Trends and Distribution in Mortality Rates of Coronary Heart Disease in Hexi Corridor of Gansu in China from 2006 to 2015

CURRENT STATUS: POSTED

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DOI: 10.21203/rs.2.16003/v1

SUBJECT AREAS
Cardiac & Cardiovascular Systems
Abstract

Background: The mortality rate of coronary heart disease (CHD) in China is different from region to region, and there are sex, age and urban-rural differences. This study described trend and distribution of CHD in Hexi corridor of Gansu province from 2006 to 2015.

Method: The death data of CHD were obtained using the Death Reporting System of Gansu CDC for 2006-2015. The trend of the death cases of CHD by year, month and its distribution by sex, age and region were studied, and the changing characteristics of epidemiology was analyzed.

Results: Overall, The mortality rate of CHD in Hexi corridor showed a decline trend from 2006 to 2015, a tendency that higher in winter and spring, and lowest in summer. The relative mortality of males was higher than that of females (P < 0.05), increased with age (P < 0.05), and that of rural areas was higher than that of urban areas (P < 0.05). The trend analysis of death rate for ten-year showed a marked decline in females, an increase in 18-39 years old, a small change in 40-59 years old, a decrease in over 60 years old, and a downward tendency of urban areas. Further analysis showed that the mortality rate of males were higher than that of females in 18-39 years old and 40-59 years old group and also in urban areas group (P < 0.05), while no sex difference in over 60 years old group and rural areas group (P > 0.05).

Conclusion: The mortality of CHD in Hexi corridor of Gansu province in China was lower than the national average from 2006 to 2015, but increased gradually in specified population such as in males, young and middle-age, rural areas groups. The prevention and control measures should be strengthened in these special populations.

Background

With the social and economic reform, the changes of people's lifestyle and the aging process of the population in China, the risk factors of cardiovascular disease continue to
increase, the morbidity and mortality of cardiovascular diseases are still on the rise [1].

CHD is one of the most important cardiovascular disease, which has a high mortality rate and affect the health of people in different countries of the world, a decline trend of CHD mortality rates has showed in developed countries, and many studies have documented the important contributions of both improvements in health care and management in risk factor levels [2]. However, the mortality rate of CHD is on the rise in China, especially in rural areas [1]. Knowledge of trends in CHD mortality can encourage the development of effective prevention and intervention strategies, support public health policies aimed at reducing disparities in CHD mortality. Many reports in this field are mostly found in large and medium-sized cities [3-6]. Hexi Corridor is located in the northwest of Gansu province, China, and west of the Yellow River, which is 1100 kilometers long and the narrowest place is only several kilometers, and covers Dunhuang, Jiuquan, Zhangye, Jinchang and Wuwei district [Fig. 1], with a total population of about 4.7 million, backward economic development, and inadequate health investment. This study retrospectively analyzed the mortality rate of CHD between 2006 and 2015, and its trend and characteristics among residents in Hexi Corridor area, in order to provide basic data and scientific basis for the formulation of targeted prevention and control measures.

Methods

The death cases of CHD (International Classification of Disease 10th revision codes ) in Hexi Corridor from Jan. 1, 2006 to Dec. 31, 2015 were studied. The demographic data was provided by local household registration department and the death data were obtained from the National Death Cause Monitoring and Registration Information System. The underlying cause of death was judged to be the CHD that initiated the sequence of events leading directly to death. The detailed information includes the exact date of death, sex, age, residence, therapeutic hospital and so on, which are checked and proofread regularly.
by the professional staff of Centers for Disease Control and Prevention of Gansu Province. Data on cause-specific numbers of deaths and population numbers, by sex, age and region classification were exported, and the mortality rates were calculated and standardized to the local population database using the direct method. The age groups analysed were (i), 18-39 years, (ii) 40-59 years, and (iii) ≥60 years, and the region groups were urban and rural areas according to the jurisdiction of the local government. We used Excel sheet to input the data, statistical software PSS20.0 to analyse the data, categories variables were given as the percentage. 2-tests were used to compare proportions, and the test level was α=0.05. The relative mortality refers to the proportion of the sample number taken to the total population of the region (/100,000). This investigation was approved by the Ethics Committee of Gansu People's Hospital.

Results

The demographic characteristics of subjects are shown in Table 1, it can be seen from the composition ratio, the male were higher than the female, over 60 years old were higher than the 40-59 years old, and the lowest was 18-39 years old, the rural areas population was also higher than urban areas. As shown in Table 2, the average local population was about 4.7243 million from January 1, 2006 to December 31, 2015, during which 26,656 people died of CHD, with an average annual mortality rate of 56.42/100,000. We observed the rate in males was higher than that in females (P<0.05), increased with age (P<0.05), and in rural areas were higher than that in urban areas (P<0.05). It also can be seen the mortality rate of males were higher than that of females in 18-39 years old and 40-59 years old group (P < 0.05), but there were no significant difference in over 60 years old (P > 0.05). Similarly, the rate of males were higher than females in urban areas (P<0.05), while no gender difference were found in rural areas (P >0.05). Figure 2 showed a downward trend in mortality rate from 2006 to 2015, it was higher in winter and spring
but lowest in summer when compared by month (Fig 3). The trend was decreased obviously in females, but no significant changes in males from 2006 to 2015 (Fig 4). Population in 18-39 years subgroup was sparse, but the trend was still increased, the older than 60 years was gradually declined, and no changes in 40-59 years old (Fig 5). We also found that the urban population seems to have a downward trend, while was not showed significantly in the rural population (Fig 6).

Discussion

According to the latest China Cardiovascular Disease Report 2018, the mortality rate of CHD among urban and rural residents in China continues to increase, but in rural areas was more obviously, in males was more higher than in female [7]. The report also pointed out that the mortality rate of CHD in China from 2006 to 2015 was 57.1-110.67/100,000 in males and 33.74-110.91/100,000 in females [7]. Our results showed that the mortality rate of CHD in Hexi Corridor was 58.89-53.49/100,000 from 2006 to 2015, including 35.96-33.08/100,000 in males and 23.96-19.26/100,000 in females. The mortality rate in this area was lower than the national average, and the overall trend had been gradually decreasing in the past decade. We speculated there are several possible reasons as follows. Firstly, the level of economic in this area was relatively underdeveloped and with less risk factors of CHD, we know that the level of economic development is positively correlated with the incidence of CHD and the risk factors such as cigarette smoking, obesity, less exercise and hyperlipidemia increased accordingly, so the morbidity of CHD itself was relatively lower. Secondly, in recent years, with the improvement of medical diagnosis and treatment measures, active and standardized construction of “chest pain centers” in many hospitals, especially the implementation and development of percutaneous coronary intervention (PCI) and coronary artery bypass graft (CABG) surgery, had also gradually reduced the mortality rate. Thirdly, in the past, there had
been many sandstorms in this area, however, with the improvement and strengthening of the government's environmental protection measures, the air pollution has improved significantly in recent years. It has been pointed out that the increase of environmental pollution, especially particulate matter (PM)2.5 in the atmosphere, can increase the mortality of ischemic heart disease [8-10], which the specific mechanism still needs to be further clarified [11,12]. In terms of the death season of CHD, the mortality rate in winter and spring was higher than that in summer and autumn, which was consistent with the domestic research results [13,14]. It was speculated that the death rate was related to the cold climate, air pollution, elevated blood pressure and high activity of sympathetic nerves in this season. Subgroup analysis showed that the mortality rate of males was higher than that of females, and the trend analysis for 2006-2015 showed that in females were significantly declined than in males. Possible reasons are that the males are associated with more risk factors such obesity, smoking, alcohol consumption, high stress and less exercise and so on. The mortality increased with age, ten-year trend suggested an increase in young people, a small change in middle-aged people, and a decline in the elderly. It is worth noting that the incidence of CHD has gradually become younger in recent years [15], this study indicated that the death rate of CHD in the 18-39 age group was relatively small, but also had an increasing trend year by year, therefore, early prevention and treatment should be strengthened. The declining trend of the mortality rate of the elderly was obvious, which considering the personal self-care awareness and social health concern are more relevant with the increase of age, but young and middle-aged people are lack of active participation or passive acceptance in this respect. When classified by region, the mortality rate in rural areas was higher than that in urban areas, this is related to the relatively advanced medical resources available to urban residents in recent years, such as easier access to relatively high-level hospitals and better medical
insurance system. In addition, the educational level, economic support and health consciousness are also helpful. On the contrary, the rural patients were limited by the above reasons, and the mortality rate had not been decreasing correspondingly. This distribution is consistent with the previous report [7]. Among young and middle-aged groups, the mortality rate of male was higher than that of female, which was the male more likely to be exposed to the above-mentioned risk factors, especially in urban areas [16]. The mortality rate of elderly women was close to that of men, and that of rural women was similar, considering that estrogen reduces the protective effect of CHD [17], studies have shown that most of the women with coronary atherosclerotic plaque formation and maturity are later than men [18]. There are two limitations in our study. One is that this study was a retrospective analysis, and there is no statistical data of the morbidity of CHD at that time. Secondly, there is no further analysis on the classification of CHD, such as acute myocardial infarction, angina pectoris, asymptomatic myocardial ischemia and sudden death.

Conclusions

In conclusion, this is the first study to analyze the trend and characteristics of CHD mortality among people living in Hexi corridor of Gansu province, which is a remote and impoverished desert area in Northwest China. The prevention and treatment of cardiovascular diseases in China has achieved initial results, but at the same time, it is facing new and severe challenges [19, 20]. Our study showed that mortality rate of CHD was lower than the national average from 2006 to 2015, and there is a trend of gradual decline of CHD mortality compared with the rising trend in China. We proposed this difference resulting from a relatively less risk factors, effective medical and pharmaceutical therapies and improvement of environmental pollution. However, for the special population of subgroup, such as the males, young and middle-age, rural areas
residents, it is still necessary to strengthen the effective prevention and treatment experience and improve the inadequate measures to prevent the occurrence of CHD and reduce the mortality rate in the future.

Abbreviations

CABG: Coronary artery bypass graft; CHD: Coronary heart disease; ICD: International Classification of Diseases; PCI: Percutaneous coronary intervention; PM: Particulate matter

Declarations

Acknowledgements

We sincerely thank Pengfei Ge of Chronic Non-communicable Diseases, Gansu Provincial Center for Disease Control and Prevention; Wenli Li of central Meteorological Station of Gansu Meteorological Bureau.

Funding

Research reported in this publication was supported by the National Natural Science Foundation of China grant no. 81660065.

Availability of data and materials

The source of data for determining all mortality rates for the study was the National Death Cause Monitoring and Registration Information System, the China Centers for Disease Control and Prevention. After the death of patients, clinicians in hospitals are required to fill in “the resident death medical certificate” which including the cause of death, diagnosis of disease and
specific
time etc. According to medical record system, public health department of hospital is
required to
report to “the death information registration and management system” in time, which is
under the
unified management of the CDC. The demographic data was provided by local household
registration department.

Authors’ contributions
Xinghui Li conceived the study, contributed to its design and drafted the manuscript.
Xiaolan
Ren contributed to the study design and performed the analysis. Qiao Yan contributed to
the
study design and critically reviewed daft versions. All authors read and approved the final
manuscript.

Ethics approval and consent to participate
This study was approved by the Ethics Committee of Gansu People's Hospital.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

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Tables

Table 1. Demographic Characteristics in Hexi Corridor from 2006 to 2015

| Characteristics     | Number of deaths |
|---------------------|-----------------|
|                     | □n(%)□          |
| Gender group        |                 |
| Male                | 1624 □60.93□    |
| Female              | 10414 □39.07□   |
| Age group (years)   |                 |
| 18-39               | 341 □1.28□      |
| 40-59               | 6768 □25.39□    |
| ≥60                 | 19547 □73.33□   |
| Area group          |                 |
| urban               | 11903 (44.65)   |
| rural               | 14753 (55.35)   |

Compared with the male group, □P<0.05; compared with 40-59 years old group, □P<0.05; Compared with urban group, □P<0.05

Table 2 The distribution of CHD mortality stratified by gender, age and area in Hexi Corridor from 2006 to 2015

|                    | Relative mortality 10,000,year □□ | Number of male deaths □□ | Number of female deaths □□ |
|--------------------|----------------------------------|--------------------------|---------------------------|
|                    | □□n(□□10,000,year □□□)□□         | □□n□□(□□10,000,year □□□)□□ | □□n□□(□□10,000,year □□□)□□ |
| overall            | 56.42 □34.38 □22.04□             | 16242 □34.38 □22.04□      |
| 18-39              | 0.72 □34.38 □22.04□              | 16242 □34.38 □22.04□      |
| 40-59              | 5872 □12.43 □969□                | 896 □12.43 □969□          |
| ≥60                | 10053 □21.28 □494□               | 9494 □21.28 □494□         |
| urban              | 8641 (18.29) □284 □3262 (6.91)   |
| rural              | 31.23 □□ □7601(16.09) □□         |

Compared with the female group, □P<0.05; compared with 18-39 years old and 40-59 years old group, □P<0.05; Compared with urban group, □P<0.05
Maps of China and Gansu province, the Hexi Corridor. Note: The designations employed and the presentation of the material on this map do not imply the expression of any opinion whatsoever on the part of Research Square concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. This map has been provided by the authors.
Figure 2

Trend distribution of CHD death population in Hexi Corridor from 2006 to 2015

Figure 3

Monthly Trend distribution of CHD death population in Hexi Corridor from 2006 to 2015
Figure 4

The gender distribution of CHD mortality in Hexi Corridor from 2006 to 2015

Figure 5

The age distribution of CHD mortality in Hexi Corridor from 2006 to 2015
Figure 6

The area distribution of CHD mortality in Hexi Corridor from 2006 to 2015