The prevalence and associated disability burden of mental disorders in children and adolescents in China: a systematic analysis of data from the Global Burden of Disease Study

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Summary

Background Understanding the disease burden of mental disorders in children and adolescents in China, especially at the sub-national level, is important for effective prevention and intervention. This study aims to assess the prevalence and related health burden of mental disorders in children and adolescents in China.

Methods Following the same approach as the Global Burden of Disease Study 2021, we systematically analyze epidemiological and demographic information for mental disorders, and assess the prevalence, disability-adjusted life-years (DALYs), and years lived with disability (YLDs) in the children and adolescents for mental disorders and their ten subtypes across national and provinces in China from 1990 to 2021.

Findings In 2021, the age-standardized prevalence of mental disorders in children and adolescents was 8.9% (uncertainty intervals [UI]: 8.1, 9.8) in China, accounting for 30.8 million cases (26.0, 36.3) and 2.8 million DALYs (2.0, 3.7). Among mental disorders, attention-deficit/hyperactivity disorder had the highest age-standardized prevalence, at 3.6% (3.0, 4.5). From 1990 to 2021, the age-standardized prevalence increased by 4.8%, but the number of mental disorders cases decreased by 21.9%. DALYs for mental disorders are higher in boys than in girls across all age groups. At the provincial level, the age-standardized prevalence of mental disorders in some provinces was much greater than that in other provinces (e.g., bipolar disorder in Hebei was more than two times greater than that in other provinces). Although disparities in the distribution of mental disorder burden were observed across provinces, there was a reduction in income-related inequality, where the gap in the age-standardized DALY rates between the highest and lowest income provinces decreased by 61.7% between 1990 and 2021. In 2021, among 22 health condition groups in China, mental disorders accounted for the largest proportion of health life lost.

Interpretation Mental disorders are the leading causes of disability in children and adolescents in China, and the disease burden varies geographically. Careful planning of health services, including consideration of the local situation, is needed.

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Research in context

Evidence before this study

We searched PubMed for studies until July 19, 2024, with no language restrictions. The search terms "mental disorder" OR "mental health" OR "mental disease" OR "depressive disorder" OR "major depressive disorder" OR "dysthymia" OR "anxiety disorder" OR "schizophrenia" OR "autism spectrum disorders" OR "bipolar disorder" OR "conduct disorder" OR "eating disorder" OR "anorexia nervosa" OR "bulimia nervosa" OR "attention-deficit/hyperactivity disorder" OR "idiopathic developmental intellectual disability" AND "prevalence" OR "distribution" OR "mortality" OR "epidemiology" OR "disability adjusted life year" AND "child" AND "China" were used for the publication title and abstract. We also used the same search terms for papers published in Chinese in the China National Knowledge Infrastructure (CNKI). Except for a two-stage large-scale psychiatric prevalence study describing the prevalence of mental disorders and some subtypes in school children and adolescents in China, previous survey-based analyses were based on limited data or confined to local areas. The Global Burden of Disease Study has been used to assess the health burden of mental disorders at the national level; however, a subnational assessment is still lacking, which would provide important information for developing targeted health interventions.

Added value of this study

This study is the first to make a comprehensive, consistent and comparable estimate of mental disorders burden and its subtypes in children and adolescents at national and subnational units in China. In China, mental disorders were among the leading causes of years lived with disability (YLDs) and the third leading cause of disability-adjusted life-years (DALYs) in children and adolescents in 2021. Anxiety disorders accounted for the greatest burden of mental disorders in China, and attention-deficit/hyperactivity disorder had the highest prevalence rate among mental disorders. Provincially estimates of mental disorders burden indicated the different characteristics of mental disorders regionally, which illustrates the importance of targeted prevention and health care in different regions. To quantify the share of the burden due to mental disorders, we also ranked the disability due to mental disorders among health conditions in China.

Implications of all the available evidence

Mental disorders are one of the leading causes of disability for children and adolescents in China. The results of this study provided the latest national and sub-national evidence of mental disorders which make a significant contribution to understanding the health burden of mental disorders in China, and provide evidence for effective management.

Introduction

Mental disorders are among the leading causes of disability in children and adolescents and can have long-lasting effects throughout life.[1,2] They are also a significant risk factor for premature mortality.[3,4] The COVID-19 pandemic in 2020 has raised many questions about mental disorders through its direct psychological impact and long-term economic and social consequences.[5] In 2021, 252 million young people were living with mental disorders worldwide, accounting for 9.5% of all children and adolescents.[2]

In China, mental disorders are among the two leading causes of healthy life loss (musculoskeletal disorders, and mental disorders).[6] In 2021, it was estimated that over 30 million children and adolescents suffered from mental disorders out of a population of 334 million.[2] As one of the important parts of achieving national landmark development policy—the Healthy China 2030 plan[7]—a series of action plans was set to achieve mental health promotion for children and adolescents.[8] A comprehensive, consistent, and comparable assessment of the long-term, age- and sex-specific health burden of mental disorders in children and adolescents is crucial for the success of the initiative. In addition, since the mental disorder burden varies geographically,[6,9] subnational information on mental disorders will be particularly helpful in developing locally appropriate policies.

Previous studies have provided detailed insights into the burden of mental disorders in China.[4,10,11] In this study, we collected the largest amount of epidemiological information on mental disorders in China by using an improved methodological approach based on the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) 2021. We assessed the health burden of mental disorders in children and adolescents in China and its provinces. To better guide health promotion practices, we also assessed the health burdens associated with 10 subtypes of mental disorders. These findings provide important evidence for tailoring mental health policies and interventions in specific provinces.

Methods

Overview

In this study, the burden of mental disorders in children and adolescents in China and its provinces was estimated using the same approach as in the GBD 2021 study. The GBD 2021 study provides standardized and comprehensive estimates of health outcomes across

countries, time, age, and sex. Details of this method have been described elsewhere.[2] We aimed to use all accessible information to evaluate the health burden of mental disorders in children and adolescents in China. The sources for estimating mental disorders in China are listed in the GBD 2021 Sources Tool (https://ghdx.healthdata.org/gbd-2021/sources). In this study, we estimated the prevalence of mental disorders and ten subtypes in children and adolescents in China and its provinces.

Ethics approval and consent participate

This study was approved by the Ethical Review Committee of the National Center for Chronic and Noncommunicable Disease Control and Prevention of China's Center for Disease Control and Prevention. This study followed the Guidelines for Accurate and Transparent Health Estimates Reporting (GATHER)[12] recommendations. All study procedures in current study involving human subjects conformed to the ethical standards of the ethics committee of China Chinese Center for Disease Control and Prevention (CDC) and Helsinki Declaration and its subsequent amendments or similar ethical standards. Our research did not involve patients' personal information and written informed consent was waived by the ethics committee of China CDC.

Geographical units and periods

In this study, we assessed the mental disorder status of children and adolescents aged less than 20 years and of both sexes from 1990 to 2021. Thirty-four province-level units were covered, including 23 provinces, four municipalities, five autonomous regions, and two special administrative regions (Hong Kong and Macau), all of which we refer to as provinces in this study. Owing to adjustments in administrative units (e.g., Sichuan and Chongqing in 1997), the estimates were separated to match the current boundaries of the provinces. In this study, the discussion focused on mainland China, and two special administrative regions.

Case definitions

In this study, in addition to mental disorders, ten subtypes of mental disorders, including depressive disorders, anxiety disorders, schizophrenia, autism spectrum disorders, bipolar disorder, conduct disorder, eating disorders, attention-deficit/hyperactivity disorder (ADHD), idiopathic developmental intellectual disability (IDID), and other mental disorders, were analyzed. All these mental disorders were defined according to the criteria described in the Diagnostic and Statistical Manual of Mental Disorders (DSM)[13] or the International Classification of Diseases (ICD).[14] Details of these mental disorders and their definitions are described in Appendix Text 1.

Systematic reviews of empirical data

A systematic review was conducted according to the PRISMA guidelines[15] to identify studies that provided epidemiological information on each mental disorder. In summary, the search involved electronic searches of peer-reviewed literature (using PsycINFO, Embase, and PubMed), grey literature, and consultation from experts. Additionally, the China National Knowledge Infrastructure database, which includes studies published in Chinese journals, was used to further supplement the dataset. Furthermore, we also reviewed the data sources stored in the Global Health Data Exchange, major multinational survey data catalogues, and data resources recommended by GBD collaborators, who reviewed the search results for each mental disorder.[4] The included data sources were surveys reporting estimates of the incidence, prevalence, remission, or excess mortality associated with mental disorders. Details of the inclusion criteria have been described in a previous study[2,4,16] and are shown in Appendix Text 2.

Mental disorder modeling

After the preprocessing of the data extracted from the systematic review (e.g., age and sex stratification, described in Appendix Text 3), DisMod-MR 2.1 was used to estimate the epidemiology of mental disorders by age, sex, year, and location. DisMod-MR is a Bayesian meta-regression tool that can combine multiple epidemiological data to produce internally consistent estimates of nonfatal outcomes, such as prevalence, incidence, remission, and mortality.[2,16] Additionally, DisMod-MR also provides estimations for locations with missing raw data by cascading down the geographical hierarchy. Location-level covariates are used to inform these estimations.[2] The DisMod-MR modeling strategy for mental disorders followed the standard decomposition structure of GBD 2021.[2] The modeling process included data across all epidemiological parameters.[2,4,16] In addition, the prevalence rates of anxiety disorders and major depressive disorders were adjusted for the impact of the COVID-19 pandemic.[2]

Estimation of years of life lost and disability-adjusted life-years due to mental disorders

Years of life lost (YLLs) are years lost due to premature mortality, which was calculated as the product of the number of deaths and standard life expectancy at the age at which death occurs. The cause-specific mortality in China was estimated by using the GBD cause of death ensemble modeling tool (CODEm).[2] Data on the cause of mortality in China and its provinces were derived from health surveillance systems.[6] YLLs and deaths cannot fully capture all forms of premature mortality because, in the GBD process, each death is allocated to only one cause. This means that individuals with mental disorders who die from another disease or injury are not reflected in the YLL estimates. Currently, there is no

method available to capture the proportion of premature deaths from other diseases for our estimation of YLLs.[4] In this study, eating disorders were the only mental disorders for which YLLs were estimated, and subtypes of other subtype mental disorders were not considered causes of death and did not contribute to the calculation of YLL.[4,16]

Disability-adjusted life-years (DALYs) are equal to the sum of YLLs and years lived with disability (YLDs). YLDs were measured by multiplying the prevalence of the condition by the disability weight for that condition. The disability weight for each mental disorder is described in Appendix Table S1. In this study, age-standardized rates per 100,000 population were estimated using the GBD World Population Age Standards (Appendix Table S2).

Cross-provincial social inequality analysis

To capture the difference in the average mental health status across the highest and lowest economic groups within China, we regressed the province-level age-standardized DALY rates against a relative social position scale, which was defined by the midpoint of the cumulative class interval of the population ranked by gross domestic product per capita.[17] The difference between the predicted values at the two extremes (rank 1 and rank 0) was used to generate the slope index of inequality (SII) value. The population used in this study was estimated from census data, and the detailed process can be found in Appendix Text 4.

Uncertainty analysis

We used the same process used in previous GBD studies to estimate 95% uncertainty intervals (UIs)[4,16,18,19] for the mental disorders burden of children and adolescents in China. In the process step, the uncertainty distribution was calculated using 500 draws and was subsequently used in the next steps. The 95% UIs are presented for the final estimation based on 2.5% and 97.5% ordered values from 500 draws of the posterior distribution.

Role of the funding source

The content of this paper is solely the responsibility of the authors and does not necessarily represent the official views of the funders. The funder had no role in the study design, data collection, data analysis, data interpretation, or writing of the report.

Results

Prevalence of mental disorders in children and adolescents in China

In 2021, the age-standardized prevalence of mental disorders in children and adolescents in China was 8.9% (95% UI: 8.1, 9.8), accounting for 30.8 million cases (26.0, 36.3). Compared with 1990, the age-standardized prevalence increased by 4.8%, but the number of mental disorders cases decreased by 21.9%. In 2021, the age-standardized prevalence of mental disorders for children and adolescents was greater in boys, where the prevalence was 10.3% (9.2, 11.4) for boys and 7.2% (6.5, 7.9) for girls (Table 1).

Among all studied mental disorders in 2021, ADHD had the highest age-standardized prevalence (3.6% [95% UI: 3.0, 4.5]), followed by anxiety disorders (2.6% [2.1, 3.1]), accounting for 39.8% and 27.9% of mental disorder patients, respectively (Appendix Fig. S1). Between 1990 and 2021, eating disorders showed the greatest increase in age-standardized prevalence (increased by 64.6%), and IDID showed the greatest decrease (decreased by 37.4%). There were significant sex differences in some subtypes. Compared with boys, girls had a much greater prevalence of depressive disorders, anxiety disorders, and eating disorders, and boys had a much greater prevalence of autism spectrum disorders, conduct disorder, and ADHD.

The prevalence of mental disorders varied across age groups. In the youngest age group (<5 years), autism spectrum disorders had the highest prevalence, but in the 15–19 years age group, anxiety disorders ranked first (Appendix Fig. S2). The prevalence of several mental disorders (ADHD, conduct disorder, autism spectrum disorders, and IDID) peaked among children and adolescents aged less than 20 years.

Fig. 1 shows the age-standardized prevalence of mental disorders in each province in China in 2021. The age-standardized prevalence of mental disorders was highest in Hunan, at 10.2% (95% UI: 9.2, 11.3), and Liaoning had the lowest, at 6.3% (5.4, 7.2). Between 1990 and 2021, the age-standardized prevalence of mental disorders increased in most provinces except in Taiwan, Guangdong, Sichuan, Guangxi, and Hunan, where it decreased by 5.8%, 5.3%, 2.5%, 1.0, and 0.1%, respectively (Appendix Fig. S4). For each mental disorder, the age-standardized prevalence varied across provinces (Fig. 1). The age-standardized prevalence of bipolar disorder in Hebei Province was much greater than that in the other provinces (more than two times greater than that in the other provinces). Between 1990 and 2021, some provinces presented obvious differences in the changes in the age-standardized prevalence of mental disorders compared with other provinces. Hong Kong and Macao were the only two provinces with an increase in the age-standardized prevalence of IDID. Shandong and Hunan had the greatest increases in schizophrenia and conduct disorder, respectively. Guangdong had the greatest decrease in the age-standardized prevalence of ADHD, and these changes were much greater than those in the other provinces (Appendix Fig. S4).

	1990		2021	
	Prevalence, in thousands (95% UI)	Age-standardized prevalence rate per 100,000 population (95% UI)	Prevalence, in thousands (95% UI)	Age-standardized prevalence rate per 100,000 population (95% UI)
Mental disorders				
Total	39,392.6 (33,578.9, 45,928.7)	8.5 (7.8, 9.3)	30,779.1 (25,991.7, 36,337.2)	8.9 (8.1, 9.8)
Boys	23,211.1 (19,597.0, 27,521.4)	9.7 (8.8, 10.7)	19,122.0 (16,064.5, 23,014.5)	10.3 (9.2, 11.4)
Girls	16,181.4 (13,865.8, 18,811.5)	7.1 (6.4, 7.8)	11,657.1 (9854.6, 13,636.5)	7.2 (6.5, 7.9)
Depressive disorders				
Total	3043.4 (2326.6, 3856.9)	0.6 (0.5, 0.7)	1515.5 (1177.3, 1920.2)	0.4 (0.4, 0.5)
Boys	1047.7 (796.3, 1330.7)	0.4 (0.3, 0.5)	588.9 (454.1, 748.3)	0.3 (0.3, 0.4)
Girls	1995.7 (1519.3, 2533.2)	0.8 (0.6, 0.9)	926.6 (723.1, 1162.7)	0.6 (0.5, 0.7)
Anxiety disorders				
Total	11,946.6 (9056.6, 15,453.4)	2.5 (2.1, 3.0)	8985.1 (6707.1, 11,705.2)	2.6 (2.1, 3.1)
Boys	4811.8 (3645.0, 6202.4)	2.0 (1.7, 2.3)	3743.6 (2799.4, 4886.1)	2.0 (1.7, 2.4)
Girls	7134.7 (5419.9, 9253.9)	3.1 (2.6, 3.7)	5241.5 (3927.3, 6833.2)	3.2 (2.8, 3.9)
Schizophrenia				
Total	126.1 (90.3, 171.3)	0.02 (0.02, 0.03)	81.4 (56.9, 112.4)	0.02 (0.02, 0.03)
Boys	66.1 (47.0, 90.0)	0.02 (0.02, 0.03)	44.3 (31.1, 61.2)	0.02 (0.02, 0.03)
Girls	60.1 (43.0, 81.0)	0.02 (0.02, 0.03)	37.1 (25.7, 51.3)	0.02 (0.02, 0.03)
Autism spectrum disorders				
Total	2945.7 (2465.6, 3481.3)	0.7 (0.6, 0.7)	2344.0 (1956.6, 2782.4)	0.7 (0.6, 0.8)
Boys	2216.8 (1857.4, 2619.3)	1.0 (0.9, 1.0)	1818.5 (1519.4, 2151.8)	1.0 (0.9, 1.1)
Girls	728.9 (598.8, 876.1)	0.3 (0.3, 0.4)	525.5 (431.4, 634.3)	0.3 (0.3, 0.4)
Bipolar disorder				
Total	258.2 (185.3, 348.4)	0.05 (0.04, 0.06)	164.1 (117.5, 221.5)	0.05 (0.04, 0.06)
Boys	128.9 (91.2, 173.3)	0.05 (0.04, 0.06)	86.1 (61.0, 116.1)	0.05 (0.04, 0.06)
Girls	129.4 (94.3, 176.9)	0.05 (0.04, 0.06)	78.0 (56.7, 106.8)	0.05 (0.04, 0.06)
Conduct disorder				
Total	5484.9 (3993.2, 7127.7)	1.2 (1.0, 1.5)	4437.7 (3190.5, 5741.8)	1.3 (1.0, 1.6)
Boys	3890.4 (2877.5, 5017.1)	1.7 (1.3, 2.0)	3190.4 (2317.9, 4062.8)	1.7 (1.4, 2.1)
Girls	1594.5 (1105.1, 2181.1)	0.7 (0.5, 0.9)	1247.4 (866.9, 1725.7)	0.8 (0.6, 1.0)
Eating disorders				
Total	298.9 (193.4, 453.3)	0.06 (0.04, 0.07)	316.6 (205.4, 483.0)	0.09 (0.06, 0.12)
Boys	132.4 (82.4, 207.0)	0.05 (0.03, 0.06)	148.5 (91.6, 235.8)	0.08 (0.05, 0.11)
Girls	166.5 (110.9, 251.0)	0.07 (0.05, 0.08)	168.1 (112.8, 255.7)	0.11 (0.08, 0.14)
ADHD				
Total	14,020.5 (9712.8, 20,165.9)	3.1 (2.5, 3.7)	12,789.7 (8960.4, 18,298.7)	3.6 (3.0, 4.5)
Boys	10,376.9 (7149.5, 14,939.3)	4.4 (3.6, 5.5)	9608.0 (6725.9, 13,793.2)	5.1 (4.2, 6.3)
Girls	3643.5 (2518.0, 5230.0)	1.6 (1.3, 2.0)	3181.7 (2203.0, 4553.7)	1.9 (1.6, 2.4)
IDID				
Total	2561.2 (945.0, 4205.2)	0.6 (0.4, 0.7)	1222.5 (345.3, 2139.1)	0.4 (0.2, 0.5)
Boys	1388.1 (431.9, 2376.3)	0.6 (0.4, 0.8)	645.4 (121.3, 1221.7)	0.4 (0.2, 0.5)
Girls	1173.0 (503.3, 1832.3)	0.5 (0.4, 0.7)	577.2 (223.2, 932.3)	0.4 (0.3, 0.5)
Other mental disorders				
Total	492.5 (293.0, 719.5)	0.09 (0.06, 0.13)	306.5 (182.5, 447.7)	0.09 (0.06, 0.13)
Boys	305.2 (185.4, 444.2)	0.11 (0.07, 0.15)	196.4 (119.3, 285.8)	0.11 (0.07, 0.15)
Girls	187.3 (107.2, 275.5)	0.07 (0.04, 0.10)	110.1 (63.0, 161.9)	0.07 (0.04, 0.10)

ADHD, attention-deficit/hyperactivity disorder; IDID, idiopathic developmental intellectual disability.

Table 1: **Prevalence and age-standardized prevalence of mental disorders in children and adolescents in China in 1990 and 2021.**

Disability-related burden of mental disorders in children and adolescents in China

In 2021, mental disorders in children and adolescents in China accounted for 2.8 million DALYs (95% UI: 2.0, 3.7), which equaled the age-standardized DALY rates of 810.6 per 100,000 people (680.5, 960.4) or 11.8% (9.1,14.6) of the total DALYs. Between 1990 and 2021, the age-standardized DALY rates and proportion of

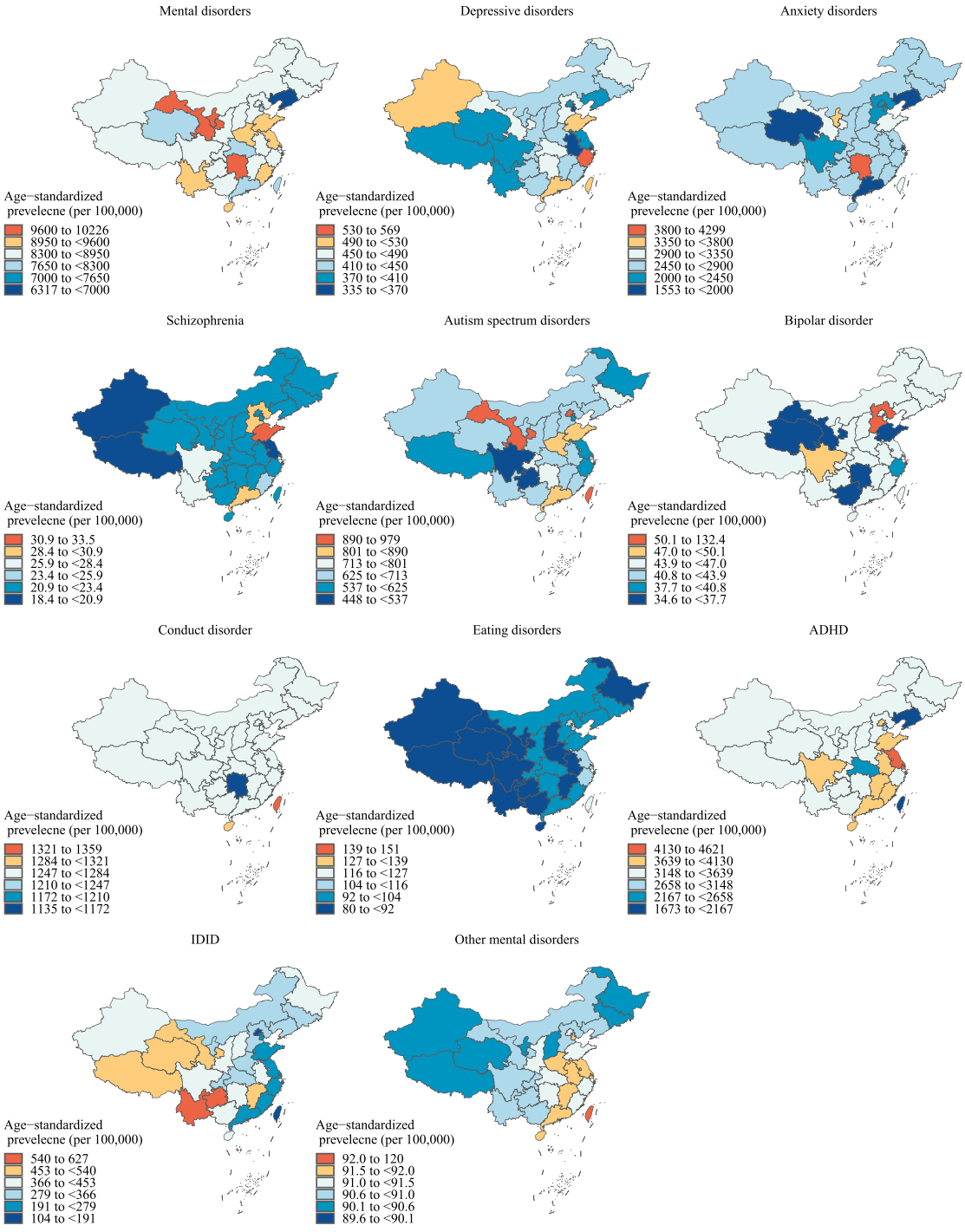

***Fig. 1*: Age-standardized prevalence of mental disorders in children and adolescents in China, 2021**. ADHD, attention-deficit/hyperactivity disorder; IDID, idiopathic developmental intellectual disability.

DALYs attributed to mental disorders in China increased by 0.9% and 365.0%, respectively, but the number of DALYs decreased by 26.9% (Appendix Tables S3 and S4).

For each mental disorder, anxiety disorders had the highest age-standardized DALY rates in China in 2021 (324.1 per 100,000 people [95% UI: 251.3, 403.8]), accounting for 40.3% of the total mental disorder DALYs

(Appendix Fig. S1). Followed by conduct disorders, autism spectrum disorders, and depressive disorders. Compared with other countries with similar development statuses, China had the highest age-standardized DALY rates for schizophrenia (Appendix Fig. S5).

All age groups of children and adolescents carried certain levels of mental disorder burden. Autism spectrum disorders accounted for the majority of DALYs of mental disorders in the youngest age group (<5 years), and anxiety disorders were much more common in the older age group. Boys had higher DALYs than girls across all age groups (Fig. 2).

The geographical distribution of mental disorder DALYs in 2021 by province was similar to that of the prevalence of mental disorders. The highest age-standardized DALY rates were observed in Hunan, at 1015.3 (830.3, 1222.3). The lowest value was observed in Qinghai, at 667.3 (557.3, 806.2) (Appendix Table S5). Provinces with higher incomes presented a lower age-standardized DALY rates, where a difference of 65.8 DALYs per 100,000 people existed between provinces with the highest and lowest incomes in 1990, but this difference decreased to 25.2 in 2021 (a decrease of 61.7%) (Fig. 3).

Share of burden due to mental disorders

Among 22 health conditions, mental disorders were the leading contributor to YLDs for children and adolescents in China in 2021 (Appendix Table S4). At the disorder level, among the top 10 leading causes of YLDs in China, anxiety disorders were ranked first, followed by conduct disorder and autism spectrum disorders, which were ranked 4th and 7th, respectively. For each age group, except for the <5 years age group, where autism spectrum disorders was the leading contributor of YLDs for mental disorders, anxiety disorders ranked first among the other age groups (Fig. 4). The ranking of YLDs due to mental disorders varied among boys and girls in China (Appendix Figs. S7 and S8).

For DALYs in China, mental disorders ranked third among the 22 health conditions in 2021 (Appendix Table S4). At the disorder level, among the 10 leading causes of DALYs, anxiety disorders ranked 5th, followed by conduct disorder, which ranked 8th. For each age group, anxiety disorders had the highest percentage of DALYs among the three age groups except for the <5 years age group. The ranking of DALYs for mental disorders differed by sex (Appendix Figs. S7 and S8).

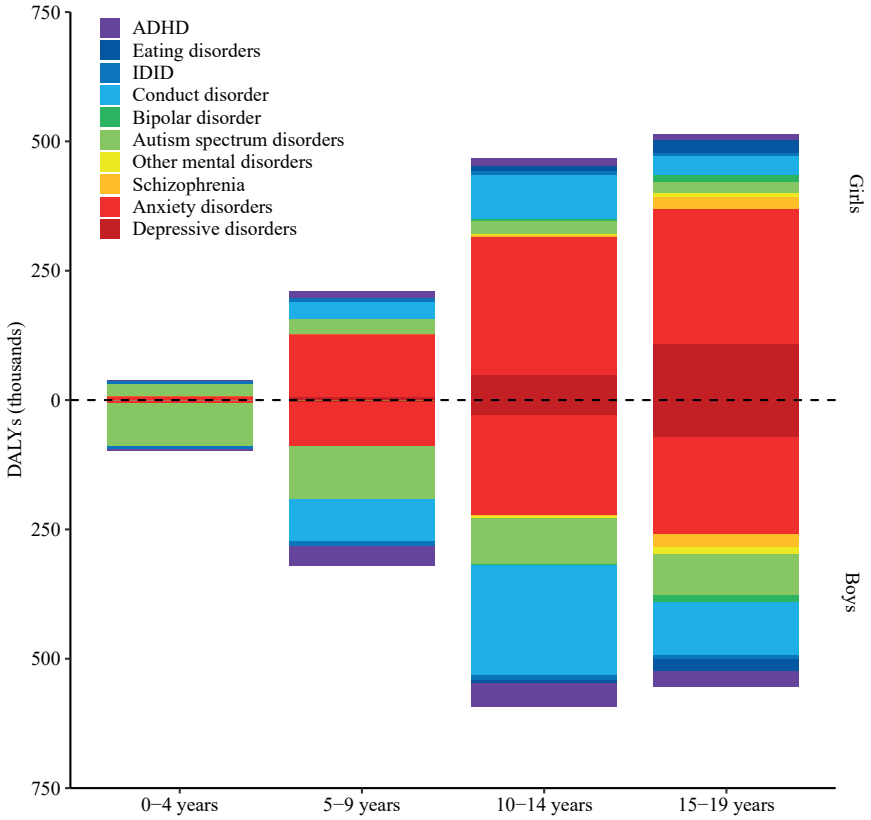

***Fig. 2:* Disability-adjusted life-years (DALYs) for mental disorders in children and adolescents in China by age and sex, 2021.** DALYs, disability-adjusted life-years. ADHD, attention-deficit/hyperactivity disorder; IDID, idiopathic developmental intellectual disability.

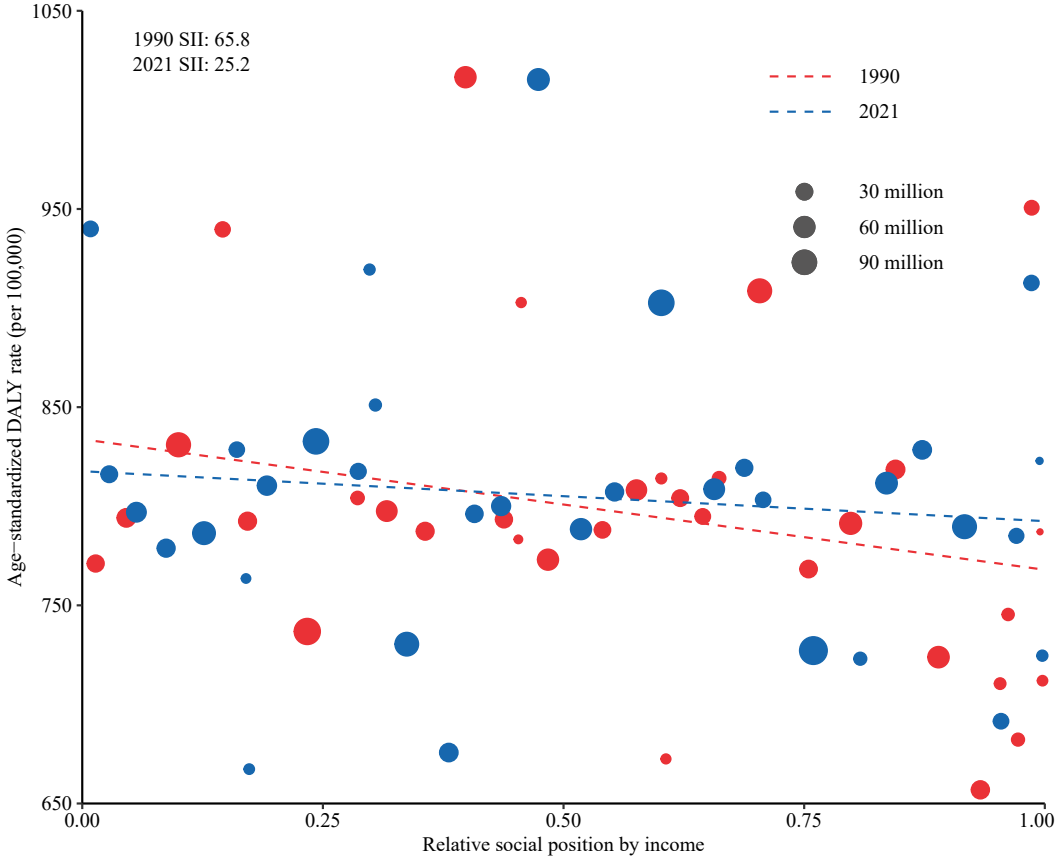

Fig. 3: **Income-related health gradient for mental disorders in children and adolescents in China, 1990 and 2021.** DALYs, disability-adjusted life-years. Each colored circle indicates the age-standard DALY rate for mental disorders in each province. The dashed line depicts the regression line. SII, the slope index of inequality, represents the difference between the predicted values at the two extremes (rank 1 and rank 0).

Discussion

In this study, we provide a comprehensive description of the burdens associated with mental disorders and their subtypes for children and adolescents in China. In 2021, almost 30.8 million children and adolescents in China were affected by mental disorders, ranking first in terms of healthy life loss. Among mental disorders, anxiety disorders accounted for the greatest proportion of DALYs. The mental disorder burden varied among the different provinces, with provinces with higher income having a lower burden of mental disorders in general, but this inequality has decreased over the last three decades.

Our estimate of the prevalence of mental disorders in both sexes was 8.9%, which was lower than that of the previous large-scale survey conducted in five provinces in China by Li and colleagues,[20] where the prevalence of mental disorders was estimated to be 17.5%.[20] This difference may be driven mainly by the different subtypes of mental disorders included in the study. For the simultaneously owned subtypes of mental disorders, e.g., depressive disorders, conduct disorder, and ADHD, the estimation of prevalence was similar. In addition, different methodologies between studies may also partly explain these differences. Rather than relying solely on epidemiological data to estimate the mental disorder burden, we systematically reviewed the literature to obtain all available data[6,21] and corrected bias caused by survey methodology.[4] Similar research methods have been widely used to assess disease burden globally.[4,6,16]

In this study, we found that both the age-standardized prevalence rates and DALY rates of mental disorders in children and adolescents in China increased slightly from 1990 to 2021. In China, rapid socioeconomic progress has been correlated with social structure changes, increased gaps between urban and rural areas, rapid urbanization, and increased competition and social pressure.[22] For children, high academic requirements and pressure can lead to an increase in negative emotions. In addition, people are more willing to admit that they are experiencing symptoms of mental disorders than before, which may reduce the phenomenon of stigma-induced concealment of symptoms.[23] As

YLDS (2021)

<20 years	<5 years	5-9 years	10-14 years	15-19 years
1 Anxiety disorders	5 Autism spectrum disorders	1 Anxiety disorders	1 Anxiety disorders	1 Anxiety disorders
4 Conduct disorder	20 Anxiety disorders	5 Autism spectrum disorders	2 Conduct disorder	5 Depressive disorders
7 Autism spectrum disorders	24 IDID	8 Conduct disorder	7 Autism spectrum disorders	6 Conduct disorder
15 Depressive disorders	35 ADHD	16 ADHD	13 Depressive disorders	11 Autism spectrum disorders
22 ADHD	83 Depressive disorders	29 IDID	16 ADHD	21 Eating disorders
30 Eating disorders	NA Conduct disorder	37 Depressive disorders	34 Eating disorders	22 Schizophrenia
35 Schizophrenia	NA Eating disorders	63 Eating disorders	36 IDID	30 ADHD
38 IDID	NA Schizophrenia	NA Schizophrenia	46 Schizophrenia	33 Bipolar disorder
49 Bipolar disorder	NA Bipolar disorder	NA Bipolar disorder	47 Bipolar disorder	37 Other mental disorders
53 Other mental disorders	NA Other mental disorders	NA Other mental disorders	61 Other mental disorders	48 IDID

DALYs (2021)

<20 years	<5 years	5-9 years	10-14 years	15-19 years
5 Anxiety disorders	12 Autism spectrum disorders	4 Anxiety disorders	1 Anxiety disorders	2 Anxiety disorders
8 Conduct disorder	55 Anxiety disorders	9 Autism spectrum disorders	3 Conduct disorder	7 Depressive disorders
13 Autism spectrum disorders	61 IDID	13 Conduct disorder	10 Autism spectrum disorders	10 Conduct disorder
23 Depressive disorders	73 ADHD	23 ADHD	19 Depressive disorders	17 Autism spectrum disorders
36 ADHD	104 Depressive disorders	45 IDID	22 ADHD	30 Eating disorders
52 Eating disorders	NA Conduct disorder	58 Depressive disorders	48 Eating disorders	32 Schizophrenia
61 Schizophrenia	NA Eating disorders	92 Eating disorders	54 IDID	39 ADHD
64 IDID	NA Schizophrenia	NA Schizophrenia	66 Schizophrenia	47 Bipolar disorder
78 Bipolar disorder	NA Bipolar disorder	NA Bipolar disorder	67 Bipolar disorder	53 Other mental disorders
87 Other mental disorders	NA Other mental disorders	NA Other mental disorders	85 Other mental disorders	68 IDID

Fig. 4: **Ranking of YLD and DALY rates for mental disorders by all ages and the four age groups in both sexes, 2021**. ADHD, attention-deficit/hyperactivity disorder; IDID, idiopathic developmental intellectual disability.

early as the 1980s, China focused on mental health education for children and adolescents. With the gradual implementation of mental health education across the country since 2000,[24] the age-standardized prevalence of mental disorders has started to decrease (Appendix Fig. S3), but mental disorders account for the largest proportion of health-related causes of healthy life loss for children and adolescents in China. To address this issue, many efforts have been made in China, and the first national mental health law in 2013 was a positive development in this area.[25] In addition, an important target action plan for children and adolescents was

also set in 2019.[8] Interestingly, despite the rising trends in age-standardized prevalence rates, the number of mental disorder cases decreased over the last three decades. This may be attributed to changes in the population's age structure. From 1990 to 2021, the population under 20 years old decreased by 24.9% (from 445 million in 1990 to 334 million in 2021).[26] Notably, the COVID-19 pandemic has significantly impacted the burden of mental disorders among children and adolescents globally.[27] In the first year of the pandemic, 1 in 4 youths experienced symptoms of depression, and 1 in 5 experienced symptoms of anxiety, which were higher than rates observed before the pandemic.[28] A lack of contact with friends and classmates, boredom, fears of infection, a lack of personal space, and family financial issues may result in enduring effects of mental disorders on children and adolescents,[29] but the opportunity for more family activities may partly meet the mental health needs of children.[29]

With respect to the subtypes of mental disorders, anxiety disorders accounted for the greatest health-related life loss among all diseases in children and adolescents, followed by conduct disorder, autism spectrum disorders, and depressive disorders. This composition of mental disorders is not consistent with that of adults.[4] The burden of mental disorders varies at different stages of life, with certain disorders emerging early in life, including idiopathic intellectual disabilities and autism spectrum disorders, and some continue to be the main contributors to mental disorders in adulthood, such as depressive disorders, anxiety disorders, and schizophrenia.[4] Among mental disorders, ADHD is the most common disorder in children and adolescents in China and has the highest age-standardized prevalence. However, the hospital consultation rate was only 10%[30]; even for parents of children diagnosed with ADHD, knowledge about ADHD is insufficient.[31] Under the backdrop of the Healthy China Initiative on promoting the mental health of children and adolescents,[8] more attention is needed in ADHD. Notably, compared with other countries with similar sociodemographics, the age-standardized DALY rates of schizophrenia is unusually high in China. The treatment rate for schizophrenia is relatively high in China, but most treatments occur in nonpsychiatric medical institutions,[32] and the use of national management and treatment services is low.[33] Considering the heavy disability for individuals with schizophrenia (those with acute schizophrenia had the highest disability weight of all mental disorders, Appendix Table S1), targeted mental health services should be improved to meet the requirements of these patients. In this study, the ranking of mental disorders between YLDs and DALYs was not consistent. In our estimation process, we did not include premature deaths from other diseases or injuries due to the lack of a proper method to capture the proportion of these premature deaths. This omission likely contributed to a lower estimation of DALYs and accounts for the observed differences.[4]

In this study, we assessed the health outcomes of children and adolescents with mental disorders in provinces in China, which is important for understanding the geographical distribution of various mental disorders and helping to develop targeted prevention and treatment strategies. Our study revealed that although the prevalence of mental disorders in most provinces is similar to that at the national level in China, significant differences were found between provinces. These geographic differences may be explained by the development of social and economic factors,[6,34] health services,[35,36] and mental health-related knowledge and behaviors.[37,38] Notably, the age-standardized prevalence of bipolar disorder in Hebei Province was much greater than that in the other provinces. However, from a global perspective, the prevalence of bipolar disorder was lower in China (which has the lowest age-standardized prevalence globally[2,39]), and this phenomenon warrants further attention. In addition, changes in prevalence during the last three decades in some provinces were markedly different from those in other provinces, which is a reminder call for future health plans in these provinces. Our results indicate that the burden of mental disorders among provinces in China exhibits a unique gradient related to economic development. Specifically, provinces with higher incomes tend to have a lower burden of mental disorders. This phenomenon seems inconsistent with the national-level estimation of mental disorders globally, where high-income countries have more DALYs.[4] Internally, the mental disorder burden was not as high in each province as it is at the global level,[4] and on the basis of national health planning as a whole, the differences in health-care access and quality were not as significant as they are at the global level.[40] In the past three decades, inequality among these provinces has decreased by 61.7%. In 1990, the difference in DALY rates between provinces with the highest and lowest incomes was 65.8, while this difference decreased to 25.2 in 2021. These trends are consistent with the overall achievements of mental health reform in terms of including mental health in national public health programs, treatment and intervention programs, and workforce training.[41]

This is the first study to provide a comprehensive and comparable estimation of mental disorders and their subtypes in children and adolescents in China and its provinces. Our findings provide important evidence supporting the need for policy development and interventions for mental disorders in subnational entities. Nonetheless, this study is subject to all the limitations associated with GBD-based studies.[2] First, although we collected the most comprehensive information available to assess the mental health burden in China and its provinces, we acknowledge that sparse or missing primary data in some locations may have introduced bias

in our estimations. While enhancements in data processing and modeling can partially improve the accuracy of our estimates, fundamental improvements will require more extensive and better-quality primary data resources. Second, several important national mental disorder surveys are planned for the future. For example, on October 15, 2021, the Ministry of Education of China announced a nationwide screening for depression in children and adolescents.[42] Combined with the latest location-specific survey data,[43] updated estimations will be included in future assessments. Third, this study used the same approach as the GBD study regarding the assessment of the mental disorder burden in China. Like in the GBD study, we did not provide information on mental disorders stratified by location (i.e., rural and urban areas). Considering that some mental disorders are significantly different between these regions (e.g., schizophrenia[23]), further estimations are needed to extend these findings to rural and urban areas. Fourth, we did not assess the specific impact of the COVID-19 pandemic on the burden of mental disorders. Considering the significant impact of the COVID-19 epidemic on mental health,[27] future research with improved methodologies and updated data will be valuable in providing a clearer understanding. Fifth, disability was defined to reflect health loss but not welfare loss. The estimation does not reflect the consequences of mental disorders on family, social or economic factors. In addition, disability weights in this study were extracted from several surveys.[2,4] It is difficult to capture the complexity of health states using lay descriptions, resulting in a source of imprecision.[21] Furthermore, as in the GBD study, most of the disability weights in this study were extracted from high-income countries.[4,16] Using these weights in some provinces with relatively few health resources may underestimate the burden.

Conclusion

In summary, mental disorders constitute the major health burden in children and adolescents in China, especially in terms of disability. Differences in the health burden of mental disorders among children and adolescents exist across provinces in China, underscoring the need for targeted strategies that consider sociodemographic variations. Such approaches aim to maximize the effectiveness of health investments and ensure the successful implementation of evidence-based health policies.

Contributors

Maigeng Zhou directed the study, secured research funding, provided administrative support, and had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. Ruhai Bai and Wanyue Dong initially conceived the research idea, designed the study, performed data management and analysis, and drafted the manuscript. Wanyue Dong, Yunning Liu, Lei Zhang, Ruhai Bai, and Maigeng Zhou critically revised the manuscript. All coauthors have read and approved the final manuscript. The corresponding authors attest that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted. The corresponding author had full access to all the data in the study and had responsibility for the decision to submit for publication.

Data sharing statement

The data are not publicly available due to data sharing regulations established by China CDC, but they were available from the corresponding authors on reasonable request.

Editor note

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Declaration of interests

We declare no competing interests.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.lanwpc.2025.101486.

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