Observational Study

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Relationship between mortality in people with mental disorders and suicide mortality in China during 2000 to 2014

An observational study

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Abstract

Suicide is one of the top 10 causes of death in many countries. Although there are many studies on mental disorders, few studies have examined mortality in suicide population and mentally ill population. This study examined the association between mortality and mental disorders using data on suicides and mental disorders in China. Data from China's Health and Family Planning Statistical Yearbook for 2000 to 2014 were used to analyze the relationship between mortality associated with suicide and mental disorders. The analyses found that mortality among people with mental disorders dropped from 5.42/10 million in 2000 to 2.68/10 million in 2014, decreased more among females than males, and differed between urban and rural areas; that suicide mortality dropped from 10.79/10 million in 2000 to 6.79/10 million in 2014; the decrease was greater in women than in men, with suicide being highest among male residents of cities; and no significant correlation was found between mortality among persons with mental disorders and suicide mortality. There was no correlation between suicide mortality and mental-disorder mortality during 2000 to 2014; however, overall mortality decreased more among females than males during this period.

Abbreviations: CNKI = China National Knowledge Infrastructure, GDP = gross domestic product, SPSS = Statistical Package for the Social Sciences, WHO = World Health Organization.

Keywords: correlation analysis, mental disorders, suicide, suicide mortality

1. Introduction

Suicide, which is the most serious public health problem in the world, decreases the psychologic, social, and occupational functioning of relatives and friends by about 20%, and increases the total social burden of health by 38%.[1] According to the 1st global report on suicide prevention by the World Health Organization (WHO) in 2014, about 800,000 people die by suicide every year in the world, and about 1 person commits suicide every 40 seconds.[2,3] Patients with mental disorders are more prone to suicidal behavior, and they have a higher short-term risk of suicide even after a hospitalization.[4,5] Previous studies have shown that severity of depression is a key factor in suicidal behavior,[2,6,7] with the lifetime suicide rate of patients with severe depression being 10% to 20%.[8,9] The suicide rate of patients with paranoid schizophrenia is also relatively high (about 12%).[10]

Several recent studies have investigated the relationship between suicide and socioeconomics and biogenetics. However, few studies have examined the association between suicide mortality and mental disorders other than depression, especially in developing countries. Therefore, relevant data on suicide and mental disorders in China were collected for 2000 to 2014. The relationship between suicide and mental disorders was analyzed and compared with the aim of preventing suicide, reducing the risk of suicide, establishing sound mental-health services, and building an entire social mental-health system. This study's results provide a theoretical basis for a system of treatment and prevention.

2. Methods

2.1. Collecting and collating information

The China National Knowledge Infrastructure (CNKI) database was searched using the following term: "China's Health and Family Planning Statistical Yearbook" and "Year = 2000 or 2001 or 2002 or 2003 or 2004 or 2005 or 2006 or 2007 or 2008 or 2009 or 2010 or 2011 or 2012 or 2013 or 2014." The relevant

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yearbook data on the mortality rates of persons with mental disorders and the suicide rates for the general population were only available by living area (urban and rural) and sex (male and female). Thus, we collected and collated this information for analysis. As the data were obtained from China's Health and Family Planning Statistical Yearbook, ethical approval was not necessary.

2.2. Statistical analysis

All the data were compiled using Excel 2007 and the data analysis was performed using the Statistical Package for the Social Sciences 19.0 (SPSS 19.0). The following information was analyzed: total mortality among patients with mental disorders, mortality among patients with mental disorders in urban areas, mortality among patients with mental disorders in rural areas, total rate of suicide mortality, suicide mortality in urban areas, and suicide mortality in rural areas. The relationship between the mortality of patients with mental disorders and suicide in China during 2000 to 2014 was analyzed using correlation analysis. $P < .05$ was considered statistically significant.

3. Results

3.1. Mortality among persons with mental disorders in China during 2000 to 2014

The 2000 to 2014 Chinese mortality data showed that total mortality among persons with mental disorders declined over time, and that the trend for both men and women declined. Although data on mortality related to mental disorders was not available for 2001, the other data showed a downward trend, except for 2007 (Table 1).

Table 1 shows that the total mortality rate of persons with mental disorders dropped 2.02 times, from 5.42/10 million in 2000 to 2.68/10 million in 2014. Comparisons of the mortality rates for urban and rural areas and for males and females during 2000 to 2014 found that the mortality rate of females with mental disorders decreased more than the rate of males and the total mortality rate, that the mortality rate in cities decreased more than the rate in rural areas, and that this decline was most pronounced for females residing in cities (Table 2).

Table 2

The rate of decline in mental disorder mortality in 2014 compared with 2000 (1/10 million).

China	2000	2014	Front to back ratio
Total	5.42	2.68	2.02
Male	5.08	2.69	1.88
Female	5.77	2.67	2.16
Total mental disorder mortality* in cities	6.70	2.66	2.51
Male of mental disorder mortality* in cities	6.24	2.68	2.32
Female mental disorder mortality* in cities	7.19	2.64	2.72
Total mental disorder mortality* in rural areas	4.14	2.70	1.53
Male mental disorder mortality* in rural areas	3.93	2.70	1.45
Female mental disorder mortality* in rural areas	4.36	2.70	1.61

* The term "mental disorder mortality" refers to the mortality rate among persons with mental disorders.

The sample of urban residents was further divided into city residents with mental disorders who resided in metropolitan areas and those who resided in medium-sized cities. Table 3 shows the results, excluding those years in which the relevant data were not available. As seen in Table 3, the death rate of persons with mental disorders in metropolitan areas exhibited a downward trend, except in 2005 and 2007.

3.2. Data on suicide mortality in China during 2000 to 2014

The data on suicide mortality in China during 2000 to 2014 showed that the total rate of suicide mortality increased from 2000 to 2002 and tended to decline thereafter; this decline was

Table 1

Mental disorder mortality* in China during 2000 to 2014 (1/10 million).

Year	Total	Male	Female	Total mental disorder mortality* in cities	Male mental disorder mortality* in cities	Female mental disorder mortality* in cities	Total mental disorder mortality* in rural areas	Male mental disorder mortality* in rural areas	Female mental disorder mortality* in rural areas
2000	5.42	5.08	5.77	6.70	6.24	7.19	4.14	3.93	4.36
2001	5.37	5.15	5.60	–	–	–	–	–	–
2002	3.62	3.43	3.81	3.16	3.16	3.15	4.08	3.71	4.47
2003	3.71	3.52	3.9	3.47	3.36	3.62	3.93	3.69	4.18
2004	3.52	3.43	3.62	3.78	3.76	3.80	3.26	3.10	3.44
2005	3.77	3.46	4.08	5.19	4.82	5.55	2.34	2.11	2.62
2006	3.61	3.22	4.00	3.44	2.99	3.90	3.77	3.45	4.10
2007	4.43	3.93	4.93	5.35	4.67	6.05	3.50	3.19	3.82
2008	3.99	3.43	4.55	3.69	3.21	4.18	4.27	3.65	4.92
2009	3.34	3.03	3.65	3.60	3.35	3.85	3.08	2.71	3.46
2010	2.94	2.80	3.08	2.90	2.82	2.98	2.99	2.79	3.19
2011	2.81	2.61	3.02	2.47	2.31	2.63	3.15	2.91	3.41
2012	2.46	2.50	2.43	1.93	1.96	1.90	3.01	3.05	2.97
2013	2.79	2.76	2.82	2.86	2.85	2.88	2.72	2.68	2.76
2014	2.68	2.69	2.67	2.66	2.68	2.64	2.70	2.70	2.70

* The term "mental disorder mortality" refers to the mortality rate among persons with mental disorders.

Table 3

Mental disorder mortality* among Chinese urban residents during 2002 to 2010.

Year	Total mental disorder mortality* in metropolitan areas	Male mental disorder mortality* in metropolitan areas	Female mental disorder mortality* in metropolitan areas	Total mental disorder mortality* in medium-size cities	Male mental disorder mortality* in medium-size cities	Female mental disorder mortality* in medium-size cities
2002	3.37	3.51	3.21	2.40	2.28	2.22
2003	3.76	3.84	3.69	3.14	2.49	3.83
2004	3.66	3.74	3.58	4.17	3.84	4.50
2005	5.58	5.61	5.54	5.00	4.47	5.55
2006	3.40	2.93	3.88	3.48	3.07	3.91
2007	4.78	4.34	5.23	5.88	4.97	6.81
2008	3.78	3.23	4.34	3.27	3.11	3.44
2009	3.93	3.63	4.23	2.41	2.35	2.47
2010	2.89	2.83	2.94	2.95	2.79	3.12

* The term "mental disorder mortality" refers to the mortality rate among persons with mental disorders.

Table 4

Suicide mortality in China during 2000 to 2014 (1/10 million).

China	Total	Male	Female	Total suicide mortality in cities	Male suicide mortality in cities	Female suicide mortality in cities	Total suicide mortality in rural areas	Male suicide mortality in rural areas	Female suicide mortality in rural areas
2000	10.79	11.05	10.54	4.70	4.83	4.55	16.85	17.28	16.54
2001	11.54	11.79	11.29	4.22	4.70	3.75	18.53	18.88	18.83
2002	13.96	14.2	13.72	12.79	13.16	12.40	15.32	15.24	15.04
2003	13.61	12.98	14.24	10.96	10.90	11.05	7.10	15.07	17.44
2004	9.67	9.06	10.29	7.36	7.50	7.21	11.96	10.63	13.37
2005	11.5	11.13	11.88	12.89	12.65	13.13	10.08	9.62	10.64
2006	7.13	7.47	6.80	5.02	5.39	4.65	9.26	9.56	8.95
2007	7.59	8.21	6.97	4.89	5.46	4.30	10.31	10.97	9.64
2008	5.91	6.31	5.52	3.59	4.00	3.18	8.25	8.62	7.87
2009	7.01	7.59	6.44	4.95	5.43	4.47	9.10	9.76	8.41
2010	8.42	8.99	7.85	6.86	7.37	6.32	10.01	10.61	9.39
2011	7.26	7.86	6.67	5.28	5.78	4.77	9.28	9.95	8.58
2012	6.69	7.19	6.19	4.82	5.30	4.33	8.58	9.09	8.05
2013	7.01	7.92	6.10	5.29	6.02	4.54	8.77	9.82	7.66
2014	6.79	7.68	5.90	5.01	5.71	4.29	8.61	9.65	7.51

exhibited by both sexes (Table 4). The downward trend in suicide mortality was observed year by year for the total, city, and rural rates of suicide since 2005 (Table 4).

Table 4 shows that the total rate of suicide mortality decreased 1.58 times from 10.79/10 million in 2000 to 6.79/10 million in 2014. A substantial difference was found in the mortality rates for males and females with mental disorders in 2014 compared to 2000. By 2014, the mortality rate of the females had decreased more than the rate of the males. A comparison of the mortality rates for urban and rural areas in 2000 and 2014 found the mortality rate decreased in rural areas but not in urban areas by 2014 (Table 5).

Table 5

The rate of decline in suicide mortality in 2014 compared to 2000 (1/10 million).

China	2000	2014	Front to back ratio
Total	10.79	6.79	1.58
Males	11.05	7.68	1.43
Females	10.54	5.90	1.78
Total suicide mortality in cities	4.70	5.01	0.93
Male suicide mortality in cities	4.83	5.71	0.84
Female suicide mortality in cities	4.55	4.29	1.06
Total suicide mortality in rural areas	16.85	8.61	1.95
Male suicide mortality in rural areas	17.28	9.65	1.79
Female suicide mortality in rural areas	16.54	7.51	2.20

We further divided the suicide mortality of city residents into metropolitan and medium-size city residents. The relevant data for cities were not available in the 2000 and 2001 China's Health and Family Planning Statistical Yearbooks. The results showed that total suicide mortality decreased between 2002 and 2009, but sharply increased in 2010. The suicide mortality dropped sharply in medium-size cities in 2004, jumped sharply in 2005, and returned to roughly 2004 levels over the next 5 years (Table 6).

3.3. Analysis of the relationship between suicide mortality and mortality among persons with mental disorders in 2000 to 2014

Table 7 shows that mortality among people with mental disorders generally decreased from 2000 to 2014; the mortality rate was highest in 2000 (5.42 per 10 million) and lowest in 2012 (2.46 per 10 million), with the rate decreasing year by year. Suicide mortality was highest in 2002 (13.96 per 10 million) and lowest in 2008 (5.91 per 10 million), and decreased over most years. The correlation analysis found no correlation between

Table 6

Suicide mortality among Chinese urban residents during 2002 to 2010 (1/10 million).

Year	Total suicide mortality in metropolitan areas	Male suicide mortality in metropolitan areas	Female suicide mortality in metropolitan areas	Total suicide mortality in medium-size cities	Male suicide mortality in medium-size cities	Female suicide mortality in medium-size cities
2002	6.22	6.90	5.51	17.66	18.18	17.12
2003	5.31	5.61	4.99	17.27	17.98	16.47
2004	5.31	7.75	7.59	6.37	6.71	6.02
2005	4.80	5.47	4.09	16.93	16.24	17.65
2006	3.62	4.03	3.20	6.81	7.10	6.52
2007	4.09	4.73	3.43	5.63	6.14	5.11
2008	3.34	3.78	2.88	4.81	5.02	4.59
2009	3.95	4.33	3.57	8.55	9.33	7.74
2010	6.41	6.86	5.95	8.37	9.08	7.63

mortality among persons with mental disorders and suicide mortality ($r=0.447$, $P=.10$).

4. Discussion

4.1. Suicide mortality in China during 2000 to 2014

4.1.1. General trends in suicide mortality. Suicide mortality was clearly in a downward trend in China during 2000 to 2014, mainly in rural areas, and especially among females living in rural areas. In this study, the rate of decline in suicide mortality in 2014 (compared with 2000) rose by 1.06 times in urban areas, while it decreased by 1.95 times in rural areas. Suicide mortality in rural areas was much higher than in cities; suicide mortality in 2000 was 4.70/10 million in cities and 16.85/10 million in rural areas. In recent years, there has been an obvious trend toward narrowing the gap; suicide mortality in 2014 was 5.01/10 million in cities and 8.61/10 million in rural areas. First, the reason for the decline in rural areas may be that the number of rural migrant workers has been increasing annually, and given the high mobility of this population (a population base less than the urban population), this decreases suicide mortality annually. A study by Professor Jie Zhang found a significant negative correlation between suicide mortality and the number of migrant workers in rural areas ($r=-0.885$, $P<.001$)[11]; as the proportion of rural migrant workers increased, suicide mortality in rural areas decreased. Second, with the economic transformation in China from a planned economy to a market economy, farmers have sought employment in cities, which has not only changed the living conditions of migrant workers, but also improved their economic situation at home.[12,13] Migrant workers are generally identified with their past residence, not with city dwellers. From the beginning of 2004, as China has gradually implemented the policy of reducing agricultural taxes and agricultural subsidies, the standard of living of Chinese farmers has been improved, with a corresponding improvement in life satisfaction and happiness. Although there is still a gap between rural and urban life, compared to the past, the standard of living of rural residents has improved somewhat. The change of economic structure and the improvement in living standards make Chinese farmers see a narrowing of the gap between the ideal and reality, thus, reducing a feeling of being deprived. Therefore, the observed suicide mortality rate in rural areas was significantly lower than it had been, compared to urban areas. Related reports indicate there is a strong relationship between suicidal behavior and negative life events in the Chinese rural population. As the incidence of negative life events is closely related to the economic level, and the gross domestic product (GDP) in Chinese cities is higher than that in rural areas, 1 might expect suicide mortality in rural areas to be higher than it is in cities.[14–16]

Table 7

Mental disorder mortality* and suicide mortality in 2000 to 2014 (1/10 million).

Years	Mental disorder mortality* (1/10 million)	Suicide mortality (1/10 million)
2000	5.42	10.79
2001	5.37	11.54
2002	3.62	13.96
2003	3.71	13.61
2004	3.52	9.67
2005	3.77	11.5
2006	3.61	7.13
2007	4.43	7.59
2008	3.99	5.91
2009	3.34	7.01
2010	2.94	8.42
2011	2.81	7.26
2012	2.46	6.69
2013	2.79	7.01
2014	2.68	6.79

* The term "mental disorder mortality" refers to the mortality rate among persons with mental disorders.

4.1.2. Time trends in suicide mortality. The overall trend in suicide mortality in urban areas is declining, but the fluctuations are large, with rates up to 12.79/10 million in 2002 and 12.89/10 million in 2005; the suicide mortality rate was at a high level in 2002 to 2005. The reason may be that China's economy has gradually improved, after the Asian financial crisis in 1997.[17] Investment in fixed assets in the whole society has reached 78,650 billion yuan in 2005, and accounted for more than 51% of GDP. Thus, people in white-collar jobs are experiencing greater pressure at work and a faster pace of life, which creates a high state of tension over a long time for workers who often are unable to obtain timely treatment. Over time, this produces anxiety, depression, and other symptoms, and can induce psychologic or mental disorders. As can be seen in Table 1, mortality among people with mental disorders rose year by year from 2002 to 2005. In addition, because Chinese men generally bear the responsibility and burden of families, men in urban areas are more stressed than women are.[18] This can also explain why male suicide mortality in urban areas increased from 4.70/10 million in 2000 to 5.01/10 million in 2014.[18] The fast pace of life

also has led to an increase in divorce rates. Lester, who explored the relationship between family integration and the rates of suicide, homicide, unemployment, and divorce, concluded that economic change is an important determinant of suicide mortality.[19] Therefore, the rapid economic development in China during 2002 to 2005, not only in cities but rural areas, led to increased suicide mortality rates in cities and the countryside, reaching the highest point within the past ten years.

4.1.3. Gender differences in suicide mortality. In western countries, suicide mortality is 3 to 5 times higher in males than females.[20] In some East Asian countries, including China, even though women have a lower socioeconomic status, suicide deaths among women are also lower than they are among men.[21,22] Consistent with the results of this study, suicide mortality in males was higher than that in females in China.[11] Although male suicide was not 3 to 5 times higher than it was in females, the suicide mortality of males was higher than that of females in both cities and rural areas. For example, male suicide mortality in rural areas was 17.28/10 million in 2000, while it was 16.54/10 million for females; by 2014, male suicide mortality in rural areas was 9.65/10 million. The rate of decline in suicide mortality in 2014 (compared with 2000) decreased by 1.79 in rural males and decreased by 2.20 in rural females. First of all, the reason for the phenomenon may be that the concept of women in rural China has changed with the gradual development of a market economy.[11] Housework is not their only way of life; many rural women work in cities, most of them have changed the traditional concept of marriage and love, and the traditional idea of female inferiority has changed. Women are free to choose marriage and family life, and many women even play a dominant role in the family. As the conflict between the traditional values and modern values about men and women has gradually faded, the overall status of women has improved.[23] These changes have effectively reduced the importance of the conflict, so that the suicide mortality of rural women was significantly lower than that of rural men in this study. Second, many studies have reported that the method of suicide used by males is usually violent, such as shooting, cutting the throat, or jumping from a height, whereas the female method of suicide is less lethal, such as cutting the wrist or a drug overdose.[24,25] As females using these suicide methods are more likely to be found and rescued, male suicide mortality is significantly higher than that of females.[26,27]

4.1.4. Urban-rural differences in suicide mortality. This study found that the suicide mortality in rural areas was higher than that in urban areas. For example, suicide mortality in urban areas was 4.70/10 million in 2000, while suicide mortality in rural areas was 16.85/10 million; thus, suicide mortality in rural areas was nearly 4 times higher than it was in cities. The 1st reason for this difference may be that the cultural quality and level of education among rural residents is lower than they are in the city. Studies have shown that level of education is one of the independent variables that affect suicidal behavior. For instance, a study of the psychological autopsy of Hong Kong showed that level of education was associated with suicide.[28] Second, whether the physical damage resulting from an attempted suicide can be effectively treated is a reason for suicide mortality. The availability of emergency services is low in the Chinese countryside. Prehospital care usually requires considerable time, and as a person who attempts suicide cannot obtain effective treatment within a short time in rural areas, suicide mortality in rural areas is significantly higher than it is in cities. There have been reports in China that the timeframe of organophosphorus pesticide poisoning during pre-hospital care is a minimum of 20 minutes and a maximum of up to 3.5 hours. In many rural areas, especially remote rural areas, it is clear that organophosphorus pesticide poisoning cannot be treated effectively.[29,30]

4.2. Relationship between mental disorders and suicide mortality

Although some studies have shown that mental disorders, psychologic barriers, and social structure are important variables for understanding suicide risk factors and the motives for suicide,[31–33] Nock et al found no significant correlation between suicidal deaths and mental disorders.[34] Consistent with this negative result, we found no correlation between mortality among people with mental disorders and suicide in China between 2000 and 2014. Suicide is an extreme behavior caused by a number of complex factors, such as economic, cultural, social, and genetic variables. Good social support may help reduce the risk of suicidal behavior.[35–37] Because of continuous improvements in the medical security system in China, rapid economic development, and good social support, the death rate from suicide was reduced from 10.79/10 million in 2000 to 6.79/10 million in 2014. However, during the period of 2000 to 2014, the rate of suicide mortality exhibited a zigzag pattern with the highest rate of suicide mortality occurring in 2002. In contrast, mortality associated with mental disorders systematically dropped from 2000 to 2014 in China with improvements in the preventive health system, which may account for the lack of correlation between suicide mortality and mortality among people with mental disorders. In addition, suicide mortality is associated with physical health, lifestyle, physical activity, cigarette smoking, alcohol consumption, and medication use, which have been demonstrated to influence the correlation between suicide mortality and mortality among people with mental disorders.[38–40]

4.3. Limitations

Many factors contribute to suicide mortality and mortality among people who have mental disorders, including social, natural, regional, economic, cultural, and physical-health factors. A large number of studies have shown that the distribution of suicide across geographical regions reflects differences in region characteristics, such as the geographical environment, political system, religious beliefs, customs, and ethics.[41] None of these variables were examined in the present study. Therefore, there is need for further study of the relationship between suicide mortality and morality associated with mental disorders, which include these variables.

5. Conclusion

The present study's findings indicate that it is especially important in China to identify people in rural areas, particularly men in rural areas, who are at risk for suicide in order to provide appropriate interventions. Besides gender and living area, economic condition and level of medical services are risk factors for suicide mortality and mental-disorder mortality. Given the observed changes over time, however, mental-health professionals will need to develop a broader range of risk factors for identifying persons with and without mental disorders who are likely to commit suicide.

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