Analysis of injury death trend among women in Macheng city, China, 1984-2008

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\textbf{Keyword:} women's injury; death trend; suicide
Abstract

Background: There is no study about injury trend as the Chinese society experienced tremendous change in recent decades. This paper examined the trends in mortality rates for injuries among women older than 15 years in Macheng city in 1984-2008.

Methods: Data on women injury deaths were obtained from the Death Registry System in Macheng city from 1984 to 2008, injuries were classified using International Classification of Diseases, 9th and 10th Revision (ICD-9 and ICD-10).

Results: Injuries were the first leading cause of death for women ages 15-44 and the fourth leading cause of death overall for women older than 15 years during 1984-2008. The all-cause injury mortality rate decreased from 149.01 per 100,000 population in 1984 to 32.90 per 100,000 population in 2008 for women older than 15 years. Road traffic injury (RTI) was the only one whose mortality rate increased dramatically from 1984 (1.35 per 100,000) to 2008 (4.63 per 100,000). For all age groups, suicide was the leading cause of injury death, and for women aged between 15 and 64, RTI and drowning were the second and third leading causes of injury deaths.

Conclusion: During the period 1984-2008, injury mortality rate for women older than 15 years decreased by 77.92% during 1984-2008, but RTI death increase sharply in 2000s compared with 1980s. Although suicide rate decreased dramatically, it was still the leading cause of injury death for women. Research is needed to identify the risk factors contribution to the increased RTI and to explain decreased suicide.
**Background**

Injuries have been shown to account for a significant health burden on all populations, regardless of age, sex, income, or geographical region [1]. It was reported that around the world, almost 16,000 people died from injuries every day. In China, injuries have also emerged as a significant public health problem [2]. It was estimated that each year injury claimed about 700,000 lives and accounted for 9% of all cause deaths, and was the fifth leading cause of death among people in China [3].

Studies both in China and other countries showed that, men and women respond differently for the mortality and pattern of injury [4, 5]. Despite injury mortality rate for men was higher than that of women, with the ratio of 1.67:1 [3], injury for women has also been a worldwide severe problem. It was reported that injuries were the leading causes of death for women aged 1-34 and were responsible for more years of potential life lost than any other causes of death. Discerning the injury profile and trend are essential for the adoption of adequate policy and planning for injury prevention and control.

The Chinese society having been undergone many changes during recent decades, little is known the impact of the rapid economic growth, urbanization, housing, education, increased road and motor-vehicle et al. on the disease and injury profile. The purpose of this study was therefore to examine the trend of women injury in 15-year-old or older people in Macheng city (a city with 1.2 million population and the complete Death Registry System in China) during 1984-2008.
Methods

Data Source

Injury death data on resident of Macheng city were obtained from the death registry system in Macheng city. The death database included information of primary cause of death, death date, sex and age. The International Classification of Disease (ICD) 9th and 10th editions were used to define specific causes of injury mortality that are referred to in this study. In 2003, the coding of death in Macheng city changed from ICD-9 to ICD-10. The codes of ICD-9 and ICD-10 were grouped in this study into RTI (E800~E848, V01-V79, V99, Y850 for ICD-10), poisoning (E850~E869 for ICD-9, X20-29, X40-49 for ICD-10), fire/flames injury (codes E890~E899 for ICD-9, X00-X09 for ICD-10), drowning (E910 for ICD-9, W65-W74 for ICD-10), suicide (E950~E959 for ICD-9, X60-X84, Y870 for ICD-10), falls (E880~E888 for ICD-9, W00-W19 for ICD-10) and other causes of injuries and ill-defined cause injuries were defined as others.

The annual midyear population figures in 1984-2008 were obtained from Census Bureau of Macheng city to calculate injury mortality rates per 100 000 women aged 15 and older.

Macheng city locates in the northeast of Hubei province has the earliest and complete death registry system in China. The faculties from Department of Biostatistics of Tongji Medical College supervised the process of data collection of the death registry system and verified the data each year. It was thought that the data form this registry system was complete and reliable. 1984-2008 was the most recent
continuous period for which complete individual records of death were computerized

Statistical Analysis

The injury mortality rate for women 15 years of age or older and expressed as the numbers of cased per 100,000 persons. Age-adjusted rates are calculated by the direct method standardized to the total Chinese population in 1990.

Results

From 1984 to 2008, there were totally 10915 injury deaths of women took place in Macheng city. As showed in table 1, injury was the fourth leading cause of death overall during 1984-2008 among women older than 15 years. Injury was the leading death cause for women aged 15-44, and it was the fourth or fifth leading cause for the women older than 45 years. The injury mortality increased sharply since the age of 55 years, and was highest in the 75- age group and lowest in 15-24 age group.

Over the study period, there was a dramatic decline in annual numbers of death and age standardized mortality rates of all-cause injury. Our study showed the trend of age-adjusted injury mortality rate per 100,000 population for women older than 15 years (Figure 1). The mortality rate decreased from 149.01 per 100,000 in 1984 to 32.90 per 100,000 in 2008 with the reduction rate of 77.92%.

We analyzed the cause-specific injury mortality rate for women from 1984 to 2008 (figure 2). During the study period, the mortality rates of most cause specific injury showed a decrease trend, while the mortality rate of RTI was increased from
1.35 per 100,000 in 1984 to 4.63 per 100,000 in 2008. From figure 2, we also found that, suicide persistently had the higher mortality rate than other causes of injury. In middle of 1990s, RTI surpassed drowning and became the second leading cause of injury of women.

As showed in table 2, suicide was the first leading cause of women injury for each age group. Among women aged between 15 and 64, RTI and drowning were the second and third leading causes of injury deaths; among women aged 65-74 years, the second and third injury death causes were drowning and falls; While for women older than 75 years, falls and fires/flames were the second and third causes of injury respectively.

Discussion

Our findings revealed that from 1984 to 2008, injury mortality rate decreased substantially among women aged 15 years or older. The total injury mortality rate in Macheng city decreased from 149.01/100,000 in 1984 to 39.20/100,000 in 2008, with the reduction rate of 77.92% between 1984 and 2008.

The decline of injury death rate probably lied in the improvement of economic and social status. With one of the fastest growing economies in the world, China has experienced tremendous socioeconomic changes since the economic reforms in 1978. Its rapid growth has been accompanied by substantial changes in mode of transport, housing, and other ways of life, all of which affect exposure to risk factors for injury [6]. It is reported there was inverse association between economic development and
unintentional injury mortality among children and adults in low and middle income countries [7]. Another reason of the decrease of the mortality rate probably attributed to the dramatic decrease of suicide mortality. As found in our study, suicide account most for all injury deaths and it showed a dramatic decrease during the study period. Suicide rate decreased from 131.1/100,000 in 1984 to 21.9/100,000 in 2008.

In this study we found suicide was the leading cause of injury death in all age group of women older than age 15 during the whole study period. This finding is in accordance with data from most studies in China [8, 9], but is different from other countries such as USA and Ukraine [10, 11]. The information that might help to understand the context of high suicide rate is not recorded in the death registry system. Based previous study which done in Macheng city in 1984-1986, which reported that 85.85% (1232/1435) of suicide died by swallowing pesticides. The major reasons of it may be pesticides are widely available and commonly used [12]. Although suicide was the most common cause of injury death for women, our study revealed significant improvement in mortality rate of suicide over time. We speculate that the decrease of suicide might be due to social changes, such as general improvement of living, better education of women, small family size, and more job opportunity for women, easier to divorce et al. Further research is required to delineate the mechanisms behind the downtrend trend of suicide rate to formulate strategies of suicide prevention.

The most dramatic change in injury mortality during 1984-2008 was in RTI rate, which increased in most groups of women. The alarming rise in RTI deaths is
probably the consequence of rapid increase of motor vehicles. It is reported that the number of civil vehicles was increased from 13,556 in 1985 to 1,368,635 in 2008 in Hubei province [13, 14]. It also may be associated with poor road conditions, less police supervision on the roads, insufficient emergency medical services, and higher rates of driving under the influence of alcohol. As the mortality rates of other causes of injury were decreased during the study period, and the RTI mortality rate increased sharply.

We also observed that drowning was another major reason of injury death. A similar situation exists in the study of Liu TX and Ni JH [15, 16]. It probably attributed to combination of geographic features of the Macheng city (many ponds, lakes and natural watercourses locating in Macheng city) and people’s habits of swimming in Macheng city.

When we analyzed the ranking of leading causes of injury, we found that for women older than 65 years old, injuries caused by fire and flames and falls became the major causes of injury besides suicide. As reported in some studies [17-19], falls was considered as one of the most common causes of injury for old people, especially for old women. It is reported that falls related injury rate in women older than 65 is significantly higher than in men of comparable age [20]. In our study, we found injury caused by fire and flames was another common cause of injuries of women older than 65 years old. The reasons of high mortality due to fire and flame among women are unclear. Old women spend more time to stay at home. When they are at risk, they may not have enough time to escape due to muscle weakness and loss of lower body
strength, so the injury due to fire and flames was common among old women.

There are some limitations in this study. Our study is based on death registry system, which does not contain relevant information such as socio-economic status, lifestyle risk factors, etc. Therefore it is not possible to analyze the causes of injury. Second, as the database only contain death data; non-fatal injuries were excluded from this study because of the unavailability of data. It is not possible to investigate other endpoints of injury, such as short-term and long-term disability.

Recent years Chinese governments have made significant progress in the prevention of injuries. The dramatic decline in injury mortality in Chinese reflected the effectiveness of the intervention programs. However, more targeted prevention efforts need to be adopted for reducing the injury mortality. For example, the divergent age patterns of different types of injury indicate that injury control programs should be age appropriate. For instance, besides suicide, drowning prevention should target middle-aged women and falls prevention programs should emphasize women older than 65 years old. The fact of the increasing mortality rates of RTI during the study period may require more education programs and counseling for drivers on safe driving. Intervention strategies are urgently needed to tackle the high mortality rate in suicide injuries in women older than 15 years old.

Conclusions

We analyzed the trend of injury death among women in Macheng city during 1984-2008 to increase awareness of the importance of women injury and to use
injury statistics for discussions about preventive action. During 1984-2008, injuries were the first leading cause of death for women ages 15-49 and the fourth leading cause of death overall for women older than 15 years. The age standardized mortality rate due to injury for women older than 15 years decreased substantially, but Chinese women still have a high prevalence of injury. Suicide was the leading cause of injury for women older than 15 years, and the mortality rate was higher than that for men. The cause specific injury mortality rate was decreased during 1984-2008 except RTI in Macheng city. The results in this study will provide a sound basis for measures to be taken by government agencies.

**Competing Interests**

The authors declare that they have no competing interests.

**Authors’ Contribution**

YW and YH designed the study, performed analysis and interpretation of data and drafted the manuscript. LW, DZ, assisted with the design, conception, analysis and interpretation of the data. XL reviewed and refined the manuscript. All authors read and approved the final manuscript.
References


<table>
<thead>
<tr>
<th>Age</th>
<th>All-cause mortality(‰, 95%CI)</th>
<th>Injury mortality rate(1/100 000, 95%CI)</th>
<th>Injury death as of % all-cause death</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-</td>
<td>1.35(1.31~1.40)</td>
<td>93.59(89.82~97.37)</td>
<td>69.33</td>
<td>1</td>
</tr>
<tr>
<td>25-</td>
<td>1.63(1.58~1.69)</td>
<td>92.73(88.78~96.67)</td>
<td>56.89</td>
<td>1</td>
</tr>
<tr>
<td>35-</td>
<td>2.55(2.47~2.62)</td>
<td>81.92(77.67~86.18)</td>
<td>32.13</td>
<td>1</td>
</tr>
<tr>
<td>45-</td>
<td>6.18(6.05~6.32)</td>
<td>94.51(89.13~99.88)</td>
<td>15.29</td>
<td>4</td>
</tr>
<tr>
<td>55-</td>
<td>17.88(17.61~18.16)</td>
<td>161.05(152.68~169.42)</td>
<td>9.01</td>
<td>5</td>
</tr>
<tr>
<td>65-</td>
<td>44.29(43.72~44.85)</td>
<td>269.70(255.78~283.62)</td>
<td>6.09</td>
<td>5</td>
</tr>
<tr>
<td>75-</td>
<td>108.84(107.33~110.35)</td>
<td>497.43(465.13~529.73)</td>
<td>4.57</td>
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<tr>
<td>Total</td>
<td>8.37(8.31~8.42)</td>
<td>115.54(113.37~117.71)</td>
<td>13.8</td>
<td>4</td>
</tr>
<tr>
<td>Age</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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</tr>
<tr>
<td>15-</td>
<td>suicide</td>
<td>drowning</td>
<td>RTI</td>
<td>poisoning</td>
</tr>
<tr>
<td></td>
<td>73.92 (70.56~77.27)</td>
<td>5.99 (5.81~8.31)</td>
<td>3.93 (3.15~4.70)</td>
<td>2.86 (2.20~3.52)</td>
</tr>
<tr>
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<td>RTI</td>
<td>drowning</td>
<td>poisoning</td>
</tr>
<tr>
<td></td>
<td>74.38 (70.85~77.92)</td>
<td>4.98 (4.07~5.89)</td>
<td>3.80 (3.00~4.60)</td>
<td>3.36 (2.61~4.11)</td>
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<td>drowning</td>
<td>poisoning</td>
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<tr>
<td></td>
<td>61.64 (57.95~65.33)</td>
<td>7.07 (5.82~8.31)</td>
<td>3.27, 2.42~4.12</td>
<td>2.24 (1.54~2.94)</td>
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<tr>
<td>45-</td>
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<td>RTI</td>
<td>drowning</td>
<td>fall</td>
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<td></td>
<td>69.43 (64.82~74.04)</td>
<td>8.04 (6.47~9.61)</td>
<td>3.58 (2.54~4.63)</td>
<td>2.87 (1.93~3.80)</td>
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<tr>
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<td>RTI</td>
<td>falls</td>
<td>drowning</td>
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<tr>
<td></td>
<td>125.46 (118.07~132.85)</td>
<td>7.82 (5.97~9.67)</td>
<td>6.12 (4.49~7.75)</td>
<td>5.55, 4.00~7.12</td>
</tr>
<tr>
<td>65-</td>
<td>suicide</td>
<td>drowning</td>
<td>fall</td>
<td>fire/flames injury</td>
</tr>
<tr>
<td></td>
<td>201.80 (189.76~213.84)</td>
<td>13.47 (10.36~16.58)</td>
<td>11.22 (8.38~14.06)</td>
<td>10.47 (7.73~13.22)</td>
</tr>
<tr>
<td>75-</td>
<td>suicide</td>
<td>fall</td>
<td>fire/flames injury</td>
<td>drowning</td>
</tr>
<tr>
<td></td>
<td>291.03 (266.32~315.73)</td>
<td>28.94 (21.15~36.73)</td>
<td>27.30 (19.73~34.87)</td>
<td>25.12 (17.86~32.38)</td>
</tr>
</tbody>
</table>
Fig 1  The trends of all cause injury mortality rate in Macheng city, 1984-2008
Figure 2 The trends of cause-specific injury mortality rates in Macheng city, 1984-2008