

Analysis of the Changing Trend of the Burden of Rheumatic Heart Disease in China from 1990 to 2021

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Abstract: *Objective:* This study aims to provide an accurate quantitative analysis of the burden of rheumatic heart disease in China, and to provide a scientific basis for the formulation of effective prevention and control strategies. *Methods:* Based on the latest public database 2021 Global Burden of Diseases (GBD2021), the characteristics and trends of incidence, prevalence, mortality, and attributable risk factors of rheumatic heart disease in the Chinese population from 1990 to 2021 were quantitatively analyzed. *Results:* From 1990 to 2021, the incidence of rheumatic heart disease in China decreased from 620,195 to 445,472, with an average annual decrease rate of 1.07%. The incidence rate decreased from 52.72/100,000 to 31.31/100,000 with an average annual decrease rate of 1.65%, while the age-standardized incidence rate decreased from 48.92/100,000 to 39.86/100,000 with an average annual decrease rate of 0.46%. The number of cases increased slightly from 8,923,639 to 9,073,096, with an average annual growth rate of 0.28%, and the prevalence decreased from 758.75/100,000 to 637.72/100,000 with an average annual decrease rate of 0.31%. The age-standardized prevalence decreased from 708.27/100,000 to 619.85/100,000 with an average annual decrease rate of 0.21%. The number of deaths decreased from 134,208 to 78,910, with an average annual decrease rate of 1.98%, and the mortality rate decreased from 11.41/100,000 to 5.51/100,000 with an average annual decrease rate of 2.55%. The age-standardized mortality rate decreased significantly from 19.07/100,000 to 5.00/100,000 with an average annual decrease rate of 5.00%. These data show that although the number of cases increased slightly, the incidence rate, prevalence rate, mortality rate, and age-standardized rates all showed a downward trend. *Conclusion:* From 1990 to 2021, the burden of rheumatic heart disease in China has undergone significant changes. Although the number of cases increased slightly, the incidence rate, prevalence rate, mortality rate, and age-standardized rates all showed a downward trend. Specifically, the incidence rate decreased from 52.72/100,000 to 31.31/100,000, indicating a significant decrease in the number of new cases of rheumatic heart disease per 100,000 people. The decrease in prevalence rate, from 758.75/100,000 to 637.72/100,000, reflects a decrease in the proportion of the population with rheumatic heart disease. The most significant decrease is in the mortality rate, from 11.41/100,000 to 5.51/100,000, indicating a substantial reduction in the risk of death from rheumatic heart disease. These changes may be attributed to the continuous progress in healthcare services, implementation of public health policies, and increased population health awareness in China. In addition, advances in medical technology, improvements in emergency systems, and optimization of cardiovascular disease management have also played an important role in reducing mortality rates. However, the slight increase in the number of cases suggests that despite significant progress, rheumatic heart disease

remains an important challenge in the field of public health in China, requiring continuous attention and intervention.

Keywords: Rheumatic heart disease; Disease burden; Attributable risk factors; China

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1. Introduction

Rheumatic heart disease (RHD), a sequela of rheumatic fever, remains a significant public health challenge, particularly in regions with limited access to healthcare and inadequate preventive measures^[1]. The Global Burden of Disease (GBD) study provides a comprehensive and systematic assessment of the global, regional, and national disease burden, offering invaluable insights into the epidemiological patterns of RHD^[2]. This study aims to analyze the disease burden of RHD among the Chinese population from 1990 to 2021, utilizing the GBD database. The analysis will encompass the incidence, prevalence, and mortality rates, as well as the disability-adjusted life years (DALYs), to assess the temporal trends and the impact of RHD on public health in China^[3].

Furthermore, the study will explore the attributable risk factors for RHD, which are crucial for informing targeted interventions^[4]. The GBD data allows for the quantification of the contribution of various risk factors, such as socio-economic status, environmental exposures, and healthcare access, to the overall disease burden^[5]. By identifying the predominant risk factors, this research will contribute to a more nuanced understanding of the multifaceted determinants of RHD in China. The findings are expected to guide policy-making and resource allocation for effective RHD prevention and control strategies, ultimately reducing the disease burden and improving the quality of life for affected individuals^[6]. This research is not only timely but also essential for advancing the global health agenda, especially in the context of non-communicable diseases, which have been increasingly recognized as a major challenge in the 21st century.

2. Materials and methods

2.1. Data

The data for this study are derived from the latest Global Burden of Diseases study (GBD2021) database, which provides detailed epidemiological data on rheumatic heart disease in China from 1990 to 2021, including incidence, prevalence, and disease burden indicators by age, gender, and region. GBD2021 comprehensively analyzes and estimates the disease burden of 369 diseases or injuries in 204 countries (regions) globally using a unified and comparable approach, and systematically outlines the attributable disease burden of 87 risk factors. It is currently the most comprehensive database globally. This study screened the GBD2021 data, selecting the region as “China”, disease as “Rheumatic heart disease”, and risk factors as “Select only level 3 risks”, all years from 1990–2021, all ages, and both genders. The definition of rheumatic heart disease follows the International Classification of Diseases tenth edition (ICD-10) coding.

2.2. Indicator selection

This study uses the incidence number, prevalence number, death number, incidence rate, prevalence rate, mortality rate, and age-standardized rate (ASR) of incidence, prevalence, and mortality to evaluate the epidemiological trends and disease burden of rheumatic myocarditis in China. The above data can be directly obtained from the GBD official website (<https://www.healthdata.org/gbd>).

2.3. Statistical methods

All statistical analyses were performed using R software (version 4.2.1) and SAS software (version 9.4) to ensure the accuracy and reliability of the analysis. The significance level was set at $P < 0.05$ to evaluate the statistical significance of the results.

3. Results

3.1. Incidence rate of rheumatic heart disease in the Chinese population

From 1990 to 2021, the incidence of rheumatic heart disease in the Chinese population showed a gradually decreasing trend (Table 1). The number of cases decreased from 620,195 in 1990 to 445,472 in 2021, with an average annual reduction rate of 1.07%. The incidence rate decreased from 52.72/100,000 in 1990 to 31.31/100,000 in 2021, with an average annual reduction rate of 1.65%. The age-standardized incidence rate decreased from 48.92/100,000 in 1990 to 39.86/100,000 in 2021, with an average annual reduction rate of 0.46%. These data indicate that the incidence and number of cases of rheumatic heart disease in China are significantly decreasing. This trend may be attributed to improved medical conditions, widespread public health interventions, and effective prevention and control measures for rheumatic fever and related diseases. However, despite the overall downward trend, rheumatic heart disease remains an important public health issue that requires attention. Continued strengthening of prevention and control measures and health education is crucial for further reducing the incidence rate.

Table 1. Incidence of rheumatic heart disease in the Chinese population from 1990 to 2021

Years	Incidence number	Incidence rate (Per 100,000)	Age-standardized incidence rate (Per 100,000)
1990	620195.60(484500.11–778535.74)	52.72(41.18–66.18)	48.92(38.62–60.36)
1991	615784.22(484122.84–774227.18)	51.62(40.59–64.91)	48.09(38.18–59.09)
1992	609474.47(482535.87–763760.82)	50.53(40.00–63.32)	47.23(37.62–57.94)
1993	601436.24(477024.93–750850.33)	49.41(39.19–61.68)	46.35(36.99–56.69)
1994	591866.58(470048.97–738523.85)	48.26(38.33–60.22)	45.49(36.42–55.62)
1995	582150.11(462744.51–725773.39)	47.19(37.51–58.83)	44.67(35.82–54.81)
1996	570501.72(453818.63–710014.05)	46.01(36.60–57.27)	43.81(35.14–53.86)
1997	556718.65(443871.04–691780.26)	44.72(35.65–55.57)	42.84(34.42–52.78)
1998	542486.35(433462.37–672855.02)	43.41(34.69–53.85)	41.88(33.62–51.71)
1999	529428.22(423320.92–655520.98)	42.21(33.75–52.27)	41.04(32.91–50.78)
2000	519608.28(414850.04–641468.67)	41.27(32.95–50.95)	40.45(32.34–50.17)
2001	513543.57(411300.46–634578.46)	40.60(32.52–50.17)	40.21(32.12–49.73)
2002	509902.04(407768.26–631266.55)	40.11(32.08–49.66)	40.25(32.11–49.62)
2003	507230.22(404827.78–629674.65)	39.69(31.67–49.27)	40.44(32.24–49.87)
2004	504466.13(401684.85–627168.59)	39.25(31.25–48.80)	40.66(32.40–50.04)
2005	501006.20(399127.07–624758.39)	38.75(30.87–48.32)	40.79(32.43–50.32)
2006	498879.44(397365.36–620242.96)	38.34(30.54–47.66)	40.96(32.64–50.67)
2007	498889.63(397571.36–619428.65)	38.07(30.34–47.27)	41.28(32.86–51.17)

Table 1 (Continued)

Years	Incidence number	Incidence rate (Per 100,000)	Age-standardized incidence rate (Per 100,000)
2008	499129.77(397736.57–616420.68)	37.82(30.13–46.70)	41.62(33.09–51.68)
2009	497989.27(397053.38–612984.16)	37.47(29.88–46.13)	41.88(33.24–52.07)
2010	494001.74(394802.72–605666.52)	36.95(29.53–45.30)	41.93(33.27–52.24)
2011	487247.11(390396.28–596932.72)	36.26(29.05–44.42)	41.77(33.14–52.16)
2012	479243.24(385050.06–588036.45)	35.47(28.50–43.52)	41.52(32.94–51.93)
2013	470941.70(379123.41–577355.43)	34.64(27.89–42.47)	41.22(32.69–51.60)
2014	463477.01(374494.75–567561.59)	33.88(27.38–41.49)	40.94(32.41–51.31)
2015	457748.92(370984.54–560822.51)	33.23(26.93–40.72)	40.73(32.20–51.13)
2016	453696.88(368077.61–556315.66)	32.69(26.52–40.09)	40.60(32.13–50.93)
2017	451193.26(365805.57–552444.16)	32.27(26.16–39.51)	40.47(32.09–50.77)
2018	449922.08(365449.83–551149.51)	31.97(25.97–39.17)	40.35(32.02–50.57)
2019	448973.26(364290.91–549646.80)	31.74(25.76–38.86)	40.22(31.93–50.35)
2020	445682.97(361603.38–546084.91)	31.40(25.47–38.47)	39.92(31.62–49.88)
2021	445472.95(360393.94–544036.99)	31.31(25.33–38.24)	39.86(31.52–49.65)
Estimate annual percentage change (%)	-1.07(-1.16–-0.98)	-1.65(-1.73–-1.56)	-0.46(-0.61–-0.32)

3.2. Prevalence of rheumatic heart disease among the Chinese population

The number of cases, incidence rate, and age-standardized incidence rate of rheumatic heart disease in the Chinese population have remained stable with a slight decrease from 1990 to 2021 (Table 2). The number of cases increased from 8,923,639 in 1990 to 9,073,096 in 2021, with an average annual growth rate of 0.28%. The incidence rate decreased from 758.75/100,000 in 1990 to 637.72/100,000 in 2021, with an average annual decrease rate of 0.31%. Meanwhile, the age-standardized incidence rate decreased from 708.27/100,000 in 1990 to 619.85/100,000 in 2021, with an average annual decrease rate of 0.21%. These data indicate that although the number of cases has slightly increased, the incidence rate and age-standardized incidence rate have decreased due to the growth of the population base. This shows that China has achieved certain achievements in the prevention and control of rheumatic heart disease, and the disease burden is relatively stable and has been reduced. However, rheumatic heart disease remains a public health issue that requires continuous attention and the strengthening of prevention, control, and management measures.

Table 2. Prevalence of rheumatic heart disease among the Chinese population from 1990 to 2021

Years	Prevalence number	Prevalence rate (Per 100,000)	Age-standardized prevalence rate (Per 100,000)
1990	8926339.61(6909494.23–11186049.91)	758.75(587.31–950.82)	708.27(558.87–875.81)
1991	8909723.96(6940742.62–11089930.60)	746.95(581.88–929.73)	698.02(552.14–859.49)
1992	8873528.27(6896089.93–11024845.06)	735.64(571.70–913.98)	687.41(543.75–844.91)
1993	8826660.09(6857054.27–10941132.85)	725.13(563.33–898.84)	676.67(534.10–829.01)

Table 2 (Continued)

Years	Prevalence number	Prevalence rate (Per 100,000)	Age-standardized prevalence rate (Per 100,000)
1994	8770579.50(6815716.80–10854257.55)	715.20(555.79–885.12)	665.77(525.46–814.46)
1995	8713837.81(6773062.91–10740948.06)	706.29(548.98–870.60)	654.90(516.91–800.04)
1996	8632514.70(6707178.33–10630492.77)	696.25(540.97–857.40)	643.00(507.71–785.55)
1997	8526980.00(6621487.47–10496371.65)	684.90(531.85–843.09)	629.96(497.41–770.09)
1998	8425193.94(6555988.71–10391935.76)	674.23(524.64–831.62)	617.50(487.39–755.01)
1999	8350206.41(6509949.41–10312505.10)	665.80(519.07–822.27)	607.15(478.87–742.31)
2000	8333762.90(6512748.89–10298732.67)	661.89(517.26–817.95)	600.65(473.39–734.11)
2001	8375537.36(6561641.10–10315075.27)	662.18(518.77–815.52)	598.80(472.25–730.81)
2002	8453835.47(6646036.28–10402777.02)	664.98(522.78–818.28)	600.22(473.80–731.59)
2003	8551970.36(6746514.79–10502002.48)	669.11(527.85–821.68)	603.45(476.84–737.89)
2004	8650600.06(6845121.11–10611072.88)	673.08(532.60–825.62)	606.99(480.06–745.29)
2005	8738853.22(6932017.06–10738676.92)	675.93(536.18–830.62)	609.48(482.13–749.69)
2006	8855255.98(7038780.46–10847393.96)	680.48(540.89–833.56)	613.87(485.59–754.48)
2007	9024876.13(7191569.22–11037552.10)	688.64(548.75–842.21)	621.93(491.90–764.05)
2008	9203432.01(7354488.33–11252138.78)	697.27(557.19–852.48)	630.75(498.91–773.70)
2009	9345979.12(7479206.91–11422269.83)	703.25(562.79–859.49)	637.54(504.36–780.87)
2010	9411269.24(7533929.61–11508486.25)	703.94(563.52–860.81)	639.64(506.15–782.65)
2011	9409321.64(7528742.22–11503993.82)	700.17(560.23–856.04)	638.16(504.96–781.35)
2012	9388410.18(7506034.23–11471557.35)	694.82(555.51–849.00)	636.05(503.16–779.28)
2013	9354235.04(7482880.43–11419040.33)	688.14(550.47–840.04)	633.58(501.00–776.71)
2014	9313525.46(7457707.20–11352242.82)	680.85(545.19–829.89)	631.06(498.79–774.00)
2015	9276255.78(7441681.68–11292264.08)	673.48(540.29–819.85)	628.96(496.91–771.74)
2016	9246990.94(7442456.79–11248922.44)	666.29(536.26–810.53)	627.71(496.36–770.78)
2017	9226186.92(7450183.11–11215438.57)	659.88(532.86–802.16)	626.98(496.82–770.23)
2018	9207244.24(7458147.49–11160697.13)	654.31(530.01–793.13)	626.24(497.22–769.14)
2019	9180723.88(7457306.28–11108643.43)	649.10(527.25–785.41)	625.08(497.08–767.46)
2020	9110475.29(7409807.16–11056409.17)	641.82(522.01–778.90)	621.63(494.56–765.36)
2021	9073096.05(7393885.70–10994319.08)	637.72(519.69–772.75)	619.85(492.05–763.74)
Estimate annual percentage change (%)	0.28(0.16–0.40)	-0.31(-0.43–0.19)	-0.21(-0.36–0.06)

3.3. The mortality of rheumatic heart disease in the Chinese population

Between 1990 and 2021, the number of deaths, death rate, and age-standardized death rate of rheumatic heart disease in the Chinese population have all shown a decreasing trend (**Table 3**). The number of deaths decreased from 134,208 in 1990 to 78,910 in 2021, with an average annual reduction rate of 1.98%. The death rate decreased from 11.41 per 100,000 in 1990 to 5.51 per 100,000 in 2021, with an average annual reduction rate

of 2.55%. At the same time, the age-standardized death rate significantly decreased from 19.07 per 100,000 in 1990 to 5.00 per 100,000 in 2021, with an average annual reduction rate of 5.00%. These data reflect that over the past 30 years, China has achieved significant progress in the prevention and control of rheumatic heart disease, leading to a significant reduction in the burden of disease-related deaths. The downward trend may be attributed to improvements in public health measures, better quality medical services, and the effectiveness of early intervention and management of the disease. These results indicate that continued investment and intervention are still necessary for further reducing the number of deaths and death rates related to rheumatic heart disease.

Table 3. The mortality of rheumatic heart disease in the Chinese population from 1990 to 2021

Years	Death number	Death rate (Per 100,000)	Age-standardized death rate (Per 100,000)
1990	134208.87(109948.62–157944.08)	11.41(9.35–13.43)	19.07(15.78–22.57)
1991	134352.59(113664.36–156305.06)	11.26(9.53–13.10)	18.55(15.80–21.56)
1992	132491.45(112943.06–153826.36)	10.98(9.36–12.75)	17.78(15.30–20.61)
1993	128658.83(111690.32–147737.39)	10.57(9.18–12.14)	16.84(14.62–19.51)
1994	125154.26(110900.70–141816.91)	10.21(9.04–11.56)	15.99(14.07–18.05)
1995	120701.22(106346.57–134375.12)	9.78(8.62–10.89)	15.05(13.25–16.83)
1996	115973.51(104873.38–131309.42)	9.35(8.46–10.59)	14.12(12.74–16.03)
1997	111108.81(101209.59–122899.73)	8.92(8.13–9.87)	13.21(12.05–14.62)
1998	108245.57(97583.81–122113.97)	8.66(7.81–9.77)	12.56(11.35–14.15)
1999	107238.32(97168.60–119221.94)	8.55(7.75–9.51)	12.12(10.98–13.57)
2000	106736.04(97302.01–118865.85)	8.48(7.73–9.44)	11.78(10.71–13.13)
2001	105707.96(94821.98–119187.42)	8.36(7.50–9.42)	11.41(10.27–12.83)
2002	104399.73(93781.33–116231.38)	8.21(7.38–9.14)	10.96(9.78–12.26)
2003	105351.16(94560.11–118888.26)	8.24(7.40–9.30)	10.81(9.72–12.17)
2004	105448.60(95455.25–117106.60)	8.20(7.43–9.11)	10.55(9.49–11.82)
2005	101470.21(92222.47–112316.04)	7.85(7.13–8.69)	9.87(8.95–10.94)
2006	94463.99(85135.31–103549.57)	7.26(6.54–7.96)	8.82(7.91–9.71)
2007	90156.50(82096.00–99238.48)	6.88(6.26–7.57)	8.12(7.30–8.95)
2008	89421.03(81192.32–97468.05)	6.77(6.15–7.38)	7.81(7.07–8.56)
2009	87668.79(79682.48–95512.95)	6.60(6.00–7.19)	7.42(6.69–8.06)
2010	85575.68(76768.56–93886.60)	6.40(5.74–7.02)	7.00(6.29–7.70)
2011	83078.58(74661.97–90688.75)	6.18(5.56–6.75)	6.54(5.84–7.16)
2012	80305.55(71040.61–88874.03)	5.94(5.26–6.58)	6.06(5.35–6.68)
2013	78841.88(70308.92–87845.94)	5.80(5.17–6.46)	5.74(5.08–6.39)
2014	77768.00(68123.39–86973.98)	5.69(4.98–6.36)	5.45(4.74–6.09)
2015	77148.66(67292.67–87696.72)	5.60(4.89–6.37)	5.20(4.51–5.91)
2016	78101.79(66177.47–89342.51)	5.63(4.77–6.44)	5.06(4.27–5.79)

Table 2 (Continued)

Years	Death number	Death rate (Per 100,000)	Age-standardized death rate (Per 100,000)
2017	77521.27(65773.78–91472.31)	5.54(4.70–6.54)	4.83(4.11–5.67)
2018	77134.34(63991.10–92069.26)	5.48(4.55–6.54)	4.62(3.84–5.52)
2019	77458.33(63037.67–93931.74)	5.48(4.46–6.64)	4.46(3.60–5.40)
2020	78240.76(62612.70–95617.76)	5.51(4.41–6.74)	4.34(3.49–5.27)
2021	78910.64(61703.40–100717.52)	5.55(4.34–7.08)	4.21(3.30–5.37)
Estimate annual percentage change (%)	-1.98(-2.14–-1.82)	-2.55(-2.71–-2.39)	-5.00(-5.14–-4.86)

3.4. Change trends in the disease burden of rheumatic heart disease among different genders in the Chinese population

From 1990 to 2021, the incidence, prevalence, and mortality rates of rheumatic heart disease among the Chinese population showed an overall decreasing trend, with significant differences between genders (Figure 1). Overall, the incidence rates in all age groups and age-standardized rates have gradually decreased from a peak. The incidence and prevalence rates have continuously decreased in both males and females since 1990, with similar decreasing trends but higher absolute values in females. Meanwhile, the mortality rate also significantly decreased, especially rapidly since the early 1990s, and remained low thereafter. The age-standardized incidence and prevalence rates have also shown a decreasing trend, indicating a significant reduction in the burden of rheumatic heart disease since 1990 in both total and age-adjusted views. Nevertheless, females still significantly exceed males in all indicators, suggesting the need for more interventions and disease management measures targeting females. Overall, the improvement of public health measures and medical conditions has played a positive role in reducing the burden of rheumatic heart disease.

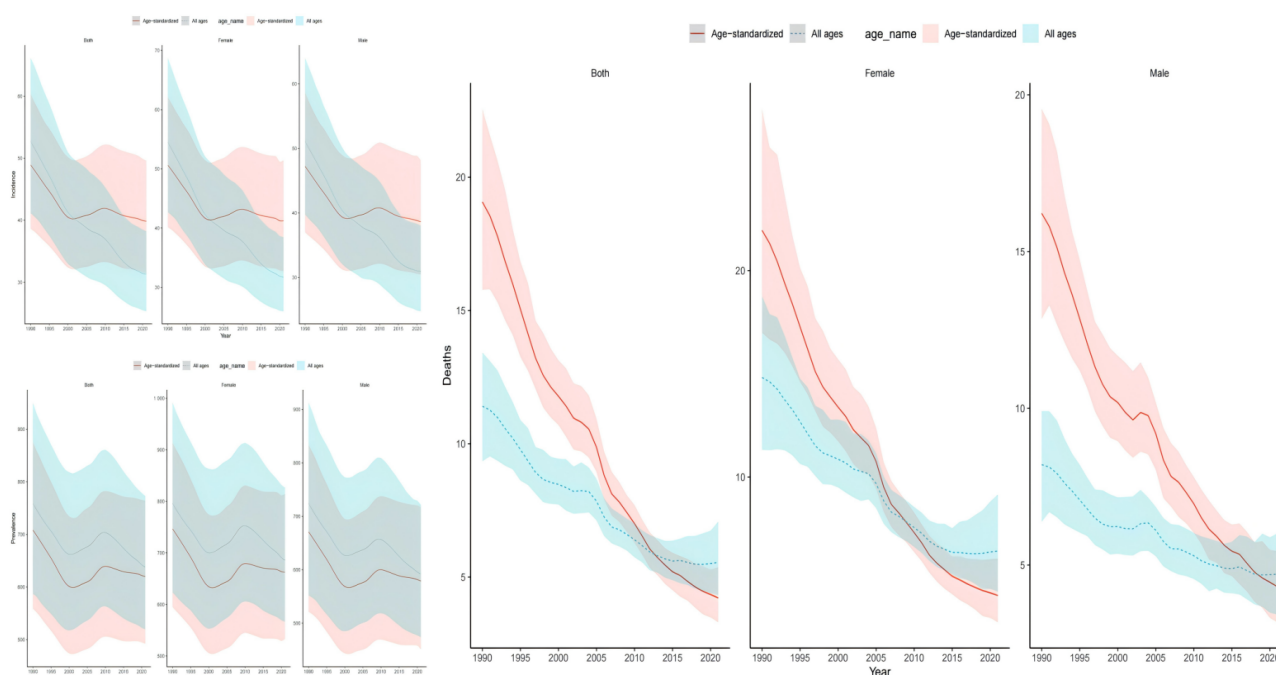


Figure 1. Change in trends in the disease burden of rheumatic heart disease among different genders in the Chinese population from 1990 to 2021

4. Discussion

Over the past few decades, China has undergone rapid socio-economic development and changes in population structure, which have had profound impacts on the field of public health. Based on the Global Burden of Disease (GBD) database, this study systematically analyzed the trends of disease burden of Rheumatic Heart Disease (RHD) in China from 1990 to 2021 and explored the differences in disease burden by gender. The results show that although the incidence, prevalence, and mortality of RHD are overall declining, this disease remains an important challenge in the field of public health in China ^[7].

Firstly, from the perspective of incidence rate, the annual average reduction rates of rheumatic heart disease in China are 1.07%, 1.65%, and 0.46% respectively, indicating significant progress in the prevention and treatment of rheumatic heart disease over the past thirty years ^[8]. This may be attributed to the improvement of healthcare services, implementation of public health policies, and increased awareness of population health. However, it is worth noting that despite the decreasing incidence rate, the number of rheumatic heart disease patients has shown a slight increase, which may be related to population aging and improved disease diagnosis rates ^[9].

The downward trends in the incidence and mortality rates indicate that China has achieved certain effectiveness in the long-term management of rheumatic heart disease ^[9]. The decrease in incidence may be related to early diagnosis and effective treatment, while the significant reduction in mortality rates may be associated with advances in medical technology, improvements in emergency medical systems, and optimization of cardiovascular disease management ^[10]. Furthermore, the declining age-standardized incidence and mortality rates further confirm the alleviation of the disease burden of rheumatic heart disease, demonstrating success in controlling disease risk factors.

In terms of gender differences, this study found that women have higher incidence, prevalence, and mortality rates of rheumatic heart disease than men, which may be related to biological differences, gender-specific social-behavioral factors, and unequal access to medical resources ^[11]. For example, women may be more susceptible to hormonal changes, which may increase the risk of cardiovascular diseases ^[12]. Additionally, women may face more obstacles in accessing medical resources and health information, which may affect their understanding and management of the disease. Therefore, future public health strategies need to pay special attention to women to reduce gender differences and improve overall health levels.

In addition, this study also found that, although the overall trend is declining, there may be differences in the disease burden of rheumatic heart disease among different regions and different socioeconomic groups ^[13]. This suggests that more targeted intervention measures are needed to address the health needs of specific groups. For example, in resource-poor areas, it may be necessary to strengthen infrastructure construction and improve the accessibility and quality of medical services. For groups with lower socioeconomic status, it may be necessary to provide more health education and economic support to promote the formation and maintenance of healthy behaviors.

The findings of this study emphasize the importance of continued investment in cardiovascular disease prevention and control measures. Despite some progress, rheumatic heart disease remains one of the leading causes of death and disability. Therefore, sustained public health efforts are needed, including health promotion, disease prevention, early diagnosis, and effective treatment. In addition, interdisciplinary research needs to be strengthened to better understand the complex causes and factors influencing rheumatic heart disease, and to provide scientific evidence for the development of more effective intervention strategies.

Based on the Global Burden of Disease (GBD) database, this study conducted a systematic analysis of the changing trend of rheumatic heart disease (RHD) burden in China from 1990 to 2021 and explored the differences in disease burden between different genders^[4]. Although the study provided valuable insights, there were some limitations. The study mainly focused on indicators such as incidence, prevalence, and mortality rates, but the disease burden of rheumatic heart disease may also be affected by other factors, such as the impact of the disease on patients' quality of life, the economic burden caused by the disease, and patient's satisfaction with medical services^[10]. Future research could consider incorporating these factors into the analysis to obtain a more comprehensive assessment of disease burden. Furthermore, although this study revealed gender differences, it did not delve into the specific reasons behind these differences. Gender differences may be related to various factors such as biology, socio-cultural factors, economic status, and access to medical resources^[14]. Future research could use qualitative methods to analyze how these factors affect the disease burden of rheumatic heart disease in different gender populations.

In conclusion, this study provides a comprehensive analysis of the changing trends in the disease burden of rheumatic heart disease in China and reveals differences in disease burden between different genders. These findings are of great significance for guiding future public health policies and the allocation of medical resources. By implementing comprehensive prevention and control measures, it is hoped that the disease burden of rheumatic heart disease can be further reduced, improving the overall health level of the Chinese population.

Disclosure statement

The authors declare no conflict of interest.

Reference

- [1] Ruan R, Liu X, Zhang Y, et al., 2023, Global, Regional, and National Advances Toward the Management of Rheumatic Heart Disease Based on the Global Burden of Disease Study 2019. *Journal of the American Heart Association*, 12(13): e028921. <https://doi.org/10.1161/jaha.122.028921>
- [2] Hu Y, Tong Z, Huang X, et al., 2022, The Projections of Global and Regional Rheumatic Heart Disease Burden from 2020 to 2030. *Frontiers in Cardiovascular Medicine*, 2022(9): 941917. <https://doi.org/10.3389/fcvm.2022.941917>
- [3] Zhang L, Tong Z, Han R, et al., 2023, Spatiotemporal Trends in Global Burden of Rheumatic Heart Disease and Associated Risk Factors from 1990 to 2019. *International Journal of Cardiology*, 2023(384): 100–106. <https://doi.org/10.1016/j.ijcard.2023.04.060>
- [4] Zuhlke LJ, Steer AC, 2013, Estimates of the Global Burden of Rheumatic Heart Disease. *Global Heart*, 8(3): 189–195. <https://doi.org/10.1016/j.gheart.2013.08.008>
- [5] Mao C, Sun X, Long D, et al., 2024, Epidemiological Study of Pediatric Rheumatic Heart Disease: An Analysis from the Global Burden of Disease Study 2019. *International Journal of Cardiology*, 2024(400): 131705. <https://doi.org/10.1016/j.ijcard.2023.131705>
- [6] Ghamari SH, Abbasi-Kangevari M, Saeedi Moghaddam S, et al., 2022, Rheumatic Heart Disease is a Neglected Disease Relative to Its Burden Worldwide: Findings From Global Burden of Disease 2019. *Journal of the American Heart Association*, 11(13): e025284. <https://doi.org/10.1161/JAHA.122.025284>
- [7] Marijon E, Mirabel M, Celermajer DS, et al., 2012, Rheumatic Heart Disease. *Lancet*, 379(9819): 953–964. [https://doi.org/10.1016/s0140-6736\(11\)61171-9](https://doi.org/10.1016/s0140-6736(11)61171-9)
- [8] Shi L, Bao C, Wen Y, et al., 2023, Analysis and Comparison of the Trends in Burden of Rheumatic Heart Disease in China and Worldwide from 1990 to 2019. *BMC Cardiovascular Disorders*, 23(1): 517. <https://doi.org/10.1186/>

- [9] Zhimin W, Yubao Z, Lei S, et al., 2006, Prevalence of Chronic Rheumatic Heart Disease in Chinese Adults. *International Journal of Cardiology*, 107(3): 356–359. <https://doi.org/10.1016/j.ijcard.2005.03.048>
- [10] Wang Z, Ma L, Liu M, et al., 2023, Writing Committee of the Report on Cardiovascular Health and Diseases in China. Summary of the 2022 Report on Cardiovascular Health and Diseases in China. *Chinese Medical Journal*, 136(24): 2899–2908. <https://doi.org/10.1097/CM9.0000000000002927>
- [11] Liang Y, Yu D, Lu Q, et al., 2023, The Rise and Fall of Acute Rheumatic Fever and Rheumatic Heart Disease: A Mini Review. *Frontiers in Cardiovascular Medicine*, 2023(10): 1183606. <https://doi.org/10.3389/fcvm.2023.1183606>
- [12] Mao C, Sun X, Long D, et al., 2024, Epidemiological Study of Pediatric Rheumatic Heart Disease: An Analysis from the Global Burden of Disease Study 2019. *International Journal of Cardiology*, 2024(400): 131705. <https://doi.org/10.1016/j.ijcard.2023.131705>
- [13] Cui J, Guo X, Yuan X, et al., 2022, Analysis of Rheumatic Heart Disease Mortality in the Chinese Population: A JoinPoint and Age-Period-Cohort Study. *International Journal of Environmental Research and Public Health*, 19(16): 9872. <https://doi.org/10.3390/ijerph19169872>
- [14] Mao F, Zhang W, Yin P, et al., 2024, Epidemiological Characteristics of Centenarian Deaths in China during 2013–2020: A Trend and Subnational Analysis. *Chinese Medical Journal*, 137(13): 1544–1552. <https://doi.org/10.1097/CM9.0000000000002823>

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