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Cover Photo：China CDC staff testing for COVID-19 virus on the outer packaging of imported seafood in a cold storage facility of Qingdao Public Bonded Warehouse company in Qingdao port.

The Effects of Diabetes and Hypertension on the Severity of COVID-19 — Yichang, Hubei Province, 2020

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Summary

What is already known on this topic?

COVID-19 has become a serious public health issue. A higher proportion of severe patients were senior patients with underlying diseases such as diabetes and hypertension and had a lack of statistical evidence so far.

What is added by this report?

When severe illness was compared with non-severe illness, senior patients were at a greater risk (4.71) than young and middle-aged patients, as well as the odds ratio was about 2.99 patients with diabetes compared to patients without diabetes and hypertension. COVID-19-infectious senior patients with diabetes were inclined to suffer severe illness.

What are the implications for public health practice?

Much more attention should be provided for the elderly and individuals with diabetes, for which a community-based education and surveillance program could be considered.

Since the middle of December 2019, cases of pneumonia caused by coronavirus disease 2019 (COVID-19) were found in Wuhan, Hubei Province, and the virus began rapidly spreading throughout China (*1–3*). The percentage of patients with diabetes or hypertension contracting COVID-19 (excluding those with both diabetes and hypertension) was approximately 10% higher than that those without these disorders. (*3*). However, statistical evidence to suggest that patients with diabetes or hypertension were more predisposed to suffer more severe illness was insufficient so far. This study aimed to explore the effects of patient characteristics on COVID-19 severity including age, sex, and underlying diseases. We analyzed hospital-based data from January 23, 2020 to February 25, 2020 in Yichang, Hubei Province by applying ordinal and binary logistic regression. The results suggested elderly (≥65 years) patients with diabetes are more likely to suffer severe illnesses. Based

on the fact that severity is directly related to patients' survival, proper treatments for this group are particularly important. Furthermore, prevention must be emphasized.

The medical records of patients who were diagnosed with COVID-19 by nucleic acid tests were obtained from hospital-based data from January 23, 2020 to February 25, 2020 in Yichang, Hubei Province and were collected by a monitoring network for two hospitals including the Third People's Hospital of Yichang and the Jiangnan branch of the Central People's Hospital of Yichang based on the big data platform. This study sample consisted of all 882 symptomatic living patients, whose clinical data involved individual information (age and sex) and a personal history of underlying disease (diabetes and hypertension). The severity of disease was diagnosed by the reporting system of communicable disease. This severity was categorized into mild, moderate, and severe illnesses, which could be regarded as an ordinal response variable based on specialized medical knowledge. Age, sex, and personal history of underlying diseases were considered to be study factors. According to global recommendations on physical activity for health developed by WHO, age, which was originally a continuous variable, was dichotomized into the young and middle-aged group (age <65 years), and senior group (age ≥65 years). Personal history of underlying diseases was classified into the following categories: patients without diabetes and hypertension, patients with hypertension only, patients with diabetes only, and patients with diabetes and hypertension. Before we fitted the ordinal logistic regression (OLR) model with studies factors, all independent variables chosen from the studied factors should be significantly associated with the severity of this disease, which were ensured by applying Pearson chi-square test (*4*). First, an OLR model-proportional odds model (POM) was adopted to explore the risk factors of the severity of this disease if the proportional odds assumption was not violated (*4–5*). Second, if the above stringent assumption was not satisfied, two efficient approaches

were generally developed to fit the data. The one solution for analyzing the data is to apply an OLR partial proportional odds model (PPOM), in which the proportional odds assumption is not valid (5). The other method is to use multiple separate binary logistic regression (BLR) models. Besides, the global goodness-of-fit is crucial to evaluating the adequacy and efficiency of statistical models. The likelihood-ratio test was commonly conducted to assess the overall goodness-of-fit of ordinal logistic regression POM and PPOM, while that of BLR models was verified by the Hosmer and Lemeshow test (4). All statistical analyses were conducted by R statistical software (version 3.5.1; The R Foundation for Statistical Computing, Vienna, Austria).

The proportion of patients with mild, moderate, and severe illnesses in symptomatic living patients was 17.69%, 61.00%, and 21.31% respectively. The distribution of patients with different illnesses according to studied influential factors is depicted in Figure 1 and Table 1. The percentage of males (51.25%) was similar to that of females in patients, and the Pearson chi-square test revealed that there was no difference on gender for the severity of this disease of patients at the 0.05 significance level. The severity of this disease was significantly different on the two age groups and four status of underlying diseases according to the results of Pearson chi-square statistics and p-values. The severity of this disease as three ordinal categories was regarded as the dependent variable, while age group and status of underlying diseases selected to be the explanatory variables were employed to fit the OLR POM. However, the score test of the proportional odds assumption is significant (Chi-square=31.569, df=4, p<0.001), and the results of single score test of that assumption for each independent variable indicated that age violated that assumption (p<0.001). Therefore, we considered the estimate of coefficients obtained to be biased and applied an OLR PPOM as well as a BLR model to analyze the data. Results of the PPOM and BLR model are separately presented in Tables 2–3. The results of PPOM suggested that the risk of suffering severe illness was 4.71 (95% CI: 3.25–6.82) times higher among senior patients, when compared with young and middle-aged patients. The odds ratio for patients with diabetes as well as patients with diabetes and hypertension compared to patients without diabetes and hypertension were approximately 3.00 (95% CI: 1.47–6.09) and 2.89 (95% CI: 1.43–5.82), respectively, when the severe illness was compared with non-severe illnesses, or moderate and severe illnesses were compared with mild illness. Nevertheless, the risk of suffering from severe illness was found insignificant for patients only with hypertension compared to patients without hypertension and diabetes. The
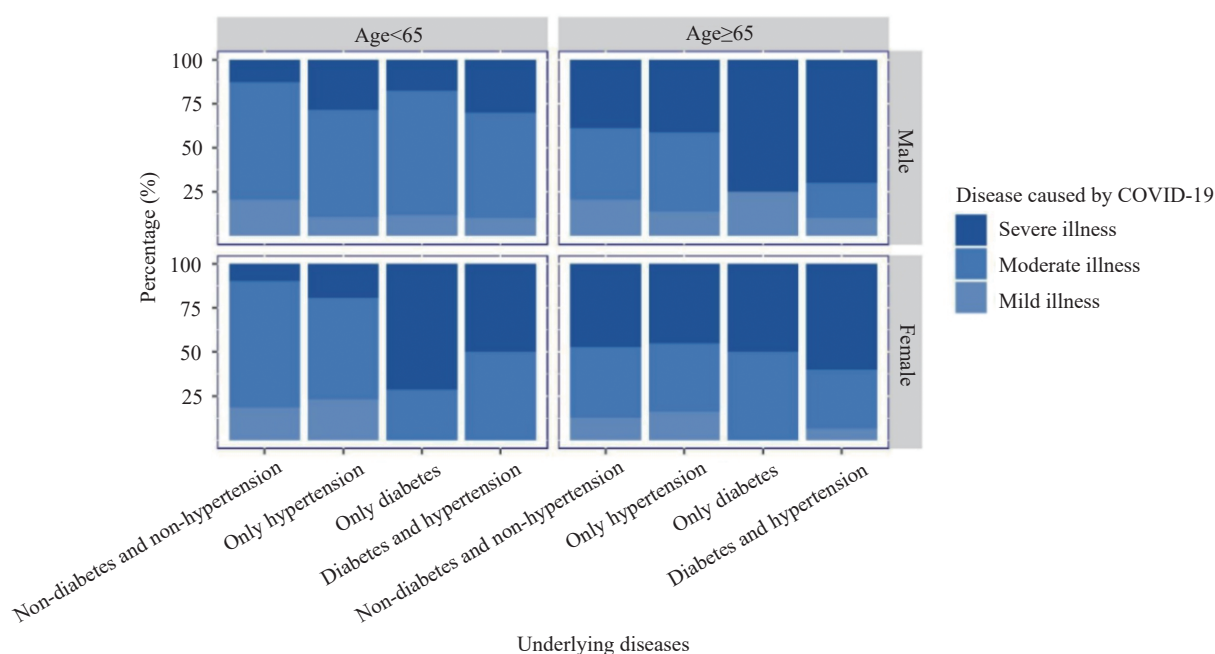

FIGURE 1. The distribution of the severity of disease according to studied influential factors from January 23, 2020 to February 25, 2020 in Yichang.

TABLE 1. Results of univariate analyses for the effect of the influential factors on the severity of illnesses from January 23, 2020 to February 25, 2020 in Yichang.

Independent variable	Mild illness	Moderate illness	Severe illness	Total	Pearson chi-square (*p*)
Age (years)					
<65	125	457	91	673	104.41 (<0.001)
≥65	31	81	97	209	
Sex					
Male	84	271	97	452	0.596 (0.742)
Female	72	267	91	430	
Underlying diseases					
Non-diabetes and non-hypertension	132	450	115	697	
Only hypertension	18	57	39	114	53.294 (<0.001)
Only diabetes	3	17	14	34	
Diabetes and hypertension	3	14	20	37	
Total	156	538	188	882	–

TABLE 2. Results of the effect of the influential factors for the severity of illnesses obtained by OLR PPOM from January 23, 2020 to February 25, 2020 in Yichang.

Influential factor	(Moderate & Severe illnesses) *vs*. Mild illness			Severe illness *vs*. (Mild & Moderate illnesses)		
	Coefficient	OR (95% CI)	*p*	Coefficient	OR (95% CI)	*p*
Intercept	1.416	–	<0.001	−1.963	–	<0.001
Age (years) (0–64 years as reference)						
≥65 years	0.100	1.105 (0.711, 1.719)	0.657	1.549	4.706 (3.248, 6.816)	<0.001
Underlying diseases (non-diabetes and non-hypertension as reference)						
Only hypertension	0.328	1.388 (0.915, 2.106)	0.123	0.328	1.388 (0.915, 2.106)	0.123
Only diabetes	1.095	2.990 (1.467, 6.086)	0.003	1.095	2.990 (1.467, 6.086)	0.003
Diabetes and hypertension	1.060	2.885 (1.430, 5.822)	0.003	1.060	2.885 (1.430, 5.822)	0.003

Note: Score test for the proportional odds assumption: Chi-square=0.607, df=3, *p*=0.895. Goodness-of-fit of overall model (Likelihood Ratio): Chi-square=111.47, df=5, *p*<0.001, Pseudo R^2=0.1402.
Abbreviation: OLR=ordinal logistic regression, PPOM=partial proportional odds model.

TABLE 3. Results of the effect of the influential factors for the severity of illnesses obtained by three separate BLR models from January 23, 2020 to February 25, 2020 in Yichang.

Influential factor	Severe illness *vs*. Mild illness			Severe illness *vs*. Moderate illness			Moderate illness *vs*. Mild illness		
	Coefficient	OR (95% CI)	*p*	Coefficient	OR (95% CI)	*p*	Coefficient	OR (95% CI)	*p*
Intercept	−0.4808	–	0.001	−1.738	–	<0.001	1.273	–	<0.001
Age (years) (0–64 years as reference)									
≥65 years	1.260	3.524 (2.130, 5.933)	<0.001	1.619	5.048 (3.406, 7.518)	<0.001	−0.385	0.681 (0.421, 1.120)	0.123
Underlying diseases (non-diabetes and non-hypertension as reference)									
Only hypertension	0.545	1.725 (0.905, 3.355)	0.101	0.429	1.536 (0.919, 2.534)	0.100	0.063	1.065 (0.599, 1.977)	0.835
Only diabetes	1.623	5.069 (1.549, 22.841)	0.014	1.077	2.937 (1.320, 6.411)	0.007	0.547	1.727 (0.567, 7.499)	0.390
Diabetes and hypertension	1.499	4.478 (1.407, 19.921)	0.022	1.025	2.787 (1.285, 6.153)	0.010	0.483	1.620 (0.506, 7.231)	0.462
Hosmer-lemeshow goodness-of-fit test	0.614			0.380			0.980		
Sample size	344			726			694		

Abbreviation: BLR=binary logistic regression.

likelihood ratio statistic and *p*-value indicated PPOM built with adequate goodness-of-fit, while the Nagelkerke pseudo R^2 of POM and PPOM were 0.103 and 0.140, respectively, further favoring PPOM as a better fit than POM. The results of the BLR model were relatively consistent with that of PPOM.

DISCUSSION

This study aimed to explore the influential factors of the severity of COVID-19. The results showed that elderly patients with diabetes are more likely to suffer from severe illness, and there was no evidence of the association between either gender or hypertension and the severity. In clinical treatment, there are currently no effective medications, thus conventional adjuvant therapy, which aims to prolong the patients' life while waiting for the host's immune system of to fight off the virus, is the primary approach. These findings suggested that more attention should be paid to the elderly with diabetes as a key population of prevention and treatment.

These results were in accordance with the conclusion deduced from an epidemiological study that the average age of patients with severe illness were about 7 years older than that of patients with non-severe illness. Furthermore, the case fatality rate of patients who reported comorbid conditions was much higher than that of those without comorbid conditions (*6*). It is generally assumed that aging and underlying diseases that would weaken the immune system of patients resulted in patients being at greater risk of developing severe illness caused by this virus (*7–8*).

There were two explanations for this situation that patients with diabetes were inclined to develop the severe illness. First, adipocytokines, of which the secretion by adipose tissue was increased in diabetic patients, played a central role in immune dysregulation, thus the immune response was changed and immune aging was accelerated (*7*). Second, the major damage caused by COVID-19 occurred in the lungs (*2*). However, the innate and adaptive immunity in the pulmonary system in diabetic patients could be destroyed, which could lead to more severe damage in these patients (*7*). There was no evidence that patients with hypertension were at greater risk of suffering from severe illness, and similar results were reported in an analysis of risk factors of influenza A-associated severe pneumonia in hospitalized patients (*9*). The elderly tended to develop severe illness caused by the virus generally due to silent or obvious inhalation of virus-containing aerosol that could be increased by reduced cough reflex and the impairment of the immune system functions (*10*). Previous literature reported antihypertensive drugs that could induce cough could reduce the risk of severe illness, which may be a reasonable explanation to these findings to some degree (*10*).

This study is subject to at least a few limitations. First, since the data were collected through retrospective surveys, the causal effect of the influential factors on the severity of COVID-19 could not be derived. Second, using multiple separate BLR models for each pair of response variables should be cautiously used because the decrease in sample size could result in a loss of statistical power. The exploration of other influential factors for the severity of this disease with larger sample sizes warrants further studies.

The prevalence of diabetes in China had gone up to 6.2% according the results of global burden disease 2017, and the elderly with diabetes accounted for approximately 30% of the overall diabetic patients. Therefore, strengthening the protection for senior patients with diabetes against COVID-19 and the control of human-to-human transmission of this virus is of great public health significance, and we should implement a community-based education and surveillance program for this group.

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Notes from the Field

A Nosocomial COVID-19 Outbreak Initiated by an Infected Dockworker at Qingdao City Port — Shandong Province, China, October, 2020

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On October 10, 2020, 3 cases of coronavirus disease 2019 (COVID-19) were detected via routine pre-admission nucleic acid screening of inpatients and their visitors at Qingdao Central Hospital. The 3 cases were all related to the Qingdao Chest Hospital. An additional 9 cases were discovered and confirmed through tracing and testing contacts of the 3 initial cases. Viral isolates from all 12 cases were found to have high degrees of genetic homology with the viral isolate from a dockworker at Qingdao Port, referred to as Patient A in this report. A joint investigation team was formed to determine the source of infection and the scale of the outbreak, and to prevent further spread of the virus.

On October 11, all inpatients, visitors, and hospital staff who had been at Qingdao Chest Hospital after September 1 underwent COVID-19 virus nucleic acid screening; close contacts of the cases were traced and provided medical care in isolation. An additional 9 new confirmed cases of COVID-19 were found, for a total of 12 cases. Among these, 7 were tuberculosis (TB) patients in Qingdao Chest Hospital, 3 were visitors of the tuberculosis patients, and 2 were family members of the tuberculosis patients or visitors. From October 11 to 17, more than 200,000 people from the community where the initial patients resided and residents of the surrounding areas were screened with PCR testing. Subsequently, all Qingdao City residents were tested. In total, 10.92 million people were tested, and no additional cases were found. Among the 12 outbreak cases, 2 infections were mild, 7 were moderate, 2 were severe, and 1 was critical. Their average age was 49 years, ranging from 23–83 years old; 6 were men and 6 were women.

Virus isolates from the 12 cases underwent whole genome sequencing. Sequences were compared and analyzed by Shandong Provincial CDC and were sent to China CDC for comparison with genetic sequences of recent COVID-19 cases. The sequences of the 12 cases' virus isolates were found to be 99.9% homologous with a virus sequenced from Patient A, a COVID-19 case diagnosed in Qingdao on September 24. Patient A is a dockworker who was infected after loading and unloading imported frozen seafood at Qingdao Port on September 19. The phylogenetic diagram of Patient A's virus isolate is shown in Figure 1, demonstrating that he was the source of infection of this outbreak. After being diagnosed on September 24, he had been transferred to Qingdao Chest Hospital, which is a designated hospital for COVID-19 care and treatment (1).

Big data screening and tracking showed that there was no temporal or spatial correlation between the patients and the close contacts in this outbreak and Patient A or his contacts before he was transferred to Qingdao Chest Hospital. A surveillance video confirmed that Patient A had been escorted from the isolation ward on the afternoon of September 24 to undergo a computerized tomography (CT) examination, possibly contaminating the CT examination room with virus due to lack of standardized disinfection. Contamination of the CT room most likely led to infections of Patients B and C, who had CT exams the following morning. They, in turn, likely brought the virus into the area for TB patients, and thus continued the spread of COVID-19.

From October 11 to 15, Qingdao City CDC collected 129 environmental samples at Qingdao Chest Hospital, including from the CT room, tuberculosis patient wards, and sewage pipes. All samples had negative nucleic acid test results. Close contacts of all cases, close contacts of the close contacts, and all staff of Qingdao Chest Hospital and their visitors underwent a total of 5 nucleic acid tests each; all tests were negative. As of October 20, no new cases have been detected in Qingdao.

This outbreak was likely an in-hospital infection caused by a lack of standardized disinfection of the hospital's CT room. Recommendations have been

FIGURE 1. Phylogenetic tree based on the genome sequences of the COVID-19 virus. The genome of the COVID-19 virus from 5 patients infected at Qingdao Chest Hospital and Patient A were highlighted in shades of orange and yellow, respectively.

made to strengthen the prevention and control of nosocomial COVID-19 infections to prevent transmission at these COVID-19-designated medical institutions.

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Swedish Response to COVID-19

Johan Carlson[1]; Anders Tegnell[1,#]

Editorial   Among the global responses to COVID-19, Sweden's response has received both praise and criticism for the implementation of certain measures. This paper, provided by Public Health Agency Sweden's Director General Johan Carlson and State Epidemiologist Anders Tegnell, describes the main goals of Sweden's public health response: minimizing transmission, mortality, and morbidity; minimizing other negative health effects and externalities of the pandemic; and safeguarding essential services in the society. While some of the stances or strategies described may differ from China CDC's recommendations or other measures adopted in China, *China CDC Weekly* seeks to act as a platform for global voices to disseminate and discuss a variety of viewpoints to achieve an improved, mutual understanding of our counterparts.

INTRODUCTION

Sweden had its first confirmed case of coronavirus disease 2019 (COVID-19) at the end of January 2020. Sweden's response to COVID-19, despite having the same objectives and goals as other countries, has received global attention with both praise and criticism. The main goals for Sweden's response has been to slow the spread of COVID-19, minimize mortality and morbidity in the entire population, minimize other negative health effects of the pandemic, and to safe guard essential services of society. The major elements of the public health response will be described briefly here without aspiring to give a comprehensive overview of the overall strategy.

POPULATION HEALTH AND THE HEALTHCARE SYSTEM IN SWEDEN

Sweden has a total population of 10 million. The general health of the population is good with life expectancies of 81.3 years for males and 84.7 years for females; low maternal and child mortality rates; and a demographic distribution with 20% of the population >65 years (*1*). Sweden has highly-subsidized universal healthcare coverage. Management of the healthcare system, including communicable disease response, is decentralized to 21 regions. The Public Health Agency coordinates communicable disease response nationally and has a broad mandate for public health, including prevention and control of non-communicable diseases and support for mental health and health equity. Government expert agencies in Sweden have strong mandates at the national level to inform policy; trust among the general population in government institutions and the healthcare system is fairly high (*2*).

THE COVID-19 OUTBREAK IN SWEDEN

Sweden had a massive introduction of the virus in February 2020, particularly in Stockholm, and not only from the Alps. During the February winter break, approximately 1 million Swedes travelled abroad, mainly from the Stockholm area. Genome sequencing of COVID-19 virus showed that the virus introduced into Sweden belonged to 3 distinct genetic groups, supporting the hypothesis that there were several separate, parallel introductions early in the pandemic (*3*).

Up to September 14, 5,846 people have died from COVID-19 in Sweden (2,650 females and 3,196 males) (*4*). Most deaths have been among individuals over 70 years, and the Stockholm region has been the most affected. Deaths among elderly people in nursing homes represent a high proportion of COVID-19 fatalities. There has been a significant decline in new cases and severe cases during the summer following a peak in late March and early April. Currently, the number of confirmed cases and the ratio of confirmed cases to the number of tests performed has declined, and various assessments show a decline in transmission and numbers of individuals infected. The national incidence of COVID-19 between August 31 and

September 6, 2020 was 13 cases per 100,000 inhabitants (*4*).

There are complex reasons for the high number of fatalities in Sweden compared with neighboring countries, and the impact of several factors needs to be considered when comparing mortality rates. These factors include important differences in the epidemiology of the pandemic and structural differences in demographics and the healthcare system. The management of the pandemic, the role and impact of different response measures, compliance with binding and voluntary measures, and other health effects are also essential considerations for understanding the high number of fatalities.

Population immunity has never been the goal of the Swedish strategy. Immunity has proven to be difficult to estimate due to heterogeneous spread of the virus. The most recent serological survey was conducted in June and showed that 18.7% (95% CI: 14.8%–23.3%) of people living in a highly affected area had antibodies to COVID-19 virus, and that nationwide, approximately 7% of the population had antibodies, with substantial variation by age group and region.

PUBLIC HEALTH RESPONSE TO COVID-19 IN SWEDEN

The Communicable Disease Act (2004:168) of Sweden guides overall responses to communicable disease threats; the responsibility of individuals in minimizing disease transmission is articulated in the Act. Sweden's main public health response has been to minimize transmission as much as possible and to protect risk groups, particularly the population above 70 years of age (*5*). Currently, Sweden has a high capacity for contact tracing and testing, including preparedness for early detection and management of new cluster outbreaks. The initial strategy of strict containment changed to mitigation and protection of risk groups on March 10, when the pandemic had become widespread across society. As testing capacity increased and the number of new cases decreased, testing and contact tracing has been scaled up significantly.

A COMBINATION OF BINDING RULES AND RECOMMENDATIONS

Sweden has developed a response package that includes both legally binding regulations and strong but voluntary recommendations. The government passed a ban on gatherings of over 50 people. Travel has been restricted on and off, and recommendations to avoid unnecessary travel have been issued. International travel was restricted by the Ministry of Foreign Affairs, including an entry ban for non-essential travel to Sweden from countries outside the EU until June 15 and advice against non-essential travel to all countries through July 15. From March 19 to May 13, the recommendation was to avoid unnecessary domestic travel. Subsequently, 2-hour trips were allowed for asymptomatic persons, and from June 12, domestic travel was again permitted under the condition that other recommendations were adhered to. Employers have been responsible for adapting workplaces to prevent the spread of infection. Distanced education has been implemented in secondary schools and universities. Visits to nursing homes were banned on April 1, and assignments were given to providers of long-term care to develop safe measures in which nursing home residents can meet with family and friends. The ban will be lifted on October 1, 2020.

Legally binding rules have been supplemented with recommendations and guidelines to facilitate compliance with recommendations, such as staying at home even with the slightest symptom of an infection, physical distancing, enhanced hygiene measures, avoiding public transportation, and working from home if possible. There have been strong recommendations for people in risk groups and individuals over 70 years of age to limit close contacts as much as possible.

TEMPORARY CHANGES IN THE SOCIAL SECURITY SYSTEM

The government made temporary changes in sickness insurance so that employees can stay at home from the very first day of symptoms without financial consequence. The requirement of a medical certificate for sick leave >7 days was temporarily removed to facilitate sick leave and home quarantine.

PRIMARY SCHOOLS HAVE REMAINED OPEN

Schools have been open for healthy children under 16 years of age. The rationales behind that decision were that children were not believed to be important

drivers of the pandemic, that closing schools has negative health consequences, and that children rarely get seriously ill from COVID-19. Children have the same recommendations as does the general public — e.g. avoiding large public gatherings, adhering to hand hygiene, and staying at home if symptomatic. Keeping primary schools open, thus far, has not generated an increase in transmission (6).

COMMUNICATION AND COMPLIANCE

Together with the National Board of Health and Welfare and the Swedish Civil Contingencies Agency, the Public Health Agency has held daily press conferences with new and updated regulations and recommendations, including the latest epidemiological information about the pandemic. Special effort has been made to inform underserved communities. Communications have been a central component of the response.

Aspects of compliance and behavioral changes of the public have been monitored repeatedly through web-based questionnaires. Monitoring includes the number of contacts and physical distancing measures. Travel patterns have been monitored with mobile phone data. The Swedish population has adjusted its behavior to a large extent.

PROTECTIVE GEAR

Medical face masks and other protective gear are considered by the Public Health Agency to be absolutely essential in healthcare facilities. Compliance with recommendations on physical distancing and the currently low level of spread in Swedish society, in combination with the still rather weak evidence of the effectiveness of public use of different kinds of face masks, has not yet prompted a recommendation for public use of face masks. However, if and

when transmission increases, face masks will be considered — for example, in settings where physical distancing cannot be maintained.

DISCUSSION

The Swedish COVID-19 strategy has focused on minimizing transmission and protecting of risk groups while at the same time trying to mitigate other public health threats. Compliance with rules, recommendations, and advice is estimated to have been satisfactory so far, and the combination of binding and voluntary response measures seem to have had an effect. The reasons for high fatality rates in Sweden, when compared to neighboring countries, is complex and cannot be explained by the nature of the Swedish response alone.

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World Mental Health Day 2020: Promoting Global Mental Health During COVID-19

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Observed for the first time on October 10, 1992, World Mental Health Day was initiated by the World Federation for Mental Health and is currently coordinated by the World Health Organization (WHO), the World Federation for Mental Health, and the United for Global Mental Health organization. These annual events promote awareness of the importance of mental health and mobilize support for providing high-quality, community-based care to all persons who need mental health services; this year, most events will be conducted online due to the coronavirus disease 2019 (COVID-19) pandemic (1–3).

MENTAL HEALTH FOR ALL: GREATER INVESTMENT — GREATER ACCESS

The theme of this year's World Mental Health Day is "Mental Health for All: Greater Investment, Greater Access". This theme highlights the chronic lack of resources for mental health and the inequitable distribution of the limited resources that are available. Despite increased awareness of the importance of mental health and psychological wellbeing to economic and social development by national governments and international agencies over the last two decades, there has not been a corresponding increase in investment in mental health. In its news release about World Mental Health Day, the WHO (4) reports that 1 billion people are currently living with mental disorders, 3 million individuals die each year of alcohol use disorder, and 1 person dies every 40 seconds by suicide. In spite of this huge toll on global productivity, 75% of people with mental disorders in low- and middle-income countries (LMICs) receive no treatment whatsoever for their condition.

Based on data from the Global Burden of Disease Study (5) in 2017, mental disorders, substance-use disorders, and self-harm accounted for 8.0% of the total global burden of disease for all health conditions and injuries, but WHO's 2017 Mental Health Atlas

(6) reports that less than 2% of government health budgets are spent on mental health and that the vast majority of these funds go to specialized mental health hospitals. Moreover, in 27% of the countries that provided data to the WHO, mental health is not covered in national health insurance plans. This mismatch between the huge burden of mental disorders, the limited government support for mental health services, and the focus of the limited financial resources available for mental health on psychiatric hospitals (which are primarily situated in urban centers) means that in many countries individuals with mental disorders, particularly those living in rural communities of LMICs, have no access to needed mental health care.

Investment in the equitable distribution of high-quality services for persons affected by mental disorders is not only an ethical imperative; it is also an economic imperative. In 2018, the *Lancet* Commission of Global Mental Health (7) estimated that the ongoing increase in mental health and substance use disorders around the world could cost the global economy US$16 trillion between 2010 and 2030. However, the Commission found that rapid expansion in investment in mental health could significantly decrease the economic burden caused by mental disorders. For example, the WHO estimates that for every US$1 invested in the treatment of common mental disorders, such as depression and anxiety, there is US$5 return in improved health and productivity.

HOW IS CHINA DOING?

China has invested substantial resources in several major mental health initiatives over the past 15 years to improve the accessibility and quality of mental health services. The Ministry of Health (MOH, then known as National Health and Family Planning Commission, now known as National Health Commision) and Ministry of Finance of China launched the *National Continuing Management and Intervention Program for*

Psychoses in 2004, which monitors the treatment of community-dwelling individuals with severe mental illnesses and provides free medication to those unable to pay for these services in 60 demonstration districts/counties. With the gradual expansion of the Program coverage, the MOH built the *National Information System for Psychoses* in 2011 to record the patients' follow-up and treatment information. As of 2017 this system was monitoring 5.4 million individuals with psychosis from all provincial-level administrative divisions (PLADs) around the country, making it the largest community-based mental health service network in the world (*8*). In 2012, China passed its first national mental health law, which provided a forward-looking roadmap for the development of mental health services with a clear emphasis on expanding community-based services (*9*). From 2013–2015 a national mental health epidemiological study involving representative samples from all 31 PLADs was conducted (*10*), and in 2015, as part of the 13th National 5-Year Plan, the 2015–2020 National Mental Health Work Plan (*11*) provided specific numeric targets for achieving the aspirational goals outlined in the 2012 mental health law.

Implementing these programs and policies has not been easy. Despite rapid improvement in the overall national access and quality of health services over the last 20 years, China has simultaneously seen an increasing gap in the access and quality of health services — including mental health services — between the rich eastern PLADs and the more rural western PLADs (*12*). As has occurred in many countries, the attempt to shift most mental health services from specialized psychiatry hospitals in urban centers to general hospitals and rural health clinics has only been partially successful; and the coordination of community-based services with hospital-based services still needs to be strengthened, especially in rural areas. The attention to the prevention of mental illnesses is just beginning, and specialized mental health services for children and the elderly are only available in large cities. The vast majority of mental health resources are focused on the management of psychotic disorders, while relatively few resources are used to actively identify and treat common mental disorders such as depression and anxiety that account for a much larger proportion of the national socioeconomic burden of mental illnesses. Mental health manpower is largely limited to psychiatrists and psychiatric nurses; meeting the increasing mental health needs of the population

will require expanding the responsibilities of all general physicians to include the recognition and management of common mental disorders and greatly increasing the numbers of clinical psychologists and psychiatric social workers. The success or failure of provincial-level and national mental health programs and policies must be regularly evaluated by independent groups of external experts in addition to routine internal evaluations by the institutions that are responsible for the programs, and the programs and policies need to be regularly revised and updated based on their findings.

COVID-19 AND MENTAL HEALTH

The COVID-19 pandemic of 2020 and the social and economic effects of managing the epidemic are likely to significantly affect community mental health (*13*). These effects will range from short-term fear and anxiety about potential infection during times of high prevalence, long-term depressive and cognitive effects in persons with chronic post-infection health conditions, pathological grieving for deceased family members who could not be visited at the time of death, the psychological effects of large-scale social and economic disruption, and increased severity of pre-existing mental disorders in individuals who cannot access their usual social support or health care networks due to lockdowns or social distancing. The prevalence, severity, demographic distribution, and social and economic effects of COVID-19 vary widely by country, so it is likely that the mental health effects will also vary widely by location and by population cohort within each community. Given that the pandemic is still ongoing, research about its effects on mental health must be considered preliminary (*14*). For example, a review of the accumulating reports about the effect of COVID-19 on suicidal behavior (*15*) finds that the quality of such studies is poor; to date, there is no evidence of changes in suicide rates. Monitoring the long-term effects of COVID-19 (and other global or national crises) on mental health will require undertaking annual, high-quality epidemiological surveys of mental health disorders, substance use disorders, and suicidal behaviors in large, nationally representative samples of community residents.

At a time when the need to support the mental health of the community is the greatest due to COVID-19, the resources available to do so in most countries have decreased because the financial needs of other community services (e.g., screening for and

treating COVID-19 infections, providing unemployment and welfare support, making schools COVID-19-safe) have increased dramatically while available government funds have been reduced due to decreased tax revenues. In this constrained economic environment, it will be difficult to convince governments and non-governmental organizations (NGOs) to earmark their limited funds and other resources for the sole purpose of increasing the access and quality of mental health services. It should, however, be feasible to include mental health issues as an essential part of governments' and NGOs' overall COVID-19 management and recovery plans, so mental health advocates will need to fight to ensure that this happens. Ideally, these challenging times could stimulate the development and promulgation of less-expensive, community-based services — such as the use of telepsychiatry or 'mental health extenders' for patients in under-served rural communities — but even if feasible, such innovations are unlikely to substantially change the dire lack of needed mental health services. Once COVID-19 vaccines are widely available, it may be possible to regain lost ground, but long-term financial damages in some LMICs will likely continue to limit the development of mental health services.

In summary, over a decade ago, global mental health advocates promoted the concept of "no health without mental health" (16). This increased awareness of the magnitude of the global mental health problem but had little effect on changing the situation. More recently, the effort to promote global mental health via World Mental Health Day and other initiatives aims to reframe mental health as an integral part of the overall social and economic development using the motto: "No sustainable development without mental health" (7). However, the COVID-19 pandemic is substantially altering the social environment and economic development of many countries, and at this point in time, no one can be certain what the post-pandemic, 'new normal' will look like. Thus, the long-term effects of COVID-19 on global mental health also remain uncertain. Ongoing monitoring of the prevalence, severity, and duration of mental health conditions and of the available services for preventing and treating these conditions will be needed to determine whether or not the current strategy of global mental health advocates of linking mental health with development will result in improved global mental health.

In 2019, Dr Tedros Adhanom Ghebreyesus,

Director-General of the WHO clarified the central role of mental health to global health as follows: "The world is accepting the concept of universal health coverage(UHC). Mental health must be an integral part of UHC. Nobody should be denied access to mental health care because she or he is poor or lives in a remote place" (17).

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Perspectives

Experiences and Lessons of Combating COVID-19 that Chinese Experts Shared with the World

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At the end of 2019, a novel viral pneumonia was detected in Wuhan City (*1*) and has spread rapidly throughout 215 countries, areas, and territories with more than 3.8 million cases and over 260,000 deaths as of May 8, 2020. This pneumonia, later named coronavirus disease 2019 (COVID-19), has become a global public security challenge. The World Health Organization (WHO) has declared it a pandemic and has called for the global community to work collaboratively to combat this novel pneumonia (*2*).

Since the early spread of COVID-19 in China, the Chinese government has implemented the most rigorous measures to prevent the spread of COVID-19 using the whole country's medical resources (*3*). Until the end of March 2020, the COVID-19 pandemic was essentially under control in China (*3*). Unfortunately, some other countries had insufficient experience in the ramping up and deployment of public health measures including prevention tactics, interventions, laboratory tests, clinical diagnosis, and treatment, which has resulted in continued suffering due to COVID-19. In order to collaborate with these countries to contain the global pandemic, the Chinese government decided to send expert teams to several countries, including Iran, Iraq, Italy, Serbia, Cambodia, Pakistan, Laos, Venezuela, Ethiopia, and Malaysia, to assist in the prevention of local COVID-19 transmission beginning at the end of February. The experiences and lessons shared by Chinese experts were intended to serve as references for these countries to inform policies on prevention and control. As one of the expert teams, here we summarized the major experiences and lessons that were shared with many countries still affected by COVID-19.

First, Chinese expert teams conducted field investigations and consulted with local governments, laboratory workers, health care workers, and citizens to collect information of the local situations of COVID-19, laboratory testing capabilities, clinical treatment protocols, and control and prevention strategies and measures implemented. Then, they comprehensively assessed the situation and future trends of COVID-19

epidemic, which provided important information for them to communicate with local experts and to provide custom consultations for those countries.

Second, based on the questions proposed by local experts, the Chinese experts introduced major prevention and control strategies and measures implemented in China including "four early measures", "four priority measures", "four necessary measures", "three lines of defense", applications of "health quick response (QR) codes", and non-pharmaceutical intervention (NPI) measures (*3*). The "four early measures" includes early detection, reporting, isolation, and treatment of COVID-19 patients. The "four priority measures" includes concentrating patients, hospitals, experts, and treatment. The "four necessary measures" include all persons with need should be tested, admitted, treated, and isolated. The "three lines of defense" referred to joint travel quarantine at all travel stations including ports and wharfs, screening at hospitals, and management of focused population in communities. Applications of health QR codes involved monitoring and managing an individual's health status by having each individual apply for a health QR code after submitting their health status online. QR codes contained three categories: green, yellow, and red. Individuals with green status can move freely without registering to enter public facilities. Those with yellow codes were quarantined, and those with red codes were isolated for further laboratory testing or treatment. The NPI mainly included restricting inter-city movement for individuals, the identification and isolation of cases, and the reduction of inner-city travel and of contact to ensure social distancing (*4*).

Third, they shared clinical experiences on the diagnosis and treatment of COVID-19 patients. For example, they introduced the "Diagnosis and Treatment Protocol for Novel Coronavirus Pneumonia" in China (*5*). They also shared the usage of computed tomography (CT) scans for diagnosis of COVID-19 patients, selection of treatment drugs, treatment for pregnant women and newborns, zoning

and classification management, optimization of medical resource allocation, multidisciplinary team building, determinants and predictors of poor prognosis, handling cases of surgery, and management of discharged patients.

Fourth, they introduced the roles of traditional Chinese medicine (TCM) in the treatment of COVID-19 patients. Medical doctors from TCM hospitals presented the effectiveness of using only TCM on clinic treatment of mild and moderate COVID-19 patients and combined protocols with western medicines on severe COVID-19 patients (6–8). Some of them joined in the development of treatment guidelines for COVID-19 by using TCM in particular countries where TCM is popular, e.g. Malaysia.

Fifth, they introduced the worldwide developmental progress of the COVID-19 vaccine and the progress in China, the evidence of effectiveness of a potential vaccination, and the possible timeline of vaccine development. Particularly, they introduced two types of vaccines, a nucleic acid vaccine and an attenuated live vaccine, that were under phase II clinical trials in China. Ideally, both vaccines could be available at the end of 2020 or in early 2021. These communication activities provided state-of-the-art information and a great opportunity for future collaboration between China and other countries in the development of a COVID-19 vaccine.

Sixth, they shared the protocols of laboratory tests for the COVID-19 virus in China, such as methods involving specimen selection and collection and the sensitivity and specificity of detection methods. The virology experts also showed that temporal shedding of the virus in patients, particularly in discharged patients, provides important information for management of discharged patients. Moreover, they shared the sensitivity and specificity of rapid test kits, such as serological tests involving IgM, IgG, or IgA.

Seventh, they provided protocol for prevention of nosocomial infections, and protection of healthcare workers in China, such as the optimization of diagnosis and treatment procedures in hospitals, selection of personal protection equations (PPE) in different settings, management of PPE when experiencing shortages, disinfection protocol, and health management of healthcare workers.

Eighth, since COVID-19 was largely controlled by the end of February in China. Governments in low-risk areas have resumed most economic activities have mostly reopened schools. Hence, Chinese experts shared experiences of the resumption and reopening. In particular, they presented the area-based risk rating strategy combined with usage of health QR codes. For example, all economic activities and normal life could be resumed in low-risk zones while focusing on the prevention of imported cases. By contrast, high-risk zones must prevent the export of cases and do not resume large-scale economic activities. Individuals with green QR codes do not need quarantine, while those with yellow or red code must follow the guidelines of quarantine or isolation for treatment.

Ninth, it has been demonstrated that the COVID-19 epidemic may psychologically impact populations of COVID-19 survivors, children, the elderly, disabled people, patients with comorbidity diseases, family members of died patients, front-line medical workers, and quarantined persons (9–10). These psychological impacts are wide-ranging, substantial, and can be long lasting (11). Therefore, the Chinese experts shared the guidelines and practices for emergency psychological crisis intervention for COVID-19 patients or associated populations implemented in China (12).

Finally, the Chinese experts also conducted a series of online risk communication activities in countries where they provided support to share their knowledge with local citizens and overseas Chinese people including workers and students. They presented the general characteristics of COVID-19, its transmission routes, susceptibility of people, clinical symptoms, measures of prevention, and selection of PPE in different circumstances. This information improved their knowledge and ability to prevent COVID-19.

These experiences and lessons provided by the Chinese experts have significantly improved the understanding and ability to contain COVID-19 for experts in the supported countries. For example, some countries have developed a treatment protocol for COVID-19 using TCM, substantially enhanced their laboratory test capability for COVID-19 virus, developed an analogical health QR code system similar with China, and gradually resumed commercial activities and returned to routine work and living using an area-based risk rating strategy (13). Meanwhile, the Chinese experts also obtained experiences and learned lessons for containing COVID-19 from foreign experts in those supported countries. Overall, the overseas supporting activities implemented by the Chinese experts not only promoted potential research collaborations between China and these countries, but also substantially contributed to the containment of the COVID-19 pandemic worldwide.

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Notifiable Infectious Diseases Reports

Reported Cases and Deaths of National Notifiable Infectious Diseases — China, September, 2020

Diseases	Cases	Deaths
Plague	1	0
Cholera	2	0
SARS-CoV	0	0
Acquired immune deficiency syndrome	6,927	2,019
Hepatitis	130,930	69
Hepatitis A	1,335	1
Hepatitis B	105,377	53
Hepatitis C	21,538	13
Hepatitis D	25	0
Hepatitis E	1,811	1
Other hepatitis	844	1
Poliomyelitis	0	0
Human infection with H5N1 virus	0	0
Measles	111	0
Epidemic hemorrhagic fever	320	1
Rabies	15	13
Japanese encephalitis	137	3
Dengue	247	0
Anthrax	36	0
Dysentery	6,206	0
Tuberculosis	75,409	175
Typhoid fever and paratyphoid fever	848	0
Meningococcal meningitis	3	0
Pertussis	201	0
Diphtheria	1	0
Neonatal tetanus	4	1
Scarlet fever	877	1
Brucellosis	4,492	0
Gonorrhea	11,643	0
Syphilis	48,965	6
Leptospirosis	110	3
Schistosomiasis	4	0
Malaria	81	0
Human infection with H7N9 virus	0	0
COVID-19[*]	356	0
Influenza	18,432	0
Mumps	13,212	0

Continued

Diseases	Cases	Deaths
Rubella	102	0
Acute hemorrhagic conjunctivitis	2,549	0
Leprosy	35	0
Typhus	184	0
Kala azar	17	0
Echinococcosis	336	0
Filariasis	0	0
Infectious diarrhea[†]	97,075	3
Hand, foot and mouth disease	115,170	0
Total	**535,038**	**2,294**

[*] The data were from the website of the National Health Commission of the People's Republic of China.

[†] Infectious diarrhea excludes cholera, dysentery, typhoid fever and paratyphoid fever.

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

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