

Temporal Trends in Disease Burden and Incidence Prediction of Ischemic Heart Disease in China and Globally, 1990-2019: A Postprint

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Abstract

Background Ischemic heart disease is globally recognized as the cardiovascular disease with the highest mortality and most common occurrence, leading to an increasing disease burden among Chinese residents. Analysis of changing trends and predictions of disease burden is an important focus of healthcare policy. **Objective** To comparatively analyze the disease burden and risk factors of ischemic heart disease in China and globally from 1990-2019, predict its changing trends, and provide evidence for prevention and treatment efforts for ischemic heart disease. **Methods** Based on the Global Burden of Disease 2019 (GBD2019) database, using the Joinpoint log-linear model to analyze trends in disease burden of ischemic heart disease in China and globally from 1990-2019, with trend testing, and using R 4.3.0 to forecast the disease burden in China from 2020-2035. **Results** From 1990-2019, China's age-standardized incidence rate, age-standardized mortality rate, and age-standardized disability-adjusted life years (DALY) rate of ischemic heart disease were all lower than global levels, but overall showed upward trends, while global trends were downward. High incidence, mortality, and DALY rates of ischemic heart disease in both China and globally occurred predominantly in elderly populations. From 2020-2035, China's ischemic heart disease burden is predicted to show an overall declining trend (average annual percent change (AAPC) of incidence, mortality, and DALY rates were -0.400, -1.167, and -1.318, respectively, $P < 0.001$), with reductions in all indicators being greater among male populations than females in both China and globally. **Conclusion** The prevention and treatment situation for ischemic heart disease in China is severe, with the disease burden being particularly heavy among male and elderly populations; the disease burden attributable to disability is substantial; high systolic blood pressure and high low-density lipoprotein are important risk factors. Future attention should be directed toward the growing trend of ischemic heart disease burden in China, with focused strengthening of preventive interventions for male and elderly populations.

Full Text

Trend and Prediction Analysis of the Changing Disease Burden of Ischemic Heart Disease in China and Worldwide from 1990 to 2019

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Abstract

Background: Ischemic heart disease is recognized globally as the most common cardiovascular disease with the highest mortality rate, imposing an increasingly heavy disease burden on Chinese residents. Analyzing trends and conducting predictive analyses of disease burden represents an important focus for health-care policy. **Objective:** To compare and analyze the disease burden and risk factors of ischemic heart disease in China and worldwide from 1990 to 2019, predict future trends, and provide evidence for prevention and treatment efforts. **Methods:** Based on the Global Burden of Disease Study 2019 (GBD2019) database, we employed Joinpoint log-linear models to analyze changing trends in the disease burden of ischemic heart disease in China and globally from 1990 to 2019, with trend significance testing. Predictions for China's ischemic heart disease burden from 2020 to 2035 were performed using R 4.3.0. **Results:** From 1990 to 2019, China's standardized incidence rate, standardized mortality rate, and standardized disability-adjusted life year (DALY) rate for ischemic heart disease were all lower than global levels, yet showed overall upward trends, while global trends were declining. High incidence, mortality, and DALY rates for ischemic heart disease in both China and worldwide occurred predominantly among elderly populations. From 2020 to 2035, China's ischemic heart disease burden is projected to show an overall decline (AAPC for incidence, mortality, and DALY rates: -0.400, -1.167, and -1.318, respectively; $P < 0.001$), with greater reductions observed in male populations compared to females in both China and globally. **Conclusion:** The situation of ischemic heart disease prevention and control in China is severe, with particularly heavy disease burdens among male and elderly populations. The burden attributable to disability is substantial, with high systolic blood pressure and high low-density lipoprotein representing important risk factors. Future efforts should focus on the growing trend of disease burden in China, with strengthened preventive interventions targeting male and elderly populations.

Keywords: Ischemic heart disease; Disease burden; Global Burden of Disease Study; Risk factors; Forecasting analysis

Ischemic heart disease (IHD) refers to conditions caused by coronary artery narrowing or occlusion that lead to myocardial ischemia, hypoxia, and even necrosis. It is recognized globally as the most common cardiovascular disease and ranks first worldwide in mortality. With socioeconomic development and lifestyle changes, the prevalence and mortality of ischemic heart disease in China have continued to rise, making it the second leading public health challenge after lung cancer. Overall, current domestic and international research on ischemic heart disease focuses primarily on clinical aspects and treatment, with relatively few studies examining disease burden. Moreover, existing research adopts narrow perspectives, often concentrating on single risk factor attribution, local regions, or special populations. Studies describing and analyzing the overall epidemiological characteristics, population and societal disease burden, and development trajectories from a longitudinal perspective remain largely absent, despite such research being fundamental to implementing long-term disease control actions and facilitating targeted prevention and intervention strategies. Based on this context, this study analyzes GBD2019 statistics to compare the disease burden, risk factors, and changing trends of ischemic heart disease in China and worldwide from 1990 to 2019. Additionally, we project future trends to provide empirical evidence for policy formulation.

1.1 Data Sources

This study utilized data from the Global Burden of Disease 2019 database. GBD2019 encompasses disease burden assessments for 369 diseases and injuries and 87 risk factors across 204 countries and territories from 1990 to 2019, providing standardized and comparable public data.

1.2 Research Methods

Disease burden was measured using indicators including incidence rate, prevalence rate, mortality rate, years of life lost (YLL), years lived with disability (YLD), and disability-adjusted life years (DALY) to reflect health impacts and mortality risks. Incidence rate represents the frequency of new cases and reflects disease impact on population health, while mortality rate measures fatal risk. YLL is calculated by multiplying deaths by standard life expectancy at each age. YLD is computed by multiplying prevalence by disease-specific disability weights for mutually exclusive sequelae. DALY, the sum of YLL and YLD, integrates premature mortality and disability to represent total healthy life years lost from disease onset to death, measuring both life reduction and disability extent. This study compiled data on disease burden and risk factors for ischemic heart disease in China and worldwide from 1990 to 2019. Predictions of standardized rates utilized GBD database population projection data and corresponding standard population structure data for 2017–2100.

1.3 Statistical Methods

Data preprocessing was performed using Excel. We described the disease burden and risk factors of ischemic heart disease in China and worldwide through standardized mortality rates, standardized DALY rates, and other indicators. Line charts illustrated trends from 1990 to 2019. Considering the data distribution characteristics, we employed log-linear models using Joinpoint 5.0.1 to analyze changing trends, calculating average annual percentage change (AAPC) for standardized indicators with significance testing. Bidirectional grouped bar charts displayed epidemiological status and disease burden by age group and sex for 1990 and 2019. Using the Bayesian age-period-cohort analysis (BAPC) package and integrated nested Laplace approximation (INLA) package in R 4.3.0, we implemented BAPC with INLA algorithms to directly approximate posterior marginal distributions, projecting incidence, mortality, and DALY rates for China and worldwide from 2020 to 2035. Graphics were generated using the ggplot2 package. Statistical significance was set at $P < 0.05$.

2 Results

2.1 Epidemiological Status of Ischemic Heart Disease in China and Worldwide, 1990-2019

2.1.1 Morbidity Trends From 1990 to 2019, both the number of cases and incidence rate of ischemic heart disease showed upward trends in China and globally. After age standardization, China's standardized incidence rate remained substantially lower than the global rate but demonstrated an overall upward trajectory, while the global standardized incidence rate showed a declining trend. In 2019, China's standardized incidence rate was 197.39 per 100,000 person-years compared to 262.39 per 100,000 person-years globally. China's proportion of global total cases increased from 10.74% to 16.51%, with its incidence growth rate exceeding the global rate by more than fivefold. By sex, standardized incidence rates were significantly higher among males than females in both China and worldwide [FIGURE:1, TABLE:1].

2.1.2 Mortality Trends From 1990 to 2019, both the number of deaths and mortality rate of ischemic heart disease increased in China and globally. However, after age standardization, China's standardized mortality rate showed overall growth while the global rate declined substantially. In 1990, China's standardized mortality rate was far below the global level, but by 2019 it reached 116.41 per 100,000 person-years, approaching the global level of 117.95 per 100,000 person-years. The line chart of standardized mortality rates [Figure 1: see original paper] clearly shows that from 1990 to 2019, standardized mortality rates for ischemic heart disease were higher among males than females in both China and worldwide. China's standardized mortality rate fluctuated more substantially than the global rate, particularly among males. Since 2011, China's total population and female standardized mortality rates have remained largely consistent with global levels, while the male rate, after exceeding global

levels in 2010, has recently declined and gradually converged toward global levels.

2.2 Comparative Analysis of Disease Burden in China and Worldwide, 1990 and 2019

Overall, global standardized YLL and DALY rates were higher than China's, while global standardized YLD rates were lower than China's. From 1990 to 2019, China's standardized DALY rate remained essentially unchanged, far below the global average but showing a slight overall increase, while the global standardized DALY rate declined. By sex, standardized DALY rates among males exceeded those among females in both China and worldwide. China's female standardized DALY rate remained stable over the 30-year period, while the male rate showed notable fluctuations. Global standardized DALY rates declined steadily among both males and females [FIGURE:2, TABLE:3].

2.3 Age Distribution of Disease Burden in China and Worldwide, 1990 and 2019

Regarding epidemiological status, both incidence and mortality rates of ischemic heart disease in China and worldwide increased continuously with age, with rates among elderly populations far exceeding those among younger and middle-aged adults. In terms of disease burden, DALY rates also increased continuously with age, with the highest age group exceeding the lowest by more than 300-fold. Among Chinese populations aged 15-69 years, DALY rates declined, while rates among those over 70 years increased, with the 85-94 age group showing nearly 50% growth. Globally, DALY rates declined across all age groups, with decreases among those over 50 years remaining within 30%±5%. In 1990, DALY rates across all Chinese age groups were below global averages, but by 2019, Chinese populations over 80 years surpassed global averages, with those over 90 years exceeding global levels by 1.5-fold [Figure 3: see original paper].

2.4 Risk Factor Comparison in China and Worldwide, 1990 and 2019

Comparing 1990 and 2019, high systolic blood pressure and high low-density lipoprotein remained the top two risk factors for ischemic heart disease in both China and worldwide. Particulate matter pollution and smoking ranked third and fourth in China and remained within the top five globally. Household air pollution from solid fuels declined in ranking in both China and worldwide from 1990 to 2019. Ambient ozone pollution and high body mass index (BMI) rose steadily in rankings in both China and worldwide. Compared to global levels, high sodium diet represented a more significant risk factor affecting the Chinese population.

2.5 Projections for Ischemic Heart Disease Prevalence and Burden in China and Worldwide, 2020-2035

Based on model projections, China's incidence rate will show an overall decline from 2020 to 2035, while global incidence will remain relatively stable with slight increases. Chinese male incidence is projected to decrease from 236.76 to 217.36 per 100,000 person-years, and Chinese female incidence from 164.86 to 157.44 per 100,000 person-years. Global male incidence will increase from 333.78 to 337.67 per 100,000 person-years, and global female incidence from 199.22 to 203.96 per 100,000 person-years. The number of cases will decrease in China but increase globally [Figure 4: see original paper].

Regarding mortality, both China and worldwide will maintain declining trends over the next 15 years, with greater reductions in China. Chinese male mortality will decrease from 159.02 to 128.34 per 100,000 person-years, and Chinese female mortality from 96.17 to 78.88 per 100,000 person-years. Global male mortality will decline from 141.82 to 130.11 per 100,000 person-years, and global female mortality from 94.73 to 89.08 per 100,000 person-years. Deaths will decrease in China but remain essentially stable with slight increases globally.

For disease burden, DALY rates will decline overall in both China and worldwide over the next 15 years, with greater reductions in China. Chinese male DALY rates will decrease from 2,537.98 to 2,061.23 per 100,000 person-years, and Chinese female rates from 1,389.01 to 1,066.31 per 100,000 person-years. Global male DALY rates will increase from 2,289.79 to 2,744.04 per 100,000 person-years, while global female rates will decrease from 1,638.70 to 1,561.18 per 100,000 person-years. DALY values will decrease in China but increase slightly worldwide. Overall, the magnitude of change in standardized rates is substantially greater among Chinese males than females, while global sex differences are smaller. Both China and worldwide will maintain higher standardized rates among males than females throughout 2020-2035.

3 Discussion

3.1 Severe Prevention and Control Situation in China, Particularly Heavy Burden Among Males and Elderly

Our findings indicate that although China's standardized incidence and mortality rates for ischemic heart disease in 2019 were lower than global levels, both indicators showed overall upward trends from 1990 to 2019, while global trends declined. China's standardized YLL, YLD, and DALY rates all demonstrated upward trends, while global disease burden indicators declined. This suggests that China's increasing ischemic heart disease burden relates to growing burdens from both premature mortality and disability, with disability-related burden being particularly severe.

By sex, standardized incidence, mortality, and DALY rates among males exceeded those among females in both China and worldwide. Notably, standard-

ized incidence and mortality rates among Chinese males have surpassed global levels and show clear increasing trends. This suggests that China's ischemic heart disease prevention and control situation is severe, with urgent need to strengthen focus on male populations in disease prevention and control efforts. Regarding age, high incidence, mortality, and DALY rates concentrate among elderly populations in both China and worldwide, consistent with previous research identifying elderly populations as high-risk groups for ischemic heart disease. China has entered a comprehensive aging society, which aligns with the changing trends in Chinese population indicators before and after standardization. Compared with 1990, differences between elderly and younger populations in incidence, mortality, and DALY rates became more pronounced in China by 2019, while global differences remained relatively smaller. Therefore, China must strengthen tertiary prevention of ischemic heart disease, improve social security mechanisms, optimize health resource allocation, and appropriately shift prevention priorities toward elderly populations.

3.2 High Systolic Blood Pressure and High Low-Density Lipoprotein as Primary Disease Burden Contributors

Our results show that high systolic blood pressure and high low-density lipoprotein remained the top two risk factors contributing to high DALY rates for ischemic heart disease in both China and worldwide in 1990 and 2019, confirming their importance as risk factors consistent with existing research. In recent years, hypertension prevalence has risen in China, while awareness, treatment, and control rates remain low. Additionally, low-density lipoprotein cholesterol levels have increased among Chinese adults. Effective health education, strengthened self-management and monitoring awareness, enhanced primary healthcare services, and improved community health service levels and utilization rates will help reduce the prevalence of high systolic blood pressure and high low-density lipoprotein, thereby mitigating their associated disease burden.

Among other top ten risk factors, particulate matter pollution and smoking remained within the top five in both China and worldwide. Ambient ozone pollution and high BMI showed rising rankings in both regions. Regarding dietary factors, high sodium diet, low whole grain diet, and low legume diet represented major contributors to disease burden, with high sodium diet being more pronounced in China than globally. Previous studies demonstrate that environmental particulate matter pollution, gaseous pollutants like ozone, and smoking exacerbate atherosclerosis risk and increase myocardial burden, with interrelated effects: high sodium diet, high BMI, and air pollution all increase hypertension risk, directly and indirectly affecting China's ischemic heart disease burden. Therefore, China must implement government-led air pollution control, guide lifestyle interventions, promote healthy diets with appropriate sodium restriction, encourage regular moderate-intensity exercise, support smoking cessation and alcohol limitation, and establish effective protection measures against environmental pollution to build a comprehensive societal prevention network

for ischemic heart disease.

3.3 Projected Declines in Standardized Incidence, Mortality, and DALY Rates in China, 2020-2035

Our projections indicate that China's standardized incidence, mortality, and DALY rates will decline from 2020 to 2035, while global levels remain relatively stable, with only slight increases in standardized incidence and decreases in the other two indicators. In terms of absolute numbers, China will see reductions in cases, deaths, and DALY values, while global values will increase slightly. This demonstrates that China's recent prevention and control measures for ischemic heart disease have been effective. The development of national essential public health services, implementation of primary care management pathways, and improved disease treatment capabilities have somewhat alleviated the heavy disease burden on Chinese residents. Future policy formulation and implementation can build upon these experiences to strengthen prevention measures and maintain effective control of China's ischemic heart disease burden.

3.4 Summary

In summary, from 1990 to 2019, China's standardized indicators for ischemic heart disease burden transitioned from being below global averages with certain gaps to approaching or even surpassing global averages. The disease burden is particularly heavy among Chinese males and elderly populations. High systolic blood pressure and high low-density lipoprotein represent the most significant disease burden contributors. Projections for 2020-2035 indicate declining standardized incidence, mortality, and DALY rates in both China and worldwide. Therefore, establishing a robust ischemic heart disease prevention and control network in China is imperative. This can be achieved through strengthened health education, improved tertiary prevention, appropriate resource allocation toward priority populations, and ultimately achieving whole-society participation to alleviate disease burden among Chinese residents.

Author Contributions: Su Wei designed the study, processed and analyzed data, created figures, and drafted the manuscript. Zhang Ying collected background information, summarized current status, and formatted the manuscript. Ma Shuang revised the manuscript, was responsible for quality control and review, provided overall supervision, and managed the project.

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References

- [1] World Health Organization. Cardiovascular diseases (CVDs). 2021 [N/OL]. (2021-06-11) [2023-07-09]. [https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-\(cvds\)](https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds)).
- [2] Global Burden of Disease Collaborative Network. Global Burden of Disease Study 2019 (GBD2019) Results [DB/OL]. Seattle, United States. 2020 [2023-07-09]. <https://ghdx.healthdata.org/gbd-2019>.
- [3] National Bureau of Statistics of China. China Health Statistics Yearbook 2020 [J/OL]. (2022-05-23) [2023-07-09]. <https://ghdx.healthdata.org/record/china-statistical-yearbook-2020>.
- [4] Murray CJL, Lopez AD. Measuring the global burden of disease. *The New England Journal of Medicine*. 2013;369(5):448-457. DOI:10.1056/NEJMra1201534.
- [5] Qu Y, Wang TY, Yang J, et al. Data extraction methods and procedures for the GBD database. *Chinese Journal of Evidence-Based Cardiovascular Medicine*. 2019;11(9):1043-1046. DOI:10.3969/j.issn.1674-4055.2019.09.04.
- [6] GBD 2019 Diseases and Injuries Collaborators. Global burden of 369 diseases and injuries in 204 countries and territories, 1990-2019: A systematic analysis for the Global Burden of Disease Study 2019. *Lancet*. 2020;396(10258):1204-1222. DOI:10.1016/S0140-6736(20)30925-9.
- [7] Li XY, Zhou Y, Huang H, et al. Research progress on disease burden. *Chinese Journal of Public Health*. 2018;34(5):777-780. DOI:10.11847/zgggws1118319.
- [8] GBD 2019 Demographics Collaborators. Global age-sex-specific fertility, mortality, healthy life expectancy (HALE), and population estimates in 204 countries and territories, 1950-2019: A comprehensive demographic analysis for the Global Burden of Disease Study 2019. *Lancet*. 2020;396(10258):1160-1203. DOI:10.1016/S0140-6736(20)30977-6.
- [9] Riebler A, Held L. Projecting the future burden of cancer: Bayesian age-period-cohort analysis with integrated nested Laplace approximations. *Biometrical Journal*. 2017;59(3):531-549. DOI:10.1002/bimj.201500263.
- [10] Yang M, Wang SW, Yu CH. Disease burden and incidence trend prediction of malignant skin tumors in China, 1990-2019. *China Cancer*. 2022;31(11):853-861. DOI:10.11735/j.issn.1004-0242.2022.11.A002.
- [11] Liang SS, Zhou ZH, Li CC, et al. Analysis of disease burden and incidence prediction of diabetes in China from 1990 to 2019. *Chinese General Practice*. 2023;26(16):2013-2019. DOI:10.12114/j.issn.1007-9572.2023.0009.
- [12] Zeng Y. Study on cardiovascular risk assessment and comprehensive intervention in the elderly [D]. Changsha: Central South University, 2012.

- [13] Hou JW. New characteristics and trends of China' s population development from seven national censuses. *Academic Forum*. 2021;44(5):1-14. DOI:10.3969/j.issn.1004-4434.2021.05.001.
- [14] Chinese Cardiovascular Health and Disease Report Writing Group. Summary of the China Cardiovascular Health and Disease Report 2021. *Chinese Circulation Journal*. 2022;37(6):553-578. DOI:10.3969/j.issn.1000-3614.2022.06.001.
- [15] Joint Expert Committee on Revision of Chinese Guidelines for Blood Lipid Management. Chinese guidelines for blood lipid management (2023). *Chinese Circulation Journal*. 2023;38(3):237-271. DOI:10.3969/j.issn.1000-3614.2023.03.001.
- [16] Ma LY, Wang ZW, Fan J, et al. Overview of hypertension prevalence and prevention status in the China Cardiovascular Health and Disease Report 2021. *Chinese General Practice*. 2022;25(30):3715-3720. DOI:10.12114/j.issn.1007-9572.2022.0502.
- [17] Song PK, Man QQ, Li H, et al. Trends in lipids level and dyslipidemia among Chinese adults, 2002-2015. *Biomedical and Environmental Sciences*. 2019;32(8):559-570. DOI:10.3967/bes2019.074.
- [18] Xie YF, Wei SF, Yang Q, et al. Study on the preventive and therapeutic effects of personalized nutritional intervention on hypertension among elderly populations in community health and wellness services. *Modern Preventive Medicine*. 2023;50(6):1080-1085. DOI:10.20043/j.cnki.MPM.202204604.
- [19] Joint Committee on Revision of Chinese Guidelines for Prevention and Treatment of Dyslipidemia in Adults. Chinese guidelines for prevention and treatment of dyslipidemia in adults (2016 revision). *Chinese Circulation Journal*. 2016;31(10):937-953. DOI:10.3969/j.issn.1000-3614.2016.10.001.
- [20] Sun QH, Wang AX, Jin XM, et al. Long-term air pollution exposure and acceleration of atherosclerosis and vascular inflammation in an animal model. *JAMA*. 2005;294(23):3003-3010. DOI:10.1001/jama.294.23.3003.
- [21] Song W. Effect of smoking and quitting smoking on cholesterol outflow from macrophages in patients with coronary heart disease [D]. Beijing: Peking Union Medical College, 2012.
- [22] Xu JH, Wang DZ. Research progress on the epidemiological effects of atmospheric particulate matter pollution and smoking on cardiovascular and cerebrovascular diseases. *Chinese Journal of Chronic Disease Prevention and Control*. 2022;30(6):469-472. DOI:10.16386/j.ejpcd.issn.1004-6194.2022.06.015.
- [23] Wu CF, Kuo IC, Su TC, et al. Effects of personal exposure to particulate matter and ozone on arterial stiffness and heart rate variability in healthy adults. *American Journal of Epidemiology*. 2010;171(12):1299-1309. DOI:10.1093/aje/kwq060.

- [24] Ma YQ, Wang JD. Research progress on the relationship between environmental pollution and cardiovascular disease. *Chinese Journal of Public Health*. 2011;27(6):800-802.
- [25] Ente A, O' Donnell MJ, Rangarajan S, et al. Association of urinary sodium and potassium excretion with blood pressure. *The New England Journal of Medicine*. 2014;371(7):601-611. DOI:10.1056/NEJMoa1311989.
- [26] Wang Q, Du WW, Song XY, et al. Relationship between BMI trajectory and hypertension and blood pressure levels among Chinese adults. *Journal of Hygiene Research*. 2023;52(3):354-361. DOI:10.19813/j.cnki.weishengyanjiu.2023.03.002.
- [27] Fu P, Li JQ, Si SC, et al. Association between air pollution exposure and risk of hypertension: a cohort study based on UK Biobank. *Chinese Journal of Disease Control and Prevention*. 2022;26(10):1229-1234. DOI:10.16462/j.cnki.zhjbkz.2022.10.020.
- [28] Dong YH, Shi ZY, Yin XH. Research progress on sodium intake in hypertension. *Advances in Cardiovascular Diseases*. 2018;39(02):190-194. DOI:10.16806/j.cnki.issn.1004-3934.2018.02.015.
- [29] Zhang Q, Song XP, Ren MJ, et al. Current research status on the impact of low-sodium diet on cardiovascular events. *Chinese Journal of Cardiovascular Medicine*. 2019;24(5):477-480. DOI:10.3969/j.issn.1007-5410.2019.05.021.
- [30] Liu ZY, Xiao Y, Zhao K, et al. Implementation progress and effectiveness of national essential public health service projects. *Chinese Journal of Public Health*. 2019;35(6):657-664. DOI:10.11847/zgggws1121468.
- [31] Zeng YX, Zhu SZ, Yu XS, et al. Expert consensus on primary care management pathways for atherosclerotic cardiovascular disease in Chinese adults (draft). *Chinese General Practice*. 2017;20(3):251-261. DOI:10.3969/j.issn.1007-9572.2017.03.001.

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