the following rights:

1. To receive occupational health education.
2. To receive information about occupational hazards in the workplace.
3. To receive access occupational health services.

Surveillance of the health of the workers

There were two types of health examination for the

workers. One was the general health examination, the other was the occupational health examination. The general health examination for the workers who were not exposed to occupational hazards was carried out once a year by the institutes of health care and prevention or by community health service centers. For the workers exposed to the occupational hazards listed in legislation, the occupational health examinations, including pre-employment, periodic and pre-departure examinations, were executed by CDC or the institutes of health care and prevention. These health examinations were all carried out according to the relevant regulations once a year or every two years⁷⁾.

On completion of health examinations, the physicians would draw conclusions indicating fitness for the job. The authority, the employers and the employees would be notified if an occupational disease or a medical contraindication was detected in the process of a health examination. According to the law, workers suffering from occupational diseases were sent to specialized occupational medical clinics for treatment under the supervision of the authority. They would also get financial compensation for the occupational disease. For a worker with a contraindication, the authority and the employer would collaborate to find alternative employment to avoid exposure to occupational hazards.

Surveillance of the working environment

Working environment surveillance was one of the key elements of BOHS. The surveillance was carried out once a year by CDC and the institutes of health care and prevention. The surveillance team was usually made up of two occupational hygienists and representatives of the factories. The team first walked through the workplaces to identify hazardous exposures, such as physical and chemical hazards, affecting the health of the workers. The team was in charge of assessing the levels of the exposures, the assessment of sanitary installations and personal protective equipments and providing guidance and advice on modifications to the working environment. If the level of the exposure exceeded the national performance standards, the team would not only provide guidance and advice, but would also report the data to the authority. Then, the authority would order the factory to rectify and improve the environment of the workplaces within a prescribed time limit.

Risk control and assessment

We made risk control and assessments in large factories and factories where occupational accidents happened. This job was carried out by CDC. In short, occupational health hazards were identified in the factories, then risks resulting from the hazards were analyzed, evaluated, treated and reviewed. To manage the risks, usually more than one control measure was adopted. For example, the

Table 4. Summary of the awareness of occupational health among the interviewees between 2006 and 2008

Part	Workers (N=4,500)		Managers (N=150)	
	2006 (N (%))	2008 (N (%))	2006 (N (%))	2008 (N (%))
Understanding the law and regulation	2,136 (47.4)	4,236 (94.1)*	103 (68.7)	146 (97.3)*
Knowing the workplace hazards and their dangers	1,987 (44.2)	3,972 (88.2)*	82 (54.6)	143 (95.3)*
Correct use of personal protective equipment	1,467 (32.6)	4,296 (95.5)*	67 (44.7)	139 (92.7)*
Knowing ways to get OHS and complain to authority	1,039 (23.1)	4,157 (92.3)*	42 (28.0)	142 (94.7)*
Grasping skills about training others in OHS	276 (6.1)	2,723 (60.5)*	21 (14.0)	129 (86.0)*

*: $p < 0.01$, Chi-square tests for comparison between 2006 and 2008. The matching of companies was not considered because some different companies responded to surveys in 2006 and 2008.

risk level of benzene poisoning was determined to be at a high level in a printing factory after a risk surveillance and evaluation. To avoid the risk, benzene was substituted with industrial alcohol, workers were told to wear masks and gloves and a fume cupboard was set up to enhance the ventilation. After these control measures were taken, we reviewed their effectiveness and drew conclusions about the risk control measures.

Inspection of occupational health

The Occupational Diseases Prevention and Control Act of the People's Republic of China, which was brought into effect on May 1st, 2002, was enforced by the institutes of health inspection. The enforcement mainly took place as a preventive inspection to secure compliance with the law and standards. The inspection visits could be triggered by a complaint from employee or relevant information from the public or the government. If the employer violated the law, he or she would receive a warning and improvement or prohibition notices. For serious offences, a maximum fine of 500,000 RMB could be imposed or prosecution in the criminal law courts.

Human resources and financial support

There were altogether 615 professionals appointed as occupational health personnel in Baoan by the end of 2008. Among them, 218 professionals worked full-time in CDC and the institutes of health care and prevention and 397 professionals worked part-time in community health service centers. Almost all full-time professionals were graduates who undertook one-year professional training following recruitment. They also had access to mid-career training to keep them well-qualified. The part-time professionals were all physicians and nurses. They were trained in OHS by CDC and the institutes of health care and prevention.

The employers and the government share the burden of BOHS together, like in other countries⁸). The employers took responsibility for the surveillance of workers' health and working environment according to

the law⁹). BOHS training, education and the relevant instruments were provided by the government. The government also offered free BOHS to workers who were self-employed or worked in informal factories.

The evaluation of BOHS

We randomly selected 150 factories with occupational hazards, one manager and 30 workers were enrolled in our survey in every factory. In 2006 and 2008, each participant was given an occupational health knowledge assessment questionnaire to collect demographic information and information on knowledge and problem-solving skills in occupational health. The questionnaire included five parts: understanding the law and regulation, knowing the workplace hazards and their dangers, correctly using the personal protective equipment, knowing ways to get OHS and to complain to authority, and grasping skills about training others in OHS. There were 10 questions in each part. If the interviewee answered more than 40 questions (8 questions for every part) correctly, he or she would be considered to be aware of the knowledge of occupational health. Questions left unanswered were considered as being answered incorrectly. The information on the number of workers and factories covered by BOHS was compiled from our statistics. The chi-square test was used to compare the awareness rate of occupational health of the interviewees between 2006 and 2008.

Results

The comparison between 2006 and 2008 showed that the knowledge and recognition rate of occupational diseases increased significantly. There were 69 questionnaires having missing data in our survey. Among the 150 managers and 4,500 workers, only 66 managers and 1,347 workers were aware of the knowledge of occupational health in 2006. While in 2008, the number of managers and workers had reached 143 and 4,043, respectively. The awareness rate also rose in each part of the questionnaire (Table 4).

In 2006, there were 10,600 factories and 2.1 million workers in Baoan. The number of factories covered by OHS was 3,700, and the number of workers receiving health surveillance was 610,000. In 2008, BOHS covered 9,200 factories and 1.9 million workers out of 11,200 factories and 2.3 million workers. The coverage rate of factories increased from 35% in 2006 to 82% in 2008. The coverage rate of workers with health surveillance increased from 29% to 81%.

Our survey showed that BOHS are feasible, accepted and affordable for the employers. According to our estimation, employers spent just 200 RMB for each worker on occupational health per year to avoid the loss of 3,000 RMB caused by occupational diseases per year. We assumed that one worker suffered from an occupational disease in a factory hiring 100 workers. The loss to the factory was 300,000 RMB, including the fine and the compensation. However, the expenditure for BOHS was only 20,000 RMB, including the health surveillance and the working environment surveillance. The loss and the expenditure were estimated from our experiences. The employers find BOHS are cost-effective, so they are willing to ask for BOHS for their workers.

Discussion

To provide OHS for the employees in Baoan, a series of measures were taken. These measures have been proved to be effective and accepted by society, including the government, employers and employees. Though the BOHS system was adaptable to Baoan's economic and social development, it was not perfect because the services could not cover all workers. We found it difficult to cover the workers who changed their workplaces and jobs frequently. Such workers changed jobs three or more times a year. How to provide OHS to these workers remains to be further investigated.

It is indispensable to integrate occupational health with a primary health care system to provide universal BOHS. To build up a new system providing OHS independent of the primary health care system is probably the best solution but it is rather optimistic to expect realization in the short run. Society and the government do not yet have enough funds and human resources to develop such a system. With the help of the primary health care system, we trained physicians and nurses in primary health care in occupational health and got them involved in the BOHS system, rather than hiring new staff for BOHS. We found the physicians and nurses grasped the knowledge of occupational health more easily than other people, because they had majored in medicine or nursing.

The development of OHS was divided into four stages: the starting level (Stage I), BOHS (Stage II), international standard services (Stage III), comprehensive OHS (Stage IV)²⁾. Part of our OHS, including the services provided

by the community health service centers, were BOHS, because the service infrastructure was primary health care structure. Others belonged to international standard services (Stage III), such as surveillance and risk assessment, as the services were provided by trained occupational health experts according to national regulation.

We made great efforts to improve the awareness of occupational health among employers and employees. After the popularization of occupational health, employers realized that the protection of workers' health was not only their obligation but also their social responsibility. They no longer thought providing BOHS for workers was nothing but an economic burden. The workers learned which kinds of occupational hazard they were exposed to and how to protect themselves from hazards. They wore personal protective equipments actively, not thinking these equipments were useless and inconvenient. Measures were also taken to make BOHS affordable to the factories. BOHS were supported and sponsored by the government in Baoan, so employers only needed to be responsible for a part of the cost of BOHS. In our survey, most SMEs had the financial ability to provide BOHS for their employees.

As BOHS measures performed their function of protecting the health of workers, their social and economic benefits attracted the attention of both the government and employers. The benefits also motivated the government and employers to improve BOHS and regulation. Thus, our BOHS system runs smoothly and effectively and is sustainable. In the future, we propose to develop not only the primary health care services model but other models, for instance, group services organized jointly by SMEs, to expand the coverage of BOHS.

In summary, the BOHS system in Baoan has proved to be an effective way of providing BOHS for workers in SMEs. It is integrated with the primary health care approach, with support from the government and involves both employers and employees. Our BOHS model can point the way to the expansion of the coverage of OHS for workers in SMEs, although it needs further development to improve the content and expand the coverage.

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References

- 1) International Labor Office. Thirteenth session of the Joint ILO/WHO Committee on Occupational Health; Dec 9–12 2003: Summary Report JCOH/2003/D.4. Geneva: ILO; 2003.
- 2) Rantanen J. Basic occupational health services: A

- WHO/ILO/ICOH/FIOH guideline. 3rd ed. Helsinki (Finland): Finnish Institute of Occupational Health; 2007.
- 3) World Health Organization. Workers' health: Draft global plan of action. 120th session, executive board. Geneva: WHO; 2007.
 - 4) Zhi S, Sheng W, Levine SP. National Occupational Health Service policies and programs for workers in small-scale industries in China. *AIHAJ* 2000; 61: 842–9.
 - 5) Wei L, Shi-Da W. Occupational health management and service for small-scale industries in Shanghai. *Toxicology* 2004; 198: 55–61.
 - 6) Ministry of Health of People's Republic of China. The categorized administrative measures of occupational diseases for the construction project. Beijing: MOH of PRC; 2006.
 - 7) Ministry of Health of People's Republic of China. Technical specifications for occupational health surveillance. Beijing: MOH of PRC; 2007.
 - 8) Vanhoorne MN, Vanachter OV, De Ridder MP. Occupational health care for the 21st century: From health at work to workers' health. *Int J Occup Environ Health* 2006; 12: 278–85.
 - 9) Su Z. Occupational health and safety legislation and implementation in China. *Int J Occup Environ Health* 2003; 9: 302–8.