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Cover Photo: Local CDC staff are making field epidemiological investigation.

Preplanned Studies

Occupational Stress and Risk Factors Among Workers from Electronic Manufacturing Service Companies in China

Jin Wang[1]; Xiaoman Liu[1]; Tao Li[1]; Shuang Li[1,#]

Summary

What is already known about this topic?

Occupational stress and workplace health have become issues of significant concern for both employees and employers. The workers from electronic manufacturing services (EMS) industry in China are exposed to increasing occupational hazards and injuries. Despite the fact that it is a known health risk for psychological and medical disorders, only few studies have investigate the prevalence of occupational stress and risk factors among EMS workers.

What is added by this report?

Analysis of data from the EMS industry of Occupational Stress Surveillance Program with a sample of 21,362 participants from 20 EMS companies. Results show that the prevalence of high strain and effort-reward imbalance were 19.5% and 15.8%, respectively, which are significantly differed by selected socio-demographic and job characteristics. Participants who are migrant, or working in the assembly-line position or in shift are exposed to higher stress level.

What are the implications for public health practice?

EMS workers are liable to be at risk for occupational stress and for developing psychological disorders and diseases. The findings of this study contribute to an evidence-base which inform the development and implementation of strategies aimed at reducing occupational stress of EMS workers should be at organizational and individual level.

Occupational stress contributes to a wide range of health problems, including acute traumatic injuries, psychological issues, musculoskeletal disorders, and cardiovascular diseases. As a group, these disorders are responsible for much morbidity, mortality, and disability, as well as healthcare utilization (*1*). According to the National Institute for Occupational Safety and Health, occupational stress is defined as the stress that occurs when the needs of the job poorly align with the abilities of the employee, available resources, and expectations of the employer and this stress is thought to cause harmful physical and emotional responses (*2*). The electronic manufacturing services (EMS) industry refers to the companies that engaged in testing, distribution, and providing return and repair services for electronic components and assembling for original equipment manufacturers. With further industrialization and modernization, EMS workers are exposed to increasing occupational psychological problems have gained attention from all social sectors (*3*). Occupational Stress Surveillance Program (OSSP) is an ongoing, nationwide, surveillance program that collects self-reported information on psychosocial conditions and well-being at workplace, in order to explore occupational stress level of key population from typical industry and to improve mental health and well-being among occupational populations. It is administered by National Institutes of Occupational Health and Poison Control, China CDC, in collaborating with participating local occupational disease prevention institutions.

In the present report, we analyzed combined OSSP data from years of 2015, 2016, and 2017 that focusing on EMS industry of the survey. Response rates for the 3 years of surveys ranged from 91.0% to 94.4% and it produced a 3-year sample of 21,362 participants from 20 electronic manufacturing companies. Among those, as the typical areas of EMS industry in China, five distributed in the central and western regions (Sichuan and Hunan), seven around Bohai Rim (Beijing and Tianjin), two around Yangtze River Delta (Jiangsu), and six around Pearl River Delta (Guangdong) regions.

All questionnaires and group interviews were completed during July to September of each year. Participants were considered to be working at current position for at least more than half a year and without any history of mental disorders or relative medications. Specifically, they were asked to complete a self-report questionnaire consisting of socio-demographic

characteristics (examples including age, gender, and education level), job characteristics (such as hours of work, number of shifts, etc.) and occupational stress, as well as symptoms of other mental disorders (not involved in this report).

Occupational stress was assessed using the Chinese short version of occupational stress inventory, which is developed based on two extensive used theoretical frameworks, Job-Demand-Control and Effort-Reward-Imbalance models, and demonstrated with good reliability and validity (*4–5*). It consists of a set of 38 items that assess 6 dimensions of psychosocial factors: work demands, job control, social support, effort, reward, and over-commitment. Each item is measured on a five-point Likert scale ranging from one (never) to five (almost all the time). Each variable was then added up separately. Each sum of demand and control was dichotomized into high and low using the median of the distribution as cut-off. Then high strain was labelled according to dichotomized variables (high job demand with low control). Another two summed variables, effort and reward, were divided ($\Sigma_{effort}/\Sigma_{reward}$) and then multiplied with a correction factor (0.4545), thus creating the effort-reward ratio. A larger ratio indicates a greater imbalance between effort and reward. The effort-reward imbalance was characterized when the ratio is greater than one.

Prevalence for high strain and effort-reward imbalance were calculated overall and by socio-demographic characteristics and job characteristics. The chi-square test was used to determine statistically significant difference between groups. All statistical assessments were considered significant at $p<0.05$. Statistical analyses were performed using SPSS statistical software (version 22.0, SPSS Inc, Chicago, IL, USA).

Among all respondents, the prevalence of high strain and effort-reward imbalance were 19.5% and 15.8%, respectively (Table 1). Characterized by socio-demographic factors, the prevalence of high strain were significantly differed by age, education and income level, while the prevalence of effort-reward imbalance were significantly differed by gender and income level. Compared to those working at other job positions, assembly-line workers present higher level of occupational stress. Specifically, 20.9% of assembly-line workers were exposed to high strain due to high demand with low control job and 17.4% of them were exposed to effort-reward imbalance. Migrant workers among those respondents reported significantly higher prevalence of high strain and effort-reward imbalance (21.1% and 16.5%) than non-migrant workers. For those working in a shift position, the prevalence of high strain were significantly higher (20.0%) compared to non-shift workers. Exposed to long working hours may increase the risk of occupational health, for those who has been working over 50 hours per week averagely had higher level of high strain (20.8%) and effort-reward imbalance (18.3%).

Discussion

Occupational stress is a prevalent and costly problem of pandemic proportions in today's workplace affecting millions of people across the world (*6*). As reported, those working at machine-paced assembly-line is high stressful with 20.9% of them were exposed to high strain job. This type of work requires vigilance yet is monotonous and repetitive, which typically presents a harmful combination of short interval demands with lack of control. Technical development in assembly-line work has often resulted in more meticulous and complicated tasks for the workers who may have to work at the highest intensity for hours, and, consequently, more stress.

Migrant workers, mostly from rural areas of their original residence to urban areas, are a unique phenomenon occurring developing countries with experiencing economic transformations. Previous studies showed that because of their exposure to poor working conditions, hazards and long working hours, migrant workers have suffered from the highest incidences of occupational diseases in all labor force in China (*7*). In this report, migrant workers from EMS industry were exposed to higher stress level. The degree of acceptance felt in a new home, relationships with coworkers, job-related and behavior customs may lead to occupational stress for migrant workers. It may be further exacerbated by fear of job loss or deportation, particularly among those without job authorization. The International Labour Organization (ILO) calls for policies that recognize the contributions made by migrant workers and promote decent work opportunities and social protections, including ensuring that wages are regularly and directly paid to the workers, protecting social security benefits, and promoting written employment contracts.

Preventing or reducing occupational stress is challenging, given the economic, political, and labor-market factors that are increasing stressors at work.

TABLE 1. Prevalence of occupational stress among EMS workers based on JDC and ERI models by selected demographic and job characteristics (n=21,362).

Characteristics	Number	High strain (high demand – low control)		Chi-square test	*p* value	Effort reward imbalance (E/R ratio >1)		Chi-square test	*p* value
		Number	%			Number	%		
Overall	21,362	4,159	19.5			3,376	15.8		
Gender									
Male	10,039	2,023	20.2			1,948	19.4		
Female	11,323	2,136	18.9	5.623	0.018	1,428	12.6	184.526	<0.001
Age (years)									
18–25	2,391	436	18.2			402	16.8		
26–30	6,999	1,365	19.5			1,101	15.7		
31–35	3,411	1,346	21.0			1,023	16.0		
36–40	3,215	633	19.7			484	15.1		
≥41	2,346	379	16.2	29.328	<0.001	366	15.6	3.401	0.493
Education									
<high school	5,811	1,066	18.3			896	15.4		
≥high school	15,551	3,093	19.9	6.439	0.011	2,480	15.9	0.888	0.346
Marital status									
Married	13,721	2,659	19.4			212	15.5		
Unmarried	7,641	1,500	19.6	0.199	0.656	1,255	16.4	3.445	0.063
Income (¥)									
<3,000	9,380	1,752	18.7			1,423	15.2		
3,000–5,000	9,762	1,933	19.8			1,545	15.8		
>5,000	2,220	474	21.4	9.447	0.009	408	18.4	13.889	0.001
Migrant worker									
Yes	16,819	3,541	21.1			2,777	16.5		
No	4,543	618	13.6	126.628	<0.001	599	13.2	29.736	<0.001
Position									
Assembly-line	10,222	2,135	20.9			1,778	17.4		
Others	11,140	2,024	18.2	25.109	<0.001	1,598	14.3	37.246	<0.001
Shift									
Yes	12,224	2,448	20.0			1,964	16.1		
No	9,138	1,711	18.7	5.655	0.017	1,412	15.5	1.485	0.223
Work hours									
≤50 h	10,528	1,907	18.1			1,398	13.3		
>50 h	10,834	2,252	20.8	24.329	<0.001	1,978	18.3	99.456	<0.001

Developing and implementing multiple types of preventive measures is necessary to protect and promote worker health and well-being. Based on a large number of practical examples, there are many practical ways of eliminating occupational stress for assembly-line workers, ranging from strengthening the individual's response to stress, to improving the physical work environment and changing the organization of work. A combination of organizational change and stress management is often the most useful approach for preventing stress at work. Activities at organization level include adjusting workload to workers' abilities, defining role and responsibilities clearly, promoting interaction among workers, and establishing good communication about workplace issues, etc. Most stress management approaches focus on individual level to teach coping skills and techniques for reduction of stress, such as exercise,

progressive relaxation, Yoga, and so forth. The National Institute for Occupational Safety and Health (NIOSH), for example, recommends the "Total Worker Health" (TWH) approach (*8*), which integrates health promotion and stress management aimed at individuals with "health protection" (occupational health), with the goal of reducing both physical and psychosocial hazards in the workplace. The TWH approach has the potential to identify and change barriers behaviors, such as inflexible schedules, shift work, and long duration of work, and to reduce risks of chronic disease caused by stressful work.

The findings in this report are subject to at least three limitations. First, data are self-reported and therefore subject to inherent biases. Second, this study is a cross-sectional survey, being cautious for the causal relationship between occupational stress and relevant risk factors. Thirdly, the study population was from selected areas only, and the generalization of the findings may be limited.

Acknowledgment

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Conflict of Interests

No conflicts of interest were reported.

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Preplanned Studies

Trends in Leisure-Time Physical Activity Among Chinese Adults — China, 2000–2015

Qinpei Zou[1,2]; Huijun Wang[1]; Wenwen Du[1]; Chang Su[1]; Yifei Ouyang[1]; Zhihong Wang[1]; Gangqiang Ding[1]; Bing Zhang[1,#]

Summary

What is already known about this topic?

The monitoring report on nutrition and health status of Chinese residents from 2010 to 2013 reported that the participation rate of leisure-time physical activity (LTPA) was 13.8% among those 6 years and older.

What is added by this report?

Among 18 years old and older, the age-standardized LTPA prevalence increased from 7.13% in 2000 to 11.79% in 2011 before dropping to 7.33% in 2015.

What are the implications for public health practice?

As levels of LTPA participation are low, further research is necessary to develop and test valid interventions to encourage people to take part in more LTPA especially for residents in rural areas and with low-income.

China has a high prevalence physical inactivity which leads to poor health outcomes. Among Chinese adults, the prevalence of leisure-time physical activity (LTPA) participation is low. Data collected in the China Health and Nutrition Survey (CHNS) from 2000 to 2015 were used to observe trends in LTPA participation among adults aged 18 years and above. The overall age-standardized LTPA prevalence increased from 7.13% in 2000 to 11.79% in 2011 before dropping to 7.33% in 2015. Over 80% of LTPA participants reported vigorous-intensity LTPA. Although LTPA prevalence and the proportion to reach the vigorous-intensity level had been increasing overall, they were still at a low level. Efforts to improve rates of LTPA among Chinese adults, especially for residents in rural areas and with low-income, through education or other interventions has the potential benefits for improving overall health.

Physical inactivity contributes 12%–19% to the risks associated with the 5 major noncommunicable diseases (NCDs) in China (*1*). Increasing physical activity (PA) is an effective way to improve both individual and population-level health outcomes. However, PA levels appear to be declining globally (*2*). Occupational, travel, domestic, and leisure-time PA are four dimensions of the overall PA and the first three showed a striking decrease. LTPA was the smallest contributor to overall PA, but it plays an important role to keep healthy (*3*). The proportion of LTPA in China was also much lower than that of Western countries (*3–5*) such as Brazil, the United States, Finland, etc. Increasing LTPA to compensate for declines in the other three domains of PA to maintain the current level of the overall PA and further promote its improvement is vitally important because only LTPA is self-directed and the other three types have passively declined due to high speed economic development, which include examples such as driving cars instead of walking to the office and using washing machines instead of washing by hand. To understand whether Chinese adults actively participate in LTPA to improve the decreasing total PA, CHNS provides the opportunity to investigate the trend of LTPA participation over time with the overall goal of informing health policies.

Details of the study design and methods of the CHNS have been previously reported (*6*). A multi-stage, stratified, random cluster sampling design was used across 10 rounds of surveys from 1989 to 2015. The samples in the present paper included 6 rounds of survey data collected in 2000, 2004, 2006, 2009, 2011, and 2015. Nine provincial-level administrative divisions (PLADs), including Shandong, Liaoning, Heilongjiang, Jiangsu, Henan, Guizhou, Hunan, Hubei, and Guangxi were chosen because they were present in all six surveys. Adults aged 18-100 years old with complete data on LTPA, socioeconomic status, and demographics in each survey year were considered eligible subjects. We excluded individuals who were disabled, pregnant, or lactating during each particular wave. Finally, our study consists of 59,504 observations in total.

Information on LTPA within the latest year

included participation in sports such as martial arts, gymnastics, dancing, aerobics, jogging, swimming, soccer, basketball, tennis, badminton, volleyball, or other LTPA (table tennis, or doing Tai Chi, etc.). For each LTPA item, respondents reported the average hours per week spent in the last year. To measure energy expenditure for each LTPA item, metabolic equivalent of task hour per week (MET·h/w) were calculated. Therefore, the average MET-hours per week measurements comprise both the average intensity of each activity and the time spent in each one. Participants were classfied into four categories by LTPA (0 MET·h/w = inactive, 0.1–7.4 MET·h/w = low-intensity, 7.5–14.9 MET·h/w = moderate-intensity and ≥15.0 MET·h/w = vigorous-intensity) (*7–8*). LTPA prevalence was defined as the proportion of the number of LTPA participants among the total number of participants in each survey. Standard questionnaires were used by trained interviewers to collect sociodemographic characteristics and annual per household income, which was categorized into tertiles (high, middle, and low) according to each survey round. Descriptive analysis was stratified by gender, age group, and urban-rural residence in each round. The overall prevalence from 2000 to 2011 was standardized according to the age composition in 2015 of CHNS. Chi-square tests were used to test for differences among males and females, age groups, urban and rural residence, and LTPA levels. Trend Chi-square test was used for changes over time and income levels. $p<0.05$ were considered statistically significant. All tests were conducted in SAS software (version 9.4, SAS Institute, Inc., Cary, NC, USA).

Table 1 shows that the proportion of adults aged 18 to 44 years old declined in these 15 years and the proportion of 45–64 years old group and ≥65 years old group increased, consistent with observed aging of the population. Participants in urban area represented around 30% of the sample in each survey year. Figure 1 gives information about the LTPA prevalence of adults by demographic characterristics during the study period. The age-standardized LTPA prevalence increased from 7.13% in 2000 to 11.79% in 2011, then dropped to 7.33% in 2015. The proportion of participants that were male or living in urban areas were higher than that of females and rural residents, respectively. There was significantly statistical difference between males and females as well as urban and rural. Compared to groups of adults aged 45 to 64 years old and ≥65 years old, the group aged 18 to 44 years old had the highest LTPA prevalence. People at high income levels had approximately 7 to 15 percentage pointed higher LTPA prevalence than those at low income levels, and the income level trend tests were significant in each year. The increasing trend by years was statistically significant in the LTPA prevalence of total population, males and females groups, three age groups, rural group, high and low income groups, respectively. Figure 2 illustrates that from 2004 onward, over 80% of LTPA participants were able to reach the vigorous-intensity level and this proportion increased each year. Specifically, 60% of LTPA participants exercised at vigorous-intensity PA in 2000 and then rising to 90% in 2015.

Discussion

PA was classified into four parts: occupational,

TABLE 1. Samples and proportion (%) of adults aged 18 years and above from 2000 to 2015, stratified by gender, age group and urban-rural.

Variable	2000	2004	2006	2009	2011	2015
Overall	11,308	9,618	9,662	9,892	9,427	9,597
Gender						
Male	5,781(51.12)	4,698(48.85)	4,625(47.87)	4,797(48.49)	4,512(47.86)	4543(47.34)
Female	5,527(48.88)	4,920(51.15)	5,037(52.13)	5,095(51.51)	4,915(52.14)	5,054(52.66)
Age group (yrs)						
18–44	6,277(55.48)	4,178(43.44)	4,048(41.90)	3,701(37.41)	3,108(32.97)	2,945(30.69)
45–64	3,749(33.14)	3,942(40.99)	3,985(41.24)	4,393(44.41)	4,398(46.65)	4,452(46.39)
≥65	1,287(11.38)	1,498(15.57)	1,629(16.86)	1,798(18.18)	1,921(20.38)	2,200(22.92)
Urban-rural						
Urban	3,388(29.96)	3,010(31.30)	3,035(31.41)	3,139(31.73)	3,059(32.45)	2,994(31.20)
Rural	7,920(70.04)	6,608(68.70)	6,627(68.59)	6,753(68.27)	6,368(67.55)	6,603(68.80)

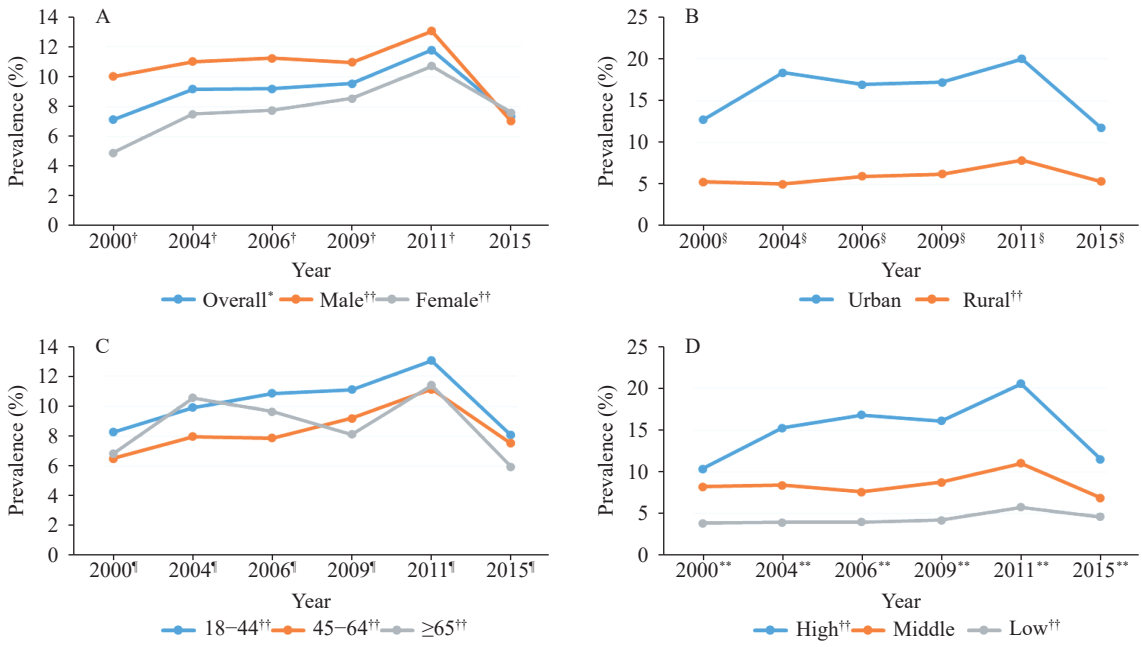

FIGURE 1. LTPA prevalence (%) of adults aged 18 years and above in subgroups from 2000 to 2015. (A) gender for LTPA prevalence; (B) area for LTPA prevalence; (C) age for LTPA prevalence; (D) income level for LTPA prevalend.
* indicates that the prevalence from 2000 to 2011 was standardized according to the age composition in 2015. † indicates a statistical significant difference by gender for LTPA prevalence in each survey round; § indicates a statistical significant difference between urban and rural for LTPA prevalence in each survey round; ¶ indicates a statistical significant difference among age groups for LTPA prevalence in each survey round; ** indicates a statistical significant income level trend for LTPA prevalence in each survey round; †† indicates statistical significant year trend for LTPA prevalence in each subtype group, such as male gourp, rural group, low income group.

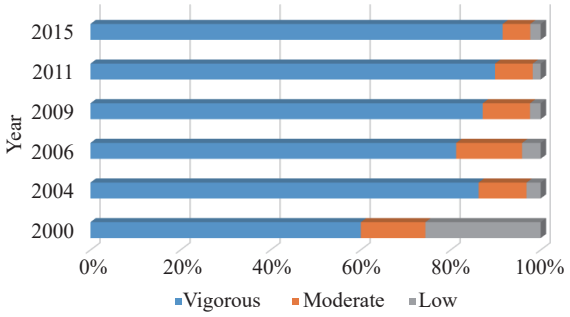

FIGURE 2. The proportion of LTPA participants (≥18 years old) at different intensity level from 2000 to 2015.

domestic, travel, and leisure-time (*2*). The first three domains were highly related to work type, whereas awareness and attitude were determining factors in participating in LTPA. Our study showed LTPA participation among Chinese adults is generally increasing, while other research from CHNS showed the total PA was decreasing (*9*). Health policies encouraging LTPA have increased the awareness of the effects of LTPA on health for all age groups, the effect of which may be seen in our study as yearly increases in LTPA participation. World Health Organization (WHO) published the global recommendations on physical activity for health in 2010, in which adults were advised to increase their moderate-intensity PA at least 150 min/week and to go up to 300 min/week for additional health benefits (*8*). Seniors 65 years and older have the same recommended amount of exercise as adults. Chinese Adult Physical Activity Guidelines according to WHO recommendations was published the following year (*7*). These two guidelines advocated the LTPA in all populations.We observed the LTPA participation rate increased dramatically in 2011. The monitoring report on nutrition and health status of Chinese residents from 2010 to 2013 reported that the participation rate of LTPA was 13.8% in 6 years old and above (*10*), which was a little higher than our results in 2011 because they contained the students from 6 to 17 years old with the fixed physical training time set by school. However, the prevalence of LTPA decreased in 2015, which may be due to changes in survey method. Electronic questionnaires were used in the field survey in 2015, which was convenient to control the quality of data and upload data quickly. However, whether the new survey method would lead to the unexplained declines needs to be further investigated and verified.

In the United States, there was a distinct increase in the proportion of meeting minimum aerobic PA guidelines from 43.5% in 2008 to 54.2% in 2018, and the proportion of meeting high aerobic PA guidelines increased from 28.4% in 2008 to 37.4% in 2018 (*4*). In Finland, 37% of women and 43% of men were physically active in their leisure time in 2000–2002, then it increased to 39% of women and maintained in 43% of men in 2007, with 30 MET·h/w as the cut-off point of PA (*5*). The prevalence of LTPA of Brazilian adults was 30.2% (*3*). People in Western countries had much higher participation rate of LTPA than in China.

Women had lower LTPA participation rates than men in each survey year in our study, although their rates increased over time. High and moderate PA levels during leisure time was recommended especially for middle-aged women because women with high and moderate PA levels have less severe menopausal symptoms compared to inactive women (*11*).

Our study found that residents living in urban areas had higher LTPA than those living in rural areas. Residents in urban areas usually have higher education levels and incomes, which may increase enthusiasm for LTPA participation. Because a projected billion people will be living in China's urban areas in 2030, pushing the health of all populations starting from urban areas is one of the health strategies in China. China has launched the Healthy China campaign including the National Fitness Action Plan and achieved health integration in all policies for the initial goal of improving health (*12*). Improving the built and social environment to be more conducive to LTPA is an important step for achieving higher levels of LTPA (*3*). In addition, local CDCs should take responsibility for health promotion to improve the awareness of villagers, and fitness facilities should be constructed by local governments to provide more fitness accessibility in rural areas.

Our study showed that among those who were engaging in LTPA, 60%–92% reached vigorous-intensity because they maintained a regular exercise schedule including weekend only or daily exercise. LTPA plays an important role in reducing cancer, cerebrovascular disease (CVD), and all-cause mortality risk regardless of only exercising on weekends or other LTPA patterns characterized by one or two sessions per week (*13*). LTPA can also cut down on direct cost of short-term sickness absence for employers when employees are regularly physically active or improve from moderately active to vigorous activity (*14*). A recommended 150 minutes per week (7.5 MET·h/w) in LTPA is the minimal level to reduce risk of NCDs, and 300 min/week (15 MET·h/w) is recommended to maintain weight (*7*–*8*).

Regular monitoring is an effective way to master the level of PA, and governments publishing PA guidelines is the universal mean in countries. Publicizing and educating about PA behavior and health and implementing necessary policies and plans are urgent (*15*). Longitudinal changes in LTPA in Chinese was clearly represented and it is necessary and significant to continue to monitor.

Overall, the LTPA prevalence and the proportion to reach the vigorous-intensity level increased over the years studied, but they were still at a relative low level. Continuous survey is necessary, and carrying out publicizing, educating, or other interventions to encourage people to take part in more leisure-time physical activity especially for residents in rural area and with low-income has potential benefits for improving overall health.

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Notes from the Field

Key Points of the Program for Disinfection Technology in Special Places During the Coronavirus Disease-2019 (COVID-19) Outbreak

Jiaqi Wang[1]; Baoying Zhang[1]; Hongyang Duan[1]; Chen Liang[1]; Huihui Sun[1]; Jian Zhang[1]; Jin Shen[1,#]; Liubo Zhang[1]

Since January 2020, the coronavirus disease 2019 (COVID-19) epidemic has been prevalent throughout China. Disinfection, as an effective measure to cut off routes of transmission, is crucial in addressing epidemics of infectious diseases. To further guide prevention and control of COVID-19 and on-site disinfection nationwide, the *Program for Disinfection Technology in Special Places* (first edition) has been developed on January 28. The second and third edition has been revised and formulated on February 6 and 21, 2020. This program was created by using current trends of the epidemic situation and the combined characteristics of COVID-19 and its transmission mode and by referring to the *General principle on disinfection for infectious focus* (GB 19193-2015), *Hygienic requirements of disinfectant for infectious focus* (GB 27953-2011), and other standards. This program was released by the General Office of the National Health Commission on January 28, 2020 and was released again after revision on February 6 and 21.

The program guidelines are suitable for the disinfection of special places in which patients and infected persons live such as homes, isolation wards of medical institutions, and transferred tools storage areas. The program also includes guidelines on application scope and differences for concurrent and terminal disinfections and methods for infectious focus. Furthermore, it points out that disinfection should be performed in a timely manner in place where patients live such as sick houses, medical institutions, and transferred tools storage areas. In addition, specific disinfection methods of commonly contaminated objects are reintroduced in detail including indoor air, contaminants, feces and sewage, ground walls, surfaces of objects, clothes, beddings and other textiles, hands, skin and mucous membranes, tableware (drinkware), transported and transferred tools, domestic waste of patients, medical waste, treatment of corpse, etc. At the same time, evaluation methods and judgment criteria of the on-site disinfection effects are provided. The natural bacteria or indicator microorganisms can be selected for effect evaluation, and the evaluation should be performed by relevant professionals with the qualifications of inspection and detection.

Selecting a disinfection method is particularly important when disinfecting in a special place. The program offers a basic principle of selection: medical institutions should choose disposable medical supplies. For non-disposable medical supplies, pressure steam sterilization should be preferred. For non-heat-resistant objects, chemical disinfectants or low-temperature sterilization equipment for disinfection or sterilization can be selected. For the surface of environmental objects, chlorine-containing disinfectants, chlorine dioxide, and other disinfectants should be selected to wipe, spray, or soak for disinfection. For hands and skin, selection of effective disinfectant is recommended such as iodophor, chlorine-containing disinfectants and hydrogen peroxide disinfectants, or quick-drying hand disinfectant for wiping disinfection. Regarding the disinfection of indoor air, disinfectants, such as peroxyacetic acid, chlorine dioxide, hydrogen peroxide, can be selected for spray disinfection. Meanwhile, the specific disinfection methods of 13 common contaminated objects are listed in detail (Table 1) (*1–3*). During disinfection, on-site contamination conditions should be understood. If there are obvious contaminants, contaminants should be disinfected first. After removal, disinfection measures can be taken according to the characteristics of the objects. The disinfection products used shall meet the management requirements of relevant national health departments.

Objects and places contaminated by patients should undergo concurrent disinfection. If people are present, spray disinfection is not recommended. Ventilation measures, including natural and mechanical ventilation, can be adopted in isolated places to maintain circulation of indoor air. Non-negative pressure isolation wards should be well ventilated, ventilation, including natural and mechanical

TABLE 1. Disinfection methods for commonly contaminated objects in the epidemic focus.

Object	Disinfection method
Indoor air	peroxyacetic acid, chlorine dioxide, hydrogen peroxide, etc.ultra-low volume spray
Contaminants (blood, secretions, etc. from patient)	Water absorbent material carrying disinfectant (5,000–10,000 mg/L chlorine-containing disinfectant) for 30 min, or disinfectant dry wipes achieving high level of disinfection
Container for contaminants	Soaking with 5,000 mg/L chlorine-containing disinfectant for 30 min and then cleaning
Feces and sewage	Separate septic tank: adding chlorine-containing disinfectant and 10 mg/L the total residual chlorine after 1.5 h. Excreta in container: soaking with 20,000 mg/L chlorine-containing disinfectant for 2 hours when the ratio of fecal to disinfectant is 1:2. Massive dilution of excreta in container: disinfecting with 70%–80% dry bleaching powder for 2 h when the ratio of fecal to disinfectant is 20:1
Ground wall	Wiping and spraying with 1,000 mg/L chlorine-containing disinfectant or 500 mg/L Chlorine dioxide disinfectant for no less than 30 min, the range of spray volume from 100 mL/m^2 to 300 mL/m^2
Surface of objects	Spraying, wiping, or soaking with 1,000 mg/L chlorine-containing disinfectant or 500 mg/L chlorine dioxide disinfectant for 30 min and then wiping with clean water
Clothing, bedding and other textiles	Circulating vapor or boiling for 30 min, soaking with 500 mg/L chlorine-containing disinfectant for 30 min, and then washing
Hand	Rubbing with quick-drying hand disinfectants containing alcohol or alcohol compound (first choice), wiping with 75% ethanol, rubbing with quaternary ammonium salt hand disinfectant, or soaking or wiping hands with 0.05% chlorine-containing or 3% hydrogen peroxide hand disinfectant, or wiping with 0.5% polyvidone iodine
Skin	Wiping with 0.5% polyvidone iodine or 3%hydrogen peroxide disinfectant for 3–5 min
Mucous membrane	Flushing saline or 0.05% polyvidone iodine
Tableware	Soaking with 500 mg/L chlorine-containing disinfectant for 30 min 500 mg/L or boiling
Transported and transferred tools	Spraying with 1,000 mg/L chlorine-containing disinfectant or 500 mg/L chlorine dioxide disinfectant for 30 min and then wiping with clean water
Domestic waste of patients	Treating as medical wastes
Medical wastes	Treating as medical wastes
Corpse	Filling the wound with 3,000–5,000 mg/L chlorine-containing disinfectant or cotton ball or gauze soaked with 0.5 % peroxyacetic acid,wrapping the corpse with double sheet soaked the disinfectant, and then putting it in the double corpse bags

ventilation, can be adopted, and circulating air disinfection machine can also be used for air disinfection. The source of infection should be terminally disinfected after leaving the relevant places to ensure the absence of pathogens in disinfected places and related objects. Large-area disinfection of outdoor environments including air is not necessary. There is no need for terminal disinfection in place with no obvious contaminants where patients and infected persons might have briefly visited.

On-site disinfection work should be conducted by relevant units in a timely manner under the guidance of the local disease prevention and control agencies, or the local disease prevention and control agencies should be responsible for disinfection. Concurrent and terminal disinfections of medical institutions should be performed by specially-assigned persons, and disease prevention and control agencies should provide technical guidance. Non-professionals should receive professional training from local disease prevention and control agencies before disinfecting, adopt correct disinfection methods, and adhere to high standards of personal protection.

The introduction of this program provides technical support to effectively address the epidemic and the performance of scientific and precise disinfections by providing specific methods for on-site disinfection. Thus, the program has important public health significance for effectively safeguarding the physical health and life safety of the people.

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Healthy China

Interpretation of the Diabetes Prevention and Control Action of the Healthy China Initiative 2019–2030

Wenjuan Wang[1,#]

Summary

In the past 30 years, the prevalence of diabetes in China has been increasing, but the awareness rate, treatment rate and control rate of diabetes are relatively low, and the death rate, disability rate, disease burden of diabetes and its complications are constantly increasing, which brings heavy burden to individuals, families and social economy. The Healthy China Initiative (2019–2030) is a roadmap to a healthy China and an innovative public policy system project. The Diabetes Prevention and Control Action is one of the four chronic and noncommunicable diseases prevention and control actions in the Healthy China Initiative (2019–2030).

Based on the background, basic principles and key contents of diabetes prevention and control, this paper interpreted the diabetes prevention and control action from five aspects, that is, healthy lifestyle is the foundation, which emphasized that individuals are the first responsibility for their health, and advocates reducing the risk of diabetes by practicing healthy diet, increasing physical activity and maintaining a healthy weight; Early detection and early intervention are key links, which emphasized to pay attention to individual blood glucose level, high risk individuals regularly test blood glucose; Standardize health management is the priority, which emphasized to strengthen the implementation of graded diagnosis and treatment standards, and medical institutions provide guidance on self-management of health for patients with diabetes; The improvement of capacity in primary level is the guarantee, where emphasis is placed on improving the ability of medical personnel to screen, intervention and standardize diagnosis and treatment; And innovative health service models are the key measures which emphasized the use of information technology to improve the efficiency of health management.

As industrialization, urbanization, aging population progress and lifestyle change, the main cause of death and disease burden in Chinese residents becomes chronic and noncommunicable diseases (NCDs). Currently, cardiovascular disease, cancer, chronic respiratory disease, diabetes, and other NCDs account for 88% of all deaths and more than 70% of the total burden of disease. China has the world's largest diabetes epidemic, which continues to increase as the prevalence of diabetes in China was reported to be 0.67% in 1980 and 10.9% (95% CI*, 10.4%–11.5%) in the latest published nationwide estimate in 2013—an increase of 15 times in 30 years with an average annual increase of 9.1% (*1–4*). Based on the adult population of 1.09 billion and a prevalence of 10.9%, China has 109 million (113–125 million) diabetics in 2013. The International Diabetes Federation (IDF) reported that the figure reached 114.4 million (104.4–146.3 million) in 2017 and predicted that it would reach 119.8 million (86.3–149.7 million) by 2045 (*5*).

Complications resulting from improperly controlled diabetes can involve multiple organs such as blood vessels, eyes, kidneys, and feet, and can cause increases in disability rates, mortality, and burden of disease [also known as the disability adjusted life year (DALY)]. The prevention, diagnosis, and treatment of diabetes in China have not been sufficient in several aspects. First, the results of national surveillance of diabetic patients in China in 2013 showed that the patient awareness rate, treatment rate, and blood glucose control rate in this year were 36.5% (95% CI: 34.3%–38.6%), 32.2% (95% CI: 30.1%–34.2%), and 49.2% (95% CI: 46.9%–51.5%), respectively (*4,6*). Second, people with diabetes have an increased risk of death, mortality, and disease burden. Compared with nondiabetics, Chinese diabetics have a risk of death from all causes of 2.00 (95% CI: 1.93–2.08), from chronic kidney disease of 13.10 (95% CI: 10.45–16.42), from ischemic heart disease, stroke, chronic

* CI=Confidence Interval.

hepatitis, and infection is between 1.8–2.4 (*7*). Compared with 1990, diabetes-related mortality in China increased by 63.5% in 2016 and DALYs of diabetes increased by 95%. The ranking of DALYs attributed to diabetes rose from 22 in 1990 to 6 in 2016. The top five causes of diabetes disease burden are chronic kidney disease, peripheral artery disease, ischemic heart disease, stroke, and tuberculosis (*7–9*). Thirdly, China has a large number of people with high risk factors for diabetes. Type 2 diabetes is the most common type in China, and pre-diabetic and obesity patients are at the highest risk of developing this type of diabetes. In 2013, the prevalence of pre-diabetes was 35.7% (95% CI: 34.1%–37.4%), and the prevalence of overweight and obesity were 32.4% and 14.1%, respectively, which indicates that 356.4 million people are pre-diabetic and 506.9 million people are overweight and obesity in China (*4*,*6*). Without adequate prevention measures, this large population could develop diabetes.

The current state of diabetes control in China may be due to the capability of government departments, society, and individuals to implement comprehensive prevention and control measures for diabetes and other health promotion not being fully formed and that existing strategies have not been well implemented.

Diabetes can be prevented and controlled. Lifestyle interventions for high-risk populations can prevent or delay diabetes and its complications (*10–11*). The WHO global action plan for prevention and control NCDs 2013–2020 proposed a goal of a 25% relative reduction in risk of premature mortality from cardiovascular diseases, cancer, diabetes, or chronic respiratory diseases by 2025 (*12*). The Chinese government attaches great importance to comprehensive NCDs prevention and control as diabetes prevention and control is included in national strategies. General-Secretary Xi Jinping gave a speech at the National Health Conference in 2016 that indicated the need for concerted attention for the prevention and control of major diseases. For NCDs, cancer, hypertension, and diabetes should be viewed as breakthrough points so that China can strengthen comprehensive prevention and control, strengthen early screening and early detection, promote early diagnosis and treatment, and transform disease treatment into health management. The Healthy China 2030 Initiative put forward goals and key indicators to be achieved by 2030. The main goals are to achieve significant increases in healthy life expectancy, effective control of major risk factors, substantial increases in the capacity of health services, and a 30% decrease in the premature death rate of major NCDs (including diabetes) compared to 2015 (*13*). The Healthy China Initiative 2019–2030 (*14*) is a roadmap to a healthier China and an innovative public policy system project. The Diabetes Prevention and Control Action is one of the four NCDs prevention and control actions in the Healthy China Initiative. The goals of the action include the following: by 2030, the awareness rate of diabetes among residents aged 18 years and above should be at least 60%, the standard management rate of diabetes patients should reach at least 70%, and the treatment rate, control rate, and complication screening rate of diabetes should increase.

The NCDs prevention and control strategy in China is "3.3.3.1 strategy", i.e. for three populations (general population, high-risk population, and patients), three dimensions (control risk factors, early screening, diagnosis, and management) need to be addressed using three methods (health education and health promotion, health intervention, and disease management), and creating a foundation (a healthy supportive environment). The basic principles and key contents of the Diabetes Prevention and Control Action are the embodiment of "3.3.3.1 strategy".

First, a healthy lifestyle is the foundation. Unhealthy lifestyles are the main cause of chronic and noncommunicable diseases and an important determinant of the effect of patient management. Being overweight and obese are caused by unhealthy diets, and together with physical inactivity contribute the largest risk for diabetes and its complications. Unhealthy diets are the main reason for lower control rates for glucose and blood pressure. Therefore, the Diabetes Prevention and Control Action advocates and practices a healthy lifestyle for individuals, which emphasizes that individuals have the first responsibility for their health. It is hoped that the public can take the initiative to gain health knowledge, cultivate health cognition, and practice healthy behaviors to fundamentally prevent the occurrence of diabetes and effectively improve the quality of life of patients. It also emphasizes attention on individual glucose levels, regular glucose screening in high-risk populations, and reducing the risk of diabetes in people with pre-diabetes and overweight and obese people by diet control and scientific exercise.

Second, early detection and early intervention are key links. Practical experience from international and domestic studies have proved that the prognosis of chronic and noncommunicable diseases is closely related to early detection. The earlier the detection, the

earlier the intervention and the more effective therapy and management. Therefore, the Diabetes Prevention and Control Action highlights the importance of early detection and early intervention, and also emphasizes that individuals should pay attention to their personal glucose levels, high-risk individuals should regularly test their glucose, and patients should strengthen health management.

Third, standardizing health management is the priority. NCDs have a long course as once patients become ill, they often suffer for a lifetime. Standardized management of patients with NCDs can steadily control their condition, reduce complications, allow patients to enjoy life like healthy people, and improve their quality of life. The Diabetes Prevention and Control Action highlighted the implementation of graded diagnosis and treatment standards and medical institutions providing guidance of diet, exercise, self-monitoring blood sugar, and self-health management for patients with diabetes. The government and society should promote standardized screening of diabetes at the primary health care level.

Fourth, the improvement of capacity in primary level is guaranteed. Screening and management of diabetes and its complications mainly rely on primary health care, and the capacity of primary health care is a basic guarantee of patient management. The Diabetes Prevention and Control Action proposes to strengthen the primary level service capacity by improving the ability of screening, early interventions, standardized diagnoses, and treatment of diabetes and its complications for medical staff to delay the progress of complications and reduce the disability rate, mortality, and premature death.

Fifth, innovative health service models are the key measures. It highlighted the use of information technology to promote "internet plus public health" services and improve health management by relying on regional public health information platforms.

The Diabetes Prevention and Control Action is an important part of the Healthy China Initiative 2019–2030, which together with other actions of the Healthy China Initiative, promotes the prevention and control of diabetes and contributes to achieving the goal of a healthier China. Other actions include health knowledge action, healthy diet action, national fitness action, tobacco control action, health promotion action for students, health promotion action for the elderly.

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