



Yang ZHAO

Doctor of Philosophy -  
Medicine, Dentistry and  
Health Sciences

The Nossal Institute for  
Global Health, Melbourne  
School of Population and  
Global Health, the University  
of Melbourne

**PhD Research Project:**  
Socioeconomic inequalities  
in health care and financial  
protection among people  
with non-communicable  
diseases in China

**Supervisor:**

Professor Ajay Mahal,  
University of Melbourne  
Professor Shenglan Tang,  
Duke University



[zhao11@student.unimelb.edu.au](mailto:zhao11@student.unimelb.edu.au)

## *Regional disparity in care cascade for cardiovascular diseases in China: evidence from a nationally representative population-based survey*

Top-prize paper - 2021 Chinese Studies Research Brief Prize

### Yang ZHAO

Mr Yang Zhao works as a young epidemiologist and research fellow at the Digital Health & Stroke Program at The George Institute for Global Health after graduating with a PhD degree from the University of Melbourne in 2021. His research focuses on multi-morbidity epidemiology, cardiovascular disease prevention, global health system and policy.

## Background to the research

China, with over 1.4 billion people, has experienced a huge epidemiological change in last decades, with the burden on health moving from infectious diseases to non-communicable diseases (NCDs), including cardiovascular diseases (CVDs), stroke, and cancers [1]. However, the epidemiological shift varied substantially among provinces, with more developed provinces having a larger burden of NCDs [2-5] and less developed provinces having a higher burden of communicable, maternal, neonatal, and nutritional disorders. [6-9] This variation in epidemiological profile, combined with unequal distribution of healthcare resources across provinces, has significant consequences for subnational health policy decisions in China.

The cascade of care framework is a useful tool for understanding provincial variation in quality of care in managing NCDs. This framework calculates the percentage of patients with a relevant NCD who are aware of their condition, taking medication, and in control. [10, 11] While several studies have been done to evaluate the care of NCDs in China, most of them have focused on the national level. [12-16] Data on the quality of NCD care at the provincial level is currently scarce. Furthermore, the relationship between provincial-level economic development, quality of care, and socioeconomic disparities in NCD management is hardly unknown in China.

## Research aims and objectives

To address this critical evidence gap, this study employed data from a nationally representative survey that includes information on respondents' health behaviors and clinical measurements for three prevalent NCDs to examine: 1) province-level variations in the proportion of Chinese adults at various degrees of risk for acquiring CVD across provinces in China; 2) province-level variations in the proportion of adults with hypertension, diabetes, and dyslipidemia who have reached each step of the care cascade (awareness of diagnosis, sought treatment, and blood pressure/glycemic/blood lipids, control); and 3) the association of individual factors with the quality of care for NCDs.

## Research design and methods

This national representative cross-sectional study used data from the China Health and Retirement Longitudinal Study (CHARLS), which included 12,597 participants aged 45 years (Fig S1). The CHARLS' objectives, design, and methodology are described in full elsewhere. [17] Using a care cascade framework, we examined the quality of care provided to patients with three prevalent NCDs: hypertension, diabetes, and dyslipidemia. Smoking, alcohol consumption, physical inactivity, sleep deprivation, body mass index, total cholesterol, blood pressure, and fasting glucose were all used to assess behavioral risk score for CVDs. [18] We also used the recently updated non-laboratory-based WHO CVD risk prediction charts, which calculate the 10-year risk of a CVD event defined as myocardial infarction or stroke for each sex. [19]

In the CHARLS, a trained nurse assessed respondents' systolic and diastolic blood pressures (SBP and DBP) three times. SBP 140 mmHg and/or DBP 90 mmHg were used to diagnose hypertension, as well as the use of hypertension medication [20, 21]. Diabetes was defined as having one or more of the following: 1) fasting blood plasma glucose level of 126 mg/dL; 2) HbA1c concentration of 6.5 percent; and/or 3) insulin treatment and/or medication for hyperglycemia [22, 23]. Dyslipidemia was defined as the presence of the following: 1) total cholesterol levels of 240 mg/dL and/or; 2) low-density lipoprotein cholesterol levels of 160 mg/dL and/or; 3) high-density lipoprotein cholesterol levels of 40 mg/dL and/or; 4) triglyceride levels of 200 mg/dL and/or 5) use of anti-dyslipidemia medication [24].

At the national and provincial level, we describe the prevalence of chronic disease risk factors, cardiovascular disease health behaviors, and the prevalence and cascade of care for the three NCDs. For statistical analyses, we used multivariate logistic regression to determine the individual-level drivers of NCD risk variables and outcomes. To examine sociodemographic relationships with CVD and behavior risk, linear regression models were applied.

## Preliminary findings and contributions

Our study revealed that the prevalence of hypertension, diabetes, and dyslipidemia was 39%, 20%, and 37%, respectively, among Chinese adults. China's national level of diabetes and dyslipidemia management is suboptimal, with over 67% and 79% of the population, respectively, having untreated diabetes and dyslipidemia. We found a higher rate of hypertension awareness and treatment in northern provinces and a lower rate in southern provinces. The average CVD risk score and behavior risk score in China were 4.98 and 3.10, respectively. CVD risk was higher in the north-eastern region and lower in the south-east. This study revealed similar patterns for behavior risk scores. Individual-level wealth was related to higher CVD risks, but with improved NCD diagnosis, treatment, and control for hypertension, diabetes, and dyslipidemia after controlling for other potential confounding variables. Our findings regarding regional differences in the prevalence and care cascade indicators for NCDs [14-16] and CVD risk are largely consistent with previous reports [18].

The primary strength of this study is the use of a nationally representative dataset to collect comprehensive

biomedical data that allows for more reliable estimates of hypertension, diabetes, and dyslipidemia prevalence. [25] Additionally, measuring CVD risk and behavioral risk scores at the provincial level provides compelling evidence about local epidemiology and the disproportionate burden of NCDs across geographic areas. This information is critical for refining current strategies for preventing premature death from NCD.

China is undergoing a rapid epidemiological transition, with increased exposure to risk factors for NCDs and a corresponding increase of economic burden. Interventions aimed at reducing risk factors and improving NCDs management should be integrated into national and local health policies. These strategies should include increased investment in public health interventions, such as the adoption of the Framework for Community-Based Interventions to Control NCD Risk Factors [26] and province-specific implementation of the WHO Framework Convention on Tobacco Control and the Global Strategy for Diet, Physical Activity, and Health. [27, 28] People-centered, integrated healthcare may enable more equitable access across the population. [29] Provincial governments should also use growing availability of resources for the health system to prioritise reducing the financial burdens of ill health experienced by the poorest households through increasing the generosity of the provisions of their insurance systems.

## Presentation of evidence & Appendix

[\[Access from Here\]](#)

## Reference

- [1] Maigeng Z, Haidong W, Xinying Z, et al. Mortality, morbidity, and risk factors in China and its provinces, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet*. 2019;94(10204):1145-1158.
- [2] Zhao Y, Oldenburg B, Zhao S, et al. Temporal Trends and Geographic Disparity in Hypertension Care in China. *Journal of Epidemiology*. 2019; 30(8). DOI:10.2188/jea.JE20190029.
- [3] Wang N, Cong S, Fan J, et al. Geographical Disparity and Associated Factors of COPD Prevalence in China: A Spatial Analysis of National Cross-Sectional Study. *International Journal of Chronic Obstructive Pulmonary Disease*, 2020, 15.
- [4] Zhuo Q, Wang Z, Piao J, et al. Geographic variation in the prevalence of overweight and economic status in Chinese adults. *British Journal of Nutrition*. 2009; 102(3): 413–418
- [5] Ma J, Wang J, Liu, Cao J. Geographical and Socioeconomic Disparity Analysis -- An Empirical Study of Hypertension and Its Comorbidities in China. 49th Hawaii International Conference on System Sciences (HICSS).2016: 3318-3327, doi: 10.1109/HICSS.2016.414.
- [6] Zuo Z, Wang M, Cui H, et al. Spatiotemporal characteristics and the epidemiology of tuberculosis from 2004 to 2017 in China by the nationwide surveillance system. *BMC Public Health*. 2020; 20:1284. doi: 10.1186/s12889-020-09331-y.
- [7] Chen Z, Li Z, Wang Q, et al. Large Disparity between Prevalence and treatment rates for hepatitis C in Western China. *Journal of Clinical and Translational Hepatology*. 2018; 6(4).
- [8] Wen H, Nan H. Geographical distribution of perinatal death and low birth weight infant in china: trend-surface analysis. *Journal of Sun Yat-sen University (Medical Sciences)*. 1993.
- [9] Chen M, Liu X, Liang J. Regional differences of maternal mortality and death cause in China. *Chinese Journal of Practical Gynecology and Obstetrics*. 2015.
- [10] Paul A, Joseph C. Infectious Disease-Led Hepatitis C Care in a Primary Care Clinic Setting: Cascade of Care Modeling and Experiences From an Integrated Clinic. *Open Forum Infectious Diseases*, 2017(suppl\_1):S200-S200.
- [11] Ramnath S. A model for the tuberculosis cascade of care in India that integrates the WHO onion model with concepts from the HIV cascade of care. 2016.
- [12] Lu J, Lu Y, Wang X, et al. Prevalence, awareness, treatment, and control of hypertension in China: data from 1.7 million adults in a population-based screening study (China PEACE Million Persons Project). *Lancet*.

2017:2549.

- [13] Li Y, Teng D, Shi X, et al. Prevalence of diabetes recorded in China using 2018 diagnostic criteria from the American Diabetes Association: national cross sectional study. *BMJ*. 2020; 369:m997. <https://doi.org/10.1136/bmj.m997>
- [14] Wang X, Bots ML, Yang F, Hoes AW, Vaartjes I. Prevalence of hypertension in China: a systematic review and meta-regression analysis of trends and regional differences. *Journal of Hypertension*. 2014; 32(10):1919-27.
- [15] Yang Z, Liu J, Ge J, Chen L, Zhao Z, Yang W, and China National Diabetes and Metabolic Disorders Study Group. Prevalence of cardiovascular disease risk factor in the Chinese population: the 2007–2008 China National Diabetes and Metabolic Disorders Study. *European Heart Journal*, 2012; 33(2):213-220.
- [16] Song P, Zha M, Yang X, et al. Socioeconomic and geographic variations in the prevalence, awareness, treatment and control of dyslipidemia in middle-aged and older Chinese. *Atherosclerosis*. 2019; 282:57-66.
- [17]. Zhao Y, Hu Y, Smith JP, et al. Cohort profile: the China Health and Retirement Longitudinal Study (CHARLS). *International journal of epidemiology* 2014;43(1):61-8.
- [18] Zhang M, Shi Y, Shi O, et al. Geographical variations in cardiovascular health in China: A nationwide population-based survey of 74,726 adults. *The Lancet Regional Health - Western Pacific*. 2020. 3:100033.
- [19]. Kaptoge S, Pennells L, De Bacquer D, Cooney MT, Kavousi M, Stevens G, et al. World Health Organization cardiovascular disease risk charts: revised models to estimate risk in 21 global regions. *Lancet Global Health*. 2019; 7(10):e1332–45. [https://doi.org/10.1016/S2214-109X\(19\)30318-3](https://doi.org/10.1016/S2214-109X(19)30318-3).
- [20]. Mancia G, Fagard R, Narkiewicz K, et al. 2013 ESH/ESC guidelines for the management of arterial hypertension: the Task Force for the Management of Arterial Hypertension of the European Society of Hypertension (ESH) and of the European Society of Cardiology (ESC). *Blood pressure* 2013; 22(4):193-278.129
- [21]. Chobanian AV. National heart, lung, and blood institute joint national committee on prevention, detection, evaluation, and treatment of high blood pressure; national high blood pressure education program coordinating committee: the seventh report of the joint national committee on prevention, detection, evaluation, and treatment of high blood pressure: the JNC 7 report. *Jama* 2003; 289:2560-72.
- [22]. American Diabetes Association. 2. Classification and diagnosis of diabetes: standards of medical care in diabetes—2019. *Diabetes Care* 2019; 42(Supplement 1): S13-28.
- [23]. Zhu J, Gao R, Zhao S, et al. 2016 Chinese guidelines for the management of dyslipidemia in adults. *Journal of Geriatric Cardiology Jgc*, 2018, 15(1):1-29.
- [24]. Zhang M, Deng Q, Wang L, et al. Prevalence of dyslipidemia and achievement of low-density lipoprotein cholesterol targets in Chinese adults: a nationally representative survey of 163,641 adults. *International journal of cardiology* 2018; 260:196-203.
- [25] Ning M, Zhang Q, Yang M. Comparison of self-reported and biomedical data on hypertension and diabetes: findings from the China Health and Retirement Longitudinal Study (CHARLS). *Bmj Open*. 2016; 6(1):e009836.
- [26][https://www.apec.org/-/media/APEC/Publications/2014/8/Framework-on-Community-Based-Intervention-to-Control-NCD-Risk-Factors/FRAMEWORKS\\_ForPrint\\_OKE\\_2.pdf](https://www.apec.org/-/media/APEC/Publications/2014/8/Framework-on-Community-Based-Intervention-to-Control-NCD-Risk-Factors/FRAMEWORKS_ForPrint_OKE_2.pdf)
- [27] World Health Organization. *The Global Strategy on Diet, Physical Activity and Health (DPAS)* [Internet]. Geneva, Switzerland: World Health Organization, 2006.
- [28] World Health Organization. *WHO package of essential noncommunicable (PEN) disease interventions for primary health care*. 2020.
- [29] Wang X, Sun X, Birch S, Gong F, Valentijn P, Chen L, et al. People-centred integrated care in urban China. *Bull World Health Organ*. 2018; 96(12):843-52.



当代中国研究中心

Centre for Contemporary Chinese Studies  
Asia Institute, the Faculty of Arts, University of Melbourne



[China-centre@unimelb.edu.au](mailto:China-centre@unimelb.edu.au)



<https://arts.unimelb.edu.au/centre-for-contemporary-chinese-studies>



@CCCS\_unimelb

Centre for Contemporary Chinese Studies  
Sidney Myer Asia Centre  
The University of Melbourne  
Parkville, Victoria 3010  
Australia

March 2022