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Comorbidities and group comparisons of epilepsy-caused mental disability in China

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ABSTRACT

Epilepsy is the third leading cause of mental disability in China. This report estimates the prevalence rate of comorbidities with epilepsy-caused mental disability (EMD) and identifies vulnerable Chinese subgroups. The second China National Sample Survey on Disability was used to identify people with EMD based on the WHO International Classification of Functioning, Disability, and Health and the International Statistical Classification of Diseases. Logistic regressions were used to compare comorbidities by sex, age, community, and region. A total of 1490 respondents were diagnosed with EMD, which was more prevalent in rural communities, in the western region, and among younger people. Brain diseases and organic mental disorders were the most prevalent comorbidities with EMD. Children and people of the eastern region were more likely to have comorbidities with other chronic brain diseases. This first national study of comorbidities with EMD highlights the vulnerability of children.

1. Introduction

The World Health Organization (WHO) estimates that eight out of 1000 people have epilepsy and that approximately 100,000,000 people worldwide suffer from active epilepsy [1]. Due to a variety of interacting genetic, biological, and environmental factors, a number of people with epilepsy have a range of co-occurrence with other conditions [2,3]. People with epilepsy have a higher risk of depression [4,5] and other psychiatric disorders [6,7], as well as behavioral [8] and somatic comorbidities [2,9].

The estimated lifetime prevalence rate of epilepsy in mainland China is seven per 1000 [10], and the annual incidence is similar to that in the United States and in Europe [1]. Epilepsy has been reported as the third leading classified cause of mental disability in China (8.6%) [11], and people with epilepsy have a three- to four-fold increased risk for premature death compared with the general Chinese population [12]. It is well recognized that comorbidities of epilepsy are associated with increased health care needs, poorer health-related quality of life, and premature mortality [2,3]. However, there have been few studies of the comorbidities of epilepsy in China.

No nationwide population-based survey on epilepsy has been conducted in China. The present study used data from a nationwide survey of disabilities to assess the comorbidities of epilepsy-caused mental disability (EMD) in China and to reveal Chinese populations that are particularly vulnerable.

2. Methods

Subjects in this study included non-institutionalized individuals with EMD in mainland China. We examined (1) the demographic distribution of people with EMD, (2) the prevalence of the primary comorbidities associated with EMD, and (3) the demographic distribution of the primary comorbidities among people with EMD.

2.1. Data source

We used data from the 2006 national survey of non-institutionalized people in China [13]. The protocol and sampling methodology of this survey have been described previously [11]. The aim of the survey, which was conducted from April 1st to May 31st, 2006, was to examine visual, hearing, speech, physical, intellectual, and mental disabilities, as well as the primary causes of each disability.

We used four-stage (county, town, village, and community) stratified random cluster sampling, with probability proportional to size, to include nationally representative cases. This survey excluded Taiwan, Hong Kong, and Macao, covering the remaining 31 of the 34 provinces, autonomous regions, and municipalities of China. The study comprised a total of 734 counties, 5964 communities, 771,797 households, and 2,526,145 Chinese inhabitants, representing 1.9 of every 1000 non-institutionalized inhabitants. This study was approved by the Chinese State Council. All survey respondents provided consent to participate in the study to the Chinese government.

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More than 20,000 trained field interviewers, 6000 physicians of various specialties, and 50,000 survey assistants participated in this study. During the survey, interviewers visited the households and interviewed each family member regarding the disabilities. An appointment was made for a second visit to those individuals who were not at home during the initial interview. If the target person was absent during the second visit, his/her information was obtained from other family members. Please refer to Table 1 in our published work on the prevalence of disabilities in China [11] for the screening questions and the definitions of various types of disabilities. The questions posed during the screening of mental disability were the following: 'Are you or your family members forgetful?', 'Do you have difficulty concentrating?', 'Can you not control your moods?', 'Do you have strange behavior that is out of the ordinary?', and 'Are you addicted to alcohol or drugs?'

After the first stage of screening for disabilities, those respondents who were seven years old and older and were suspected to have a disability, as well as all children aged six years or less, were referred to different physicians for further disability screening and confirmation. The designated doctors performed medical examinations and followed diagnostic manuals to make a final diagnosis, to assess the severity of the disability, and to confirm the primary causes.

2.2. Measurements

2.2.1. Mental disability

Mental disability was defined in this 2006 survey as a mental disorder lasting more than one year that resulted in cognitive, affective, and behavior disorders and that restricted the patient's daily life and social functioning according to the WHO International Classification of Functioning, Disability, and Health (WHO-ICF) guidelines [14]. Other types of disabilities were also defined according to the WHO-ICF guidelines.

2.2.2. Mental disorders and epilepsy, primary causes of other disabilities, and comorbidity

Mental disorders that were reported as the primary cause of mental disability (including epilepsy) were diagnosed by psychiatrists according to the International Statistical Classification of Diseases, 10th Revision (ICD-10) [15]. The diagnoses of the primary causes of other disabilities were performed in the same way. In the current study, comorbidity referred to more than one diagnosis for an individual at the same time.

2.3. Statistical analyses

Information regarding the individuals diagnosed with EMD was included in a custom-designed database and analyzed using the SPSS statistical package (Windows version 16.0; SPSS Inc.; Chicago, Illinois, USA).

Because of the complex sampling design, we constructed sample weights using standard weighting procedures [16] to report the weighted number of people with EMD and to estimate the proportions of individuals with EMD in different demographic groups. Binary logistic regression models in the complex survey module were used to compare the prevalence of EMD by sex, age group (three age ranges), urban or rural residence, and regional division (eastern, central, or western regions of China) for the individuals diagnosed as disabled.

For each diagnosis, we calculated the weighted prevalence, with 95% confidence intervals, among individuals with EMD as a whole. A prevalence rate of more than 1% of the individuals with EMD was classified as a primary comorbidity.

We also calculated the percentages of prevalence of each diagnosis for some basic demographic categories. Binary logistic regression models in the complex survey module were used to compare prevalence rates of the primary comorbidities by sex, age group (three age ranges), urban or rural residence, and regional division (eastern, central, or western regions of China) among individuals with EMD.

3. Results

Of the 2,526,145 sampled non-institutionalized inhabitants, 1490 individuals were identified with an EMD. Of these individuals, 817 (54.8%) were women, 1201 (80.6%) lived in rural communities, and 1211 (81.3%) were between 15 and 59 years old. Epilepsy-caused mental disability among the disabled people was more common in rural than in urban areas after controlling for sex, age, and region of China (adjusted odds ratio: 1.26 [1.11–1.44], $p<0.001$). Similarly, EMD was more common in younger people and more common in the western region of China (Table 1).

Table 1
Epilepsy-caused mental disability among disabled Chinese people.

	Total	Percentage[a]	Adjusted OR (95% CI)[b]	p value
Total population screened	2,526,145			
Population diagnosed as disabled	161,479			
Epilepsy-caused mental disability	**1490**			
Sex				
Men	817	54.8[a]	0.95(0.86–1.05)[b]	0.319
Women	673	45.2		
Community				
Rural	1201	80.6	**1.26(1.11–1.44)**	**<0.001**
Urban	289	19.4		
Age				
0–14 (Y)	177	11.9	**Y>M>O**	
15–59 (M)	1211	81.3		
60[a] (O)	102	6.8		
Region				
Eastern (E)	454	30.5	**W>E, C**	
Central (C)	469	31.5		
Western (W)	567	38.1		

[a] Values in this column represent percentages of the subsample. For example, the number of men (817) in the total sample (1490) is 54.8%.

[b] Values in this column refer to the odds ratio (OR) and 95% confidence intervals, adjusted for sex, age, community, and region in the total weighted number of 163,106 respondents that were diagnosed as disabled. For example, the OR for men is 0.95 with 95% confidence intervals of 0.86 to 1.05.

3.1. Prevalence rates of primary comorbidities

We found seven types of diseases coexisting with EMD in at least 1% of the sample. Of these primary comorbidities, other chronic brain diseases (excluding epilepsy) and organic mental disorders had prevalence rates of more than 10%, and birth defects and neurotic disorders had prevalence rates of more than 2%, respectively (Table 2).

Table 2
Prevalence rates of primary comorbidities in a sample of 1490 Chinese people with epilepsy-caused mental disability.

	Total	95% CI
Brain diseases (excluding epilepsy)	151	10.13% (8.65–11.78)
Organic mental disorders (excluding dementia)	107	7.18% (5.92–8.61)
Dementia	54	3.62% (2.73–4.70)
Birth defects	36	2.42% (1.70–3.33)
Neurotic disorders	32	2.15% (1.47–3.02)
Cerebral palsy	29	1.95% (1.31–2.78)
Schizophrenia	21	1.41% (0.87–2.15)

Table 3
A comparison of the prevalence rates of primary comorbidities in a sample of 1490 Chinese individuals with epilepsy-caused mental disability, in different communities, at different ages (years), and in different regions.

	Percentage[a]		OR [d]95%CI	p value	Percentage[a]			Comparisons*	Percentage[a]			Comparisons**
	Rural n = 1201	Urban n = 289			0–14 Y; n = 177	15–59 M; n = 1211	60[d] O; n = 102		Eastern E; n = 454	Central C; n = 469	Western W; n = 567	
Brain diseases[c]					14.69	9.91	4.90	Y > M, O	14.76	8.32	8.11	E > C, W
OMD[b]	6.16[a]	11.42	0.50(0.32–0.79)	0.002	2.82	7.93	5.88	M > Y	5.07	5.54	10.05	W > E, C
Birth defects					6.78	1.82	1.96	Y > M, O				
Cerebral palsy	1.67	3.46	0.42(0.19–0.94)	0.036	5.08	1.65	0	Y > M				
Schizophrenia									2.20	1.07	0.88	E > C, W

[a] Values in the percentage columns represent percentages of the subsample. For example, of the 1201 subjects with epilepsy-caused mental disability who lived in rural communities, 6.16% showed organic mental disorder comorbidities.
[b] Organic mental disorders (excluding dementia).
[c] Brain diseases (excluding dementia).
[d] Odds ratio adjusting for sex, age groups, and region.
* Comparisons adjusting for sex, residence in a rural or urban community, and residence in different regions. Significant differences ($p<0.05$) are shown.
** Comparisons adjusting for sex, age group, and residence in a rural or urban community. Significant differences ($p<0.05$) are shown.

3.2. Comparison of comorbidities by basic demographics

Most of the prevalence rates of the seven primary comorbidities with EMD varied significantly depending on age, residence in rural or urban communities, and residence in the different regions of China. None of these seven comorbidities had statistically significant different prevalence rates in men compared with women.

Brain disease, the most prevalent comorbidity among individuals with EMD, was more common among men than women. Brain disease was also a more common comorbidity among young people aged 0–14 years (Y) compared with people aged 14–59 years (M) and 60 years and over (O). Brain disease was also a more common comorbidity in the eastern (E) compared with the central (C) and western (W) regions of China. Organic mental disorders (excluding dementia) were more prevalent in urban than in rural areas (adjusted rural: urban odds ratio = 0.50 [0.32–0.79], p = 0.002), in individuals aged 14 to 59 years (M > Y), and in the western regions of China (W > E, C). Birth defects were more common among young people aged 0–14 years (Y > M, O). Cerebral palsy was more prevalent in urban areas (adjusted rural: urban odds ratio = 0.42 [0.19–0.94], p = 0.036) and among young people aged 0–14 years (Y > M). Schizophrenia was more prevalent in the eastern region of China (E > C, W) (Table 3).

4. Discussion

4.1. Principal findings

A weighted number of 1490 respondents were diagnosed as mentally disabled because of epilepsy. Of the disabled respondents, prevalence rate of EMD was higher in rural areas, in the western region, and among younger people. Brain diseases and organic mental disorders were the most prevalent comorbidities with EMD. Of individuals with EMD, young people and people living in the eastern region were more likely to have comorbidities with brain diseases. People living in urban areas, of group 15–59 years of age, and living in the western region were more likely have comorbidities with organic mental disorders (excluding dementia).

4.2. Reflection on methodology

This study reported an alarming prevalence of EMD among mainland Chinese. The study employed a nationally representative survey in mainland China with a sample size of 2.5 million, thus minimizing random sample selection errors. However, the survey excluded the institutionalized population that might reside in social welfare organizations for more than half a year. Because such social welfare organizations designated for EMD do not exist in China, the reported prevalence in the current study (1490 cases of EMD among 2.5 million inhabitants) may seem robust but may actually underestimate the true burden of EMD in China.

The disability-specific diagnoses for the primary causes were considered as comorbidities with EMD in an individual, which may have reduced the range of comorbid diseases with EMD. However, the sole, widely used and universal standard of diagnoses (ICD-10) [15] that was applied in the present study allowed for the comprehensive and reliable assessment of medical conditions at the national level and provided an important and reliable overview of the comorbidities associated with EMD in China.

4.3. Vulnerable population

The present findings enrich the literature on general disability and mental disability among Chinese and highlight the vulnerability of Chinese children with EMD. First, based on analysis of results from the same sample of more than 2.5 million Chinese in 2006, our previous report showed that general disability is more prevalent in rural than in urban communities (the all-persons age-standardized prevalence: 4.7%; rural versus urban: 5.2% versus 3.7%). The same was true for mental disability (all-persons: 0.5%; rural versus urban: 0.6% versus 0.4%) [11]. This rural prevalence of general disability and mental disability among Chinese people coincides with that of EMD, as revealed in our present study. Second, the 2006 study showed that general disability is more prevalent in men (all-persons: 4.7%; men versus women: 5.0% versus 4.3%), whereas mental disability is more prevalent in women (all-persons: 0.5%; men versus women: 0.6% versus 0.5%) [11]. However, our present study shows no difference between men and women in the prevalence of EMD. Third, the 2006 study showed that the weighted prevalence rate of general disability increases monotonically with age among Chinese people of seven years of age and older [11], as does that of the mental disability among Chinese adults aged 18 years and older (except for the 60–64 and 65–69 age groups, among whom the weighted prevalence rate is lower than the younger age group by approximately 0.5%, respectively) [17]. This age distribution of general disability and mental disability differs from that of EMD among the disabled revealed in our present study and highlights the vulnerability of Chinese children with EMD.

We further explore the vulnerability of Chinese children with EMD by considering their coexisting medical conditions in this study. Epilepsy is recognized as one of the most common serious neurologic disorders of childhood [18]. The risk of premature mortality is highest soon after the onset of seizures [19], and epilepsy in Chinese children is

associated with a higher rate of mortality [20,21]. This present study reveals that of the people who were diagnosed as disabled, the possibility of being diagnosed as having EMD was highest among younger people. This finding suggests the need for special attention on epilepsy in children. Further research is also needed to better understand the higher prevalence rates of EMD among the disabled population in rural areas and in the western region of China.

Previous research shows that risk of epilepsy is highest in patients with an associated serious neurologic abnormality, such as mental retardation [18,22], cerebral palsy [18], dementia [9,22], schizophrenia [23], or other chronic brain diseases [24]. Our present study also shows that organic mental disorders, cerebral palsy, and schizophrenia were the primary comorbidities associated with EMD. Our study also reveals the coexisting conditions of birth defects of all types. Previous studies have shown that birth defects contribute to higher mortality among Chinese children [20,25,26]. The mortality risk also decreases with increasing age [20,25]. Therefore, the comorbidity distribution for epilepsy in this study also suggests paying special attention to children with epilepsy.

Our present study also reveals that age, residence in a rural or urban community, and region are associated with the prevalence of the primary comorbidities after adjusting for the remaining three factors. Of those with EMD, children aged 0–14 years and people in the eastern region were more likely to show comorbidities with brain diseases. People living in urban areas, in the 15–59 age group, and living in the western region of China were more likely to show comorbidities with organic mental disorders (excluding dementia). Further studies are needed to explore the reasons for this distribution of comorbidities in China. The present findings also suggest practical priorities for epilepsy-related services.

4.4. Conclusion

This understanding of the detailed epidemiology of comorbidities with EMD reveals the vulnerability of children and of people living in rural areas and in the western region of China. The prevalence of comorbidities associated with EMD revealed in this study demonstrates a substantial health burden for individuals with EMD, especially children. Our results are just one component of a country-specific analysis supporting the reinforcement of mental health services in low-income and middle-income countries, as recommended by international mental health advocates [27]. Further, the effect on children with epilepsy and comorbid conditions highlighted in this study demonstrates that extra attention is required for practical and theoretical epilepsy-related services for affected children.

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