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Preplanned Studies

Association Between Combinations of 24-Hour Movement Behaviors and Depression Among Adolescents — Inner Mongolia Autonomous Region, China, 2019–2021

Wen Yuan^{1,&}; Yihang Zhang^{1,&}; Tian Yang^{2,&}; Shan Cai¹; Ziyue Chen¹; Xinli Song¹; Yanhui Dong^{1,&}; Jun Ma¹; Xiuhong Zhang^{2,&}; Yi Song^{1,&}

Summary

What is already known about this topic?

In recent years, there has been growing concern regarding the escalating rates of depression among adolescents. While certain individual behaviors have been suggested as potential protective factors for mental health, there is a scarcity of research examining the collective influence of 24-hour movement behaviors.

What is added by this report?

This research documented the prevalence of adolescent depression, along with the rates of adherence to 24-hour movement behavior guidelines encompassing moderate to vigorous physical activity, screen time, and sleep time, in the years 2019, 2020, and 2021. A significant correlation was observed between levels of depression and combined health behaviors. Of particular note was the finding that adherence to the “screen+sleep time” recommendation was linked with the lowest risk of depression.

What are the implications for public health practice?

A comprehensive intervention that targets three 24-hour movement behaviors should be accentuated, with the combination of “sleep and screen time” potentially offering the most effective approach to managing depression.

Depression is a prevalent mental disorder on a global scale. However, limited knowledge exists regarding the correlations between combinations of 24-hour movement behaviors and depression. The aim of this study was to investigate the association between combinations of moderate to vigorous physical activity (MVPA), screen time, and sleep duration with depression in adolescents. The data was obtained from the monitoring of prevalent diseases and contributing factors to health in student populations within Inner Mongolia from 2019 to 2021. The sample consisted of

a total of 238,440 adolescents ranging between 13–18 years of age. The findings indicated a dose-response correlation between the number of attained movement guidelines and the risk of depression. Furthermore, in relation to adolescents who met all three guidelines, the “sleep+screen time” combination demonstrated the lowest associated risk with depression. These results propose that limited screen time coupled with ample sleep duration may effectively mitigate the risk of depression among adolescents.

Depression prevalence among adolescents has significantly escalated over the past decade, raising concern due to the critical developmental and transitional occurrences during this stage of life (1). Previous studies indicated specific behaviors, such as promoting physical activity and limiting sedentary times, could potentially contribute to improved mental health among adolescents (2). However, there is a growing consensus that an amalgamation of 24-hour movement behaviors could have a more profound impact on health than isolated behaviors. This is particularly pertinent during adolescence as it is foundational for establishing lifelong behavioral patterns (3). Therefore, this study aims to investigate the correlation between patterns of 24-hour movement behaviors, including MVPA, screen time, and sleep duration, and their associations with depression in adolescents.

Annual health surveillance was conducted on common diseases among students in the Inner Mongolia Autonomous Region, spanning all 12 cities (103 counties) of the region. A stratified cluster random sampling technique was utilized for this purpose. Initially, junior and senior high schools within each county were chosen at random, determined by geographic classification (rural or urban). Thereafter, stratification by grade was carried out, with students participating in the study in class units to meet the minimum quota of 80 students per

grade. In this study, three cross-sectional data sets from the years 2019, 2020, and 2021 were leveraged, encompassing 83,866 adolescents (49.3% boys) in 2019, 67,998 adolescents (49.4% boys) in 2020, and 86,576 adolescents (49.5% boys) in 2021, aged 13–18 years, all with complete data records.

Depression was quantified using the Center for Epidemiological Studies Depression Scale (CES-D). This scale encompasses 20 symptom-related items, which were evaluated based on their frequency of occurrence over the preceding week, utilizing a 4-point grading system ranging from 0 to 3. A cumulative score of ≥ 16 was delineated as indicative of a depressive mood (4).

Information regarding MVPA, screen time, and sleep duration was obtained through a questionnaire derived from the national program for monitoring and intervention of common diseases and health influencing factors among students. This questionnaire was designed in alignment with the Canadian 24-hour movement guidelines for children and youth (5).

Participants meeting the behavioral recommendations were defined as those engaged in at least one hour of MVPA daily, less than or equal to two hours of daily screen time, and daily sleep duration of at least nine hours for junior high school students or eight hours for senior high school students. These

guidelines consider both Canadian and Chinese standards (6).

Covariates, including gender and school level, were gathered through the questionnaire, while geographical location was designated by administrative divisions.

Statistical analyses were performed utilizing SPSS 26.0 (web version 26.0; IBM, New York, USA) and R 4.2.3 (R Core, TeamVienna, Austria). Categorical variables were described using numbers and percentages, while the chi-square test was utilized to examine group differences. A multivariate logistic regression model was used to analyze the associations between depression and 24-hour movement behaviors, inclusive of subgroups and different combinations. All analyses were two-sided, with a *P*-value of less than 0.05 indicative of statistical significance. Visualizations were created using R.

Figure 1 illustrates the pattern and group variances in rates of depression. On the whole, the prevalence of depression was 29.1%, 32.2%, and 30.9% in the years 2019, 2020, and 2021, respectively, with significant differences observed in the distribution by sex, stage of schooling, and geographical location across the three years (all $P < 0.05$). In particular, girls and senior high school students demonstrated significantly higher rates of depression compared to boys and juniors (2019: $\chi^2 = 254.16$, 298.28; 2020: $\chi^2 = 491.94$, 938.81;

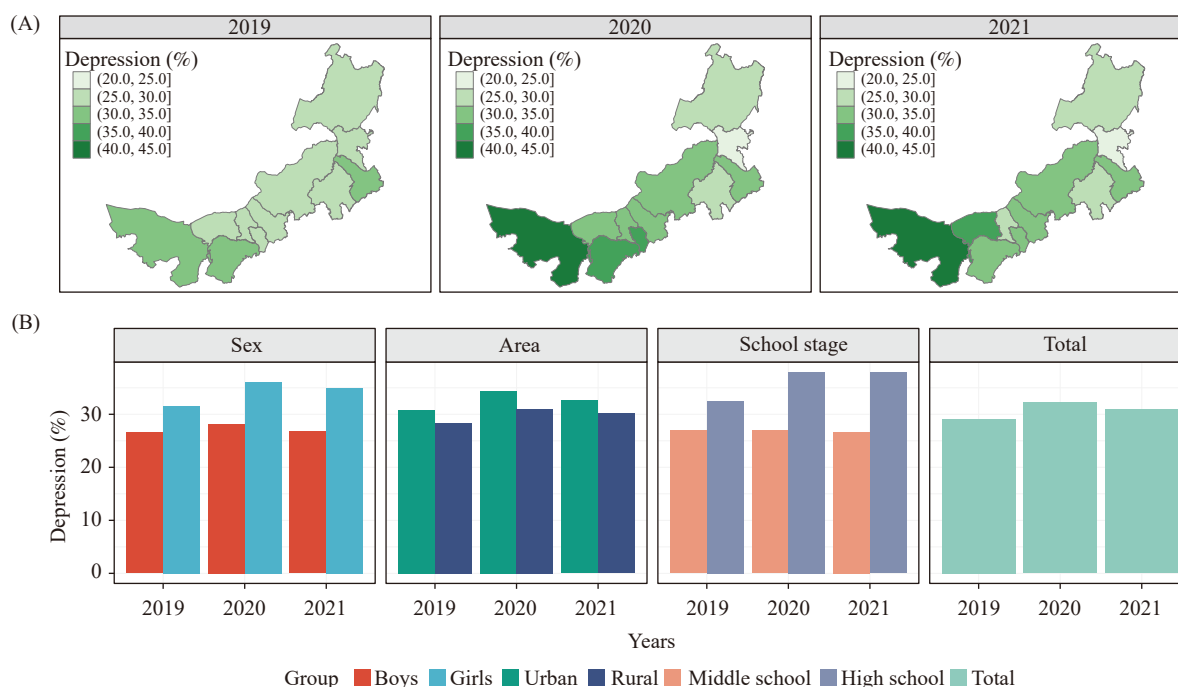


FIGURE 1. Trends and group differences in depression among adolescents aged 13–18 years in Inner Mongolia Autonomous Region, 2019–2021. (A) depression proportions of adolescents from 2019 to 2021; (B) sex, area, and school stage difference of adolescents' depression proportions.

2021: $\chi^2=676.89$, 1197.56; all $P<0.001$). Regarding the geographical variation, rates of depression across 12 league cities in the Inner Mongolia Autonomous Region showed discrepancies, with a higher proportion of depressive symptoms found in the southwest. Furthermore, only 1.2%, 1.2%, and 2.3% of adolescents across the three years met all three recommended guidelines. Detailed characteristics of depression are presented in Supplementary Table S1 (available in <https://weekly.chinacdc.cn/>). Additionally, trends and group differences in 24-hour movement behaviors are depicted in Supplementary Figures S1 and S2 (available in <https://weekly.chinacdc.cn/>).

Figure 2 illustrates the differing distribution of depressive symptoms in adolescents in correlation with assorted 24-hour movement behaviors from 2019 to 2021. Generally, a higher adherence to guidelines saw a lower rate of depression ($\chi^2=2,735.56$, $P<0.001$). Analyzing the data from a behavioral combination viewpoint, adolescents who adhered to the “screen+sleep” combination displayed the least rate of

depression, while those who adhered to the “MVPA only” combination exhibited the highest. The proportion of depressive symptoms increased from 2019 to 2021 among adolescents adhering to the “MVPA only” and “screen only” combinations. Conversely, it decreased among adolescents adhering to the “screen+sleep” combination ($\chi^2=26.62$, 44.60, 51.20, all $P<0.05$).

Figure 3 illustrates the correlations between depression and 24-hour movement behaviors from 2019 to 2021. There exists a dose-response relationship between the adherence to 24-hour movement guidelines and the prevalence of depression. When examining various combinations of the three behaviors, all combinations — with the exception of the “screen+sleep time” combination — were significantly correlated with an increased risk of depression. Notably, abiding by the “MVPA only” guidelines was associated with the highest risk. Correlations in subgroups defined by sex, school stage, and geographic location are detailed in Supplementary Table S2 (available in <https://weekly.chinacdc.cn/>). On the

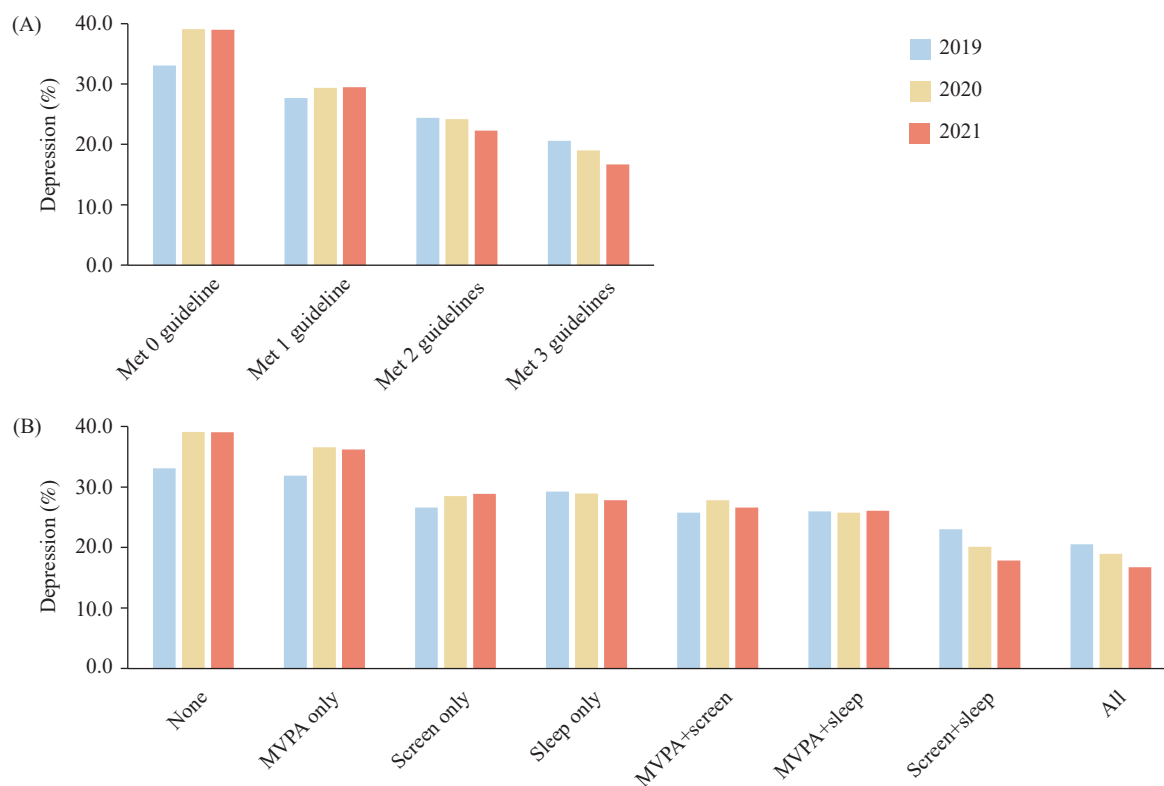


FIGURE 2. Distribution of depression among adolescents aged 13–18 years in Inner Mongolia Autonomous Region in relation to different 24-hour movement behaviors, 2019 to 2021. (A) adolescents' depression proportions with met different numbers of 24-hour movement behaviors guidelines; (B) adolescents' depression proportions with different combinations of 24-hour movement behaviors.

Abbreviation: MVPA=moderate to vigorous physical activity.

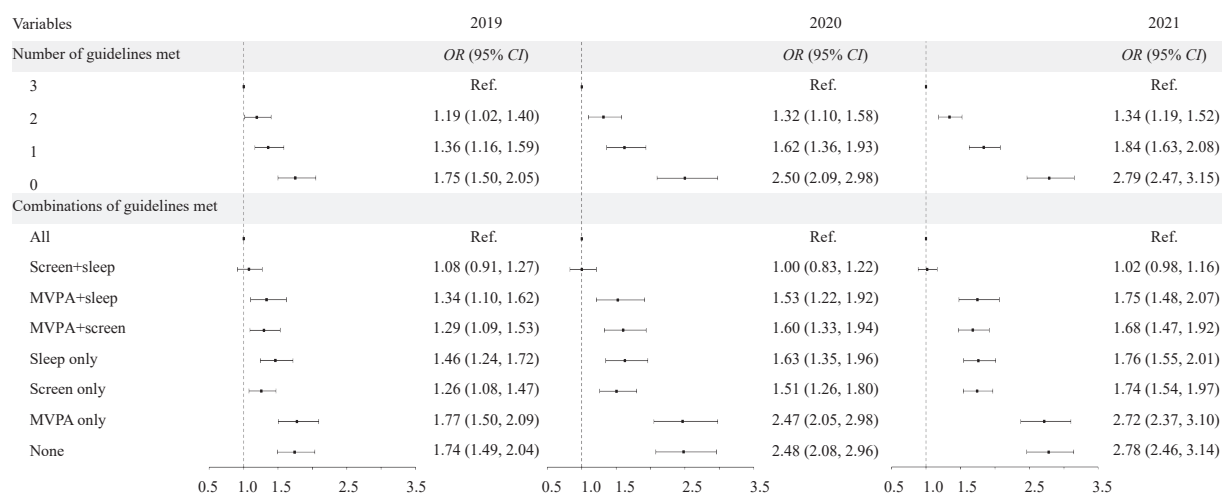


FIGURE 3. Association between combinations of 24-hour movement behaviors and depression among adolescents aged 13–18 years in Inner Mongolia Autonomous Region, 2019–2021.

Note: Adjusted for age, sex, school stage, and area.

Abbreviation: MVPA=moderate to vigorous physical activity; OR=odds ratio; CI=confidence interval.

whole, stronger associations were found between the quantity and combinations of 24-hour movement behaviors and depression among male and urban students.

DISCUSSION

In this study, we explored the cross-sectional associations among adolescents in Inner Mongolia from 2019 to 2021. The results indicated that: 1) the prevalence of depression was consistently high among school students throughout the three-year period, with an increase in 2020 followed by a decline in 2021; noteworthy disparities were observed between genders and across different school stages. 2) The current disposition of 24-hour movement behaviors among adolescents was relatively unsatisfactory. 3) The adherence to guidelines exhibited a dose-response relationship with the depression rates, with the conjunction of “sleep+screen time” in particular displaying the lowest risk associated with depression.

Our data revealed that approximately 30% of surveyed adolescents exhibited symptoms of depression, alongside an alarmingly low adherence rate to all three recommendations under examination in this study. These changes in depression rates align with the findings from a previous systematic review and meta-analysis of the impact of the COVID-19 pandemic on the mental health of children and adolescents. The study noted a significant escalation of anxiety and depressive symptoms in 2020, with a

subsequent decline, followed by a mild uptick during the second wave of the pandemic (7). Disturbingly, adherence levels to the 24-hour movement behavior recommendation were markedly lower than previous results (8). Compounded by pandemic-related restrictions, achieving the recommended minimum of one hour of MVPA daily proved to be the most challenging guideline for individuals to comply with. Our study also underlines gender and school-stage disparities in depression rates, confirming the vulnerability of these particular demographics. Girls typically exhibit higher rates of suicidal thoughts and behaviors (9), while senior school students confront greater academic pressures. Depression negatively affects academic performance, a repercussion that potentially extends into college; thus, there’s an urgent necessity for heightened attention to the mental health of girls and students in advanced grades (10).

Our research uncovered correlations between failing to meet a greater number of behavioral recommendations and an increased risk of depression, underscoring the importance of holistic interventions for daily movement behaviors. In terms of specific combinations, our findings align with previous research (11), indicating that meeting recommendations for both screen time and sleep duration possesses more mental health benefits than solely adhering to the MVPA recommendations. This suggests that failure to meet either screen or sleep time recommendations may negate the benefits of exercise. Given the close links between social media use, sleep

disruption, and depression (12), our research recommends adherence to both screen time and sleep duration guidelines as a more effective approach to enhance adolescents' mental health, as opposed to solely focusing on physical activity interventions.

This study does present several limitations. First, our participant pool was sourced from surveillance data exclusive to the Inner Mongolia province in China. This could potentially confine the extent to which our findings can be generalized across the country. Second, the cross-sectional nature of the study prohibits us from establishing causality. Lastly, we gathered information on 24-hour movement behaviors via questionnaires as opposed to objective instruments, which likely led to some degrees of bias, particularly in relation to physical activity and screen time.

In conclusion, the prevalence of depression and adherence to the 24-hour movement guidelines was suboptimal among adolescents aged 13–18 years in Inner Mongolia from 2019 to 2021, highlighting the urgent need for attention and intervention. A dose-response relationship was observed between the number of guidelines met and the rate of depression. Furthermore, it was found that adhering to the “sleep+screen” combination could provide additional mental health benefits. Nevertheless, it remains critical to maintain all three healthy movement behaviors. Beyond the known benefits of physical activity, achieving recommended screen-viewing and sleep durations is also paramount in reducing depressive symptoms.

Conflicts of interest: No conflicts of interest.

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SUPPLEMENTARY MATERIAL

SUPPLEMENTARY TABLE S1. Characteristics and distribution of depression among adolescents aged 13–18 years in Inner Mongolia, 2019–2021 (N=238,440).

Characteristics	2019 (N=83,866)		2020 (N=67,998)		2021 (N=86,576)		χ^2	P value [†]
	Total, N (%)	Depression, n (%)	Total, N (%)	Depression, n (%)	Total, N (%)	Depression, n (%)		
Sex							24.635	<0.001
Boy	41,309 (49.3)	10,984 (26.6)	33,575 (49.4)	9,447 (28.1)	42,887 (49.5)	11,473 (26.8)		
Girl	42,557 (50.7)	13,445 (31.6)	34,423 (50.6)	12,421 (36.1)	43,689 (50.5)	15,257 (34.9)		
School stage							756.29	<0.001
Junior high school	51,127 (61.0)	13,784 (27.0)	35,896 (52.8)	9,681 (27.0)	54,104 (62.5)	14,427 (26.7)		
Senior high school	32,739 (39.0)	10,645 (32.5)	32,102 (47.2)	12,187 (38.0)	32,472 (37.5)	12,303 (37.9)		
Area							124.31	<0.001
Urban	25,980 (31.0)	8,019 (30.9)	22,575 (33.2)	7,769 (34.4)	25,229 (29.1)	8,220 (32.6)		
Rural	57,886 (69.0)	16,410 (28.3)	45,423 (66.8)	14,099 (31.0)	61,347 (70.9)	18,510 (30.2)		
24-hour movement behaviors								
MVPA time ≥ 1 hour	11,136 (13.3)	3,100 (27.8)	9,382 (13.8)	2,843 (30.3)	13,977 (16.1)	3,968 (28.4)	16.455	<0.001
Screen time ≤ 2 hours	39,228 (46.8)	10,141 (25.9)	34,260 (50.4)	9,352 (27.3)	47,886 (50.9)	12,679 (26.5)	19.655	<0.001
Enough sleep time*	16,382 (19.5)	4,320 (26.4)	9,927 (14.6)	2,431 (24.5)	16,966 (19.6)	3,771 (22.2)	77.973	<0.001

* No less than 9 h for junior high school students and 8 h for senior high school students.

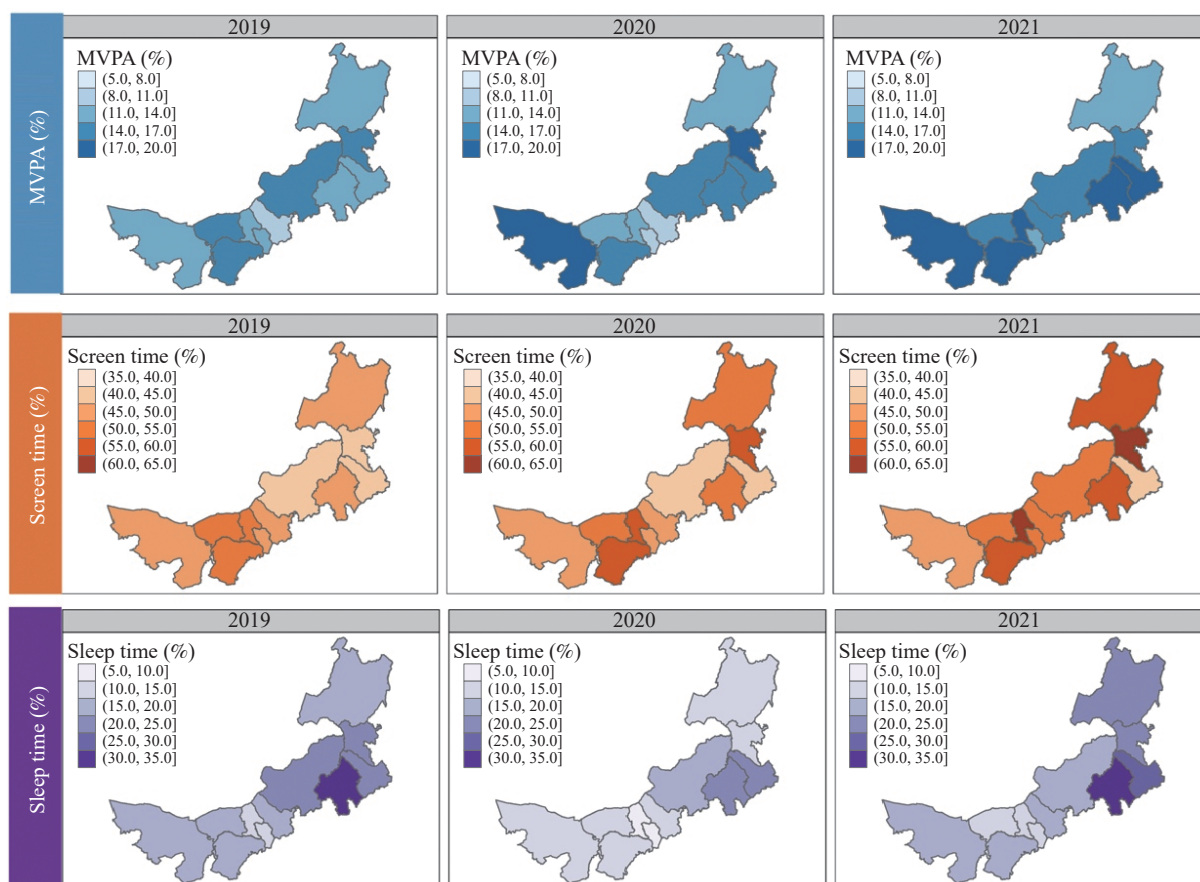
[†] Chi-square test results of the distribution of depression in different characteristics and three years.

Abbreviation: MVPA=moderate to vigorous physical activity.

SUPPLEMENTARY TABLE S2. Associations between combinations of 24-hour movement behaviors and depression in different subgroups of sex, area and gender among adolescents aged 13–18 years in Inner Mongolia, 2021 (N=86,576).

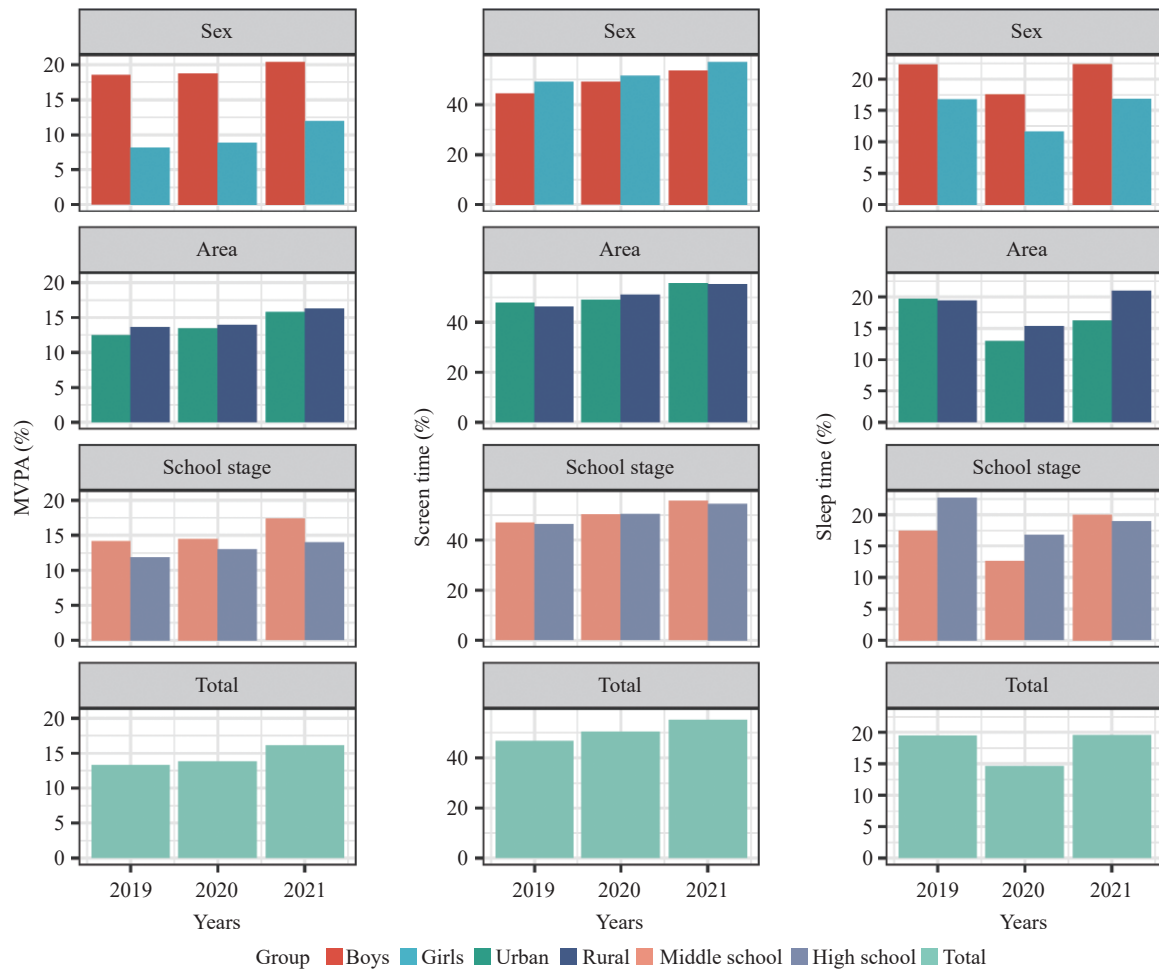
Variables	Sex				Area				School stage			
	Boy		Girl		Urban		Rural		Middle school		High school	
	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)
Number of guidelines met												
3	Ref		Ref		Ref		Ref		Ref		Ref	
2	0.000	1.42 (1.20, 1.67)	0.019	1.26 (1.04, 1.53)	0.000	1.70 (1.29, 2.25)	0.001	1.26 (1.10, 1.45)	0.030	1.26 (1.02, 1.55)	0.000	1.40 (1.20, 1.64)
1	0.000	1.93 (1.65, 2.27)	0.000	1.81 (1.50, 2.18)	0.000	2.39 (1.82, 3.14)	0.000	1.75 (1.53, 2.00)	0.000	1.92 (1.57, 2.35)	0.000	1.83 (1.57, 2.13)
0	0.000	2.86 (2.44, 3.36)	0.000	2.84 (2.35, 3.44)	0.000	3.52 (2.68, 4.63)	0.000	2.73 (2.38, 3.13)	0.000	2.72 (2.22, 3.33)	0.000	2.98 (2.56, 3.47)
Combinations of guidelines met												
All	Ref		Ref		Ref		Ref		Ref		Ref	
Screen+sleep	0.655	1.04 (0.87, 1.25)	0.691	0.96 (0.78, 1.18)	0.099	1.28 (0.95, 1.73)	0.378	0.93 (0.80, 1.09)	0.373	1.08 (0.91, 1.28)	0.318	0.89 (0.72, 1.11)
MVPA+sleep	0.000	1.81 (1.47, 2.24)	0.001	1.60 (1.22, 2.10)	0.000	2.31 (1.63, 3.27)	0.000	1.60 (1.32, 1.94)	0.000	2.04 (1.65, 2.51)	0.043	1.33 (1.01, 1.76)
MVPA+screen	0.000	1.76 (1.48, 2.10)	0.000	1.67 (1.36, 2.05)	0.000	1.99 (1.49, 2.66)	0.000	1.68 (1.44, 1.95)	0.000	1.66 (1.40, 1.96)	0.000	1.81 (1.45, 2.26)
Sleep only	0.000	1.79 (1.51, 2.14)	0.000	1.69 (1.38, 2.07)	0.000	1.90 (1.42, 2.54)	0.000	1.73 (1.50, 2.01)	0.000	1.94 (1.65, 2.30)	0.000	1.53 (1.23, 1.90)
Screen only	0.000	1.80 (1.53, 2.12)	0.000	1.75 (1.45, 2.12)	0.000	2.35 (1.79, 3.10)	0.000	1.63 (1.42, 1.87)	0.000	1.64 (1.41, 1.91)	0.000	1.96 (1.60, 2.40)
MVPA only	0.000	2.84 (2.39, 3.38)	0.000	2.77 (2.24, 3.42)	0.000	3.41 (2.54, 4.56)	0.000	2.67 (2.30, 3.11)	0.000	3.09 (2.61, 3.65)	0.000	2.35 (1.88, 2.94)
None	0.000	2.86 (2.44, 3.36)	0.000	2.84 (2.35, 3.44)	0.000	3.51 (2.66, 4.61)	0.000	2.71 (2.37, 3.11)	0.000	2.96 (2.54, 3.45)	0.000	2.72 (2.22, 3.33)

Note: Adjust for age, sex, school stage and area.
Abbreviation: MVPA=moderate to vigorous physical activity.



SUPPLEMENTARY FIGURE S1. Distribution of MVPA, screen time, and sleep time in different cities among adolescents aged 13–18 years in Inner Mongolia, 2019–2021.

Abbreviation: MVPA=moderate to vigorous physical activity.



SUPPLEMENTARY FIGURE S2. Distribution of MVPA, screen time, and sleep time in different groups among adolescents aged 13–18 years in Inner Mongolia, 2019–2021.
Abbreviation: MVPA=moderate to vigorous physical activity.

Preplanned Studies

The Long-Term Impacts of COVID-19 on Physical and Psychological Health — Beijing Municipality, China, December 2022–April 2023

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Summary

What is already known about this topic?

Reports detailing the clinical presentation of coronavirus disease 2019 (COVID-19) are extensive in China. However, data remains limited regarding the long-term effects of the 2022 outbreak on the community and healthcare workers (HCWs).

What is added by this report?

In the follow-up study conducted with 1,069 community members and 3,309 HCWs infected with COVID-19, we observed that five months post-outbreak, 39.2% of community members and 28.7% of HCWs reported experiencing at least one symptom. The symptoms most frequently reported included fatigue or muscle weakness, insomnia, cognitive dysfunction, hair loss, joint or muscle pain, and persistent cough. HCWs tended to experience fewer long-term physical consequences and their symptoms had an expedited recovery time compared to the community members. Nevertheless, HCWs displayed a higher prevalence of moderate to severe depression and anxiety.

What are the implications for public health practice?

The establishment of a public healthcare system dedicated to continual monitoring, prevention, and clinical treatment of persistent COVID-19 symptoms is imperative.

Following the relaxation of lockdown measures in China on November 11, 2022, there was a rapid uptick in coronavirus disease 2019 (COVID-19) cases from November to December 2022. By January 31, 2023, Beijing observed a cumulative infection rate of 92.3% (1). The urgent necessity now pertains to the evaluation of the short-term and long-term impacts of

COVID-19 on the Chinese population. Long COVID-19, classified by the World Health Organization (WHO) as the persistence of symptoms for 12 weeks post-infection, is alarming in various countries (2). However, it remains inadequately explored in China's context, especially pertaining to the 2022 outbreak (3). Beyond the physical implications, the psychological ramifications of COVID-19 are increasingly concerning. Factors such as the stress associated with medical care, extensive hospital stays, social isolation, and stigma substantially contribute to prolonged mental health issues, including depression, anxiety, insomnia, and posttraumatic stress disorder (PTSD) (4). Furthermore, research accentuates the varying duration and severity of COVID-19 symptoms across different populations. Healthcare workers (HCWs) appear to be particularly susceptible (5). Thus, this research aims to conduct a comprehensive examination of the long-term physical and psychological symptoms among the community and HCWs, aiming to enhance epidemic prevention policies and health care support in the post-COVID-19 era.

In this research, two cohorts were established in January 2023: a HCW cohort comprised of 6,237 participants from Peking University Third Hospital (PUTH), a tertiary institution in Beijing Municipality, and a community-based cohort with 2,011 participants. The latter was enlisted from four Beijing communities, including 528 civilians from PUTH's Second Outpatient Department in the Haidian District, 574 from the Dongpingli Community in the Chaoyang District, 360 from the Zizhuyuan Community in the Haidian District, and 549 teachers and students associated with Peking University Health Science Center. A digital survey was employed to collect participants' demographics and COVID-19 infection details such as infection date, onset

symptoms within two weeks, duration of symptoms, treatment received, and vaccination status (6–8). Infection was diagnosed based on a positive result from either an antigen test or a nucleic acid test. Two follow-up periods were conducted: the first from March 1 to 10, 2023 (approximately three months post-outbreak), and the second from April 20 to 30, 2023 (roughly five months post-outbreak). During each follow-up, participants filled out an online questionnaire, detailing symptoms they experienced within the preceding week and the duration of symptoms. Furthermore, the Depression Anxiety and Stress Scale (DASS-21) was utilized to evaluate participants' mental health condition. By the end of the study, 4,229 HCWs and 1,287 community members had successfully completed the entire process, of which 3,309 HCWs and 1,069 community individuals, who had contracted the virus, were included in the final analysis.

The statistical analysis was executed with the use of R software (version 4.1.0, R core team, Vienna, Austria). We represent qualitative data as frequencies (percentages), which have been compared via the chi-square test or Fisher's exact test. The measurement of recovery time was conducted in days and juxtaposed between groups utilizing Kaplan-Meier analysis. To control for potential confounders, such as age, sex, history of illness, and vaccination status, Cox regression analysis was carried out. The DASS-21 was deployed to compute scores for stress, depression, and anxiety, which were then compared between groups using the Mann-Whitney nonparametric test. Log-binomial regression was additionally used to control confounders. A *P*-value of less than 0.05 was deemed statistically significant.

Among 4,229 HCWs, 3,309 (78.2%) were infected with COVID-19. Within the broader community sample of 1,287 individuals, 1,069 (83.1%) were infected (Table 1). The average ages for the infected persons were 37.4 ± 9.8 years for HCWs, and 41.7 ± 17.4 years for the community cohort, respectively. Preexisting medical conditions were reported in 25.5% of the HCWs and 37.0% of the community cohort. Regarding COVID-19 vaccination, 95.8% of HCWs and 92.6% of the community cohort had received the vaccine. Furthermore, 38.7% of HCWs had been administered the adenovirus-based vaccine.

As depicted in Table 2, a significant majority of both the community population (95.3%) and HCWs (97.0%) reported experiencing at least one acute symptom. Interestingly, HCWs exhibited higher rates

of acute symptoms as compared to the community population overall. A notable decrease in symptom occurrence was observed between the first and second follow-ups: by the 3-month mark, 54.3% of the community population and 59.0% of HCWs reported an absence of symptoms. This increased to 60.8% and 71.3% respectively, five months post COVID-19 infection. At the final follow-up session, the most frequently reported symptoms among both groups were fatigue or weakness (19.2% community *vs.* 18.2% HCWs), sleep disruptions (10.0% *vs.* 7.7%), cognitive dysfunction (9.0% *vs.* 9.5%), hair loss (5.7% *vs.* 6.1%), musculoskeletal discomfort (5.1% *vs.* 4.4%), and persistent cough (5.1% *vs.* 5.0%). Interestingly, five months post COVID-19 onset, HCWs had a lower symptom prevalence compared to the community population, with the exceptions of cognitive dysfunction and diminished interest.

Figure 1 demonstrates that among HCWs, the median recovery period amounted to 41 days. This duration is notably shorter than the median recovery span of 62 days observed within the broader community. The latter group reported prolonged recovery times relating to symptoms such as breathlessness, cognitive dysfunction, chest discomfort, reduced interest, hair loss, and palpitations, with the median recovery terms being equal to or surpassing 60 days. Conversely, HCWs exhibited prolonged symptoms such as reduced interest, hair loss, mood changes, palpitations, breathlessness, and chest discomfort. It's worth noting that, except for mood changes that took longer to resolve, HCWs generally reported faster symptom resolution in comparison to the community cohort.

Psychological symptom scores, including those indicating stress, depression, and anxiety, demonstrated a decreasing trend following infection with COVID-19. Importantly, during the final follow-up, both the numerical scores and the percentage of individuals displaying moderate to severe depression (15.5% *vs.* 9.4%, adjusted *P*<0.001) and anxiety (21.7% *vs.* 17.4%, adjusted *P*=0.025) were observably greater among HCWs compared to the general population (Figure 2).

DISCUSSION

In December 2022, China revamped its policies on epidemic prevention and control due to a peak in a COVID-19 outbreak. "Long COVID-19" is rising as a significant public health crisis. Subsequently, a cohort

TABLE 1. Basic demographic characteristics of the community population and HCWs — Beijing Municipality, China, December 2022–April 2023.

Characteristics of participants	Community (N=1,069)	HCW (N=3,309)	P
Age (mean±SD)	41.67±17.43	37.40±9.80	0.003
Gender, n (%)			
Male	388 (36.3)	903 (27.3)	<0.001
Female	681 (63.7)	2,406 (72.7)	
History of disease, n (%)			
Hypertension	175 (16.4)	273 (8.3)	<0.001
Diabetes	88 (8.2)	109 (3.3)	<0.001
Hyperlipidemia	142 (13.3)	305 (9.2)	<0.001
Respiratory disease	47 (4.4)	76 (2.3)	<0.001
Cardiovascular disease	55 (5.1)	16 (0.5)	<0.001
Kidney disease	12 (1.1)	26 (0.8)	0.302
Digestive system diseases	56 (5.2)	90 (2.7)	<0.001
Immune system diseases	10 (0.9)	38 (1.1)	0.561
Reproductive system diseases	44 (4.1)	121 (3.7)	0.493
Any	396 (37.0)	845 (25.5)	<0.001
Vaccination, n (%)			
Inactivated vaccine	952 (89.1)	2,922 (88.3)	0.504
Adenovirus injection vaccine	32 (3.0)	1,281 (38.7)	<0.001
Adenovirus inhalation vaccine	18 (1.7)	165 (5.0)	<0.001
mRNA vaccine	3 (0.3)	192 (5.8)	<0.001
Recombinant protein vaccine	10 (0.9)	187 (5.7)	<0.001
Any	990 (92.6)	3,171 (95.8)	<0.001

Abbreviation: SD=standard deviation; HCW=healthcare worker.

of HCWs and a separate cohort representative of the general community were established and tracked in Beijing from November 2022 through April 2023. The research findings showed that five months post-outbreak, 39.2% of the general community and 28.7% of HCWs experienced at least one symptom. Furthermore, the median recovery durations documented were 62 days for HCWs and 41 days for the general community, respectively.

The present study has unveiled common enduring physical symptoms amongst COVID-19 patients, which include fatigue or weakness, insomnia, cognitive impairment, alopecia, musculoskeletal pain, and a persistent cough. Similar observations have emerged from numerous studies conducted in various Chinese metropolises such as Shanghai, Beijing, and Guangzhou, where fatigue, a lingering cough, cognitive focus challenges, and anxiety have been identified as chronic symptoms (4,9). Additionally, the CDC's findings from the USA corroborate this data, noting that long-haul COVID patients typically report

fatigue, cognitive difficulties, sleep disturbances, alterations in olfaction or taste, depression or anxiety, as well as digestive and other systemic symptoms (10). Such unanimous findings indicate the urgency of creating a comprehensive public health infrastructure for the continuous monitoring, prevention, and treatment of prolonged manifestations of COVID-19. Special emphasis must be placed on strategic interventions for symptoms like dyspnea, cognitive impairment, thoracic pain, mood alterations, hair loss, and sleep disorders, owing to their stubbornly prolonged recovery periods. Such endeavors will serve to augment the well-being and health outcomes of those affected by COVID-19.

HCWs face an elevated risk of contracting COVID-19 because of their constant, close contact with potentially infected individuals or critically ill patients within healthcare settings (5). Our study identified a higher prevalence of acute symptoms at the onset of COVID-19 among HCWs compared to the general population. Remarkably, HCWs demonstrated

TABLE 2. Acute and chronic symptoms reported at each follow-up among the community population and HCWs — Beijing Municipality, China, December 2022–April 2023, *n* (%).

Symptoms	Acute symptoms			First follow-up			Second follow-up		
	Community (<i>N</i> =1,069)	HCW (<i>N</i> =3,309)	<i>P</i>	Community <i>N</i> =1,069	HCW (<i>N</i> =3,309)	<i>P</i>	Community (<i>N</i> =1,069)	HCW (<i>N</i> =3,309)	<i>P</i>
Anyone of the following symptoms									
No	50 (4.7)	99 (3.0)	0.011	580 (54.3)	1,953 (59.0)	<0.001	650 (60.8)	2,359 (71.3)	<0.001
Yes	1,019 (95.3)	3,210 (97.0)		489 (45.7)	1,134 (34.3)		419 (39.2)	950 (28.7)	
Fatigue/tired or weakness	716 (67.0)	2,555 (77.2)	<0.001	308 (28.8)	744 (22.5)	<0.001	205 (19.2)	603 (18.2)	0.513
Smell disorder	306 (28.6)	1,267 (38.3)	<0.001	51 (4.8)	94 (2.8)	<0.001	29 (2.7)	73 (2.2)	0.402
Hypogeusia	345 (32.3)	1,372 (41.5)	<0.001	51 (4.8)	73 (2.2)	<0.001	31 (2.9)	62 (1.9)	0.057
Shortness of breath or breathlessness	162 (15.2)	734 (22.2)	<0.001	37 (3.5)	106 (3.2)	<0.001	41 (3.8)	77 (2.3)	0.011
Cough	645 (60.3)	2,679 (81.0)	<0.001	107 (10.0)	218 (6.6)	<0.001	55 (5.1)	165 (5.0)	0.900
Headache	384 (35.9)	1,529 (46.2)	<0.001	49 (4.6)	129 (3.9)	<0.001	37 (3.5)	109 (3.3)	0.868
Problems sleeping	280 (26.2)	1,099 (33.2)	<0.001	123 (11.5)	351 (10.6)	<0.001	107 (10.0)	256 (7.7)	0.023
Joint or muscle pain	498 (46.6)	1,886 (57.0)	<0.001	78 (7.3)	170 (5.1)	<0.001	54 (5.1)	147 (4.4)	0.457
Cognitive dysfunction	261 (24.4)	1,095 (33.1)	<0.001	109 (10.2)	409 (12.4)	<0.001	96 (9.0)	313 (9.5)	0.684
Chest pain	153 (14.3)	671 (20.3)	<0.001	36 (3.4)	99 (3.0)	<0.001	40 (3.7)	81 (2.4)	0.033
Change in mood	80 (7.5)	373 (11.3)	0.001	29 (2.7)	107 (3.2)	<0.001	33 (3.1)	103 (3.1)	>0.999
Decreased interest	98 (9.2)	424 (12.8)	0.002	27 (2.5)	96 (2.9)	<0.001	26 (2.4)	84 (2.5)	0.936
Stomach pain	110 (10.3)	473 (14.3)	0.001	31 (2.9)	77 (2.3)	<0.001	40 (3.7)	63 (1.9)	0.001
Hair loss	103 (9.6)	415 (12.5)	0.012	45 (4.2)	215 (6.5)	<0.001	61 (5.7)	201 (6.1)	0.714
Diarrhea	111 (10.4)	612 (18.5)	<0.001	16 (1.5)	38 (1.1)	<0.001	13 (1.2)	37 (1.1)	0.923
Sore throat	394 (36.9)	1,888 (57.1)	<0.001	53 (5.0)	132 (4.0)	<0.001	41 (3.8)	116 (3.5)	0.682
Fever	596 (55.8)	2,252 (68.1)	<0.001	26 (2.4)	66 (2.0)	<0.001	10 (0.9)	50 (1.5)	0.209
Chilliness	225 (21.0)	1,105 (33.4)	<0.001	30 (2.8)	61 (1.8)	<0.001	30 (2.8)	51 (1.5)	0.011
Palpitations	172 (16.1)	829 (25.1)	<0.001	53 (5.0)	212 (6.4)	<0.001	41 (3.8)	139 (4.2)	0.664
Nausea/vomiting	104 (9.7)	506 (15.3)	<0.001	13 (1.2)	26 (0.8)	<0.001	9 (0.8)	26 (0.8)	>0.999
Postexertional malaise	117 (10.9)	775 (23.4)	<0.001	52 (4.9)	180 (5.4)	<0.001	45 (4.2)	130 (3.9)	0.751

Abbreviation: HCW=healthcare worker.

lower rates of long-term symptoms and a shorter recovery period. This phenomenon may be attributed to HCWs' comprehensive understanding of the disease and their convenient access to medical support.

COVID-19 patients may endure various psychological issues due to multiple factors such as the viral infection's direct effects, corticosteroid therapy, social isolation, and stigma. Around five months following the onset of COVID-19, an estimated 21.7% of HCWs and 17.4% of the general population reported suffering from moderate to severe anxiety. Additionally, 15.8% of HCWs and 9.4% of community members experienced depression, underscoring the necessity for heightened concern for the mental health of individuals afflicted with COVID-19. Depression and anxiety scores were

noticeably higher among HCWs when compared to the general population. Literature consistently indicates that HCWs bear a higher risk of psychological distress during the COVID-19 pandemic, derived from the heavy workload and the exposure to patient suffering. Our research underscores the pressing need to prioritize the mental well-being of hospital HCWs and establish initiatives to safeguard their well-being both in the present and moving forward.

This study bears certain constraints that warrant acknowledgement. First, the HCW cohort is sourced from a singular facility in a Chinese tertiary hospital, positioning the study's representations of all HCWs in China as potentially incomplete. Additional research in hospitals varying in both size and location is necessitated. Second, this research gathered symptoms

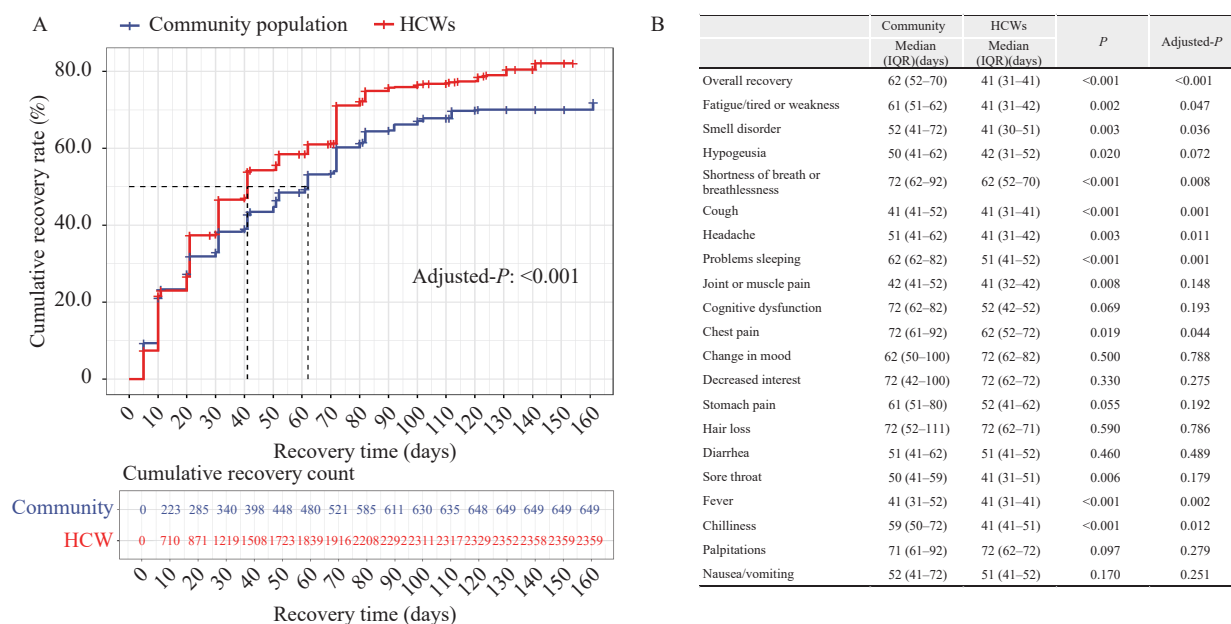


FIGURE 1. Duration of recovery for the community population and HCWs — Beijing Municipality, China, December 2022–April 2023. (A) The overall recovery duration among HCWs and the general population. (B) The median recovery duration for each symptom was also determined.

Note: The adjusted *P*-value was calculated using Cox regression, taking into account confounding variables such as age, gender distribution, history of any disease, and vaccination status. Recovery time, measured in days, was compared between these groups using Kaplan-Meier analysis in panel A.

Abbreviation: HCWs=healthcare workers; IQR=interquartile range.

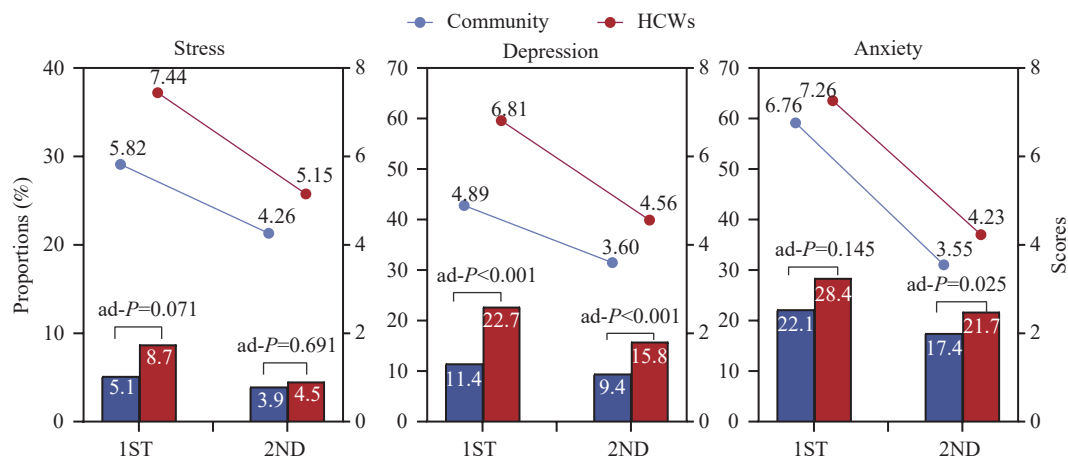


FIGURE 2. Comparison of psychological consequences among the general population and HCWs during the first and second follow-up periods — Beijing Municipality, China, December 2022–April 2023.

Note: The scores for stress, depression, and anxiety from both groups were evaluated at the first and second follow-ups and are represented as points in the associated figure. Furthermore, the prevalence of moderate to severe stress, depression, and anxiety in the observed sample was computed and illustrated as bars in the same figure. The comparative analysis between the community and HCW cohorts was executed using log-binomial regression. Potential confounders, which include age, gender proportions, medical history, and vaccination status, were accounted for in the analysis. It should be noted that “1ST” and “2ND” refer to the initial and subsequent follow-ups, respectively.

Abbreviation: HCWs=healthcare workers; ad-*P*=adjusted-*P*.

and recovery period data through self-reported online questionnaires, inherently exposing the study to potential ascertainment bias due to individual recall

processes and judgment. Finally, the focus of our study was to primarily provide a comprehensive review of the long-term effects on both the community population

and HCWs. Consequently, these distinct groups may carry inherent differences, and as such, some potential confounding factors may not be adequately considered in comparing community and hospital-based participants.

This research represents a concurrent evaluation of two cohorts with the broadest period of follow-up subsequent to the most substantial and recent outbreak of COVID-19 in China. The data suggests that among recovered COVID-19 patients, prevalent symptoms include fatigue or muscle weakness, sleep difficulties, and psychological complications. Notably, while HCWs initially presented with a higher prevalence of acute symptoms, their physical symptom recovery trajectory surpassed that of the general community population. However, HCWs experienced significant psychological distress. The findings from our comprehensive study offer critical insights into future directions for improving long-term healthcare system development in the context of the post-COVID-19 pandemic era.

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Recollections

The Development and Evolution of Community Mental Health Policies in China from 1998 to 2013

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This paper presents a detailed analysis of the development and evolution of community mental health policies in China, from their reestablishment in 1998 to the establishment and implementation of the “Mental Health Law of the People’s Republic of China” in 2013. The development of these policies across a 15-year period is segmented into three distinct phases, each characterized by a thorough exposition and an encompassing view. The paper scrupulously reviews and elucidates the crucial occurrences in each phase, emphasizing the significant impact of the prevailing conditions on the progression of policy formation. The paper concludes by sharing insights acquired from the policy development process.

Within this framework, community mental health policies entail a myriad of legislations, strategies, methodologies, protocols, regulations, and ordinances, instituted by national governance to enhance the proliferation of community-based mental health services.

INTRODUCTION

Approximately 16 million individuals in China are living with severe mental illnesses (1), which include six distinct disorders: schizophrenia, bipolar disorder, schizoaffective disorder, delusional disorder (paranoid psychosis), mental retardation, and epileptosis. Without appropriate treatment or management, these severe mental illnesses pose a considerable risk of self-harm and danger to others. The socio-emotional challenges associated with these disorders often emerge from difficulties in self-managing the illness and forming meaningful connections within the social sphere (2). In response, the World Health Organization (WHO) advocates for the incorporation of community-based, ongoing mental health services focusing on managing and treating individuals with severe mental illnesses within their communities. This strategy aims to provide critical support and assistance in the recovery process from these debilitating conditions.

Between the 1950s and the late 1990s, the Chinese government embarked on three significant initiatives to promote community-based mental health services. The earliest effort began in the early 1950s, culminating in the establishment of psychiatric hospitals at the grassroots level and a nationwide distribution of psychiatric beds (3). Several urban and rural areas started exploring community-based approaches to mental health services. The Cultural Revolution, however, disrupted this progress in the late 1960s. The second initiative spanned from the mid-1980s to early 1990s and made considerable strides in aligning community-based mental health services with global developmental trends (4). The momentum of this progress was curtailed by the rise of market-oriented reforms in healthcare services in the early 1990s. The third initiative surfaced in 1991, advocated by the Chinese Disabled Persons’ Federation, asserting “socialized, open, and comprehensive” efforts to prevent and rehabilitate mental disorders in some areas (5). However, owing to inadequate resources for mental health services and insufficient organizational and management structures, this initiative did not manage to formulate a nationwide policy on community mental health. Nevertheless, these three efforts, with the challenges and lessons derived from them, provided a critical foundation for the next phase of China’s community mental health policies, initiated in 1998.

THE PROCESS AND MAIN CONTENTS OF CONSTRUCTING COMMUNITY MENTAL HEALTH POLICIES IN CHINA

Revamping Community-Based Mental Health Services: An Examination of Policy Schemes and Implementation Enhancements from 1998 to 2004

The period from 1998 to 2004 signifies the genesis of China’s community-based mental health service pilot, dubbed Project 686. It was a period of

revitalization for community-based mental health services in China. Foundational structures for community mental health policies were established, creating a bedrock within governmental departments, organizations, intellectual communities, and the wider society. These early initiatives laid a foundation of subsequent pilot projects in the field of community-based mental health services.

The growing mental health problem in China China, a developing country possessing a vast geographic reach, a large population, a rich historical background, and a diverse cultural framework, is confronted with a distinctive set of challenges in the field of mental health. These challenges not only mirror those faced by other countries globally but also include unique dynamics (6). The 1993 Chinese national epidemiological survey of mental disorders demonstrated an increasing prevalence of severe mental disorders, from 1.269% in 1982 to 1.347% (excluding neurosis) (7). This data underscores the evolving mental health landscape in China. Moreover, the article “Rapid Health Transition in China, 1990–2010: Findings from the Global Burden of Disease Study 2010” highlighted a significant trend. Over a decade, from 1990 to 2010, the proportion of disease burden ascribed to mental and behavioral disorders, as measured in disability-adjusted life years (DALYs), increased from 6.69% to 9.46% of the total disease burden (8). This exemplifies the rising importance of mental health issues within the broader health framework in China during this time period.

China's transition from a traditional agricultural society to an industrial and now post-industrial society within a mere century, owing to its unique historical trajectory, has expedited the process of modernization. However, this swift transformation imposes two key challenges on mental health. On one hand, the profound societal changes accompanying this transition have triggered a spike in the occurrence of diverse psychological and behavioral issues. On the other hand, China's mental health services and management systems are relatively nascent, dealing with a substantial workload. Equally, the evolution of mental health institutions and the dispersion of human resources vary considerably across the country, which leads to considerable disparities in the number, distribution, and quality of mental health resources (9). Consequently, a significant portion of individuals suffering from mental illnesses struggle to access professional treatment, thereby causing worryingly low identification and treatment rates for these conditions

(10). The imbalances and inadequacies apparent within the developmental environment, management system, and service infrastructure of mental health, in addition to service networks, create a substantial void relative to the extensive mental health needs of the population.

The United Nations General Assembly, in the early 1990s, ratified Resolution 46/119, establishing the “Principles for the Protection of Persons with Mental Illness and the Improvement of Mental Health Care.” This resolution initiated a global campaign devoted to enhancing community-based mental health care. Consonant with this international appeal for cooperative action towards community mental health service promotion, the Chinese government introduced substantial measures. In November 1999, China's Ministry of Health (MOH) hosted the “China/WHO High-Level Seminar on Mental Health.” During this convening, the State Council's former Vice Premier Li Lanqing, through a letter to the symposium, affirmed the government's commitment, stating, “The Chinese government is deeply committed to partnering with the global community in enduring efforts to improve public health.” Further affirmation was provided by former President Jiang Zemin in March 2001, stating, “The Chinese government has perpetually prioritized mental health advancements and is resolved to engage society in its entirety to cultivate an empowering environment for individuals with mental disorders to reintegrate into society.” This global call to uplift mental health found robust support and endorsement from the highest echelons of the Chinese government.

Government's policy framework release: strengthening the mental health sector In October 2001, the MOH, in conjunction with three other governmental bodies, organized the Third National Mental Health Conference. Here, they presented guiding principles which emphasized “prevention as the primary focus, integration of prevention and treatment, targeted intervention, wide coverage, and lawful management.” This symbolized China's robust dedication towards the considerable enhancement of community-based mental health services. The Chinese government positively responded to the global appeal for community mental health programs by creating a supportive societal atmosphere, further driving China's renewed efforts in setting up comprehensive community-based mental health services. In 2000, MOH resumed the process of penning mental health legislation (11), indicating the country's commitment to tackling mental health needs within a legal context.

In April 2002, MOH in collaboration with three additional departments, promulgated the “China Mental Health Work Plan (2002–2010).” Consequently, in September 2004, the State Council released the “Guiding Opinions on Further Strengthening Mental Health Work.” This publication introduced a framework for community mental health policies:

1) The principal objective of the service is to improve the treatment rates for severe mental disorders.

2) The scope of service encompasses the creation of patient records for individuals with severe mental disorders in community settings, implementation of follow-up service, and facilitation of rehabilitation processes.

3) The mental health service provision is organized around a network that includes psychiatric hospitals at its core, supplemented by general hospitals, primary healthcare centers, and community rehabilitation institutions for mental health. These psychiatric hospitals undertake the critical tasks of providing technical training and guidance within this service network.

4) This approach highlights a gradual transition in focus from prevention and treatment of mental disorders to community-based and grassroots-level initiatives.

Consensus reached in the psychiatry field to implement community-based mental health services

In 1998, MOH expanded public health’s purview to include mental health (12). From 2000 onwards, the Department of Disease Prevention and Control (DDPC) of MOH organized a national committee comprised of eminent psychiatrists and scholars. These individuals, known for their dedication, accountability, and global perspective provided expert consultations. Following this, in June 2002, MOH sanctioned the creation of the Mental Health Center at Peking University Sixth Hospital, a central part of the China CDC. This center assumed the duties related to the prevention and control of mental disorders.

Institutions and experts held concurrent leadership positions within both the psychiatry sector and professional organizations, bearing the responsibility

for societal mobilization and advocacy. By embracing multiple roles and diverse tasks, they were instrumental in driving cooperative ventures encompassing public policy, societal mobilization, and professional training within the mental health domain. From the year 2000 and extending over a decade, the DDPC orchestrated a series of professional training and health education initiatives for mental health institutions nationwide, made possible through the involvement of four prominent mental health facilities*. This initiative effectively established a unified consensus regarding community-based mental health services among government officials, academic experts, organization leaders, and practitioners within the field.

The Approval and Implementation of Community Mental Health Pilot Projects: A Review of Policy Schemes and Departmental Specifications from 2004–2009

From 2004 to 2009, the Community Mental Health Pilot Project (also referred to as the 686 Project), transitioned from its preliminary “pilot first” phase to a more encompassing “from point to surface” policy strategy†. During these years, the 686 Project functioned as a practical platform for the implementation and refinement of policy frameworks. This iterative adjustment significantly contributed to the continual enhancement of organizational structures, service provisions, and operational procedures. As such, the policy initiatives became more practical and accessible, eventually receiving formal acknowledgment.

The implementation of the 686 Project concurrently facilitated the development of mental health professional teams and community personnel. Notably, it further established an expansive societal policy framework, thus providing a solid foundation for the ensuing progression of community mental health policies towards a more legal-oriented direction.

Initiation and implementation of national community mental health pilot project The Community Management and Treatment Project for Severe Psychiatric Disorders, also known as the 686 Project,

* The four influential spiritual medical institutions in China refer to the Sixth Hospital of Peking University, the Mental Health Center of Shanghai Jiao Tong University, the Second Xiangya Hospital of Central South University, and the Mental Health Center, West China Hospital, Sichuan University.

† “Pilot policy” is an innovative social governance practice of unique policy testing and innovation mechanisms in China, refers to the local experience exploration or experimental reform into the process of national policy, for the final specification of legal documents, and furthering the typical experience to other regions, points to “try first”, “from point to surface” two links (24).

was underwritten through central government transfer payments directed toward local initiatives. This support was initiated in the wake of the 2003 Severe Acute Respiratory Syndromes outbreak in China when the national government resolved to bolster public health services. In alignment with the community mental health policy framework, the DDPC proposed the aforementioned project (13). Following a successful review in 2004, the project was approved and awarded an inaugural annual budget of 6.86 million Chinese Yuan (CNY) in the first year (12).

The implementation of the 686 Project introduced the formation of integrated hospital and community multi-functional service teams. Launched in 2004, the pilot program was rolled out across 60 districts/counties, scattered among 30 provincial-level administrative divisions — 30 urban and 30 rural — encompassing a population of approximately 42.9152 million (14). By drawing from international practices, each pilot area formed integrated service teams, hospital- and community-based, in 2005[§]. These teams undertook tiered training programs to enhance their capabilities (12). Starting in 2007, support for these training initiatives was provided by international cooperation projects and aid programs (15–16). By 2011, the project had successfully trained an aggregate of 382,000 individuals through nearly 525,000 training sessions. Among the trained individuals were roughly 10,000 psychiatrists, representing about 50% of the country's registered psychiatrists at the time. Additionally, about 34,000 community doctors received training, with a ratio of mental health staff to other participants estimated at 1:7.25, effectively increasing the mental health service workforce. This constituted a fundamental step towards the preliminary establishment of community teams purposed for preventing and treating mental disorders (17).

The execution of the 686 Project served as a groundwork for evaluating and refining service delivery and processes. Throughout its development, various components such as patient record handling, community-based management, routine check-ins, rehabilitation guidelines, and application procedures were rigorously tested, defined, and improved. This recurrent process fostered an enhanced operational feasibility of the policy framework. To supplement this, the General Office of MOH dispensed a

document in April 2006, which cataloged the project's content and operating procedures. Concurrently, a “National Steering Group” for the project was instituted, along with the creation of the National Mental Health Project Office.

The implementation of the 686 Project significantly enhanced the unity of the national mental health service system. As the project evolved, leading teams from national mental health industry organizations progressively became engaged[¶]. Through these implementations, there was a robust consensus and alignment on the content and methodologies of community-based mental health services within both psychiatric institutions at the national level and industry associations. The 686 Project facilitated the establishment of collaborative channels amongst different tiers of mental health institutions, thereby promoting cooperation. This initiative provided a forum for provincial mental health institutions to create formal communication platforms, a marked shift from the formerly fragmented and limited communication practices. Consequently, local mental health institutions demonstrated increased enthusiasm towards project participation.

Refinement and adjustment of the organizational framework in community-based mental health services

A country's method of providing mental health services, structuring organizations, and developing service systems is inextricably connected to its social governance system and healthcare framework (18). When the 686 Project was first implemented in 2005, it adopted a three-tier administrative management structure consisting of “national-provincial-pilot/demonstration county.” It was supplemented by a four-tier technical management and service system composed of “national-provincial-pilot county/demonstration county-community.” This model mirrored previous public health initiatives implemented in China. The county functioned as the operational unit, and due to the lack of mental health institutions in numerous counties, the centers of disease prevention and control assumed the role of managing and organizing the community (19).

A national survey carried out by the DDPC in 2007 on mental health service resources revealed a concentration of prestigious mental health institutions at the prefecture/municipal and provincial levels in

[§] Hospital community integrated multi-functional service team staff, including psychiatrists and nurses, doctors and nurses in the community, CDC, project managers, cadres of neighborhood committees, police, patients' families, etc.

[¶] National mental health industry organizations refer to the Sub-committee of Psychiatric Sciences of Chinese Medical Association, Psychiatrists Branch of Chinese Medical Doctor Association, Psychiatric Hospital Branch of Chinese Hospital Management Association, etc.

China (20). The implementation of the 686 Project occurred mainly at the county level, where there was often an absence of specialist mental health institutions for crucial technical support. While mental health institutions at the prefecture/municipal level had the required technical skills, they did not have the authority to supervise the implementation of the 686 Project. This mismatch led to a significant disparity between the project's conceptual design and its actual execution, both in terms of technical capacities and governing authority.

The structure of service provision underwent a significant revision in March 2008, based on evidence-based research, explicitly implemented by MOH (21). Initial changes saw the primary administrative responsibility for the 686 Project transition from the county level to the municipal level. Further organizational alterations shifted from a three-tier administrative management structure (i.e., national-provincial-pilot county) along with a four-tier technical management and service structure (i.e., national-provincial-pilot county-community), to a more complex four-tier administrative structure (i.e., national-provincial-pilot municipal-project county) and a five-tier technical management and service structure (i.e., national-provincial-pilot municipality-project county-community) (19). Another change was the delegation of authority to pilot municipalities, allowing them to expand the number of project counties and extend the scope of the implementation. Lastly, if the budget for the 686 Project increased, the DDPC had the leeway to augment the number of pilot municipalities.

This realignment and refinement of the service provision's organizational structure was designed to match the actual distribution of mental health service resources in China. It successfully eliminated obstacles hindering the expansion of project coverage and stimulated active participation from municipal governments and mental health institutions with superior economic and technological capabilities. Mental health institutions organized by local department of civil affairs, and private mental health cohorts became involved in the project. In regions with an absence of mental health institutions, the centers of disease prevention and control assumed the roles of community organization and management (19). This approach enhanced the feasibility and accessibility of the policy scheme and laid a systematic groundwork for the expansion of the pilot program.

Establishing and improving institutions, systems, and

conditions to support the implementation of the 686 project

In 2006, MOH established the Division of Mental Health in DDPC. Later that year, in November, the State Council approved the establishment of the Inter-Ministerial Joint Conference on Mental Health Work. Initially, this encompassed 17 ministries under the leadership of MOH. By 2007, the number of participating units further increased to 19. The primary responsibilities of the Joint Conference entail providing research-led recommendations for the advancement of mental health initiatives, orchestrating and advancing resolutions for significant issues, determining annual work priorities, and executing and supervising inspections.

In 2007, MOH published "Core Information and Key Knowledge Points for Mental Health Promotion and Education." Subsequently, from 2008 to 2013, the DDPC conducted training on mental health policy for health managers to enhance their comprehension and command of the national mental health policies (2). This endeavor played a significant role in expediting governmental mobilization and encouraging agreement towards the execution of community-based mental health services.

Integration of community-based mental health services into national comprehensive work documents and plans

The advancement and endorsement of community-based mental health services gradually gained recognition within Chinese society, incited through substantial shifts in overall societal policies. Key components of the 686 Project strategy began having a noticeable presence in national work records and plans. In 2006, MOH amongst various departments, introduced the "Management Measures for Urban Community Health Service Institutions (Trial)." This documented the steady involvement of urban community health service centers in mental health initiatives within communities. During the "Eleventh Five-Year Plan" in 2007, the Outline of the Development Plan for Health Services incorporated management and treatment for serious mental disorders for the first time. Following this in 2008, along with 16 other departments, MOH released the "Guidelines for the Development of the National Mental Health Work System (2008–2014)." This defined the crucial need for establishing a national network dedicated to the prevention and treatment of mental illnesses, including a specialized system for managing and treating severe mental disorders.

Departmental regulations for community-based mental

health services are introduced Following nearly five years of execution, the 686 Project has attained maturity with respect to its content, implementation strategies, and organizational structure. MOH has drawn from, and synthesized, the practical experience gained from the 686 Project, resulting in the formulation of two regulatory documents which were consecutively released in October 2009. These include: the “Norms for the Management and Treatment of Severe Mental Disorders” (“Work Norms”) and the “National Basic Public Health Service Norms — Norms for Management Services of Patients with Severe Mental Disorders” (“Community Service Norms”). The enactment of these departmental norms signifies the legalization of the protocols for community-based mental health services while establishing a system all national health departments must adhere to.

Department Regulation Implementation and Promulgation of Laws from 2009 to 2013: Policy Construction Advanced from Departmental Regulation to Legal System

From 2009 to 2013, there was a transition in the regulation of community mental health from a departmental level to a legal framework. Supported by healthcare reform policies and significant financial investments, the 686 Project’s scope rapidly expanded from isolated efforts to wide-ranging implementation. With national investments in the development of mental health institutions and professional training, alongside holistic healthcare reforms, both institutions and personnel were encouraged to actively participate in community-based mental health services. The comprehensive dissemination of departmental regulations for these services was evident across the nation. The necessary groundwork was laid for legislation, which encompassed work systems, service structures, personnel management in institutions, and financial support. The content of community mental health policies was integrated into the relevant sections of the “Mental Health Law of the People’s Republic of China,” thereby achieving a transformation from policy construction to a legal framework.

Enhancing the implementation and reinforcing safeguards of community mental health policies: a scale-up approach In March 2009, the “Opinions on Deepening the Reform of the Medical and Health Care System” plan, commonly referred to as the New Medical Reform Policies, was sanctioned by the

Chinese government. The enforcement plan for the year 2009 to 2011 had been issued, which was financially supported by the central government, facilitated the provision of basic public health services, including nine key components, to rural and urban communities nationwide. Integral to these services was the management of severe mental disorders at the community level, which encompassed the creation of patient health records, conducting home visits, and providing rehabilitation guidance.

In 2011, performance evaluation methods were enacted for basic public health services by local governments. This involved monthly reports and quarterly evaluations of progress. Moreover, supervisory inspections were conducted by the central government. The “12th Five-Year Plan for the National Basic Public Service System” was later issued by the State Council in July 2012. This policy mandated that management rates for patients with severe mental disorders in community settings should reach a target of 70% by the end of 2015.

In July 2010, MOH capitalized on the opportunities afforded by the New Medical Reform Policies, convening the “National Conference on the Management and Treatment for Severe Mental Disorders.” Their objective was to progressively transition the principles of the 686 Project into community-based management and treatment for severe mental disorders, incorporating it into local government departments’ standard operations. With the assistance and funding from the New Medical Reform Policies and the adaptable structures provided by municipalities for organizing community-based mental health services, the scope of these services widened rapidly. It expanded from the pilot regions of the 686 Project, eventually reaching nationwide coverage.

The 686 Project experienced a modest funding increase of approximately 1.3 times from 2008 to 2013, increasing from 41.49 million CNY to 93.87 million CNY. Concurrently, the project’s adoption significantly expanded across municipalities and counties. In 2008, the project was implemented in 54 municipalities and 61 project counties. By 2013, these numbers had dramatically increased to encompass 275 municipalities and 1,926 project counties (22). Moreover, with assistance from the National Basic Public Health Services Fund, certain regions without direct financial support from the 686 Project were still able to establish community patient management services. According to data provided by the DDPC, as

of the end of 2012, over 3 million patients suffering from severe mental disorders had established health records within the community (22).

In September 2010, the central government approved the “Construction and Development Plan for the Mental Health Prevention and Treatment System,” which required a total investment of 15.4 billion CNY over three years, including 9.1 billion CNY from the central government. The primary objective of this initiative was to upgrade and expand 549 mental health facilities. In tandem, the central finance department allocated 149 million CNY in October of the same year to equip 608 mental health institutions with essential equipment. Starting from 2011, an annual allocation of 2.8 million CNY from the central finance was dedicated to the specialized training of mental health professionals (22). Thanks to the support of China’s Disease Prevention and Control Information System, a national information network was established. This network enabled the successful completion and activation of the first phase of the national information system for severe mental disorders by August 2011. This accomplishment allowed for nationwide connectivity and electronic management of community-based mental health services information, thus enhancing operational efficiency.

Enactment of the mental health law: legalizing the construction of community mental health policies

The implementation of the 686 Project in China culminated in arguably the world’s largest specialized mental health service network. By 2010, the network encompassed an impressive 400,000 various institutions, of which 1,110 were hospitals. Regular follow-up appointments were maintained for approximately two million patients, with close to 100,000 receiving complimentary treatment under the 686 Project. This international endeavor demonstrated the accessibility and equity of public health services (13,17). The inception of nationwide mental health institution building projects, coupled with professional training programs, has stimulated the zeal of mental health institutions and professionals to actively participate in community services. Furthermore, the integration of community mental health initiatives into local government’s yearly work objectives has fortified their execution abilities.

China’s mental health service model has undergone substantial evolution over the years, shifting from a primary reliance on hospital-based services to a comprehensive hospital-community approach. Instead of isolated, sector-based services, the Chinese model

now delivers comprehensive and continuous treatment, management, and rehabilitation services (17). This development has led to the establishment of a preliminary, integrated mental health service system that prioritizes the management and treatment of severe mental disorders within a hospital-community framework. The aspiration to transition patients from mental health institutions to community-based treatment and management has been broadly realized. The backbone of the Chinese mental health service system, built around municipal units, has successfully linked the majority of mental health institutions with all primary healthcare institutions in a hierarchical structure (19).

The validity, adjustment, and refinement of community mental health policy schemes occurred during the implementation of the 686 Project, resulting in the formulation of departmental regulations for community-based mental health services. The widespread access to these services was bolstered by support from the New Medical Reform Policies and an influx of increased funding. A comprehensive service system, secondary to the provision of essential work regulations, personnel, and funding, facilitated the maturation of the legislative conditions pertinent to community mental health policy. On October 26, 2012, the “Mental Health Law of the People’s Republic of China” was deliberated and passed by the Standing Committee of the National People’s Congress. It came into effect on May 1, 2013. The 686 Project’s significant contribution, as well as management and treatment efforts focused on severe mental disorders, broadly informed many provisions within the “Mental Health Law.” (23)

EXPERIENCE GAINED FROM DEVELOPING CHINA’S COMMUNITY MENTAL HEALTH POLICIES

The “policy pilot” mechanism (24) has been instrumental in the testing, refining, and validation of policy strategies. A crucial stage in public policy development involves introducing practical and implementable policy solutions. Given a developing nation with over 1.4 billion inhabitants, there is no prior model for developing a nationwide, sustainable, and operative community mental health policy and service framework. The construction of public policies generally follows a five-stage process: agenda setting, policy planning, policy formulation, policy

implementation, and policy evaluation. However, during the development of China's community mental health policy, the unique "policy pilot" mechanism endemic to China significantly contributed to the testing, adjusting, and official endorsement of policy initiatives.

This paper provides an analysis of the evolution of China's community mental health policies from a public policy development perspective. It clarifies the transformations and shifts observed in these policies, in conjunction with the socioeconomic factors driving them. Specifically, it encompasses the unique "pilot-first, pilot-driven" trajectory of policy formulation, which is distinctly Chinese (24). The role of the 686 Project pilot in shaping policy and elucidating China's policy construction framework is systematically discussed. This paper reveals that policy development occurs in various stages: initiating the 686 Project, pilot implementation, broadened application, and transitioning from department guidelines to legal statutes. Each phase is informed by the goal of enhancing the feasibility and accessibility of community mental health services, leading to progressive improvements. Contributing factors for each phase are distinct; for instance, international advocacy, governmental mobilization, public awareness campaigns, and professional resource preparation are pivotal during the incubation phase of the 686 Project. The creation of a policy execution framework and service network development is essential during the pilot implementation and expansion phase. As the shift from department guidelines to legal statutes occurs, promoting conditions that support the enforcement of these guidelines and strengthening the execution capabilities of organizational structures and service networks become integral to the successful legal transformation.

Insights garnered from this paper enhance both Chinese mental health policy research and the broader field of public policy research. This consequently enriches the body of knowledge that undergirds social policy theory and its application.

LESSONS FOR ADVANCING COMMUNITY-BASED MENTAL HEALTH SERVICES IN DEVELOPING NATIONS

The evolution of mental health services globally is marked by a transition from institutional-based models to community-based methodologies. The "Mental

Health Action Plan (2013–2020)" by WHO underscores the importance of government-led improvements in mental health, the development of community-oriented mental health services, and the creation of comprehensive mental health information systems. These principles align with the strategies adopted by the 686 project since its launch.

Historical trajectories, cultures, economic resources, and human capital create differences in mental health service models across countries. However, the principles of tiered mental health services, facilitated collaboration, and integration of mental health into primary healthcare have gained global acceptance as crucial tenets for nations seeking to reform or develop community-based mental health services. Many developing countries, including China, are still establishing pathways to implement these community-based mental health services. This provides China with an opportunity to consolidate, refine methodologies, and share its experiences with other developing nations (23). Despite these efforts, China's mental health resources remain significantly lower compared to developed countries, as evidenced by the ratio of mental health beds and the density of psychiatrists per 1,000 individuals. It's also important to note the considerable regional discrepancies in China's mental health resources, with urban centers and economically developed regions having significantly more mental health professionals and institutions than rural and financially disadvantaged areas (25).

Several key factors have contributed significantly to the success of China's community mental health policy development. First, Chinese health authorities capitalized astutely on the international momentum toward community mental health development that commenced in 1998. This was followed by procuring policy support from influential government leaders. Subsequently, China's mental health sector diligently incorporated pertinent international theories and practical experiences into its policy development. Within this transformative process, China effectively mobilized a considerable contingent of non-mental health human resources to partake in community-based mental healthcare delivery. This strategic convergence of mental health and primary healthcare has proved viable despite a somewhat limited pool of mental health professionals, and has been instrumental in the establishment of a functional community-based mental health service system. The fourth key factor involved the active contribution of esteemed domestic medical institutions and academic leaders to the

execution, quality control, evaluation, and research initiatives related to the 686 project. This involvement further elevated the prestige and disciplinary dominance of public mental health within clinical psychiatric institutions. Additionally, collaboration with WHO experts and public mental health specialists aided in sharing China's achievements and experiences globally. Lastly, the project's sustainability and broader social reach were reinforced by diverse financial means, including funding from central and local government entities, subsidies from medical institutions, corporate sponsorship, and philanthropic contributions.

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Notifiable Infectious Diseases Reports

Reported Cases and Deaths of National Notifiable Infectious Diseases — China, June 2023*

Diseases	Cases	Deaths
Plague	0	0
Cholera	3	0
SARS-CoV	0	0
Acquired immune deficiency syndrome [†]	5,759	1,792
Hepatitis	133,888	206
Hepatitis A	944	0
Hepatitis B	110,063	20
Hepatitis C	19,664	186
Hepatitis D	23	0
Hepatitis E	2,529	0
Other hepatitis	665	0
Poliomyelitis	0	0
Human infection with H5N1 virus	0	0
Measles	89	0
Epidemic hemorrhagic fever	365	2
Rabies	11	9
Japanese encephalitis	3	0
Dengue	55	0
Anthrax	31	0
Dysentery	4,353	0
Tuberculosis	64,788	324
Typhoid fever and paratyphoid fever	627	0
Meningococcal meningitis	9	0
Pertussis	1,512	0
Diphtheria	1	0
Neonatal tetanus	1	0
Scarlet fever	2,684	0
Brucellosis	8,326	0
Gonorrhea	8,863	0
Syphilis	52,007	1
Leptospirosis	9	0
Schistosomiasis	7	0
Malaria	264	2
Human infection with H7N9 virus	0	0
Influenza	65,289	1
Mumps	10,710	0
Rubella	110	0

Continued

Diseases	Cases	Deaths
Acute hemorrhagic conjunctivitis	4,985	0
Leprosy	24	0
Typhus	131	0
Kala azar	25	0
Echinococcosis	252	0
Filariasis	0	0
Infectious diarrhea [§]	108,442	0
Hand, foot and mouth disease	433,084	0
Total	906,707	2,337

* According to the National Bureau of Disease Control and Prevention, coronavirus disease 2019 (COVID-19) is not included.

† The number of deaths of acquired immune deficiency syndrome (AIDS) is the number of all-cause deaths reported in the month by cumulative reported AIDS patients.

§ Infectious diarrhea excludes cholera, dysentery, typhoid fever and paratyphoid fever.

The numbers 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 Chinese mainland are included in the table, whereas data of Hong Kong Special Administrative Region, Macau Special Administrative Region, and Taiwan, China are not included. Monthly statistics are calculated without annual verification which is 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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