

Death Characteristics of Neurological Diseases in Inner Mongolia between 2008 and 2015

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Abstract

Background: There are no studies of death from neurological diseases found, however, neurological diseases were the leading cause of disability-adjusted life years in 2015 worldwide. **Aim:** The scientific aim of this study is to analyze the death characteristics of neurological diseases in Inner Mongolia occurring between 2008 and 2015. **Methods:** The data collected from Death Registry System (DRS) were categorized by gender, ethnicity, age, and death location. The subjects were divided into age groups for every 10 years from the age of 20. **Mortality and gender:** age-specific mortality was calculated for every 100,000 people from 2008 to 2015. **Results:** We found that Alzheimer's disease has the highest proportion which equated to over one-fifth of all neurological diseases. Males displayed a higher mortality rate than females in all neurological diseases. The neurological diseases mortality showed a total potential year of life lost (PYLL) of about 20,151 years, and it was 2.03 times higher for male than that for female. The average potential years of life lost (APYLL) showed 17.72 years, and APYLL in males was 3.34 years longer than in females. More than 60% of the deaths resulting from the neurological disease occur at home for both males and females. **Conclusion:** Alzheimer disease is the most serious disease of all neurological diseases, however, cerebral palsy and epilepsy also displayed the highest loss of life for residents. Mortality of neurological diseases was generally higher in males than in females, and this increased with age.

*Yujia Ma, Yonggang Qian and Zhiqiang Sun contributed equally to this paper.

Keywords

Neurological Diseases, Mortality, Inner Mongolia

1. Introduction

Neurological diseases were the leading cause of disability-adjusted life years (DALYs) in 2015 worldwide although there have been no studies on death from neurological diseases [1]. Infections of the central nervous system (CNS) are frequent causes of neurological disorders [2], with viruses being among the most important causes of infectious neurologic illness worldwide [3]. Among the neurological disorders examined in the Global Burden of Disease, Injuries, and Risk Factors Study (GBD) 2015, extrapyramidal and movement disorders (mainly for Parkinson's disease) were the fastest growing in prevalence, disability, and the number of deaths [4]. World Health Organization (WHO) Study Group identified epilepsy to be a disorder that also has a high prevalence in developing countries and represents potentially severe consequences [5]. However, the burden of neurological disorders is more severe in low- and middle-income countries [1]. Previous work has revealed a significant correlation between motor disability and neurological diseases, and demonstrated that the severity of disability is higher in the elderly, people with less education, the self-employed, and widows [6].

Here we study the neurological diseases using data obtained from the Death Registry System (DRS) in Inner Mongolia. Our results show the characteristics of neurological diseases in Inner Mongolia and provide theoretical support for further studies.

2. Materials and Methods

2.1. Data Source

The data used in this study included the total population of Inner Mongolia between 2008 and 2015, the total number of deaths, and the number of deaths due to neurological disorders. The death data from 2008 to 2015 were collected from the Death Registry System (DRS) maintained by the Chinese Ministry of Health, and executed by the Inner Mongolia Autonomous Region Centers for Disease Control and Prevention (CDC). Six monitoring points were monitored in 2008. They then expanded to eight points between 2009 and 2012 and 20 points between 2013 and 2015. The sampling was performed using a multistage cluster probability sampling strategy with stratification according to the classification of eastern, midwestern of Inner Mongolia, the local gross domestic product (GDP), proportion of rural dwellers, and the total population of local areas [7]. The "Diseases of the nervous system" (G00-G99) in this study was coded according to the International Classification of Diseases 10th edition (ICD-10) including Alzheimer disease (G31), epilepsy (G40), sleep disorders (G47), cerebral palsy

(G80), and others (G00-G30, G32-39, G41-G45, G48-G79, and G81-G99).

2.2. Statistical Analysis

The data collected from DRS were categorized by gender, ethnicity, age and death location. Ethnicity was divided into Mongolian, Han, and other nationality. The death location was divided into died at the hospital, died at home, died on the way to the hospital, and other location. Gender was divided into male and female. The subjects were divided into age groups for every 10 years from the age of 20. Mortality and mortality by gender were calculated for every 100,000 people from 2008 to 2015. The death proportion of various neurological diseases is displayed using a pie chart. The potential years of life lost (PYLL), potential years of life lost rate (PYLLR) and average potential years of life lost (APYLL) were calculated.

The statistical significance level was set at $P \leq 0.05$ (two-sided). Data entry and statistical analysis were completed using Microsoft Office Excel and SPSS 20.0, respectively.

3. Results

Figure 1 shows the proportions of various neurological diseases diagnosed throughout Inner Mongolia between 2008 and 2015. Alzheimer's disease's proportion was the highest which is over one-fifth of all neurological diseases. The proportions of epilepsy, sleep disorders, and Cerebral palsy each were approximately 9%. Each of the other 96 diseases accounted for less than 7%.

Mortality rates for neurological diseases fluctuated between $2.05/10^5$ and $5.25/10^5$ from 2008 to 2015 in Inner Mongolia. The annual-specific mortality for Alzheimer's disease displayed the highest mortality ranging from $0.37/10^5$ to $1.17/10^5$ from 2008 to 2015. **Table 1** shows the mortality rates of various neurological diseases by gender in Inner Mongolia of 2008-2015. The mortality rate of neurological diseases combined was $3.91/10^5$. The mortality rates of males were higher than those of females for all neurological diseases. Alzheimer's disease has the highest mortality rate for both males and females, with males displaying a rate 1.45 times higher than females.

Table 2 shows the age-specific mortality rates for the different neurological diseases diagnosed in Inner Mongolia from 2008 to 2015. Age-specific mortality and age-specific mortality by gender for all neurological diseases showed an upward trend, with the highest mortality ($70.60/10^5$) occurring in the oldest age group. The age-specific mortality for males with a neurological disease was over one time higher than in females.

Table 3 shows the PYLL, APYLL and PYLLR for the various neurological diseases categorized by gender in Inner Mongolia between 2008 and 2015. The mortality for neurological diseases showed a total PYLL of about 21,604 years. For males, this rate was 1.67 times higher than that for females. The APYLL showed a total of 19 years, with females having an APYLL that was 0.09 years

longer than that of males. PYLL for Alzheimer disease, epilepsy, sleep disorders and Cerebral palsy accounted for more than 50% of all neurological diseases. Cerebral palsy had the highest PYLLR (0.15 years/10³) of all neurological diseases.

Table 4 shows the proportion for sociodemographic characteristics of neurological disease in Inner Mongolia between 2008 and 2015. The proportion of males with a neurological disease was 1.68 times higher than the proportion of females (62.62% and 37.38% for male and female, respectively). The Han nationality accounted for the highest proportion of all nationalities both in male and female subjected (86.10% and 83.29% for males and females, respectively). More than 60% of deaths from the neurological disease occurred at home for both males and females.

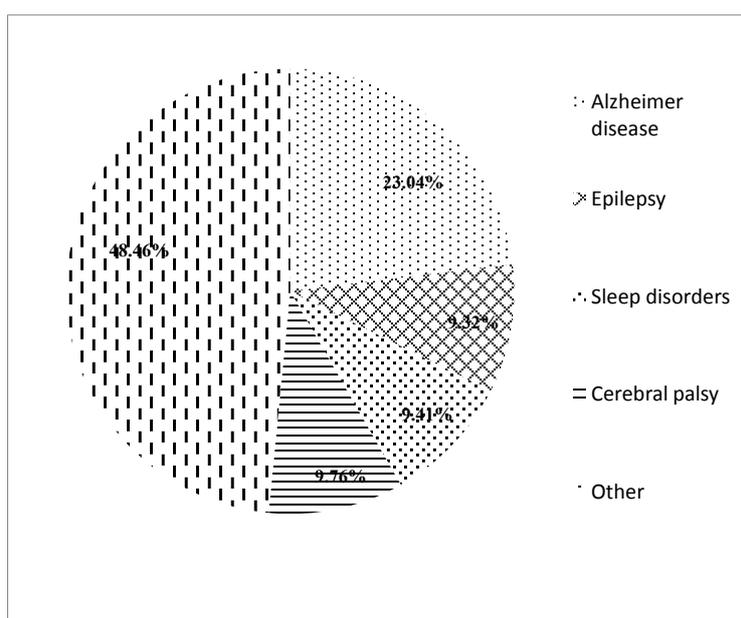


Figure 1. The proportion of various neurological diseases in Inner Mongolia between 2008 and 2015.

Table 1. Mortality for various neurological diseases by gender in Inner Mongolia between 2008 and 2015.

	Total		Male		Female	
	n	Mortality (10 ⁵)	n	Mortality (10 ⁵)	n	Mortality (10 ⁵)
Total	1137	3.91	712	4.70	425	3.04
Alzheimer disease	262	0.90	160	1.06	102	0.73
Epilepsy	106	0.36	69	0.46	37	0.26
Sleep disorders	107	0.37	81	0.53	26	0.19
Cerebral palsy	111	0.38	69	0.46	41	0.29
Other	551	1.89	331	2.19	218	1.56

Table 2. Age-specific mortality for neurological diseases in Inner Mongolia between 2008-2015.

Age	Total		Male		Female	
	n	Mortality (10 ⁵)	n	Mortality (10 ⁵)	n	Mortality (10 ⁵)
20-	56	1.13	36	1.38	20	0.84
30-	99	1.96	70	2.61	29	1.22
40-	137	2.40	98	3.26	39	1.45
50-	125	3.18	88	4.33	37	1.94
60-	147	7.65	90	9.57	57	5.81
70-	264	22.94	150	26.29	114	19.64
80-	197	70.60	111	80.43	86	60.98

Note: n- is n- n + 9 years old group (e.g. 20- means 20 - 29 years old group; 80- means ≥80 years old group).

Table 3. PYLL for various neurological diseases in Inner Mongolia of 2008-2015.

	PYLL			PYLLR			AYLL		
	male	female	total	male	female	total	male	female	total
Total	13,213.11	7925.79	21,604.34	0.87	0.57	0.74	18.56	18.65	19.00
Alzheimer disease	936.57	845.51	1829.04	0.06	0.06	0.06	5.85	8.29	6.98
Epilepsy	2103.63	1162.09	3318.65	0.14	0.08	0.11	30.49	31.41	31.31
Sleep disorders	1545.04	501.42	2149.93	0.10	0.04	0.07	19.07	19.29	20.09
Cerebral palsy	2687.47	1687.92	4417.76	0.18	0.12	0.15	38.95	40.19	39.80
Other	5940.40	3728.86	9888.96	0.39	0.27	0.34	17.84	17.10	17.95

Table 4. The proportion for sociodemographic characteristics of neurological diseases in Inner Mongolia between 2008 and 2015.

	Male		Female	
	n	%	n	%
Total	712	62.62	425	37.38
Nation				
Han	613	86.10	354	83.29
Mongolian	90	12.64	55	12.94
Other	9	1.26	16	3.76
Place of death				
Hospital	204	28.65	113	26.59
Home	449	63.06	291	68.47
On the way	27	3.79	9	2.12
Other	32	4.49	12	2.82

4. Discussion

The present study provides a profile and determines the severity of diseases of the nervous system in Inner Mongolia between the years 2008 and 2015. We found that the mortality rates of neurological diseases fluctuated within a small range during the period of observation.

Nervous system diseases include a large number of disorders, and deaths from each individual disease are very small. We found that Alzheimer disease, epilepsy, sleep disorders and cerebral palsy account for the top four diseases which totals approximately half of all neurological diseases. Alzheimer's disease is the most prevalent disease with the highest mortality rate, more than twice as high as cerebral palsy which ranks as the second most prevalent neurological disorder in Inner Mongolia. People with cerebral palsy or epilepsy display a higher loss of life than those with Alzheimer's disease. This was due to the smaller age of onset and death in patients with either cerebral palsy or epilepsy, where Alzheimer's disease is more common in the elderly. The loss of life in cerebral palsy and epilepsy is more significant in assessing the residents' health.

Examining demographic characteristics, we found the mortality rate for neurological diseases to be generally higher in males than in females, and this may be related to differences in gene expression in the brains of males and females [8]. The average mortality for neurological diseases increased with age between 2008 and 2015, which conforms to the general pattern of diseases between these time periods. At the same time, as they grow older, they are likely to be accompanied by other diseases [9], which will also cause the rate of mortality to increase. Among all deaths in neurological diseases, the Han nationality has a much higher proportion than the Mongolian nationality, which was the second most represented. Most people die at home, which may be due to epilepsy is usually a sudden unexpected death [10], and Alzheimer disease, sleep disorders and cerebral palsy are chronic diseases [11] [12] [13], which pre-death symptoms, are not easily noticed, decreasing the likeliness of receiving timely medical treatment.

5. Conclusion

Alzheimer disease, epilepsy, sleep disorders and cerebral palsy are the top four most represented neurological diseases diagnosed throughout Inner Mongolia. Alzheimer disease is the most serious disease with the highest mortality rate. However, cerebral palsy and epilepsy showed the greatest loss in life expectancy. Mortality of neurological diseases is generally higher in males than in females. The average mortality for neurological diseases increased with age. Among all deaths in neurological diseases, the Han nationality displayed the highest proportion, and most people die at home.

Limitation

We did not describe every specific disease because their mortality was very low.

Ethical Clearance

We used data of death only and no people were involved, so the ethics committee was not involved.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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